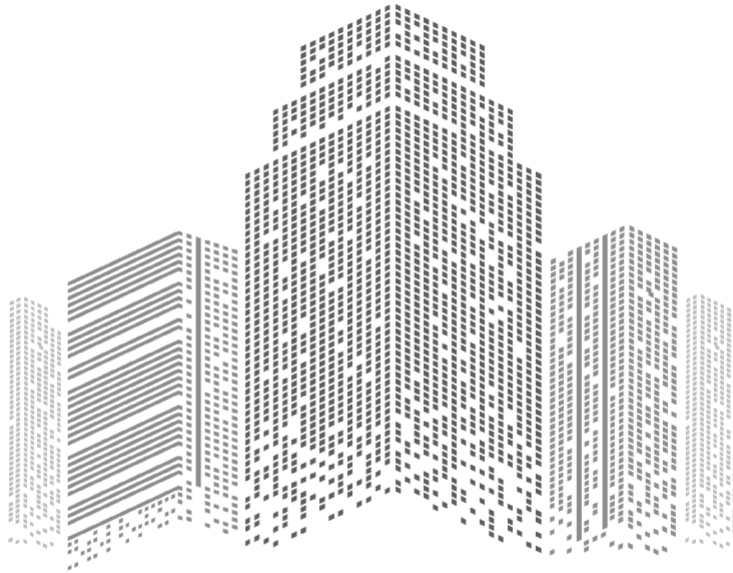


2030 Danube Region Digital Innovation Strategy for Circular Construction



Circular DigiBuild project
Interreg Danube Program

Summary

SYNOPSIS	4
BACKGROUND AND RATIONALE	5
CONSOLIDATED FINDINGS FROM THE FOUR STUDIES	6
PREPAREDNESS AND NEEDS (D.2.1.2)	6
COMMON REPORT (D.2.2.2)	6
CROSS-SECTORAL OPPORTUNITIES (D.2.3.2)	6
POLICY REVIEW (D.2.4.2)	6
STRATEGY CONSTRUCT	7
1. INTRODUCTION	7
2. ALIGNMENT WITH THE EU STRATEGY FOR THE DANUBE REGION (EUSDR)	7
3. STRATEGY PILLARS & OBJECTIVES	7
PILLAR 1: ENABLING POLICY & REGULATORY FRAMEWORKS	7
PILLAR 2: FOSTERING DIGITAL INNOVATION & TECHNOLOGY ADOPTION	9
PILLAR 3: BUILDING SKILLS & CAPACITY	11
PILLAR 4: STRENGTHENING COLLABORATION & SUPPLY CHAINS	13
PILLAR 5: RAISING AWARENESS & CHANGING MINDSETS	15
4. KEY ACTIONS & PROJECTS	18
5. FINANCIAL STRATEGY	18
FUNDING SOURCES:	18
ALLOCATION OF FUNDING ACROSS THE DIFFERENT PILLARS AND PROJECTS	19
6. STAKEHOLDER ENGAGEMENT	19
7. SUSTAINABLE IMPLEMENTATION PLAN	20
GOALS:	21
GOVERNANCE STRUCTURE:	21
TIMELINE FOR MONITORING AND EVALUATION:	21
MONITORING ACTIVITY MILESTONES:	21
STAKEHOLDER ENGAGEMENT	22
POLICY AND REGULATORY FRAMEWORKS	22
	2

FINANCIAL INCENTIVES	22
TRAINING AND CAPACITY BUILDING	22
INNOVATION AND TECHNOLOGY ADOPTION	22
MONITORING AND EVALUATION	23
AWARENESS AND MINDSET CHANGE	23
COLLABORATION FOR CIRCULAR SUPPLY CHAINS	23
LONG-TERM SUSTAINABILITY GOALS	23

8. STRATEGY STRUCTURE AND PILLARS INTERCONNECTION **24**

ANNEX 1 STRATEGY UPDATE AFTER THE TERRITORIAL ACTION PLAN ELABORATION **25**

COUNTRY-SPECIFIC ADVANCEMENTS, CATEGORIZED BY THE FIVE STRATEGIC PILLARS	25
NATIONAL KPI'S COMPARATIVE ANALYSIS	25
COMPARATIVE TABLE: NATIONAL KPI TARGETS BY 2030	26
KEY OBSERVATIONS ON KPIS	27
TERRITORIAL ACTION PLANS ANALYSIS OF UPTAKE:	27
TRANSFORMED AND NON-UPTAKEN ELEMENTS	27
RECOMMENDED NEW PILLAR AND OBJECTIVE STRUCTURE	28
IMPLEMENTATION TOOL: THE DUAL KPI REGISTER	29

Synopsis

Vision: To establish the Danube Region as a leader in circular and digital construction practices, fostering sustainable economic growth, environmental resilience, and social well-being.

Mission: To facilitate collaboration, knowledge sharing, and the adoption of innovative solutions among stakeholders in the Danube Region to transform the construction sector towards a circular economy.

The 2030 Danube Region Digital Innovation Strategy for Circular Construction represents a joint effort of 13 partner countries to modernize one of the most resource-intensive sectors of the economy. It builds upon four comprehensive studies carried out in 2024–2025 and identifies both the urgent need for transformation and the pathways to achieve it.

Key findings highlight that while some countries (Austria, Germany, and Slovenia) are frontrunners in adopting circular economy (CE) policies and digital tools, others remain at an early stage, lacking adequate frameworks and enforcement mechanisms. Stakeholders across the quadruple helix stress the importance of harmonized policies, capacity building, and regional cooperation.

The strategy sets out a vision for 2030: to position the Danube Region as a European leader in digital and circular construction. It proposes five strategic pillars, a phased Transnational Action Plan (TAP), and a governance model that relies on multi-level coordination. Expected impacts include a rise to 80% recycling¹ and reuse rate for construction and demolition waste (above the 70% target already set by the European Commission for 2020), widespread adoption of BIM and digital twins, and the creation of thousands of green jobs through Circular Economy (CE) -driven business models.

¹ Recycling of demolition waste is the process of collecting, sorting and processing materials recovered from demolished buildings and civil structures (concrete, bricks, wood, metal, glass, asphalt, ceramics, etc.) so they can be reused or turned into secondary raw materials for new construction or other applications, rather than being landfilled or incinerated.

Background and Rationale

In 2025, GDP growth reached 1.5% in the European Union and 1.4% in the euro area. For 2026, growth is expected to slow down to 1.1% in the EU and 0.9% in the euro area, while inflation is projected to increase again, reaching 3.1% in the EU and 3.0% in the euro area. This weaker macroeconomic outlook, combined with persistent cost pressures, tighter financing conditions and lower private investment appetite, continues to weigh on the construction sector. After two consecutive years of contraction, total investment in construction in the EU is expected to return to growth in 2026. In current prices, investment in construction amounted to around EUR 1,353 billion in 2025, representing 8.1% of EU GDP. Construction gross value added reached EUR 824.8 billion in the EU sample, corresponding to 5.3% of the total economy. The construction industry also remains a major employer, accounting for around 6.5% of total employment and 31.1% of industrial employment, with more than 12 million workers². In the Danube Region, this sector is both a driver of growth and a major contributor to environmental degradation. Construction and demolition waste (CDW) accounts for over one-third of total waste streams in many countries. In contrast, energy consumption and CO₂ emissions related to the buildings and construction sector continue to be critical challenges.

The European Green Deal, the New Circular Economy Action Plan, and the EU Strategy for the Danube Region (EUSDR) all advocate for a sustainable transformation of the construction sector. This requires not only adopting circular economy principles and lifecycle thinking but also harnessing digital technologies such as Building Information Modeling (BIM), blockchain, artificial intelligence, digital twins, and material passports. These tools can significantly improve resource efficiency, traceability, and collaboration across the value chain.

Despite progress in some member states, several gaps persist, including weak enforcement of CE policies, insufficient infrastructure for recycling, limited adoption of BIM, a lack of cross-border standards, and a shortage of skilled professionals. Addressing these gaps collectively, through transnational cooperation, is the rationale for this strategy.

² Source: <https://fiec-statistical-report.eu/european-union>

Consolidated Findings from the Four Studies

Preparedness and Needs (D.2.1.2)

The preparedness study revealed that industry stakeholders are generally more engaged than academia or civil society in CE initiatives. Awareness of digital tools varies widely: while many have heard of BIM, advanced applications like AI-based resource tracking remain poorly understood. Barriers include a lack of awareness, weak citizen engagement, and low response rates to surveys for the preparedness study in several countries.

Key recommendation: stronger stakeholder engagement and targeted awareness campaigns are necessary to build a critical mass for CE adoption through the deployment of digital technologies.

Common Report (D.2.2.2)

The common assessment underlined a fragmented landscape across the Danube Region. Six out of thirteen countries received stakeholder responses, but significant gaps remain in capturing citizen interests. Construction emerged as the most proactive sector, whereas NGOs and IT actors were less present. A qualitative rather than quantitative evaluation was therefore applied.

Key recommendation: ensure citizen engagement mechanisms and stronger multi-stakeholder platforms.

Cross-Sectoral Opportunities (D.2.3.2)

The cross-sectoral analysis emphasized the transformative role of digitalization in enabling CE practices. Technologies such as BIM, digital twins, blockchain, and IoT hold immense potential, but adoption remains low. Opportunities identified include modular construction, reuse hubs, waste exchange platforms, and living labs. Economic benefits include job creation, competitiveness, and resilience of supply chains.

Key recommendation: support R&D projects, incentivize SMEs, and expand cross-sectoral innovation hubs.

Policy Review (D.2.4.2)

The review of RIS3 and policy frameworks revealed three categories of countries: advanced (Austria, Germany, Slovenia), emerging (Bulgaria, Croatia, Czechia, Hungary, Romania, Slovakia), and early-stage (Bosnia and Herzegovina, Moldova, Montenegro, Serbia).

Advanced countries integrate CE and digitalization in their RIS3, while others face enforcement and funding barriers.

Key recommendation: leverage transferable practices such as Austria's multi-level governance, Germany's material passports, Slovenia's SRIPs (Strategic Research and Innovation Partnerships), and Romania's RIS3 West.

Strategy construct

1. Introduction

- **Background:** The urgent need for circular economy principles in the Danube Region's construction sector, driven by resource scarcity, climate change, and the EUSDR priorities.
- **Strategy Goals:** Aligned with EUSDR Priority Areas.
- **Focus:** Clean construction, digital innovation, resource efficiency, and waste reduction.
- **Stakeholders:** Governments, industry, research, education, financial institutions, and civil society.

2. Alignment with the EU Strategy for the Danube Region (EUSDR)

The 2030 Danube Region Digital Innovation Strategy for Circular Construction is aligned to EUSDR Priority Areas:

- **Pillar:** Connecting the Region (Improved Infrastructure, Digitalization)
- **Pillar:** Protecting the Environment (Resource Efficiency, Waste Reduction)
- **Pillar:** Building Prosperity (Innovation, SME Growth)
- **Pillar:** Strengthening the Region (Institutional Capacity, Collaboration)

3. Strategy Pillars & Objectives

This strategy focuses on the following pillars to provide a clear structure and goals for action.

Pillar 1: Enabling Policy & Regulatory Frameworks

- *Objective 1.1:* Harmonize circular construction standards and regulations related to digitalization across the Danube Region.

Promote regional cooperation and alignment of construction standards and regulations to facilitate the adoption of circular economy principles and digital tools in construction practices, with reference to the EU Construction Products Regulation

(CPR) and proposed Circular Economy Act (CEA). This aims to enhance sustainability, reduce regulatory hurdles, and foster innovation across Danube Region countries.

- **KPI 1.1.1:** Number of Danube Region countries adopting common circular construction standards related to digitalization.

Analyzing the construction standards adoption, the studies clearly identified the fact that outdated or inconsistent regulations create hurdles for implementing innovative solutions. Digital innovation and circular economy principles are treated in isolation without integration into the construction field.

It will be measured by counting the number of countries adopting common standards.

- **KPI 1.1.2:** Reduction in regulatory barriers for secondary material use in construction.

A need for standardized systems to monitor the use and quality of recycled materials was identified in the project studies. This lack of transparency prevents confidence in the reliability of secondary materials.

The studies point to digitalization as a need in circular construction which implies that a common digital platform is needed (at national level), to ensure proper monitoring, waste sorting, and quality evaluation.

It will be measured by a qualitative assessment (Level of barriers), and by counting the number of revised regulations.

- **Objective 1.2:** Develop and implement financial incentives for circular construction practices.

The importance of financial incentives for the transition to circular construction is an issue flagged by all analysis made during the project. They highlight a need for targeted instruments, innovation, collaboration, and tailored approaches to address financial barriers to the adoption of sustainable practices.

- **KPI 1.2.1:** Amount of public and private investment in circular construction projects.

Public procurement processes for green technology (low emission and circular materials, products and technologies), in addition to private investment, are important to circular construction practices. There is a lack of dedicated financial instruments, specifically designed to support circular construction and digital innovation within the sector. Existing instruments tend to be too general or focused on other sectors.

There is a need for governments to simplify construction and sustainability regulations to accelerate the deployment of innovation and public procurement of green solutions.

It will be measured by amount per year in Euro currency.

- **KPI 1.2.2:** Number of SMEs utilizing financial incentives for circular construction.

The studies also confirmed a need for targeted financial support for adoption of new construction practices (green and digital). SMEs need financial incentives to ensure this technological advancement.

It will be measured by counting the number of SMEs yearly.

Pillar 2: Fostering Digital Innovation & Technology Adoption

- **Objective 2.1:** Promote the adoption of Building Information Modeling (BIM) and other digital technologies.

BIM and related digital tools enable better planning, design, and construction processes, reduce errors and waste, and enhance collaboration among stakeholders. Widespread adoption requires both capacity-building initiatives and demonstration projects to showcase benefits of digitalization as an enabler of circular construction. Integrating AI, digital twins, and IoT can further optimize resource use and maintenance efficiency.

- **KPI 2.1.1:** Percentage of construction projects utilizing BIM.

Measures how widely digital construction tools are being applied, reflecting industry uptake and the effectiveness of training and policy incentives.

It will be measured by the percentage of construction projects using the BIM processes.

- **KPI 2.1.2:** Number of professionals trained in BIM and other digital construction tools.

Indicates progress in building the skills necessary to implement digital solutions and embed circular practices in future construction projects.

It will be measured by counting BIM trained professionals.

- **KPI 2.1.3:** Number of best practices (pilot projects, other initiatives) demonstrating innovative digital applications in circular construction.

Tracks practical applications of digital solutions in real-world projects. Demonstration projects showcase best practices, provide learning opportunities for stakeholders, and help build confidence in new technologies.

It will be measured by counting the number of best practices/projects/initiatives per year.

- **Objective 2.2:** Support the development and deployment of digital platforms for material tracking and waste management.

Digital platforms can track material flows, monitor quality, and enable reuse and recycling across construction sites. Standardized, interoperable platforms foster cross-border collaboration, ensure regulatory compliance, and increase confidence in secondary materials. These tools are particularly important for SMEs that may lack internal tracking systems. Here, the Circular DigiBuild cluster will play a key role in the coagulation of partnerships for best practice and knowledge transfer.

- **KPI 2.2.1:** Number of digital platforms implemented for circular construction and their interoperability.

Reflects the establishment of concrete tools and systems enabling resource efficiency and traceability.

It will be measured by the number of digital platforms, with a proven interoperability.

The interoperability, for example, will be assessed by the data exchange standards compliance, integration capability (collaboration with other networks), functionality across platforms (range of effectiveness of functionalities operating between different platforms), user experience, data synchronization, stakeholder engagement, network effectiveness, document and material traceability, and feedback mechanisms.

- **KPI 2.2.2:** Increase in the volume of construction materials tracked digitally.

Measures the effectiveness of platforms in creating transparency, improving reuse, and reducing waste.

It will be measured by volumes tracked (cubic meters, tones, etc.)

Pillar 3: Building Skills & Capacity

- **Objective 3.1:** Develop education and training programs for digital skills within circular construction.

A skilled workforce is needed for the transition towards a circular and digital construction sector. The studies revealed a substantial skills gap, with professionals lacking awareness regarding digital tools (BIM, IoT, digital twins) and a practical understanding of circular economy principles. Universities, vocational institutions, and professional associations must therefore integrate CE and digital construction modules into their training programs. Developing joint curricula, certifications, and online learning platforms across the Danube Region will help standardize competencies and accelerate workforce readiness.

- **KPI 3.1.1:** Number of education and training programs in digital technologies for circular construction.

This indicator measures workforce engagement in structured capacity-building activities. A steady increase demonstrates not only the expansion of

training provision but also the growing interest of the sector in acquiring practical digital and circular competencies essential for innovation-driven construction practices.

Addressed to university and VET schools, but also to requalification and further education categories, this KPI will be measured by counting the number of programs.

- **KPI 3.1.2:** Number of universities and vocational schools incorporating digital technologies for circular construction into their curricula.

There's a need to track institutional mainstreaming of CE and digital skills. Integrating these topics into formal curricula ensures continuity and sustainability of the education process—moving beyond isolated projects toward a systemic transformation of the educational ecosystem supporting the green and digital transition.

It will be measured by counting the number of institutions (education type).

- **Objective 3.2:** Promote knowledge transfer and best practice sharing among stakeholders.

The cross-sectoral study and policy review highlighted that fragmented communication and insufficient collaboration remain major barriers to innovation uptake. Knowledge transfer mechanisms—such as cluster-led platforms, thematic workshops, cross-border projects, and living labs—can bridge these gaps and foster trust across industries, academia, and public authorities. Sharing lessons from frontrunners (e.g., Austria, Germany, Slovenia) and adapting them to emerging contexts will accelerate policy alignment and technology deployment throughout the region.

- **KPI 3.2.1:** Number of knowledge-sharing events (workshops, conferences) organized.

This indicator reflects the intensity of regional cooperation and learning dynamics within the cluster. A higher frequency of such events signals a growing culture of exchange, learning, and joint problem-solving among diverse actors of the construction ecosystem.

It will be measured by the number of knowledge-sharing events organized.

- **KPI 3.2.2:** Increase in the number of cluster members participating in cross-border circular construction projects.

A rise in participation demonstrates progress in institutional networking, cross-border integration, and the operationalization of shared CE and digitalization goals across the Danube Region.

It will be measured by the number of participating cluster members.

Pillar 4: Strengthening Collaboration & Supply Chains

- **Objective 4.1:** Facilitate the development of digital regional supply chains for recycled and secondary construction materials.

To enable the transition toward a circular and digital construction sector, the Danube Region must build interconnected, transparent, and traceable supply chains. Many countries still lack digital systems that support the cross-border exchange of recycled materials and data interoperability among stakeholders.

Key Actions suggested:

1. Establish a Danube Circular Construction Supply Network, connecting producers, recyclers, designers, and public authorities through interoperable digital platforms.
2. Develop regional digital platforms and marketplaces for tracking and exchanging secondary construction materials.
3. Introduce harmonized data standards and material passports, ensuring the traceability and safe reuse of materials.
4. Engage EDIHs and construction clusters as innovation intermediaries supporting SMEs in adopting digital tools and blockchain-based transparency systems.

- **KPI 4.1.1:** Increase in the volume of recycled and secondary³ materials used in construction projects, by using digital technologies.

This KPI tracks the actual use of recycled materials, providing a direct measure of the impact of the efforts to develop digital supply chains. The most important aspect is that digitalization is the key driver for that increase. It demonstrates the effectiveness of the strategies for strengthening digital supply chains in circular construction.

It will be measured by the volumes moving in the market (Cubic meters, tons, etc.)

- **KPI 4.1.2:** Number of companies involved in regional circular supply chains.

This KPI tracks the participation rate. It shows the size and growth of the network. It can be evaluated through network registries, membership lists of business associations, and participation in digital platforms.

It will be measured by the number of companies (businesses) part of the supply chain.

- **Objective 4.2:** Promote collaboration between research institutions, industry, and governments.

Innovation in circular construction depends on strong links between academia, business, and the public sector. Strengthening these connections will accelerate applied research, technology transfer, and the implementation of new digital solutions.

Key Actions suggested:

1. Create a Danube Network for Digital and Circular Construction Innovation, coordinated by EDIHs and regional clusters.
2. Launch collaborative R&D projects on advanced materials, AI-driven resource management, and digital twin technologies.
3. Establish regional demonstration sites (Living Labs) and open knowledge hubs for testing and sharing best practices.

³ Materials that originate from industrial by-products or purposely produced substitutes that are not primary virgin resources (e.g., blast furnace slag, fly ash, recycled glass cullet, engineered recycled polymers). They are produced or captured during industrial processes and intentionally used as input materials.

4. Foster public-private partnerships and participation in EU programs such as Horizon Europe and Digital Europe.

- **KPI 4.2.1:** Number of collaborative research and development projects focused on digital technology for circular construction.

This KPI measures the tangible outcomes of efforts to promote collaboration between research institutions and industry. It shows the level of activity in developing new digital solutions for circular construction.

It will be measured through project registries, funding applications, and publications.

- **KPI 4.2.2:** Number of public-private partnerships established for the digitalization of circular construction initiatives.

This KPI demonstrates the public sector's commitment, an indicator of the value of digitalization in circular construction. Public-private partnerships provide a stable framework for long-term collaboration and investment.

It will be measured as the number of projects from government databases, partnership agreements, and project announcements.

Pillar 5: Raising Awareness & Changing Mindsets

This pillar acknowledges that technological advancements alone aren't enough. To successfully implement digitalization within circular construction, it is essential to cultivate a culture that embraces these changes. This pillar focuses on fostering understanding, acceptance, and support for digital tools and circular economy principles within the construction industry and the wider public. It recognizes that people's attitudes, knowledge, and behaviors are crucial for driving the adoption of these innovations.

- **Objective 5.1:** Implement awareness campaigns to promote the benefits of digitalization within circular construction.

This objective is a direct action aimed at addressing the lack of awareness that might be hindering the adoption of digital tools and circular economy practices. By actively promoting the advantages, it seeks to educate stakeholders (construction

companies, policymakers, the public) about the potential benefits, thus laying the groundwork for greater acceptance and implementation.

This involves designing and executing targeted communication initiatives. These campaigns would highlight how digitalization can improve efficiency, reduce waste, enhance sustainability, and create new business opportunities within the circular construction context.

- **KPI 5.1.1:** Reach of awareness campaigns (number of people informed through various channels).

This KPI is a basic measure of how many people are being exposed to the awareness campaigns. It focuses on the breadth of the campaign. It provides a tangible metric to track how widely the message of digitalization in circular construction is being disseminated. It will be measured by the number of website visitors, social media impressions, event attendees, and media mentions.

It will be measured by the numbers of individuals reached.

- **KPI 5.1.2:** Increase in public support for digitalization in circular construction policies.

This KPI assesses whether the awareness campaigns are translating into actual support for policies that promote digitalization in circular construction. Public support is crucial for creating a favorable political and regulatory environment. It can be measured through surveys, public opinion polls, or levels of engagement in policy discussions.

It will be measured by metrics on awareness levels based on survey data.

- **Objective 5.2:** Encourage the adoption of digital technologies focusing on circular economy principles used in construction business models.

This objective takes the awareness generated in Objective 5.1 and aims to translate it into concrete action. It focuses on encouraging construction businesses to implement digital technologies that support circular economy principles in their operations.

This involves providing incentives, resources, and support to construction companies to adopt digital solutions that promote waste reduction, material reuse, and efficient resource management, in other words: transiting from a linear business model to a nonlinear circular business model.

- **KPI 5.2.1:** Number of companies within the construction supply chain adopting digital technologies in their circular business models.

This KPI directly tracks the number of companies that are implementing digital solutions in their operations to support circular economy principles in the construction sector (e.g. digital passport, BIM, etc.). It provides a clear indication of the extent to which the construction industry is embracing digitalization and circularity. It can be counted through surveys, industry reports, data on investment projects receiving public support (via subsidy programmes or loans), or tracking the uptake of specific digital tools.

It will be measured by counting the number of companies active in the construction sector using digital technologies in their circular business models.

- **KPI 5.2.2:** Increase investment share in digitalized circular construction methods.

This KPI measures the financial commitment being made to digitalized circular construction. Investment is a strong indicator of commitment and confidence in the potential of these methods.

This KPI will be measured by tracking capital expenditures, R&D spending, and funding for digital circular construction projects.

The used currency will be Euro.

It will be measured by data on investment and R&D projects receiving public support (via subsidy programmes or loans) or through other industry statistics, where relevant and available.

4. Key Actions & Projects

This strategy will be populated gradually with specific transnational projects that will be undertaken under each pillar to meet the objectives. The cluster will have a coordinating role to aggregate and facilitate the cooperation projects serving the strategy, by creating consortia of members and outside organizations to generate ideas and implement them in ready to be financed projects.

- Example: Cross-border pilot projects demonstrating innovative circular construction techniques.
- Example: Development of a Danube Region Circular Construction Knowledge Hub.

5. Financial Strategy

Funding Sources:

- EU Structural Funds (ERDF, ESF): These funds provide critical support for infrastructure, R&D, SME development, and capacity building in the construction sector. Leveraging ERDF and ESF funding can help scale circular and digital construction practices across regions.
- Horizon Europe: EU research and innovation funding can support advanced technological solutions, pilot projects, and cross-border collaborations in digital circular construction. Projects focused on BIM, digital twins, AI, and blockchain solutions can receive targeted R&D grants.
- Interreg Danube Region Programme: Supports transnational cooperation and innovation, particularly for projects that enhance regional knowledge exchange, cross-border circular construction practices, and digital solutions for material tracking and waste management.
- National and regional funding programs: Complement EU funding, addressing local priorities, infrastructure needs, and capacity building initiatives. These can help bridge gaps where EU-level funding does not cover specific regional challenges.
- Private investment: Encouraging venture capital, corporate investment, and public-private partnerships is crucial for scaling digital and circular innovations. Private funding can accelerate the commercialization of solutions, fund training programs, and support SMEs in adopting circular business models.

Allocation of funding across the different pillars and projects

Funding should be strategically distributed to ensure a balanced impact across the five pillars. Priority should be given to:

- Capacity building and skills development for digital and circular construction (Pillar 2).
- Pilot projects and demonstration sites to showcase innovative circular solutions (Pillars 3 & 4).
- Development of financial instruments and incentives for SMEs and stakeholders (Pillar 1).
- Governance and coordination mechanisms to ensure transnational collaboration and policy alignment.

6. Stakeholder Engagement

The transition towards a circular and digital construction ecosystem requires strong collaboration across all levels — public, private, academic, and civil society - to ensure inclusiveness, legitimacy, and sustainability.

Collaboration Mechanisms: Establish regular forums for communication and collaboration among stakeholders.

To promote structured cooperation, the cluster will use the multi-stakeholder networking platform created in the Circular DigiBuild project, forums, and thematic working groups focused on specific priorities such as green construction, digitalization, waste valorization, education, and policy harmonization.

These mechanisms will facilitate knowledge sharing, problem-solving, and the coordinated implementation of the Transnational Action Plans (TAPs). Online collaboration platforms and annual conferences will complement physical meetings, ensuring continuous dialogue and engagement among stakeholders from all Danube Region countries. Cluster partners will act as national contact points to ensure balanced representation and information flow across the region.

Involvement of Key Groups: Engage governments, industry associations, research, education, and financial institutions.

The engagement process will actively involve:

- Governments and public authorities to align national policies, streamline regulations, and integrate circular construction priorities into public procurement and spatial planning.
- Industry associations and SMEs, to drive innovation, pilot solutions, and ensure practical implementation of circular and digital technologies.
- Research and education institutions, to provide scientific support, develop curricula, and foster innovation and digital skills development aligned with market needs.
- Financial institutions and investors, to design and deploy dedicated financial instruments that enable the scaling of CE-based business models.
- Civil society and NGOs, to promote transparency, raise awareness, and ensure that citizen perspectives are included in decision-making processes.
- Project Partners to ensure communication through the local partners from the Regional Multi-Stakeholder Groups already formed, which include all actors (public institutions, CSOs, Academia, and the private sector).

Communication Plan: Ensure transparency and disseminate information about the strategy's progress.

A structured communication plan will ensure transparency, visibility, and continuous dissemination of results. Regular progress reports, newsletters, and digital dashboards will share updates on KPIs, pilot projects, and funding opportunities. Public awareness campaigns and media outreach will help promote the benefits of circular and digital construction practices to a broader audience. The cluster's online platform will serve as the central hub for information exchange, showcasing best practices, project outcomes, and opportunities for participation.

7. Sustainable Implementation Plan

This strategy aims to establish a resilient, circular, and digital construction sector in the Danube Region that minimizes waste, maximizes resource efficiency, and promotes sustainable practices among all stakeholders. Below are potential activities to be carried out by the strategy monitoring team to maintain a continuous and dynamic implementation over the period addressed.

Goals:

- Achieve a high level of adoption of circular construction practices by 2030.
- Facilitate regional cooperation to harmonize standards and regulations gradually by 2030.
- Sustain and advance innovation through continuous digital transformation in construction through 2030.

Governance Structure:

- The structure in charge of the governance of this strategy will be the Trans-Danubian Cluster for Circular Digitalized Construction – “DANUBE CiDiCon CLUSTER”, (hereinafter referred to as the “cluster”)

Timeline for monitoring and evaluation:

A detailed schedule with milestones and deliverables for each KPI will be elaborated by the cluster team, following a monitoring methodology. This will be done after the evaluation of T0 (Tzero) and establishing a timeline (T1-4 can be years and/or other time milestones). T0 will be evaluated after the collection of the Territorial Action Plans from each country partnering the Circular DigiBuild project and can be visualized in a table. Please find below an example:

No.	Pillar	Objective	KPI	T0 (initial value)	T1	T2	T3	T4
1	Pillar 1. Enabling Policy & Regulatory Frameworks	Objective 1.1 Harmonize circular construction standards and regulations	KPI 1.1.1 Number of Danube Region countries adopting common circular construction standards related to digitalization					

Monitoring activity milestones:

- Regular reporting on KPIs.
- Annual progress reviews.
- External evaluation at mid-term and end of the strategy.
- Risk Management: Identification of potential risks to the implementation of the strategy and mitigation measures.

Stakeholder Engagement

- **Identify key stakeholders:** Government agencies, construction companies, SMEs, educational institutions, NGOs, and communities.
- **Engagement strategy:** Organize regular workshops, forums, and collaborative projects to gather input and foster a shared commitment to sustainability goals.

Policy and Regulatory Frameworks

- **Review existing regulations:** Assess how current policies support circular construction and identify barriers.
- **Develop harmonized standards:** Collaborate with stakeholders to create unified circular construction standards and guidelines that support digitalization.
- **Advocate for supportive legislation:** Work towards government incentives and policies that promote circular economy principles and digital innovation.

Financial Incentives

- **Establish funding mechanisms:** Create public-private partnerships to develop dedicated funding sources for circular construction.
- **Develop financial instruments:** Encourage investment in circular projects through tax incentives, grants, and subsidies for businesses adopting sustainable practices.
- **Support SMEs:** Provide targeted financial support and resources for small and medium-sized enterprises to transition to circular models.

Training and Capacity Building

- **Develop training programs:** Create curricula in collaboration with educational institutions that focus on digital skills and circular economy principles for students and professionals.
- **Continuous professional development:** Offer workshops and certification programs to keep industry professionals updated on best practices and emerging technologies.
- **Knowledge transfer initiatives:** Facilitate knowledge-sharing among stakeholders through networks, forums, and best practice repositories.

Innovation and Technology Adoption

- **Promote digital tools:** Foster the adoption of Building Information Modeling (BIM), IoT, digital twins, and other technologies that enhance sustainability in construction processes.

- **Support pilot projects:** Invest in demonstration projects that showcase innovative digital applications and circular practices, encouraging others to adopt similar approaches.
- **Establish digital platforms:** Create interoperable digital platforms that track materials, monitor waste, and facilitate resource recycling and reuse.

Monitoring and Evaluation

- **Follow KPIs:** Implement measurable indicators (as outlined in previous sections) to assess progress towards sustainability goals regularly.
- **Conduct impact assessments:** Evaluate the social, economic, and environmental impacts of circular construction practices and compare them with traditional practices.
- **Regular reporting:** Create annual sustainability reports to communicate progress, challenges, and lessons learned to stakeholders.

Awareness and Mindset Change

- **Implement awareness campaigns:** Launch initiatives to educate the public and industry stakeholders on the benefits of circular economy principles and digital technologies in construction.
- **Community engagement:** Involve local communities in circular construction projects to increase awareness and foster support for sustainable practices.
- **Showcase success stories:** Highlight successful projects and innovative practices to inspire others and demonstrate the viability of sustainability in construction.

Collaboration for Circular Supply Chains

- **Establish regional networks:** Create a Danube Circular Construction Supply Network to enhance collaboration among material producers, recyclers, and construction stakeholders.
- **Standardize material passports:** Develop frameworks for tracking materials throughout their lifecycle, ensuring transparency and traceability in recycled and secondary materials usage.
- **Encourage sustainable sourcing:** Promote the use of sustainable materials in construction projects to reduce environmental impact.

Long-term Sustainability Goals

- **Set long-term targets** to reduce carbon emissions, waste generation, and energy consumption in the construction sector.

- **Aim for a substantial percentage of construction projects** in the region to incorporate circular economy principles and digital solutions by 2030.
- **Promote continuous improvement in sustainability practices** through ongoing collaboration, innovation, and stakeholder involvement

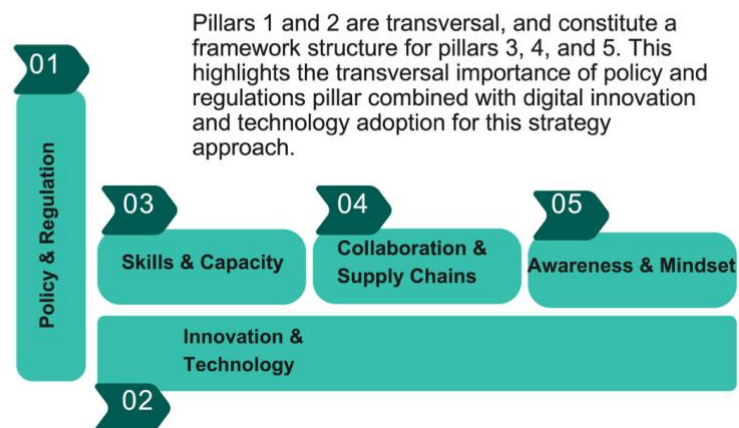
8. Strategy structure and pillars interconnection

This strategy is structured on **5 pillars, 10 Objectives and 21 KPIs**. It follows the needs identified through Circular DigiBuild project studies and analysis.

Strategy map



Pillars relation



ANNEX 1 Strategy update after the Territorial Action Plan elaboration

The **2030 Danube Region Digital Innovation Strategy for Circular Construction** serves as a comprehensive roadmap for thirteen countries to modernize their building sectors through **sustainable practices** and **digital technologies**. By aligning with the **European Green Deal**, the document aims to transition the region from resource-intensive traditional methods to a **circular economy** that emphasizes recycling and waste reduction. The strategy is built upon five core pillars, including **harmonized policy frameworks**, **advanced digital adoption** like Building Information Modeling (BIM), and intensive **workforce capacity building**. To ensure success, the plan outlines a governance structure for **transnational cooperation**, leveraging diverse funding sources such as **EU Structural Funds** and private investment. Ultimately, this initiative seeks to achieve an **80% recycling rate** for construction materials while fostering **cross-border collaboration** among governments, industry leaders, and academic institutions.

Country-specific advancements, categorized by the five strategic pillars

Refined Vision and Maturity Framework

The TAPs have translated the strategy's vision into a tiered implementation model based on national maturity levels:

- **Frontrunners (Advanced):** Austria, Germany, and Slovenia serve as "European lighthouses" or reference points for multi-level governance and advanced BIM standards.
- **Emerging Countries:** Bulgaria, Croatia, Czechia, Hungary, Romania, and Slovakia focus on adopting proven practices to close regulatory and capacity gaps.
- **Early-Stage Countries:** Bosnia and Herzegovina, Moldova, Montenegro, and Serbia are building foundational ecosystems, with some (like Moldova) explicitly linking implementation to EU accession acquis.

National KPI's comparative analysis

The national Key Performance Indicators (KPIs) across the 13 Territorial Action Plans (TAPs) are structured around the strategy's five pillars, with targets generally set for 2030 to align with the regional vision. The following table compares primary KPIs and targets extracted from the individual country plans.

Comparative Table: National KPI Targets by 2030

Country	BIM Adoption Target (Public/Major Projects)	Professionals Trained (Cumulative)	Collaborative R&D Projects	Pilot / Demo Projects	Awareness Reach (Individuals)	Investment Target (EUR)	Standards / Regs Updated
Austria	≥ 80%	≥ 15,000	≥ 40	≥ 50	≥ 500,000	≥ €250M/yr	≥ 6
Bulgaria	5%	≥ 200	≥ 2	≥ 3	≥ 20,000	€5M (cumulative)	≥ 2
BiH	≥ 10%	≥ 300	≥ 5	≥ 3	≥ 10,000	≥ €5M	≥ 4
Croatia	≥ 45%	≥ 4,000	≥ 12	≥ 8	≥ 200,000	≥ €80M/yr	≥ 5
Czechia	Activity-based	≥ 30 institutions	≥ 5 platforms	Feasibility focus	10,000	N/A	5 recs
Germany	BIM Documentation	Integrated modules	Consortia-led	Applied research	Output-based	N/A	Pilot inputs
Hungary	100%	500/year	15	10	≥ 100,000	€50M	5
Moldova	≥ 25%	150–200	Green Build Lab	≥ 3	Attitude increase	€1.5M–9M	4 norms
Montenegro	Roadmap focus	≥ 100	≥ 5	≥ 10	≥ 20,000	N/A	3 (by 2028)
Romania	50%	1,000	5	10	Digital metrics	€500M	5 (by 2028)
Serbia	≥ 40%	≥ 1,500	≥ 10	≥ 5	500 SMEs	Survey-based	4
Slovakia	100%	1,000	5 (LCA pilots)	10 (Digital Twins)	50,000	N/A	Strategy + 1

Slovenia	100%	250 (Managers)	20	10	10,000	N/A	3 (by 2028)
-----------------	------	-------------------	----	----	--------	-----	-------------

Key Observations on KPIs

- **BIM Maturity Levels:** Frontrunner countries like Slovenia and Austria have set mandatory public procurement thresholds (e.g., contracts >€2M in Slovenia) to drive 100% and 80% adoption rates, respectively. Emerging countries like Bulgaria and Serbia have set more conservative targets (5–40%) reflecting their focus on foundational roadmap development.
- **Circular Material Targets:** Several countries have introduced specific volume targets for digitally tracked secondary materials. Hungary aims for a 40% increase in registered secondary materials, while Slovakia focuses on achieving 80% compliance for mandatory pre-demolition audits.
- **Capacity Building:** Austria leads with a target of 15,000 trained professionals, while Croatia and Serbia target 4,000 and 1,500 respectively, emphasizing the integration of these skills into national university and VET curricula.
- **Financial Mobilization:** Romania and Austria have identified the largest investment targets, aiming to mobilize €500 million and €250 million per year respectively through a combination of public grants, green bonds, and private co-investment.

Territorial Action Plans analysis of uptake:

Based on an **analysis of the 13 Territorial Action Plans (TAPs) and the 2030 Danube Region Digital Innovation Strategy for Circular Construction**, there is a high level of uptake (near 100%) for the five strategic pillars. However, the implementation of specific objectives and KPIs has shifted significantly from transnational totals to territorial actions, revealing clear gaps that suggest the need for a revised strategy structure.

Transformed and Non-Uptaken Elements

While all countries maintained the five-pillar framework, several original KPIs and objectives were either transformed or omitted due to national maturity levels:

- **Shift from Transnational to Territorial Metrics:** The original Strategy's KPIs often focused on regional counts (e.g., KPI 1.1.1: "Number of Danube Region countries adopting common standards"). In the TAPs, this was not uptaken at the national level, as countries replaced it with national targets (e.g., "Number of national standards updated").
- **Hard Monetary Targets vs. Activity-Based Indicators:** Advanced countries like Germany and Austria noted that setting hard Euro targets for investment (KPI 1.2.1)

was difficult due to the project-based nature of funding. Consequently, they transformed these into activity-based indicators (e.g., "Availability of research findings" or "Number of recommendations prepared").

- **Platform Interoperability (KPI 2.2.1):** While most countries committed to implementing platforms, many lacked a defined quantitative interoperability score. The uptake focused on the existence of platforms rather than their cross-border data-exchange capability.
- **Public Support vs. Awareness (KPI 5.1.2):** The original Strategy sought to measure an "Increase in public support". This was largely not uptaken as a formal index. Instead, countries focused on simpler reach metrics (KPI 5.1.1) or localized survey-based awareness growth.

Recommended New Pillar and Objective Structure

To better reflect the territorial realities, the **updated Strategy should move from a generic 5-pillar model to a Lifecycle-Aligned Model** that incorporates new findings from the TAPs.

Pillar 1: Enabling Policy & Multi-Level Governance

- New Objective 1.3: EU Accession & Acquis Alignment (Candidate Countries). Specifically for Moldova, Serbia, BiH, and Montenegro to link construction digitalization to EU Chapters 10, 22, and 27.
- Refined KPI: Number of national roadmaps (BIM, Circularity) legally anchored in primary legislation (e.g., Slovenia's GZ-1B amendment).

Pillar 2: Digital Lifecycle Innovation

- Objective 2.1: Standard adoption (BIM/GIS/IoT).
- New Objective 2.3: Digital Handover & Operational Maintenance. Reflecting Slovakia's emphasis on "verified as-built BIM models" and "passportization of existing stock".
- Refined KPI: Percentage of newly commissioned public buildings with verified digital twins/passports.

Pillar 3: Skill Certification & Knowledge Infrastructure

- Objective 3.1: Vocational and university curricula integration.
- New Objective 3.3: Train-the-Trainers Scaling. Institutionalizing training beyond one-off grants, as proposed by Moldova and Serbia.

Pillar 4: Circular Value Chains & Material Sovereignty

- Objective 4.1: Regional secondary material supply chains.
- New Objective 4.3: Bio-based & Renewable Material Hubs. Focusing on the wood-chain potential highlighted by Slovenia and Austria as a specific circular priority.
- Refined KPI: Volume of bio-based materials (e.g., certified timber) tracked via digital passports.

Pillar 5: Market Demand & Mindset Transformation

- Objective 5.1: National "Success Story" campaigns.
- New Objective 5.3: Demand-Side Incentives (Renovation Bonus). Adding a specific objective for direct grants/tax reliefs that "pull" the market, similar to the proposed Moldovan Green Renovation Bonus.

Implementation Tool: The Dual KPI Register

To address the uptake gaps, the Strategy update should replace the single KPI list with a Dual-Track Register:

1. **Transnational (Cluster) KPIs:** Managed by the Danube CiDiCon Cluster to track macro-regional indicators (e.g., total cross-border interoperable platforms).
2. **Territorial (TAP) KPIs:** Standardized templates for countries to report national progress against localized targets (e.g., national BIM adoption rate).

This **revised structure accounts for the 13 TAPs as the primary implementation tools**, allowing for tiered progress reporting based on a country's status as Advanced, Emerging, or Early-Stage.