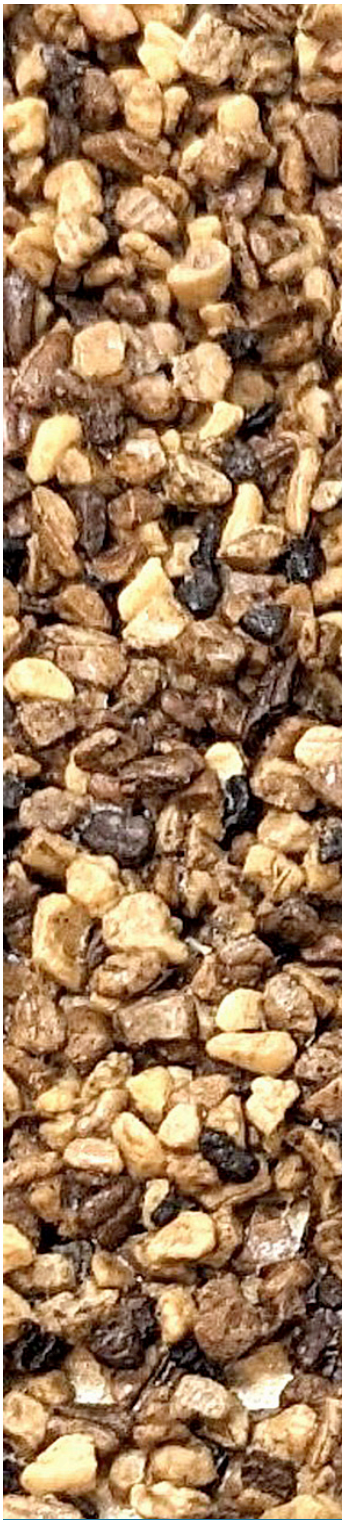


Transforming the Construction Industry through **Green** and **Digital** Innovations for a Sustainable Future



Foreword



Today's construction industry is facing a variety of challenges that will both shape the present and have a significant impact on the future. The industry must not only face the challenges of climate change and the scarcity of resources, but also deal with the ever-increasing influence of digitalization. Sustainable construction, innovative technologies and resource-saving materials are key concepts for the future.

As part of the AEC Eurocluster project, impetus was provided to bring innovative approaches to the topics of sustainable materials, new processes and digitalization to the fore. Prototypes were developed, business models adapted and new processes along the construction value chain tested through a targeted selection of projects and tailored funding.

You can find a selection of ideas and projects in the following brochure.

Erich Gaffal

Cluster Manager, Building Innovation Cluster (BIC), Austria

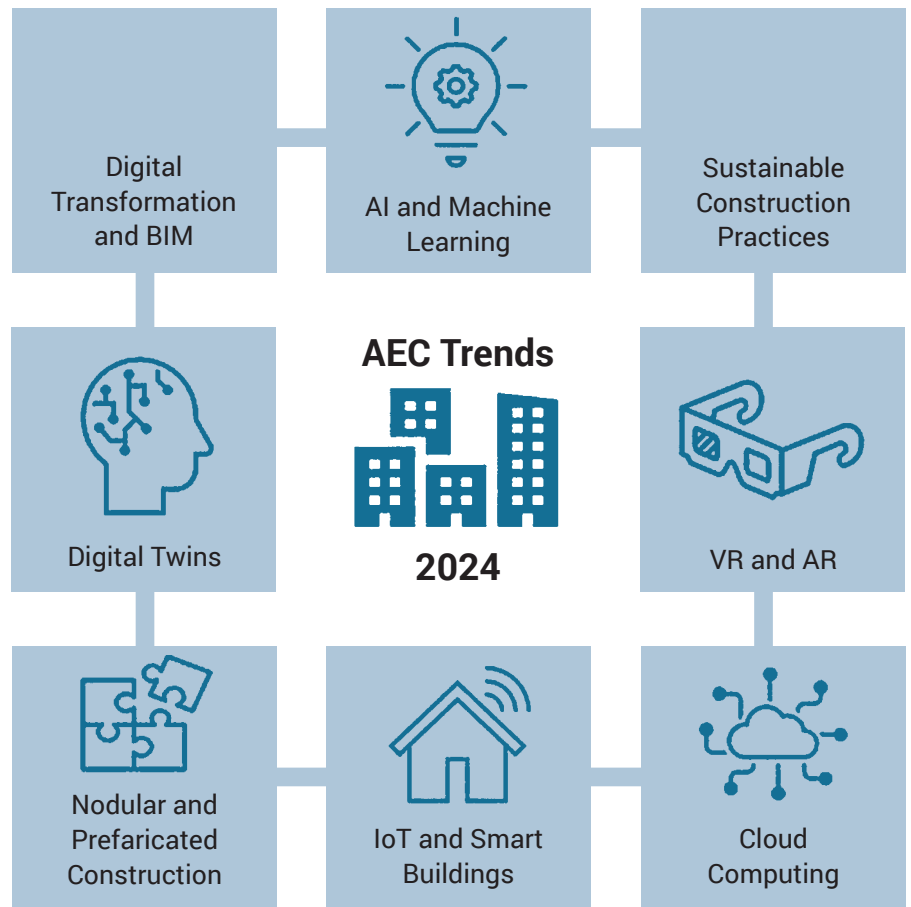


AEC sectors today and tomorrow

The global Architecture, Engineering, and Construction (AEC) market was valued at approximately USD 10 billion in 2023, and it is projected to grow at a compound annual growth rate of 10,3% from 2024 to 2032, reaching about USD 24,35 billion by the end of this period. This growth is driven by advancements in Building Information Modelling (BIM) software, increasing construction project complexity, and the expansion of infrastructure projects worldwide.

scores the growing importance of digital, robotic, AI, and automated solutions for the future. Total construction investment increased by 5,2% in 2021, reaching € 1,6 trillion (11,1% of EU GDP). Noteworthy are the increases in Italy, Estonia, Greece, and France, while Spain experienced a slight decline (-0,9%).

The employment dynamics are closely tied to skill availability, with investment



The EU construction sector plays a crucial role in economic development, contributing significantly to employment and GDP. The industrial construction ecosystem employs 24,9 million people in the EU, contributing to 9,6% of the EU's GDP. Despite the rising employment rates, the sector's growth is impeded by a persistent shortage of skilled labour. This challenge under-

typically fostering job creation, though this is constrained by the skilled labour pool. In the EU, this sector is characterized by micro and small enterprises, with 99,9% of firms being SMEs, representing 90% of employment and 83% of total value added. This presents itself both as a strength and a challenge, because the sector is quite fragmented.



Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them.

Advancing Sustainability and Innovation in the AEC Sectors

The urgency for SMEs in the AEC sectors to embrace the dual imperatives of green transition and digitalization is underscored by the sector's substantial carbon footprint. In Europe, the construction sector demands extensive resources, constituting roughly 50% of all materials extracted. Additionally, it contributes to over 35% of the EU's total waste production. Furthermore, compared to other industries, the construction sector has been slower in adopting digital technologies.

Firstly, embracing eco-friendly processes, materials, and technologies, the AEC sectors can significantly curtail carbon footprints and minimize ecological damage. An illustrative instance shows that greenhouse gas emissions stemming from material extraction, manufacturing of construction products, and building construction and renovation, are approximated to account for 5-12% of total national GHG emissions. Enhanced material efficiency holds the potential to mitigate up to 80% of these emissions.

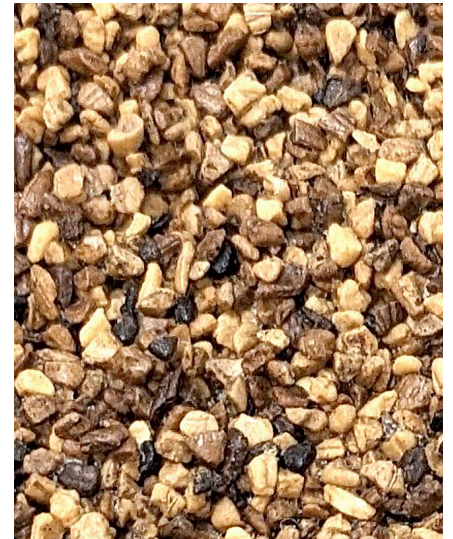
Therefore, the shift towards sustainability is vital for mitigating climate change. Secondly, digitalization revolutionizes the construction sector, offering unparalleled efficiency and innovation. Exemplified by digitalization to support prefabrication and modular construction, it can reduce waste by 23-100%. This shows how the synergy between green transition and digitalization can be potent. Below are some of the latest technologies, processes, and materials developed with the AEC EUROCLUSTER funding.

MATERIALS

Composite material made from olive endocarp

INNOSTART SRL, an Italian startup established in 2020, focuses on innovative sustainable materials derived from waste and by-products of the agri-food sector. Their flagship innovation, Uliwood, is a composite material made from olive endocarp reinforcement and currently utilizes a synthetic resin matrix. The uniqueness of Uliwood lies in its composition, with a bio-based particulate composite comprising at least 85% by weight of renewable materials. This material is intended for use in green building applications, particularly as a decorative and sound-absorbing coating for interior walls. INNOSTART aims to replace the synthetic resin with a bio-based alternative, aligning with circular economy principles and enhancing environmental sustainability. According to its founder, INNOSTART is committed to preserving natural ecosystems, aligning with the requirement of "zero deforestation."

Website: <https://www.innostartsrl.it/>



Green and bio-based building block - MISBOCK

Pedone Working S.r.l., under the Italian brand "BIOmat Canapa" from Bisceglie Italy, specializes in sustainable building solutions, particularly hemp-based products, known for their quality and environmental benefits. Unlike traditional hemp-based solutions, they're utilizing Miscanthus, a renewable and abundant plant, as the primary aggregate in their new building blocks. Combined with lime and natural binders, this material offers exceptional insulation properties comparable to hemp, making it ideal for eco-friendly building projects. Miscanthus, a perennial energy crop, requires minimal intervention and has significantly lower cultivation and processing costs compared to hemp. This innovative approach not only reduces environmental impact but also enhances productivity and affordability in sustainable construction practices.

Website: <https://biomatcanapa.it/>



Raw earth bricks, blocks and panels - iREBBELS

The **Eco Living Project SRL** company, from Romania, specializes in developing innovative raw earth bricks, blocks, and panels in collaboration with the Romanian National Research Institute for Construction Materials (URBAN-INCERC). Their technology utilizes clay mixed with aggregates including crushed concrete from demolitions and secondary products from the paper pulping industry and agriculture. The compressed raw earth bricks, blocks, and panels boast several unique features, including a very low carbon footprint, high heat storage capacity, and high-water vapor storage capacity. According to the company's statement, one of their initial bricks demonstrated the ability to withstand 34 tons of crushing pressure, yielding 11MPa, even without being fired. Their primary objective for their first product is to create an interior decorative brick with a high thermal mass and efficient vapor regulation capacity, with the goal of enhancing comfort, health, and energy efficiency in homes.

Website: <https://www.caminota.ro/>



Thermal plaster with nano-particle organic additives

Grm intrn d.o.o. is a technology transfer company based in Slovenia. The company is currently developing a technology, called SPRAYFIX, a new thermal plaster. SPRAYFIX offers cost-effective and efficient insulation solutions, with its innovative composition providing enhanced strength and insulation capabilities compared to conventional materials. The principle of SPRAYFIX is based on the organization of complex heat exchange in which occurs a radiant reflection and intensive molecular exposure of air in the evacuated ceramic microspheres within the composition. Application of evacuated microspheres reduces conductive and convective heat transfer through the isolated surface. It is suitable for diverse applications and environments due to its ability to withstand higher pressure and load. The inclusion of nano-particle organic additives gives SPRAYFIX high insulation properties. Durability is 1.2 to 1.5 times longer compared to standard insulation materials.

Website: <https://www.youtube.com/watch?v=FEX0PA6XI3M>



Waste based alkali-activated paving stones

Termit d.d., established in 1960 in Slovenia, is a mining company specializing in silica sands production and processing, along with auxiliary casting material for foundries and iron-works. Their project, named WALK, focuses on employing alkali activation technology to create durable paving stones from waste material. As the company states, "paving stones WALK will have good properties, low production costs, and the possibility to change shape and dimension that's why it can be interesting for mass production." This approach aligns with circular economy principles by reducing waste and generating value-added products. The unique aspect of their technology is the utilization of waste materials such as bottom ashes, various slags, fly ashes, and waste foundry sand to produce paving stones. This not only reduces the consumption of natural resources but also reduces costs and landfill waste. By transforming waste into valuable products, Termit promotes sustainable practices and circular economy principles.

Website: <https://www.termit.si/en/>



PROCESSES

AI-Powered Cost Estimation

Exenne Technologies is a software company specializing in SaaS products for the construction industry. They're now embarking on a project leveraging AI to enhance cost estimation accuracy, targeting construction and planning companies. By automating the creation of accurate and comprehensive cost books using AI, Exenne aims to revolutionize the bidding and estimating process, providing data-driven insights and optimizing resource allocation. The team has achieved a significant milestone by developing a model with 90% accuracy in cost estimation. This model was trained and tested in a lab setting using a standard dataset. Additionally, three intermediary models have been crafted, each focusing on different construction areas such as sanitary, electrical, and general works, using data from public projects. These models have been integrated into the eDevize platform, enhancing its functionality with AI-driven cost estimation tools.

Website: <https://edevice.ro/>



IoT-Environmental and Occupancy Sensors

Arcology System is a pioneering interior construction solution and data platform from Ireland that integrates a Meccano-like set of adaptable, multifunctional extruded aluminium components. These components are designed for easy manufacture and disassembly (DfMA) and seamlessly integrate with local and renowned construction products, enabling them to be dismantled without damage. This innovative approach reduces construction waste and allows materials to be traded and re-used, or spaces easily upgraded and adapted according to usage patterns and data insights.

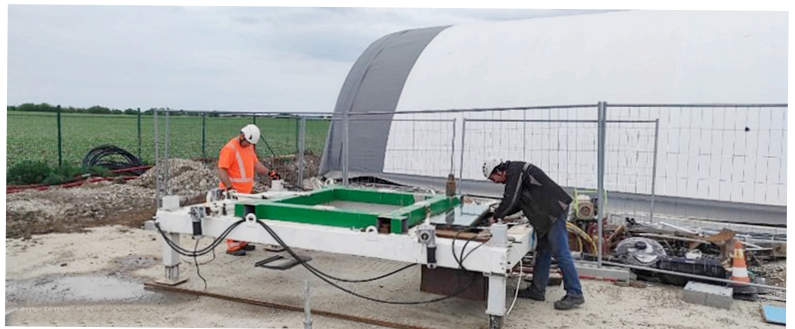
"We've made significant progress by integrating sensors within the hardware and "smart grid" components. Additionally, we've successfully developed asset-tracking protocols, overcoming challenges posed by the diverse eventualities and configurations of the space. These challenges were effectively resolved with the implementation of the 'smart grid.'" explains the CEO & Co-Founder.

Website: <https://arcologysystem.com/>



Integrated Drilled Foundations

The company **SAIDEL Engineering SA** from Romania offers integrated services in the construction industry and conducts advanced geotechnical and structural analyses for optimized foundation and structural design. Their patented innovation involves a method for constructing integrated drilled foundations for pre-cast columns, which significantly reduces costs and construction time compared to traditional methods. According to SAIDEL "this automated Monopile foundation solution significantly reduces environmental impact by enhancing the efficiency, speed of deployment, quality, and sustainability of construction projects." This drilled foundation technology has been successfully applied in 28 projects, saving around 50% in costs and construction time.



Website: <https://www.saidel.eu/>

PROCESSES

Real-time concrete curing data integration into BIM models

Cosmos Engineering, a Spanish startup, specializes in IoT solutions for the construction sector, with their flagship product being CoSMoSTM: Concrete Strength Monitoring System. This system allows real-time control over the evolution of concrete poured on-site. A unique aspect of their technology is its integration with Building Information Modelling (BIM) software, which enables users to visualize concrete data directly over a 3D model of their construction project. The integration of sensor data into the BIM model addresses the lack of standardization in the construction industry and the time-consuming nature of using multiple platforms for different purposes. According to the company, by streamlining data visualization and eliminating the need to navigate through various plots and datasets, *“the project promises to transform the AEC industry by offering an integrated solution that enhances technology adoption, reduces construction’s carbon footprint, and improves safety.”*

Website:

<https://www.cosmosengineering.es/>



TECHNOLOGIES

AI robot control technology for 3D printing

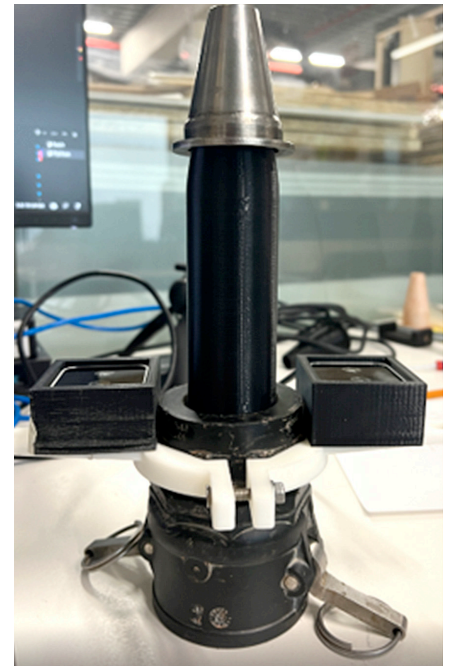
The Institute of Advanced Architecture of Catalonia (IAAC) in Barcelona, Spain, is renowned for its expertise in advanced architecture and design, integrating cutting-edge technologies such as artificial intelligence, robotics, and digital fabrication. Currently, IAAC is nearing completion of the Q3D project, which, as per the company’s statement,

“aims to foster a more sustainable and responsible approach to construction by reducing reliance on non-renewable resources, minimizing waste, and lowering carbon emissions.”

By harnessing their proficiency in robotics, AI, and material science, IAAC seeks to develop sensor and AI technology that optimizes 3D printing with natural or recycled materials. Through real-time monitoring and control of the printing process, this solution ensures consistently high-quality results. Directly benefiting large-scale 3D printing companies, the Q3D project offers solutions to challenges associated with printing natural and recycled materials. These solutions encompass precise material deposition, heightened productivity, decreased print time, optimal material usage, environmental sustainability, and improved product quality.

Website:

<https://iaac.net/>



Augmented Reality

The family business **Vermessung Thalmann** from Austria stands for reliable services in the field of surveying and geoinformation. Father and son combine experience and routine with a spirit of innovation and the latest technologies. The funded innovation project is about the correct visualization of geodata using mixed reality.

“The basic idea is that a tablet is pointed at the (future) construction site or the location of interest and tailored data from the BIM model or the geoinformation system is visualized in the right place in the camera image. The solution accompanies the entire life cycle of a building, which means that time-consuming and cost-intensive planning and execution errors can be avoided,” explains Thalmann.

Website:

<https://www.vermessung-thalmann.at/>



Building Information Modeling

Woodea is a construction company founded in 2022 in Spain with a focus on revolutionizing the traditional construction model by integrating digitalization, sustainability, industrialization, and Lean culture principles. Describing their mission, the company emphasizes,

"our goal is to enhance efficiency by applying automotive industry methods to construction. We are developing a BIM component library connected with various suppliers, allowing seamless integration with our operations management system. The BIMaS project will link our BIM models with supplier systems, increasing automation, reducing stock, and enabling customized orders. This also helps calculate carbon footprints and select environmentally friendly materials. Using Autodesk Construction Cloud and Microsoft Dynamics, we aim to enhance project management, cost, and logistics features, improving early-stage operational efficiency and supplier selection."

Website:

<https://woodea.es/en/>



Digital IoT sensor

MOXTURE, a Slovenian-based company, specializes in resolving dampness issues in building walls caused by capillary moisture. With over 80 million Europeans living in homes affected by dampness and mold problems, MOXTURE's solution addresses structural damage, economic losses, and health concerns associated with damp environments, which can increase heating expenses by up to 65%. To further enhance their solution, MOXTURE is developing an IoT digital device called MOXTECH, insertable into their condensers. MOXTECH monitors the wall drying process and humidity levels in real-time, transmitting data to a cloud-based server for 24/7 monitoring, data collection, and analytics. This innovation accelerates the digital transition of the construction sector and reduces dampness issues in EU's building stock, promoting sustainability and energy efficiency while delivering health and economic benefits.

Website:

<https://moxture.com/en/>



TECHNOLOGIES

Digital Twin

Rihter d.o.o., established in 1990, specializes in assisting customers with their housing needs, from concept to completion, focusing on low-energy prefabricated wooden houses. They produce timber frame construction elements in Slovenia. The company aims to enhance their process by incorporating 3D scanning of building foundations and construction phases to create Digital Twins of buildings. This involves generating 3D cloud points of the building, importing them into BIM models in Revit, and synchronizing them with planned prefabricated construction elements.



"Our innovative approach is set to help the entire AEC industry by showcasing the benefits of Digital Twins and BIM models. We aim to inspire industry-wide adoption of these technologies, improving project management, cost efficiency, and sustainability standards. Looking ahead, Rihter d.o.o. plans to enhance our Digital Twin models with real-time monitoring and predictive analytics, further reducing environmental impact and improving cost-efficiency" explains the Head of Sustainable Development.

Website:

<https://www.rihter.eu/>

Unmanned aerial vehicles (UAVs) – Drones

MuDD Architects, an innovative firm in Barcelona, Spain, is known for its forward-thinking and sustainability commitment in creating environmentally friendly spaces. Recognizing the need for modernization in architecture, MuDD aims to introduce a new business line using drone technology for construction applications. Their project involves automating material spraying with drones, targeting high-level application in architectural projects. Emphasizing the technology's merits, the company underscores,

"by using drones, we can quickly and efficiently coat large surfaces, eliminate the need for scaffolding, and access hard-to-reach areas. This not only accelerates construction but also significantly reduces risks for our workers."

Website:

<https://www.muddarchitects.com/>



Empowering AEC SMEs: Networks, Funding, and Expertise in Europe

Networks of SME Support Entities throughout Europe

Throughout Europe, various support organizations are available to assist SMEs in the AEC sectors in advancing their green and digital solutions through a diverse array of services.

AUSTRIA:



The **Building Innovation Cluster (BIC)** serves as a cross-industry network linking companies, educational institutions, and research organizations in architecture, construction, furniture, and timber industries. Its objective is to enhance innovation and competitiveness within these sectors by fostering collaboration and knowledge exchange.

Contact:

Isabella Mantello
Email: isabella.mantello@biz-up.at
Mobil: +43-664 787 36159

BULGARIA:



Established in 2011, the **Black Sea Energy Cluster (BSEC)** unites a diverse range of stakeholders, including businesses, educational entities, and non-profit organizations, all dedicated to advancing energy efficiency and the use of renewable energy sources. Through its commitment to fostering strong business relationships, BSEC actively contributes to environmental protection, climate change mitigation, and the promotion of a green economy. Its members, ranging from technology producers to service providers, work in synergy with local governments and educational institutions to drive sustainable development in the Black Sea region.

Contact:

Polina Antonova
Email: office@ubbsla.org
Telephone: +359888601500

ITALY:



did – distretto Interni e Design is a regional technological cluster that supports a network of 400 companies operating in the sectors of living spaces and construction intermediating their innovation at level of product, process, competences and market approach.

Contact:

Irene Burrioni
Email: irene@csm.toscana.it
Mobil: +39-0577937457

ROMANIA:



TEC is reuniting organizations from private, educational, associative and public environments into a steady partnership being based on common values of the members and medium-long term goals that are focused on raising competitiveness through innovation, co-creation and integration throughout the value chain from within the construction industry.

Contact:

Rodica LUPU
Email: office@clustertec.ro
Mobil: +4 0762 248 170

SLOVENIA:



Construction Cluster of Slovenia supports innovation, the transition to a circular economy, digital transformation and international cooperation and, in addition, enables its members to connect and network on a local and international level.

Contact:

Vladimir Gumilar
Email: vladimir.gumilar@sgg.si
Mobil: +386-041770482

SPAIN:



Secpho cluster brings together more than 150 organizations that promote technological innovation through deep tech in all sectors of our economy. The partners, engineers and experts in the AEC sector that are part of our ecosystem are the perfect combination to boost a collaboration-based environment.

Contact:

Sandra Morente
Email: sandra.morente@secpho.org
Mobil: +34-662 36 88 16

International and National Fundings

Numerous European funding opportunities are available for SMEs, yet they often remain obscured amidst a wealth of information. To assist you in navigating this complexity, we have outlined some promising opportunities below.



1) The EU has launched 30 **EUROCLUSTERS**, which AEC EUROCLUSTER is part of, to implement its Industrial Strategy. These cross-sectoral initiatives involve industry clusters, research organizations, and companies across Europe. With €42 million funding from the **Single Market Programme**, they include 171 partners from 23 countries, covering all 14 industrial ecosystems. The EUROCLUSTERS have initiated Financial Support for Third Parties (FSTP) Calls, primarily accessible via <https://cluster-submissionplatform.eu/>



2) **Horizon Europe – Cluster 4: Digital, Industry and Space**: This cluster within Horizon Europe includes funding calls specifically aimed at the construction industry. It focuses on projects that enhance digitalization and automation in construction, promote sustainable building practices, and improve materials and processes



3) **Sustainable Built Environment (SBE) Horizon Europe Partnership**: This partnership aims to coordinate and fund research and innovation activities to achieve a climate-neutral built environment. It involves collaboration between industry, academia, and government to promote sustainable construction practices



4) The **Built4People (B4P) Horizon Europe Partnership** brings together stakeholders from various sectors, including construction, architecture, engineering, urban planning, and more, to drive innovation and sustainability in the built environment. The goal is to create high-quality, sustainable buildings and spaces that improve people's quality of life while minimizing environmental impact. The partnership funded 30 projects with 250 organisations so far.



5) **Programme for the Environment and Climate Action (LIFE)**: This programme focuses on the environment and climate action, offering funding for projects related to nature conservation, climate change mitigation and adaptation, and clean energy transition. The calls for proposals are open annually, supporting initiatives that contribute to a sustainable and circular economy.



6) **EUREKA** facilitates access to public funding, having provided €48.4 billion to organizations since 1985, supporting the success of 7,496 R&D projects. It promotes international collaboration, fostering high-quality innovation in R&D projects, enabling companies to combine expertise, exchange knowledge, and enhance resources while reducing risks. EUREKA programs focus on developing close-to-market products, processes, or services. With a network spanning over 45 countries, companies can easily explore markets across Europe, North America, South America, Asia, and Sub-Saharan Africa. Further details are available at <https://www.eurekanetwork.org/>

To learn about national funding, please reach out to the Networks of SME Support Entities listed above.

Specialized Trainer Pool: Co-Creation, Innovation Methods, and AEC Sector Expertise

Implementing training methodologies is essential for SMEs to cultivate innovative thinking and enhance problem-solving abilities. By investing in these approaches, SMEs acquire the necessary skills and tools to innovate, respond to market changes, and establish sustainable business models for enduring success. Please find below a list of trainers from various countries for your reference.

AUSTRIA



Dr. Edith Öller

Email: edith@ideaz.at
Website: www.ideaz.at
Offer: Design Thinking, Open Innovation, Lego Serious Play, Innovation Canvas, Lean Startup, Business Modelling, Business Models for Circular Economy & Impact



Christoph Matthias Reiss-Schmidt

Email: christoph.reiss-schmidt@biz-up.at
Website: <https://www.biz-up.at/>
Offer: Strategic Project Development, Cluster Management, Strategy-, Business-, or Service Development and Open Innovation Formats such as LEGO® SERIOUS PLAY®.

BULGARIA



Lachezar Rossenov

Email: rossenov@gmail.com
Website: <https://src.rossenov.com/index.php/en/>
Offer: Innovation Canvas and Lean Startup

ITALY



FUTOUR SRL

Email: info@futour.it
Website: <https://futour.it/english/>
Offer: PCM Project Cycle Management and Vision Plan, Lego Serious Play, EASW European Awareness Scenario Workshop, Open Innovation, Business Innovation

ROMANIA



Qualians Servicii SRL

Email: office@qualians.com
Website: <https://www.qualians.com/>
Offer: Design Thinking, Strategic Thinking & Business Innovation, Digital Mindset for Leaders, Change Management, Data Driven Decision Making



Ionuț Tarcea

Email: Ionut.Tarcea@ascendis.ro
Website: <https://asociatia-ascendis.ro/ro>
Offer: Design Thinking, Minitab, Agile Performance Management, Adaptive Organizational Culture, Management of Change, Performance coaching

SLOVENIA



Miha Škrokov

Email: Miha.skorkov@anteja-ecg.com
Website: www.anteja-ecg.com
Offer: Design Thinking, Open Innovation, Innovation Canvas, Business Modelling, Circular and Sustainable Innovation



Milan Gabor

Email: milan@viris.si
Website: www.viris.si
Offer: Cybersecurity training and cybersecurity testing



Jure Tomc

Email: jure.tomc@jtbd.co
Website: www.jtbd.co
Offer: Innovation Canvas, Lean Startup, Business Modelling, Business Development, Fundraising, Commercialization, Scaling up, Growth Strategies, Internationalization, Partnerships, Business Planning, Market Testing, Lean Canvas, Business Canvas



Rok Slokar

Email: rok.slokar@rebiss.si
Website: www.rebiss.si
Offer: Design Thinking, Lean Startup, Business Modelling

Review of the AEC EUROCLUSTER project

Supporting SMEs for Innovation, Internationalization and Adoption of New Technologies

The AEC EUROCLUSTER project is a forward-thinking initiative that addresses the urgent need for resilience and innovation in the architecture, engineering, and construction sectors. By forming a strategic alliance across Europe, the project aims to foster collaboration and accelerate the transition to greener, digitally advanced practices. The focus on upskilling and supporting SMEs is particularly crucial, as it empowers these businesses to adapt to new challenges and disruptions in the supply chain. With its comprehensive approach to mapping the ecosystem and promoting cluster-to-cluster learning, the AEC EUROCLUSTER project is poised to make a significant impact on the industry's recovery and future growth. Some achievements of the project include:



- Four online seminars tailored for SMEs and one seminar for cluster managers, engaging over 60 participants.
- Four SMEs secured 5,000 Euros each for training initiatives.
- Twelve SMEs were awarded 60,000 Euros each for innovation projects (with the majority highlighted in the brochure).
- Five SMEs received 60,000 Euros each for technology adoption (with the majority also featured in the brochure).



- Four international missions were organised and European SMEs were financially assisted with 2,000 Euros each to participate, facilitating their path toward internationalization
- Five preparedness/business continuity plans were developed to bolster SMEs' stability and flexibility, enhancing their resilience in the face of potential market fluctuations.
- Stay informed by keeping up to date through the project's LinkedIn page: <https://www.linkedin.com/showcase/aeceurocluster/>

