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AEC EUROCLUSTER

Guide for Applicants






Version 4, 28/04/2023

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1 / AEC EUROCLUSTER, why should you apply?

Construction industry professionals and particularly Small and Medium-sized Enterprises (SMEs) face unprecedented hurdles as a result of lockdowns, high energy costs, breaks in supply chains that set timelines back weeks to months. Therefore, AEC industries (architecture, engineering and construction) are challenged with dependencies, unavailability and a lack of predictability. The last years revealed weaknesses which the EU-funded project [AEC EUROCLUSTER](#) intends to reduce by contributing to a more resilient, **digital and low-carbon economic recovery** of construction and related sectors of AEC Ecosystem.

For implementing market-demanded innovation projects with substantial transformation character, SMEs can receive lump sum **financial support** within the AEC EUROCLUSTER project. The same applies to SMEs that uptake technologies from other sectors or adopt processes not fully exploited so far in AEC industries. Companies can also cross borders within the project in order to establish business with non-European partners or benefit from upskilling activities by learning from certificated trainers how to become aware of needs and deliver solutions related to digital and green transition.

This is possible because the European Commission selected 5 European clusters ([Construction Cluster Slovenia](#), [Business Upper Austria](#), [Distretti Interni Design Italy](#), [Secpho Spain](#), [TEC Cluster Romania](#) and [Black Sea Energy Cluster Bulgaria](#)) gathered within the AEC EUROCLUSTER project in order to launch EU funded calls and look for the most innovative SME ideas accelerating digital performance or green entrepreneurship.

Altogether, AEC EUROCLUSTER is designed to drive forward cross-cluster cooperation and promote eco-innovative as well as smart products for SMEs in AEC and related industries! **And you should make use of these opportunities!**



2 / Can you apply?

You are eligible for funding if you meet **all** of the following conditions:

You are a start-up or SME (including spin-outs) according to the [EU definition](#): < 250 staff headcount **and** ≤ 50 million € turnover **or** ≤ 43 million € balance sheet total per year

You are legally registered in one of the EU27 Member States or country participating in the Single Market Programme. Check the list of eligible SMP countries [here](#).

Your company has been registered at least 6 months prior to submission deadline.

Your activities focus on AEC, or one of the sub-sectors of the AEC ecosystem:

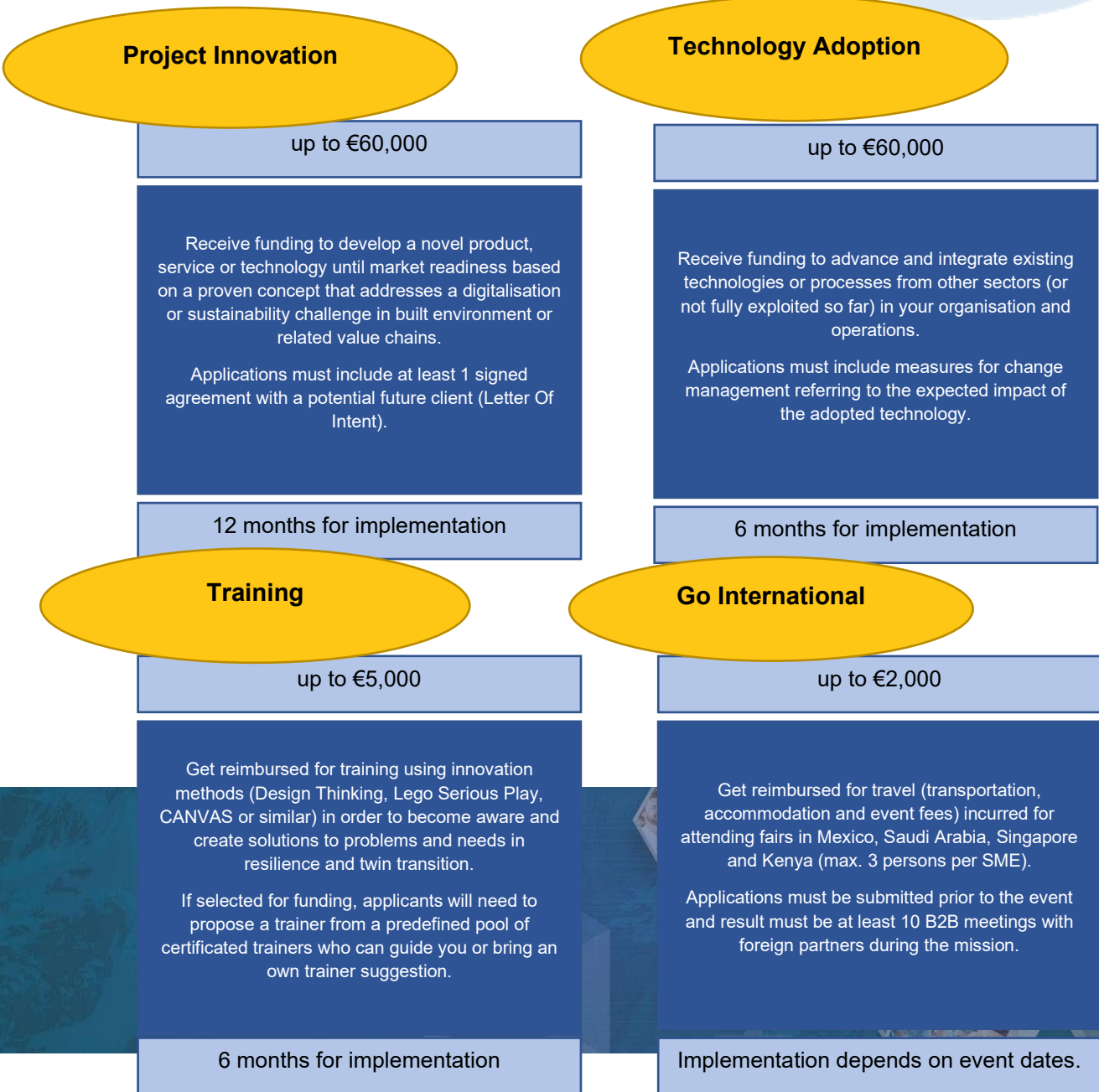
- Architecture, Engineering and Construction (AEC)
- Circular economy, Green building
- Advanced Building Materials, Bio based materials & 3D Printing
- Construction Robotics
- Workers` safety, Connected construction site
- BIM & Construction monitoring
- IT and related deep-tech if there is clear impact on built environment (AI, AR/VR, sensors, robotics, drones and other unmanned aerial vehicles, advanced materials, nanotechnology, photonics)

See annexes for description of the AEC subsectors.



3 / Which types of funding can you get?

- An SME is allowed to apply for different financial support schemes but can receive a maximum funding amount of €60,000 in total. SMEs have to fill a double-funding self-declaration to guarantee that same activities aren't funded by another support scheme. If this is the case, the SME has to inform the AEC EUROCLUSTER consortium within 7 days and has to choose one support scheme it intends to receive funding from. Further details will be determined in the SME Financial Support Agreement (SME-FSA) after a company is selected for funding.
- Only individual applications will be considered.
- Only one submission per company under the same financial support scheme is possible.



4 / What will be assessed?

Evaluation Process

Each application has to be written in English and will be assessed by **2 evaluators** from the AEC EUROCLUSTER consortium consisting of 5 construction-related clusters from Austria, Bulgaria, Italy, Romania, Slovenia and Spain.

At least one of the evaluators has to have **profound expertise** in the technical field of the application. To avoid any conflicts of interest evaluators aren't allowed to assess applications from the own home country. They will keep information strictly confidential regardless of whether an application is granted or not.

Reviewers will assess applications by scoring points (see Technical Evaluation Criteria) and will provide a **justification** of the total score. Both will be forwarded to the applicants. For detailed information on timeline, please see section 5 "How do you apply".

As per AEC Eurocluster Grant Agreement requirements, AEC EUROCLUSTER and other Eurocluster are obliged to assure that at least 10% of the supported SMEs will come from EU regions different from the countries of individual Euroclusters' partners. Specific attention needs to be paid to EU-13 countries in the calls and those EU regions with which the Euroclusters' partners had no previous cooperation and shall focus on engaging actors from regions with different levels of economic development.

A **panel discussion** by the AEC EUROCLUSTER consortium will be carried out to achieve a definite ranking, considering the following:

- If scoring results diverge significantly between reviewers for a given application
- In case of equal scores of proposals
- To assure obligations in regard 10% of the supported SMEs will come from EU regions different from the countries of individual Euroclusters' partners, and, to pay specific attention to EU-13 countries, focus on engaging actors from regions with different levels of economic development (see previous paragraph)
- An applicant is a member of a cluster, registered in ECCP platform.
- An applicant provided a 3-minute video presentation of the application.

Applicants have 15 days after notification of the evaluation outcome to file a complain in English, by contacting the following email aeceurocluster@sgg.si including the following obligatory information: contact details/email, subject of complain, information and evidence regarding the complaint. We will review your complaint within no more than seven calendar days from its reception. If we need more time to assess your complaint, we will inform you by email about the extension.

Please note that the evaluation is run by experts in the given field, and we do not interfere with their assessment, and we have to follow the AEC Eurocluster Grant

Agreement requirements, therefore we will not evaluate complaints related to the results of the evaluation other than related to the mistakes in the evaluation of the eligibility criteria.

First step: Eligibility Criteria

The evaluation is divided: first your application will go through a general **eligibility check** where **all** of the requirements below have to be fulfilled.

- SME status according to EU definition (see [here](#))
- Registered in one of the EU27 Members states or country participating in the Single Market Programme. Check the list of eligible SMP countries [here](#).
- Activities focused on one of the prescribed technical or industrial fields
- Self-declaration: Company isn't banned from EU funding and no support of any other EU programme was used to implement the respective activities.
- Registered at least 6 months before submission deadline

Second step: Technical Evaluation Criteria

In case your application passed the first step eligibility check, the technical evaluation follows. For objective assessment we developed a basic scheme. All or part of the criteria below will be assessed depending on the type of financial support you apply for:

- ✓ **Impact**
- ✓ **Concept**
- ✓ **Implementation**
- ✓ **Resources**
- ✓ **Company representation**

Your application will be reviewed based on the criteria prescribed per call, whereby evaluators rate points per criterion. The **minimum score per criterion** to be eligible for funding is 3 points. We would really like to get to know you beyond written text! Therefore, we would appreciate if you add a video to your application for project, technology, training or go international call. You won't receive extra points in the evaluation if you provide a video but it's additional information for evaluators to better understand the activities you plan to implement. The projects will be ranked based on the average score of both evaluators and projects with highest scores will be awarded for funding.

We intend to award at least:

- 5 individual SME beneficiaries for project innovation
- 11 individual SME beneficiaries for technology adoption
- 10 individual SME beneficiaries for training
- 20 individual SME for go international (max. 3 employees per company attending the mission)

The evaluation criteria are modified for assessing the 4 different types of financial support. For project innovation and technology adoption, the points assessed within the impact criterion are weighted by the factor 2 as AEC EUROCLUSTER aims to support SME activities with large positive effects on the targeted economic branches.

| Project Innovation evaluation criteria | | |
|--|--|---|
| Impact | <ul style="list-style-type: none"> • Overall impact of project for AEC sector • Industrial relevance of project • Quality of exploitation plans and market potential • Relevance of project to call objectives (digital and green transition & value chain resilience) | 5 points max Double weight = 10 points max! |
| Concept | <ul style="list-style-type: none"> • Technical feasibility • Level of innovation and technological risks • Technical capacity and expertise | 5 points max |
| Implementation | <ul style="list-style-type: none"> • Organizational and management competences • Clarity of roles and completeness of tasks • Quality of work plan | 5 points max |
| Resources | <ul style="list-style-type: none"> • Allocation of appropriate resources to the project • Justification of proposed resources | 5 points max |
| Video | <ul style="list-style-type: none"> • If video is attached | - |
| Maximum total | | 25 points |



Technology Adoption evaluation criteria

| | | |
|----------------------|---|---|
| Impact | <ul style="list-style-type: none"> • Overall economic impact of project for company • Increase of digital maturity/technology advancement • Clear description of process changes and improvements in the company and, if relevant, market impact of the project • Relevance of project to call objectives (digital and green transition & value chain resilience) | 5 points max Double weight = 10 points max! |
| Concept | <ul style="list-style-type: none"> • Company readiness to adopt the technology • Level of innovation and relevance for selected domains • Clear change management plan | 5 points max |
| Implementation | <ul style="list-style-type: none"> • Organisational and management competences • Clarity of roles and completeness of tasks • Quality of work plan | 5 points max |
| Resources | <ul style="list-style-type: none"> • Allocation of appropriate resources to the project • Justification of proposed resources | 5 points max |
| Video | • If video is attached | - |
| Maximum total | | 25 points |

Training evaluation criteria

| | | |
|----------------------------|---|------------------|
| Impact | <ul style="list-style-type: none"> • Overall impact of training for personnel, product or process • Positive effects of training results for company or market • Relevance of project to call objectives (digital and green transition & value chain resilience) | 15 points max |
| Concept and Implementation | <ul style="list-style-type: none"> • Level of innovation and ambition • Broadness of involvement of staff and/or partners | 10 points max |
| Video | If video is attached | - |
| Maximum total | | 25 points |

Addition: For quality assurance training is only eligible if it's implemented by a trainer with at least 2 years of professional experience with open innovation training in a business environment using Design Thinking, Lego Serious Play, CANVAS or similar methods. You can suggest a trainer already in your application. If you are awarded for funding and don't have a trainer in mind we will offer you access to our "pool of trainers", which is a selection of a least 2 trainers per AEC EUROCLUSTER partner country who fulfil the requirement.

| Go International evaluation criteria | | |
|--------------------------------------|--|------------------|
| Impact | <ul style="list-style-type: none"> • Overall impact of project for company and AEC sector • Quality of exploitation plans and market potential. • Relevance of project to call objectives (digital and green transition & value chain resilience) | 15 points max |
| Concept | <ul style="list-style-type: none"> • Level of innovation and technological risks | 5 points max |
| Company representation | <ul style="list-style-type: none"> • Profile relevance (languages, position in company) | 5 points max |
| Maximum total | | 25 points |



5 / How do you apply?

Timeline for Innovation project, Technology Adoption, and Training: From the start of the call to the start of your activities!



Timeline for Go International depends on the targeted trade fair in the application. The following trade fairs will open for application:



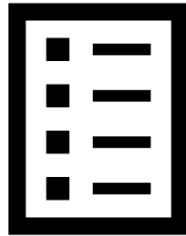
The deadlines for each or the targeted fairs and Go international mission implementation are presented in the table.

| | CIHAC October 2023 | The Big 6 Saudi February 2024 | Digital Construction Asia March 2024 | Build Expo Africa June 2024 |
|-------------------------|-----------------------|-------------------------------------|--|--------------------------------------|
| Open call published | 30.4.2023 | 30.4.2023 | 30.4.2023 | 30.4.2023 |
| Open call deadline | 30.8.2023 | 30.12.2023 | 30.1.2024 | 30.4.2024 |
| Beneficiaries selected | 15.9.2023 | 15.1.2024 | 15.2.2024 | 15.5.2024 |
| Funding contract signed | 30.9.2023 | 30.1.2024 | 29.2.2024 | 30.5.2024 |
| Mission implementation | October 2023 | February 2024 | March 2024 | June 2024 |

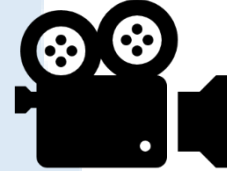


Application Documents

**Mandatory
application form**



**Optional
3-minutes video**



All applications have to be elaborated in English language after the call opening on 30/04/2023 for Project Innovation, Technology Adoption and Training support schemes at European Cluster Collaboration Platform, Funding & Tenders Portal, Enterprise Europe Network platform and AEC EUROCLUSTER coordinator's website <https://www.sgg.si/eng-aec-eurocluster/>. The call, Guide for Applicants, and application forms can be downloaded at AEC EUROCLUSTER coordinator's website <https://www.sgg.si/eng-aec-eurocluster/> when the call will be opened.

The version of the application form depends on the type of financial support you apply for but is always a **short template** with questions about your organisation and the lead applicant who is our main contact person. Besides the eligibility part you should also let us know more about your present business, the innovation you plan to develop or to adopt (further) and how you want to implement it. We would also like to see if you are member of a cluster, registered in ECCP (European Cluster Collaboration Platform).

Although the payment will be made as a lump sum (see 6 / Contracting procedure and payment scheme for lump sum definition), it is necessary to explain in the application form how the lump sum will be used, including a budget proposal with the following budget categories: Direct staff costs, Subcontracting costs, Purchase costs. Purchase cost can include travel and subsistence, equipment, other goods, works and services. All cost must be eligible according to Single Market Programme Financial rules which can be seen as Annotated Grant Agreement, available [here](#).

Last but not least every application needs to be completed by some attachments:

- For all support schemes: Current excerpt from commercial register (for eligibility check)
- For Project Innovation: At least 1 signed Letter of Intent from a potential customer (to proof market orientation)
- For Technology Adoption: At least one offer from a technology provider to proof cost of implementation

- For Go International application: no attachment is necessary but you should apply until the call deadline for the fair, one of the 4 pre-selected trade fairs you want to visit. Each SME has to attend at least 10 B2B meetings during the mission, which have to be described in a brief report to the AEC consortium afterwards.

The above listed attachments are necessary annexes to your application and will count towards general eligibility but won't be evaluated in a technical manner (therefore no evaluation points are foreseen for these attachments). Although it's not mandatory, we highly recommend to **add a video** of at max 3 minutes duration to your application. It helps reviewers to get to know you! It doesn't have to be professional work, just grab your smartphone and "ACTION"! 😊

Once the video is recorded, put it on a web-space (YouTube private video, Google Drive or Dropbox or similar) and include the link into your application form. It's up to you what you want to tell us, here some suggestions:



Tell us about the company and project team!



What are you planning to do with the financial contribution and what's unique about it?



What will be the positive impact in terms of digital and green transition in built environment?

Submission

To submit your application, please send:

- ✓ the application form, duly filled in, in Word or PDF format
- ✓ the necessary attachments (LOI for project innovation, technology provider offer for technology adoption, for all support schemes an excerpt from commercial register)
- ✓ *the video link (optional)*

to aeceurocluster@sqq.si.

Please make sure that we receive your e-mail with complete application documents between 30/04/2023 and 30/06/2023 for Project Innovation, Technology Adoption and Training support schemes; and on timeline dates for Go international scheme! You will get a notification that we received your application in time. Neither changes of application after submission nor submissions after deadline will be considered. All timely applications will be collected and after deadline distributed to the evaluators for review.

6 / Contraction procedure and payment scheme

Contracting procedure

For winning SMEs, SME Financial Support Agreement (SME-FSA) will be prepared and signed between applicant and AEC EUROCLUSTER coordinator, e.g. Construction Cluster of Slovenia. SME-FSA defines the rights and obligations that come with the financial support. It must be completed and duly signed no later than 30/9/2023 for Project Innovation, Technology Adoption and Training support schemes; and on timeline dates for Go international scheme. If SME fail to sign within this period, SMEs following the ranking order of evaluation scores will be offered a contract.

SME-FSA will define the provisions on SME project and activities implementation, including starting and end day of project, prepayment and condition for final payment. For Project Innovation and Technology Adoption, each supported SME will be accompanied by one AEC EUROCLUSTER partner as supervisor of the project implementation. He/she will regularly, at least at interim time, check the project status, implementation of the work program, and impact achieved. SME-FSA will define the provisions for actions in case of major underperformance of the project implementation observed by project supervisor.

Specific obligations

AEC EUROCLUSTER provides financial support to third parties. The beneficiaries of AEC EUROCLUSTER must ensure that their contractual obligations under Articles 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) of their GA also apply to the third parties receiving the support (SME recipients).

The beneficiaries must also ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the SME recipients.

The SME-FSA agreement with SME (e.g. third party recipients of financial support, SME beneficiaries) for the provision of AEC EUROCLUSTER funding which will define the following specific obligations.

CONFLICT OF INTERESTS: The SME beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the SME FSA Agreement could be compromised for reasons involving family, emotional life, political or national affinity, economic interest or any other direct or indirect interest ('conflict of interests'). They must formally notify the granting entity (AEC EUROCLUSTER) without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation. The granting entity (AEC EUROCLUSTER) may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

CONFIDENTIALITY AND SECURITY: The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action. If a SME beneficiary requests, the granting entity (AEC EUROCLUSTER) may agree to keep such information confidential for a longer period. Unless otherwise agreed between the parties, they may use sensitive information only to implement the SME FSA Agreement. The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only in specific situation defined in the SME-FSA.

The parties must handle classified information in accordance with the applicable EU, international or national law on classified information (in particular, Decision 2015/44417 and its implementing rules). Deliverables which contain classified information must be submitted according to special procedures agreed with the granting authority. Action tasks involving classified information may be subcontracted only after explicit approval (in writing) from the granting entity (AEC EUROCLUSTER). Classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

ETHICS AND VALUES: The action must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles. The SME beneficiaries must commit to and ensure the respect of basic EU values (such as respect for human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities).

VISIBILITY — European flag and funding statement: Communication activities of the SME beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded by the grant must acknowledge that actions are supported within AEC EUROCLUSTER and with EU support. SME beneficiaries must display the AEC EUROCLUSTER logo, Euroclusters` logo, the European flag (emblem) and the following disclaimer (translated into local languages, where appropriate): "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 EISMEA. Neither the European Union nor the granting authority can be held responsible for them."



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The EU emblem must remain distinct and separate and cannot be modified by adding other visual marks, brands or text.

SPECIFIC RULES FOR CARRYING OUT THE ACTION

GENERAL INFORMATION OBLIGATIONS: The SME beneficiaries must provide — during the action or afterwards and in accordance with record keeping obligations — any information requested in order to verify eligibility of the costs or contributions declared, proper implementation of the action and compliance with the other obligations under the SME-FSA. The information provided must be accurate, precise and complete and in the format requested, including electronic format.

The SME beneficiaries must immediately inform the granting entity (AEC EUROCLUSTER) of any of the following:

- events which are likely to affect or delay the implementation of the action or affect the EU's financial interests, in particular:
- changes in their legal, financial, technical, organisational or ownership situation (including changes linked to one of the exclusion grounds listed in the declaration signed before grant signature)

RECORD-KEEPING: The SME beneficiaries must — at least for a period of 5 years - keep records and other supporting documents to prove the proper implementation of the action supported. Beneficiaries must keep any adequate records and supporting documents to prove that their cost accounting practices have been applied in a consistent manner, based on objective criteria, regardless of the source of funding, and that they comply with the eligibility conditions.

The records and supporting documents must be made available upon request or in the context of checks, reviews, audits or investigations.

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the SME-FSA Agreement, the SME beneficiaries must keep these records and other supporting documentation until the end of these procedures. The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The granting authority may accept non-original documents if they offer a comparable level of assurance.

INTELLECTUAL PROPERTY RIGHTS (IPR): AEC EUROCLUSTER does not obtain ownership of the results produced under SME supporting schemes. 'Results' means any tangible or intangible effect of the action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights.

AEC EUROCLUSTER has the right to use non-sensitive information relating to the call, and materials and documents received from the SME beneficiaries for policy, information, communication, dissemination and publicity purposes — during the project implementation or afterwards.

COMMUNICATION, DISSEMINATION AND VISIBILITY: The SME beneficiaries must promote the project and its results via different communication channels they normally use in their business. The minimum requirements for communication are:

- Present the project (including project summary, coordinator contact details, AEC EUROCLUSTER logo, Euroclusters logo, and European flag and funding statement, and project results and impact achieved if applicable) on the SME beneficiaries' websites or social media accounts
- Upload the public project results to the Single Market Programme Project Results
- Participation in at least one AEC EUROCLUSTER networking event (online or physical).

Consequences of non-compliance

If a SME beneficiary breaches any of its obligations under SME-FSA and this chapter, the grant may be reduced. Such breaches may also lead to other measures described in General Model Grant Agreement (SMP MGA — Multi & Mono), which can be found [here](#).

Data Protection: In general, the AEC EUROCLUSTER project applies the rules within EU Regulation 2016/679 on GDPR. More specifically, each SME application contains personal and project data that is needed for the awarding process and will be kept strictly confidential by the AEC EUROCLUSTER consortium, which will also function as evaluators. To ensure secrecy, each partner signed a Non-Disclosure Agreement at project start in 2022. Application information will be stored internally and deleted after retention obligations of the AEC EUROCLUSTER consortium ends. Your data will be used only for project purposes (notification of submission, evaluation process, key account management by AEC EUROCLUSTER partners, reporting towards EU funding body). Beneficiaries will be presented to the public by success stories which will be developed together with the supported SMEs and need their approval before publication. Details will be determined in the individual SME Agreements after grant approval.



Payment scheme

AEC EUROCLUSTER financial support to applicants, e.g. SMEs, will be made as a fixed lump sum.

A lump sum is a fixed amount of money that beneficiaries, SME applicants, can use for several purposes related to achieving the project objectives, and or activities planned in the application. The granting of a lump sum does not foresee the delivery of detailed financial reporting and timesheets. The Final report review will assess the fulfilment of work plan, deliverables (outcomes), and impact achieved previously described in the application. Additional supporting documents may be requested, if deemed necessary, to evaluate the progress.

All lump sum financial support indicated in the application are limited to the prescribed maximum per support scheme:

- Project Innovation: max. 60,000€
- Technology Adoption: max. 60,000€
- Training: max. 5,000€
- Go International: max. 2,000€

One SME can receive by all AEC EUROCLUSTER calls a total maximum of 60,000€ of lump sum payments Only activities incurred from the starting date and along the duration of the action may be eligible for funding.

Although the payment will be made as a lump sum, the costs Direct staff costs, Subcontracting costs, Purchase costs (travel and subsistence, equipment, other goods, works and services) and the activities must be eligible according to financial rules of Single Market Programme (SMP) as described in the General Model Grant Agreement (SMP MGA — Multi & Mono). In case of doubt of eligibility of costs or activities, the SME applicant can check SMP MGA [here](#).

There will be a **pre-payment of 40%** approved lump sum financial support paid within 14 days after project start date stated in the individual SME-FSA agreement developed together with the AEC consortium after grant approval.

Within 30 days upon the end of supported actions in AEC EUROCLUSTER support scheme, the beneficiary must complete a Final Report. The template for the Final Report will be provided by the AEC EUROCLUSTER. After approval of the final report outlining the project results, the remaining 60% of the approved lump sum will be paid out within 14 days after report approval date.



For any questions regarding application, submission and evaluation of your proposal, you can reach us at aeceurocluster@sgg.si.

AEC EUROCLUSTER projects partners are also available for information:

- Austria: isabella.mantello@biz-up.at
- Bulgaria: mariana@ubbsla.org
- Italy: irene@csm.toscana.it
- Romania: office@clustertec.ro
- Slovenia: vladimir.gumilar@sgg.si
- Spain: gawel.walczak@secpho.org



Follow us on LinkedIn and stay updated!

<https://www.linkedin.com/showcase/aeceurocluster/>



Annex

Please find below the annexes:

1. Application form for Project Innovation and Letter Of Intent template
2. Application form for Technology Adoption
3. Application form for Training
4. Application form for Go International
5. Key sub-sectors of AEC ecosystem
6. FAQ (regularly updated)



ANNEX 1: Application form for Project Innovation

Grey marked information should assist you in providing information per category and can be deleted before submission.

| Organisation | |
|---|--|
| Name: | |
| Address: | |
| Website: | |
| Founding year: | |
| Current number of employees: | |
| Revenues in 2021 and 2022 if applicable: | |
| Self-Declaration: Is your organisation banned from EU funding? | YES / NO |
| Cluster membership of a cluster registered in ECCP | YES / NO, add name of the cluster and link to cluster presentation on ECCP (at https://clustercollaboration.eu/) |
| Lead applicant | |
| Name: | |
| Position in company: | |
| Email: | |
| Phone: | |
| Eligibility | |
| The company is an SME according to EU definition : <250 Employees AND < 50 million € Annual Turnover OR < 43 million € Total Balance Sheet | YES / NO |
| <p>Your activities focus on AEC, or one of the sub-sectors of the AEC ecosystem:</p> <ul style="list-style-type: none"> • Architecture, Engineering and Construction (AEC) • Circular economy, Green building • Advanced Building Materials, Bio based materials & 3D Printing • Construction Robotics • Workers safety, Connected construction site • BIM & Construction monitoring • IT and related deep-tech if there is clear impact on built environment (AI, AR/VR, sensors, robotics, drones and other unmanned aerial vehicles, advanced materials, nanotechnology, photonics) <p>See annexes for description of the AEC subsectors.</p> | |

| | | |
|---|--|----------|
| Self-declaration: Neither the application as a whole nor any parts of it have benefitted from other EU programmes for implementing respective activities | | YES / NO |
| Innovation | | |
| Title | | |
| Acronym | | |
| Duration | | |
| Planned Start Date | | |
| Brief summary | | |
| <i>Briefly describe your current business and how it is connected to your planned innovation.</i> | | |
| Impact | | |
| Describe your solution and the potential impact on the AEC sector. (1 point) | | |
| <i>What type of challenge does your project address and how does your solution respond to it? What changes does your technology bring into the sector? What type of companies are targeted as clients? Are there complementary and/or substitute products/services that would be affected by your innovation? Is there potential for further development?</i> | | |
| Describe the industrial relevance of the project. (1 point) | | |
| <i>Who benefits directly and indirectly? Who is targeted as clients and what are their main benefits – e.g. cost reduction or improved processes?</i> | | |
| Describe exploitation plan and market potential (2.5 points) | | |
| <i>Brief summary of business plan including go-to-market plan and financial projections. Make sure to identify relevant performance indicators and to specify starting and ending point for each if appropriate. Some possible indicators: number of Letters Of Intent from potential clients, cost reduction, process improvement, new partners, technical performance.</i> | | |
| Explain the relevance of the project to call objectives (0.5 point) | | |
| <i>Show how your project contributes to the call.</i> | | |

Describe how the gender dimension (i.e. sex and/or gender analysis) is taken into account in the project's content. If you don't consider gender as relevant in your project, please provide a justification.

Concept

Technical feasibility (2.5 points)

Describe technical details and demonstrate feasibility within the timeframe and resource constraint of the project.

Level of innovation and technological risk (1 point)

Demonstrate your project's level of innovation by comparing it with existing solutions and refer to substitute solutions if available. Identify technological risks and show how you would mitigate them.

Technical capacity and expertise (1.5 points)

Explain the company's capacity and expertise of technical staff in the field of the project including examples of relevant past projects.

Implementation

Organizational and management competences (1 point)

Clarity of roles and completeness of tasks (1 point)

Quality of work plan (3 points)

If applicable please present information on previous funding projects your company managed. Describe the project team with all roles, functions and knowledge. Add a work plan indicating tasks and responsible experts per work package.

Resources

Allocation of appropriate resources and justification (5 points)

Briefly justify the proposed budget and its allocation to cover various costs.

| Work Plan | | | | |
|--------------|-------------------|-------|-----|-------------|
| Work Package | Short Description | Start | End | Deliverable |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Deliverable is identifiable result, outcome of the work package, and not a written document produced.

| Resources | | | |
|---|----------------|-----------------|-------------|
| a. Personnel costs | | | |
| Personnel name | Costs per hour | Estimated hours | Total costs |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| b. Subcontracting costs and Purchase costs (travel and subsistence, equipment, other goods, works and services) | | | |
| Item | | Estimated costs | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total project costs: | | | |

The following attachments are included in email submission:

- Current excerpt from commercial register or other document needed for the eligibility check
- At least 1 signed Letter Of Intent of a potential customer (to proof market orientation)
- Link to video (please make sure it's available until 30/06/2023!)

Letter Of Intent: Template for Project Innovation

To: *Company Name and legal representative*

Dear Mr/Mrs.!

Following your presentation of / After analysing the documentation sent regarding your intention to develop [short description of the proposed technology / product],

our company [company name, registration number, VAT code, location, field of activity, total number of employees and total revenues in 2021 and 2022] expresses interest in testing / acquiring your technology / product if selected for funding by the European AEC EUROCLUSTER initiative, as soon as it is fully developed, but no later than September 2024 provided that it does meet the described characteristics and performance expectations.

The technology / product is interesting for us because

Our contact details:

Date:

Signed by General Manager

Signature

ANNEX 2: Application form for Technology Adoption

Grey marked information should assist you in providing information per category and can be deleted before submission.

| Organisation | |
|---|--|
| Name: | |
| Address: | |
| Website: | |
| Founding year: | |
| Current number of employees: | |
| Revenues in 2021 and 2022 if applicable: | |
| Self-Declaration: Is your organisation banned from EU funding? | YES / NO |
| Cluster membership of a cluster registered in ECCP | YES / NO, add name of the cluster and link to cluster presentation on ECCP (at https://clustercollaboration.eu/) |
| Lead applicant | |
| Name: | |
| Position in company: | |
| Email: | |
| Phone: | |
| | |
| Self-declaration: Neither the application as a whole nor any parts of it have benefitted from other EU programmes for implementing respective activities | YES / NO |

| Eligibility | |
|---|----------|
| The company is an SME according to EU definition : <250 Employees AND < 50 million € Annual Turnover OR < 43 million € Total Balance Sheet | YES / NO |
| <p>Your activities focus on AEC, or one of the sub-sectors of the AEC ecosystem:</p> <ul style="list-style-type: none"> • Architecture, Engineering and Construction (AEC) • Circular economy, Green building • Advanced Building Materials, Bio based materials & 3D Printing • Construction Robotics • Workers safety, Connected construction site • BIM & Construction monitoring • IT and related deep-tech if there is clear impact on built environment (AI, AR/VR, sensors, robotics, drones and other unmanned aerial vehicles, advanced materials, nanotechnology, photonics) <p>See annexes for description of the AEC subsectors.</p> | |
| Self-declaration: Neither the application as a whole nor any parts of it have benefitted from other EU programmes for implementing respective activities | YES / NO |
| Innovative Technology Adoption | |
| Title | |
| Acronym | |
| Duration | |
| Planned Start Date | |
| Brief summary | |
| <p><i>Describe your current business and how adopting the innovative technology will improve it. How will you implement the project? Give some brief details on the change management plan.</i></p> | |
| Impact | |
| <p>Describe the technology you intend to adopt and the expected impact on your company. (1 point)</p> <p><i>How do the foreseen changes impact your operations / products / services? Does it affect clients, employees, costs, income, profitability and if so, how? Are there other types of impact?</i></p> | |

Increase of digital maturity and/or technology advancement of the company. (1point)

Compare between your company's present level of digital / technological maturity and the level it will have after project implementation. If applicable, offer quantifiable figures related to e.g. number of employees using technology or % of activities in a department now and after the project.

Clear description of process changes, improvements and market impact if relevant (2.5 points)

If appropriate, include process mapping before and after the project for operations to be affected by the project. If the technology refers to product improvement, compare technical performance and describe how this change impacts the company's market. Please include relevant figure.

Explain the relevance of the project to call objectives. (0.5 points)

Show how your project contributes to the call.

Describe how the gender dimension (i.e. sex and/or gender analysis) is taken into account in the project's content. If you don't consider gender as relevant in your project, please provide a justification.

Concept

Company readiness for technology adoption (2 points)

Why is it the right time for the company to adopt the new technology? Present some analytical insights that state that you are ready and that it can positively affect your economic performance.

Level of innovation and relevance for selected domains. (1 point)

Demonstrate your project's level of innovation by comparing it with existing solutions. Show how your technological advancement contributes to the objectives of the call.

Change management plan (2 points)

Briefly describe the change management plan including follow-up measures after project end. Show all stakeholders involved in the change process within or outside the project framework. Which departments are affected by the change and how will they be integrated to ensure proper adoption?

Implementation

Organizational and management competences (1 point)

Clarity of roles and completeness of tasks (1 point)

Quality of work plan (3 points)

If applicable please present information on previous funding projects your company managed. Describe the project team with all roles, functions and knowledge. Add a work plan indicating tasks and responsible experts per work package.

Resources

Allocation of appropriate resources and justification (5 points)

Briefly justify the proposed budget and its allocation to cover various costs.

Work Plan

| Work Package | Short Description | Start | End | Deliverable |
|--------------|-------------------|-------|-----|-------------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Deliverable is identifiable result, outcome of the work package, and not a written document produced.

Resources

a. Personnel costs

| Personnel name | Costs per hour | Estimated hours | Total costs |
|----------------|----------------|-----------------|-------------|
| | | | |
| | | | |

| | | | |
|--|--|-----------------|--|
| | | | |
| | | | |
| b. Subcontracting costs and Purchase costs (travel and subsistence, equipment, other goods, works and services) | | | |
| Item | | Estimated costs | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total project costs: | | | |

The following attachments are included in email submission:

- Current excerpt from commercial register or other document needed for the eligibility check
- At least one offer from a technology provider to proof cost of implementation
- Link to video (please make sure it's available until 30/06/2023!)

ANNEX 3: Application form for Training

Grey marked information should assist you in providing information per category and can be deleted before submission.

| Organisation | |
|--|--|
| Name: | |
| Address: | |
| Website: | |
| Founding year: | |
| Current number of employees: | |
| Revenues in 2021 and 2022 if applicable: | |
| Self-Declaration: Is your organisation banned from EU funding? | YES / NO |
| Cluster membership of a cluster registered in ECCP | YES / NO, add name of the cluster and link to cluster presentation on ECCP (at https://clustercollaboration.eu/) |
| Lead applicant | |
| Name: | |
| Position in company: | |
| Email: | |
| Phone: | |
| Eligibility | |
| The company is an SME according to EU definition : <250 Employees AND < 50 million € Annual Turnover OR < 43 million € Total Balance Sheet | YES / NO |
| Your activities focus on AEC, or one of the sub-sectors of the AEC ecosystem: <ul style="list-style-type: none"> • Architecture, Engineering and Construction (AEC) • Circular economy, Green building • Advanced Building Materials, Bio based materials & 3D Printing • Construction Robotics • Workers safety, Connected construction site • BIM & Construction monitoring • IT and related deep-tech if there is clear impact on built environment (AI, AR/VR, sensors, robotics, drones and other unmanned aerial vehicles, advanced materials, nanotechnology, photonics) | |

| | |
|---|----------|
| See annexes for description of the AEC subsectors. | |
| Self-declaration: Neither the application as a whole nor any parts of it have benefitted from other EU programmes for implementing respective activities | YES / NO |
| Presentation | |
| <i>Describe your current business and your product/service USP! What's your target market and who are your customers?</i> | |
| <i>Describe how the gender dimension (i.e. sex and/or gender analysis) is taken into account in the project's content. If you don't consider gender as relevant in your project, please provide a justification.</i> | |
| Training | |
| In which field do you want to gain more resilience? | |
| <input type="radio"/> Personnel <input type="radio"/> Product <input type="radio"/> Process | |
| <i>What type of challenge does your training proposal address? How is it connected to digital or green transformation? To what extent do your training plans match the call objectives? What results do you want to achieve with training and how do you want to use them afterwards? Will training results affect markets and customers and/or internal processes and employees? Who benefits directly and indirectly? (15 points)</i> | |
| <i>Show why your training proposal is on the one hand innovative and ambitious and on the other hand also feasible within the timeframe of 6 months. Do you want to involve staff or other partners in the training e.g. producers, suppliers, recruiters? (10 points)</i> | |

The following attachments are included in email submission:

- Current excerpt from commercial register or other document needed for the eligibility check
- Link to video (please make sure it's available until 30/06/2023!)

Note: We are pleased to help you in finding a qualified trainer in case you are selected! If you already have one in mind – great, please put your suggestion in the application! For being eligible please make sure that he or she has at least 2 years of professional experience with open innovation training in business environment using Design Thinking, Lego Serious Play, CANVAS or similar methods!

ANNEX 4: Application form for Go International

Grey marked information should assist you in providing information per category and can be deleted before submission. You can participate in the following trade fairs. Not depending on how many persons of your organisation you send to a fair (max. 3), one company can receive max. 2,000€ of funding for one mission. Each SME has to meet at least 10 foreign business partners during the mission.



| Organisation | |
|--|--|
| Name: | |
| Address: | |
| Website: | |
| Founding year: | |
| Current number of employees: | |
| Revenues in 2021 and 2022 if applicable: | |
| Self-Declaration: Is your organisation banned from EU funding? | YES / NO |
| Cluster membership of a cluster registered in ECCP | YES / NO, add name of the cluster and link to cluster presentation on ECCP (at https://clustercollaboration.eu/) |
| Lead applicant | |
| Name: | |
| Position in company: | |
| Email: | |
| Phone: | |
| Person(s) attending mission | |
| Person 1 | Name: Position in the company: |

| | | |
|---|---|----------|
| | Language(s): | |
| Person 2 (if any) | Name: Position in the company: Language(s): | |
| Person 3 (if any) | Name: Position in the company: Language(s): | |
| Eligibility | | |
| The company is an SME according to EU definition : <250 Employees AND < 50 million € Annual Turnover OR < 43 million € Total Balance Sheet | | YES / NO |
| <p>Your activities focus on AEC, or one of the sub-sectors of the AEC ecosystem:</p> <ul style="list-style-type: none"> • Architecture, Engineering and Construction (AEC) • Circular economy, green building • Advanced Building Materials, Bio based materials & 3D Printing • Construction Robotics • Workers' safety, Connected construction site • BIM & Construction monitoring • IT and related deep-tech if there is clear impact on built environment (AI, AR/VR, sensors, robotics, drones and other unmanned aerial vehicles, advanced materials, nanotechnology, photonics) <p><i>See annexes for description of the AEC subsectors.</i></p> | | |
| Double funding self-declaration: Neither the application as a whole nor any parts of it have benefitted from other EU programmes for implementing respective activities. | | YES / NO |
| Impact & Concept | | |
| <i>Which trade fair do you want to attend?</i> | | |
| <i>What's your company's core business and how do you differentiate from others? What's the impact of internationalisation for your company? Do you already have experience with international partners and/or markets? Tell us about your exploitation plans and why your selected trade fair could help here. Briefly describe the relevance of the project to digital and green transition and/or value chain resilience. (15 points)</i> | | |
| <i>Describe the impact the project will have for the AEC sector on international level. What's innovative about your planned activities? (5 points)</i> | | |

Describe how the gender dimension (i.e. sex and/or gender analysis) is taken into account in the project's content. If you don't consider gender as relevant in your project, please provide a justification.

The following attachments are included in email submission:

- Current excerpt from commercial register or other document needed for the eligibility check
- Link to video (please make sure it's available until the deadline for particular trade fair!)

ANNEX 5: Key sub-sectors of AEC ecosystem

Circular Economy, Green building

The construction industry accounts for about 50% of our total use of raw materials. Furthermore, the built environment is responsible for 40% of CO₂ emissions and 36% of energy consumption. Addressing these impacts through circular and climate neutral development is thus crucial.

According to the circular economy principles for buildings design, prepared by the EC, the principles are divided on:

1. Overall principles

- a. Design principles of circular economy and sustainable buildings are applicable to all actors along the value chain.**
 - i. Engage with all actors along the value chain, including building users, investors and regulators.
 - ii. Promote understanding and use of existing standards, schemes and examples that enable a more holistic design and adjust business models for including circularity in construction;
 - iii. Apply ISO standards for DfD/A (ISO20887) and Levels(s), as well as pre-development audits and other guidance.
- b. Sustainable choices must take into account total life cycle costs, financial and non-financial return on investments.**
 - i. Actors along the value chain respond above all to financial incentives and these need to be tailored to each situation.
 - ii. Look at the financial aspects through a whole life cycle perspective and therefore do a cumulative cost calculation taking into account costs, revenues and residual value;
 - iii. Consider scenarios in which estimated costs for new materials, furniture and waste elimination are significantly higher than the actual costs, and in which certain elements could be sold for reuse and/or recycling.
- c. Viable business models must exist or be developed for each economic operator in the supply or value chain.**
 - i. A reliable marketplace for used products and materials must exist or be created.
 - ii. A favourable legislative environment, incentives from public decision-makers (e.g. public procurement), innovative and circular businesses as well as financial models, must be put in place to ensure a long term vision and support building owners' decision-making;
 - iii. Innovative circular business models such as "take-back business models" or "product as a service business models" can offer interesting solutions for some products and systems.
- d. Principles need to be applied taking into account proportionality - benefits should outweigh the costs.**

- i. It is important to consider the burden and costs for operators to follow these principles.
 - ii. Operators should prioritise those principles which are most relevant and generate the highest benefits and lowest costs;
 - iii. Externalities should be taken into account when assessing costs and benefits.
 - e. **Better knowledge is needed about construction techniques to facilitate deconstruction and to enhance durability and adaptability of a building.**
 - i. In all parts of the value chain, workers need to have the right skills and incentives to apply this knowledge and use the appropriate tools.
 - ii. Designers and project managers should ensure safety and consider the feasibility of demolition/renovation for the workers;
 - iii. Allocate specific funds for the upskilling of workers;
 - iv. Integrate deconstruction techniques into apprenticeship schemes.
- 2. Durability**
- a. **Durability of buildings depends on better design, improved performance of construction products and information sharing.**
 - i. Structural elements should last as long as the building does, whenever possible. If it is not possible because of intrinsic obsolescence or anticipated change in requirements (e.g. IT infrastructure), they should be reusable, recyclable or dismountable.
 - ii. Favour construction systems that incorporate circular economy thinking. For instance, enable systems to be easily maintained, repaired and replaced as this will prolong the life cycle of buildings;
 - iii. Ask for detailed information from providers and designers on products, materials and the design of the buildings. Conserve, update and share the information so that it can remain valid and relevant during the whole life cycle of the building.
- 3. Adaptability**
- a. **Prevent premature building demolition by developing a new design culture.**
 - i. Anticipate changes in requirements;
 - ii. Enable adaptations and transformations of the building for better use and reuse, new ways of using it, and prepare for the end-of-life and future lives of the building and its components.
- 4. Reduce waste and facilitate high-quality waste management**
- a. **Design products and systems so that they can be easily reused, repaired, recycled or recovered.**
 - i. When recycling, it is preferable that products and systems should be upcycled, too.
 - ii. Make use of easy to dismount elements and products;
 - iii. Prescribe in procurement contracts that waste should be separated on site to facilitate recycling;
 - iv. Use simple and recyclable products.

According to the circular economy principles for buildings design, prepared by the EC, all participants (target groups) in the building value chain must take those principles into account. Target groups in the value chain are defined as:

- Target group 1: Building users, facility managers and owners
- Target group 2: Design teams (engineering & architecture of buildings)

- Target group 3: Contractors and builders
- Target group 4: Manufacturers of construction products
- Target group 5: Deconstruction and demolition team
- Target group 6: Investors, developers and insurance providers
- Target group 7: Government / Regulators / Local authorities

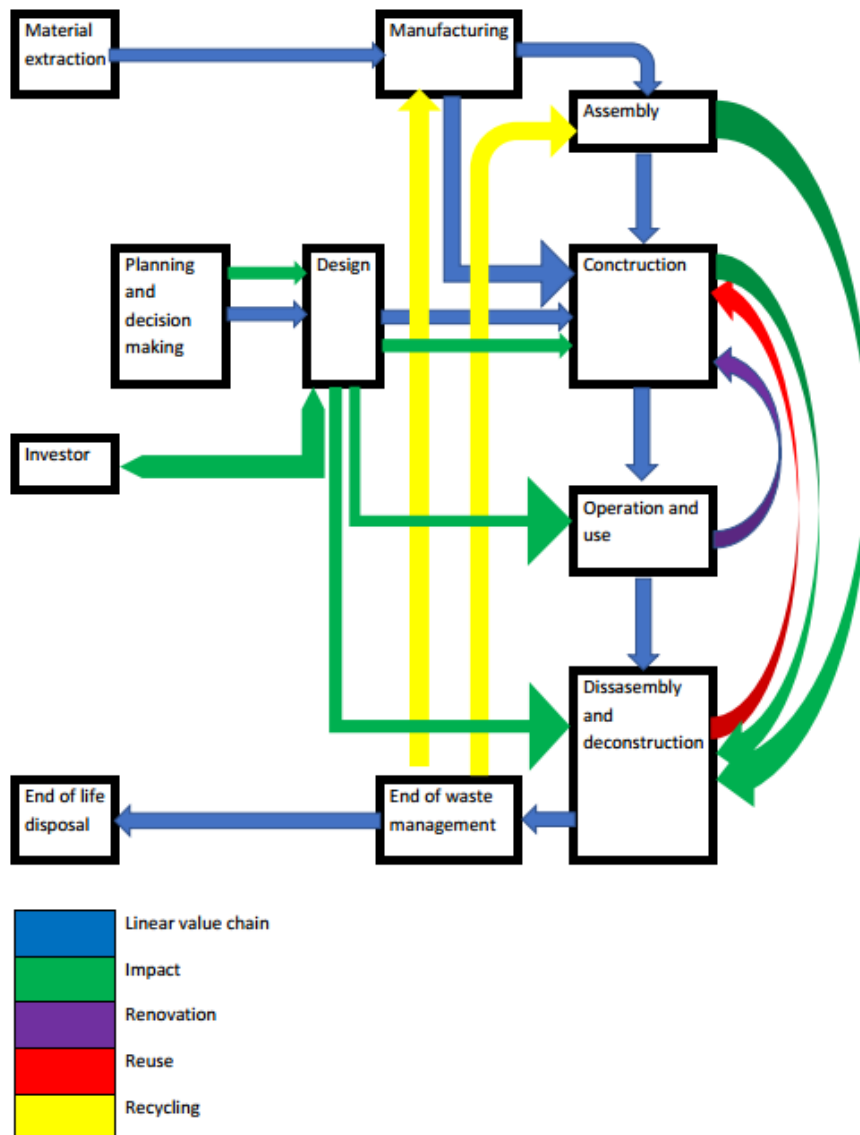


Figure 1: Circular economy value chain in construction sector

According to the International Conference on Circularity in the Built Environment, topics of the Circularity in the Built Environment include:

CDW Recycling Technologies and sustainable construction materials:

- Recycled Concrete;
- Circular Concrete;
- Recycled Cementitious Materials;
- Recycled Aggregates;
- C&DW for Alkali Activated Materials (Geopolymer);
- Alternative Raw Materials;

- Bio-Based Materials;
- Innovative Use of Recycled Building Materials;
- Performance and Durability of Recycled Building Materials and Recycled Products.

Digitalization & Circularity:

- Digital Construction;
- Concrete 3D Printing (C3DP);
- Material Passports;
- Smart Construction Materials;
- Value Creation by Digitalisation;
- Building Information Modeling (BIM).

Circular Design:

- Design for Value
- Sustainable Structural Design;
- Enabling Circular Product Design and Facilitating the Reuse of Building Materials;
- Deconstruction;
- Transformable and Reversible Building Design.

Circular Management:

- Resource Efficiency;
- C&DW Management;
- Life Cycle Assessment;
- Life Cycle Costing;
- Life Cycle Management;
- Risks & Health Safety in C&DW Management;
- Development of Circular Economy Business Models;
- Impacts of the transition to the Circular Economy in the Built Environment.

Standards, Policy Legislation:

- Quality Control of Recycled Building Materials from C&DW;
- Reverse Logistics & Circular Value Chain in Constructions;
- End of Waste;
- Circular Policy-making and Procurements.

Circular Design from Product to Cities:

- Circular Cities and Regions;
- Circular Buildings;
- Circular Infrastructures;
- Implementing Circularity in the Built Environment.

In order to better understand the principles of circularity in circular design, it is necessary to know the principles of circular design in relation to the technological and biological cycle.

Circular design strategies

1. Technical cycles
 - a. Slowing flow
 - i. Design for maintenance
 - ii. Design for reuse
 - iii. Design for refurbishing
 - iv. Design for remanufacturing
 - b. Closing flow
 - i. Design for upcycling
 - ii. Design for recycling
 - c. Narrowing flow
 - i. Design for resource efficiency (material)
 - ii. Design for resource efficiency (energy)
2. Biological cycles
 - i. Design for cascade use
 - ii. Design for biodegradation

And last but not least, in connection with circularity, it is also necessary to know various circular business models, such as:

1. Access and performance model
2. Extending product value
3. Classic long life model
4. Encouraging sufficiency
5. Extending resource value
6. Industrial symbiosis

Advanced building materials, bio based, 3D printing

Advanced building materials

A series of innovative materials play now a key role in the construction sector taking step by step the place of more traditional ones such as wood, concrete, bricks...

Advanced materials offer different advantages from eco-friendly manufacturing to sleek contemporary designs.

A list of most known advanced materials follows:

3D Printed Graphene

Graphene is a strong, lightweight material used often in microchips and sensors. Several researches have also proved that adding graphene can enhance the strength of a material. Unfortunately, it is expensive and hence, it has not been widely used despite its capabilities. However, researchers have now managed to develop 3D-printed graphene using graphene oxide hydrogel as the resin for the printer. This, however, is not a final product. 3D-printed graphene can be used to reinforce concrete.

Light Generating Concrete

Light-generating concrete or cement is non-flammable and able to reflect light, hence the name. This material is also known to absorb solar energy to 'charge' and emit light in the dark. Proven to be energy efficient, it has been used to illuminate bicycle lanes and roads in Mexico, where its research took place. As it is quite similar to the regular cement already in use, it can find application in the construction of many other structures like facades and parking lots.

Cross-laminated timber

Cross-laminated timber is a type of mass timber (man-made or engineered wood) that is binded in layers. As the name suggests, cross-laminated timber is developed in planks by gluing timber pieces in layers, each layer being perpendicular to the previous. CLT is known for its strength as well as for being lightweight. It is easy and quick to construct with CLT since it can be manufactured off-site and assembled on-site. Using CLT alongside technology that provides precise drawings and models, like [BIM \(Building Information Modelling\)](#), can reduce waste and labour needed for construction.

Self-healing materials

We have evolved from using traditional materials such as timber to using concrete as a construction material so frequently that we now live in a concrete jungle. Researchers have been developing the next stage of concrete for construction to counter its vulnerability to cracks. Yes, nothing lasts forever, but with the right materials, we may just be able to extend the lifespan of our built environments. That is, indirectly speaking, the purpose of self-healing materials including concrete; fibres or natural capsules that release an adhesive substance are added to the concrete mix, which then heals the cracks.

Strand rods

Strand rods are manufactured using carbon fibre composites in both synthetic and inorganic fibres and thermoplastic resin. It has been developed and tested in Japan to create a lightweight seismic reinforcement system. It is much lighter than metal rods of the same length and strength while being equally effective. As the lightest seismic reinforcement, it has high tensile strength and is also aesthetically pleasing. The first use of such material can be seen in the facade of Kengo Kuma's work for Komatsu Seiren's head office.

Carbon fiber

Made of thin carbon strands woven together for a fabric-like composition, carbon fiber is generally considered to be an alternative to steel that is lighter and stronger.

Some of these fabrication techniques rely on generative design methodology and tools.

Translucent wood

Through research and innovation, we now have translucent wood that is almost 90% clear. The wood is made translucent with the aid of a chemical that strips away its colour while keeping many of its natural properties intact. It is said to be energy efficient and has the potential to be a good alternative to glass and plastic as it is renewable and has low thermal conductivity.

Transparent aluminium

This material has been hailed as a material of the future, having been featured in the 1986 Star Trek movie! The difference between the movie version and the real material we have now is that in the movie, transparent aluminium is made of pure elemental aluminium while in the real-world transparent aluminium is a ceramic alloy. Extremely durable and believed to be resistant to corrosion and oxidation, it is already in use as bulletproof glass and in other security systems. The downside is that it is expensive, much more than normal bulletproof glass. However, when the price drops, we can expect a far wider use of this wonder material for windows, facades, or even underwater structures. It may just turn out to be the cost-effective and long-lasting material our construction industry needs today.

Bio-based materials

Besides its significant demand for energy, the built environment is also a large consumer of material resources.

These are mostly minerals (rocks, gravel, and sand), metals, and fossil oils used for plastic manufacturing. In developed economies such as the EU27, the construction sector is the largest single consumer of metals and uses more minerals than all other industrial sectors combined. Indeed, minerals are essential for the modern building: from concrete, to bricks and stones, to glass, plaster and ceramics. But although they are abundant materials, they are not renewable and often require invasive and polluting processes for their extraction.

In the effort to reduce the environmental impact of construction, **researchers and designers have turned their attention to biobased alternatives**. Biobased materials are organic resources produced by plants and animals, such as timber or sheep's wool. In the context of construction, biobased materials can have several benefits over conventional ones:

- They are renewable and can be sustainably produced over the long-term;
- They can naturally absorb carbon from the atmosphere during cultivation, thus positively contributing to climate change mitigation;
- They promise performance gains in terms of moisture absorption and breathability;
- They are generally less harmful to people and the natural environment in terms of pollutant emissions;
- They can be disposed of more easily and sustainably at their end of life.

Traditional and vernacular architecture across the world has always made large use of biobased materials available in the local environment. Nomadic peoples often relied on shelters made entirely of biobased materials, such as the Native American tepee or the Mongolian yurt. As humans adopted a more settled and sedentary way of life with the development of cities, architecture came to favour a wider range of minerals. Culturally, we have learned to associate bricks and mortar with stability, safety and prestige.

The term biomaterials is used to describe building materials derived from living organisms including plants, animals and fungi.

Plant-based materials are becoming increasingly popular among designers and architects due to their environmental performance.

This is because they offer cruelty-free production, are usually biodegradable and store CO₂ during their useful lifetime, thereby lowering the embodied carbon footprint of buildings and products.

Some, like wood and hemp, can be used in their raw state while others such as algae, mycelium and food waste are generally mixed with other materials to be turned into useful composites.

Architects could "definitely" construct buildings completely out of biomaterials according to Biobased Creations CEO Lucas De Man, who believes that timber, hemp and mycelium could replace non-renewable materials like steel, plasterboard and cement.

Sequestering carbon is an important way to tackle climate change. Plant matter including algae, timber and hemp capture carbon from the atmosphere and transform it into biomass via photosynthesis.

Hemp is a type of cannabis plant that is grown for medicinal and industrial use. Unlike marijuana, it has very low levels of psychoactive THC.

Hemp grows extremely quickly and is "more effective than trees" at sequestering carbon, according to Cambridge University researcher Darshil Shah.

The plant's strong, stiff fibres can be processed into a variety of commercial goods including paper, textiles, bio-plastic, food and bio-fuel as well as industrial and construction products.

An example of hemp used in buildings is [Flat House in Cambridge](#) which was constructed using hempcrete panels.

Mycelium is the vegetative part of a fungus, made up of masses of branching, threaded shoots called hyphae that grow in soil.

The material can feed on low-grade agricultural waste and sequesters carbon stored in the biomass as it grows. Mycelium is fast-growing and can be cultivated in industrial bioreactors.

Algae is an umbrella term for a group of photosynthetic organisms that mainly live in water. This includes seaweeds and kelp, which are the most important sources of oxygen in water and together are responsible for storing and sequestering more carbon than land plants.

Algae is often processed into bioplastic polymers, which can then be used as a replacement for fossil plastics.

Chitin is a fibrous substance that forms the exoskeleton of crustaceans and certain insects, as well as the cell walls of fungi.

The material is the world's second-most abundant biopolymer. But to use chitin, it must be chemically extracted before being processed into a useable material.

Due to the difficult extraction process, commercially available versions of chitin such as chitosan are typically expensive.

Wood is a renewable material that offers a low-carbon alternative to concrete and steel. Due to its highly machinable, lightweight structural tissue, which is strong yet flexible, wood has historically been used to construct furniture and products as well as small houses.

Recent advances in engineered timber, also known as mass timber, has allowed the material to be used at larger scales, with [Voll Arkitekter building](#) the world's tallest timber building, a 53-metre-high tower in Norway.

Although commonly mistaken as a type of tree, **bamboo** is actually a grass. Bamboo is the fastest growing plant on the planet, making it both affordable, rapidly renewable and capable of sequestering large amounts of carbon.

Its canes lend themselves to creating light, flexible structures that can resist natural disasters such as earthquakes and hurricanes.

Bioplastics are polymers derived from biological and renewable sources as opposed to plastics made from fossil fuels.

Polylactic acid (PLA) is the most common bioplastic. It is typically made using corn starch or sugar cane. PLA is widely used as printable filament in 3D printers, where PLA filament is fed through the printer and melted at high temperatures to create a malleable substance that is printed into the desired form.

Linoleum is a biodegradable material made from plant-based materials including linseed oil, pine resin, cork dust and sawdust. The material is typically used as a floor covering due to its durable and resistant characteristics.

The material was first patented in 1860 when rubber manufacturer, Fredrick Walton discovered linseed-based paint formed a tough and flexible film on its surface. Most

Linoleum today is derived from linseed oil, which is extracted from flax seeds and then mixed with materials such as cork and wood dust.

Cork, which is gathered from the outer bark of the cork oak tree is a popular material among designers and architects due to its compostable and easily harvestable qualities. [Cork House](#) used sustainably-sourced, cork blocks to build its five-volume structure which was supported by timber components.

Straw is an agricultural by-product that is comprised of the dry stalks of cereal plants after the grain has been harvested. The material is often used in construction and offers homes a renewable, biodegradable form of insulation. LCA Architetti used straw as insulation within the walls of [The House of Wood, Straw and Cork](#).

Cellulose is a structural compound typically found within the cell walls of green plants, the material can be extracted from a variety of plants including trees, often being used to create fibres. Swedish label Kön produced a range of gender-neutral underwear that was made from plant-based cellulose.

Barcelona-based startup Hontext developed a construction board material that is derived from a combination of enzymes and cellulose sourced from waste streams of paper production. The fibres are saved from going to landfills or being burnt and turned into construction boards to be used for interior partitioning or cladding.

3D printing

The beginning of the use of 3D printing in construction can be traced back to the experiment of Professor Behrokh Khoshnevis of the University of South Carolina who, in 2004, attempted to 3D print a wall for the first time. Since then, this innovation has exploded and it is now possible to build a house in as little as 20 hours! The professor has developed an FDM 3D printer, mounted on a robotic arm, that extrudes layers of concrete instead of layers of plastic to create a 3D model.

Contour Crafting technology has proven to have all the qualities needed for the use of additive manufacturing on construction sites: reduced costs and waste, increased construction speed, reduced accidents, complex architectural shapes and much more. His discovery marked the beginning of 3D printing in construction. However, it remains much less used than certain sectors such as aeronautics or medical.

Construction giants are rapidly realizing the potential of 3D technologies and their possible impact on the future of construction. The concrete 3D printing market is projected to reach \$56.4m in 2021, and for good reason. More and more companies are stepping up in the industry to create new innovative designs. Some are more futuristic, others are very concrete in the present, like the 3D printed house by [Apis Cor](#) in 24 hours. 3D printing for concrete is developing rapidly and relies on different technologies and materials, offering numerous advantages to its users. However, the technology is still in its infancy and is forced to respect its current limits.

Major technologies used

Robotic arms

The [Contour Crafting](#) method involves depositing the build material to create a large-scale 3D model with a smooth surface finish. Rails are installed around the building

area which will act as a structure to direct the robotic arm. The latter moves back and forth to extrude the concrete, layer by layer. Trowels placed on the side and above the nozzle to flatten the extruded layers and ensure the strength of the model.

Conventional concrete cannot be used in this process as it would need to harden before continuing in the process. If it were 3D printed, therefore, it wouldn't be able to support its own weight. Then, a quick-setting cement is used.

Contour Crafting (a company of the same name as the method) is very discreet about its progress. However, Chinese construction company [WinSun Decoration Engineering Co](#) describes it as capable of "stealing the show". These machines are huge (32m long, 10m wide and 6.6m high). This allows them to 3D print entire structures and assemble them on site. To do this, concrete and fiberglass are mixed on site and then printed. This introduced additive manufacturing to many builders and construction workers.

The different players on the market have developed machines that employ various different technologies for 3D printing concrete. French firm [Constructions-3D](#) has created a polar 3D printer that prints inside the construction site and walks out the front door of the building once construction is finished. It consists of a mechanical base and a robotic arm with a nozzle for extruding material at one end. This arm offers a printable area of more than 250 m² and more than 8 meters in height.

Cazza Construction's robot looks something like this, with a mobile crane system that allows it to 3D print a much larger area and create bigger and taller structures. This is evidenced by past prints from companies like Apis Cor and XtreeE, which quickly create entire houses.

Other companies have specialized in the extrusion of materials other than concrete with this technology. The patented process of BatiPrint 3D is an obvious example: the University of Nantes, Bouygues Construction and Lafarge Holcim have joined forces to develop an industrial robot that prints 3 layers of material at a time. Two of these layers are a polymeric foam and the third is concrete. Benoit Furet, professor at the University of Nantes explains "the foam guarantees internal and external insulation, the concrete and the reinforcement the anti-seismic load-bearing structure".

An easy to use 3D printing, a multi size and mobile 3D House concrete printers using Fused Deposition Modelling (FDM) are being developed by Interlab d.o.o. under the trade mark BetAbram (<https://www.youtube.com/watch?v=q0QbyW7xCZw>) in Slovenia. Different sizes of printers can be developed, from 3x4 m to 9x16m or larger on request.

Layers of sand

Italian architect Enrico Dini first made headlines as "the man who 3D prints houses". He recently showcased an interesting 3D printing process with his "D-Shape" 3D printer. This machine relies on powder binding which makes it possible to solidify a layer of material with a binder. Layers of sand are deposited to the desired thickness before a print head pours drops (the binder) to harden the sand. This 4 x 4 meter machine is capable of creating large structures up to 6 cubic meters in size.

Solid metal structures

Dutch company MX3D has developed a unique construction method called WAAM (Wire Arc Additive Manufacturing), which allows you to 3D print metal structures with a 6-axis robot that lays down 2 kilos of material per hour.

This robot is the result of collaboration with Air Liquide and ArcelorMittal and is equipped with a welder and a nozzle to weld metal rods layer by layer. This process is also compatible with other metal alloys such as stainless steel, bronze, aluminum and Inconel. The machine may resemble some kind of gigantic soldering iron. The team commented: "We combined an industrial robot and a welding machine to turn them into a 3D printer that runs on our software."

Advantages of 3D printing in construction

In terms of material usage, 3D printing is cost effective with additive rather than subtractive processes, using fewer materials than traditional manufacturing processes. This reduces the environmental impact, as less waste is produced. Romain Duballet, one of the co-founders of XtreeE, explains, "with a greater mastery of the geometries, we can build shapes optimized to limit the amount of materials used".

However, there are still reserves to the dream of 3D printing houses, bridges and skyscrapers. Axel Thèry of Constructions-3D explains that "the main difficulties arise from the fact that the process of 3D printing buildings is not currently a construction method recognized by many codes and standardization bodies. Because printed structures are non-traditional, strength and durability calculations are difficult to make. This is why the housing solutions created will have to be tested on a case-by-case basis at the outset". Standards bodies are concerned that these structures are really robust and able to withstand their environments.

Because printed structures are non-traditional, strength, durability, and also earthquake resistance calculations are difficult to make. This is why the 3D housing solutions created will have to be tested on a case-by-case basis at the outset and number of R&D projects need to be done, in collaboration with research institutes, testing and certification bodies. The standards and technical specifications for this technology have to be prepared on EU and national level, framing the fields of use and implementation. Besides printing house, there are numerous other application for built environment, such as urban furniture, and different options for material use, including secondary raw materials, including recycles waste for other industrial sectors.

3D Printed Houses: A Sustainable Solution?

Some construction companies are heading into additive manufacturing. Among these, the Italian company WASP which aims to build a more sustainable world through 3D printing. He developed one of the world's largest 3D printers, capable of building houses from locally sourced materials using solar, wind or hydroelectric power. This allows regions that do not yet have access to electricity to 3D print environmentally friendly structures using local resources.

Similarly, in Brazil, Anielle Guedes founded Urban3D to respond to the Brazilian housing crisis. Her company 3D prints parts of buildings in a dedicated factory before assembling them on site. This allows her to create buildings of a height that would not be possible if 3D printing was done on site. The company is currently testing several prototypes and hopes to offer a solution to the development of Brazilian slums.

The Russian company Apis Cor is also convinced of the positive impact that 3D printing can have on homes. Founder and CEO Nikita Chen-iun-tai explains, "we believe that additive manufacturing is an effective solution against the housing crisis and that is why we developed our project. We hope that in a few years this approach will be thoroughly tested in various parts of the world to demonstrate its feasibility. We believe that more and more construction companies will adopt this technology, as some of them already do today".

Construction robotics

The construction industry is of paramount importance to the European economy, as it provides 18 million direct jobs and contributes to almost 10% of the EU's GDP. In this context, there has been a considerable interest in construction robotics since the 1960s, which in following decades was accompanied by a significant increase in investment, research and real-world uses. As a consequence, robots are noticeably improving at performing complex tasks and becoming increasingly autonomous. The effectiveness of robotic systems and automation can be seen in reduced labor costs, improved quality, increased productivity, efficiency and flexibility in manufacturing. Additionally, it is generally known that it contributes to reducing injuries since it takes over dangerous tasks from workers. In recent years, there has been more and more developments in this field, as the trends below show:

1. On-site construction robots. A number of prototypes have been developed for various applications of on-site construction, such as masonry robots. They can build walls independently from bricks. Another trend is the robo-welder, which can handle a variety of welding tasks. Also, on the rise are robots that erect objects or parts of buildings using 3D printing.
2. Robots in machine prefabrication. Robotic arms and machines have been used in factory production lines for decades, but now there is a growing market for prefabricated homes also using this technology.
3. Humanoid robots in construction. This robot at the construction site is primarily intended to support the construction process where stationary or large machines cannot be used.
4. Autonomous vehicles. From excavators to bulldozers, there are numerous construction vehicles that are suitable for automation in construction. As a consequence, construction and clearing work can be carried out nonstop.
5. Inspections by robots on the construction site. Such inspection tasks usually require time and energy; therefore, number of robots are being developed to handle this task more efficiently.
6. Exoskeletons. These are worn by construction site workers and support them with robotic functions for various activities and robots can help reduce the risk to workers.

The advantages of using the above-mentioned technologies are others are obvious, for example, robotic automation can help reduce waste by improving quality and consistency. This can be of utmost importance in times of increasingly stringent environmental regulations in the industry, as well as rising demand for cost-efficient buildings. Another factor that it is related to cost and time savings is that robots can work around the clock. This means that certain phases of projects can be completed at a much lower cost than usual and significantly faster. Another point worth mentioning is that there are several construction work-related injuries, more specifically, around 30 percent of occupational accidents occur in construction. At the same time, the risk

of being involved in a fatal accident in construction is four times higher than in other industries. This can be significantly reduced with the use of exoskeletons or autonomous inspection robots. Additionally, there is shortage of skilled workers in this sector. In the EU, more than 200,000 low- and high-skilled construction jobs were unfilled in the second quarter of 2020 alone. This means that nine out of ten construction companies will expect a shortage of skilled workers by 2030. This gap can be filled with the introduction of robots. This is in line with the results from the ABB (a leading global technology company) commissioned global survey of 1,900 construction companies in Europe, the USA and China, which shows that 81 percent of those surveyed want to introduce robots in the next ten years.

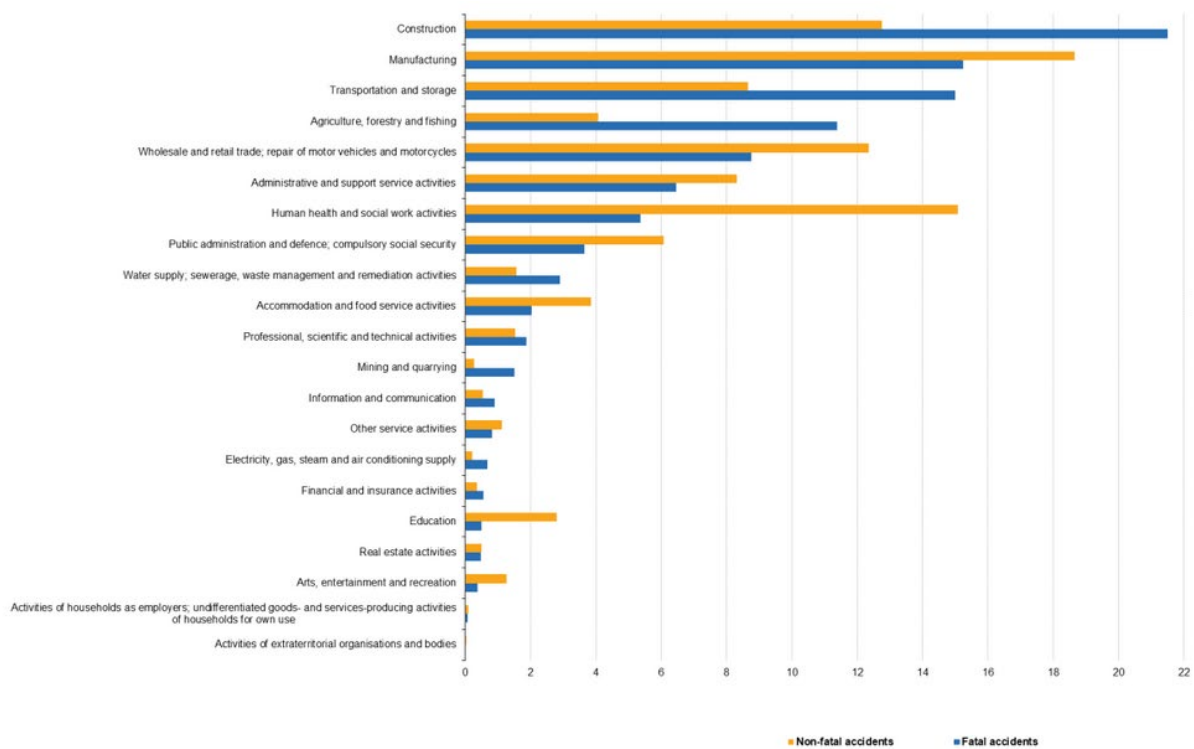
Still, the use of robots in construction is considered to be in its infancy. Proof for this was also identified in the ABB survey, where only 55 percent of the companies surveyed already use robots - compared with 84 percent in the automotive industry and 79 percent in manufacturing. The reasons for the challenging implementation of construction robots are several. For instance, robots are most successfully used in mass production lines, where they perform the same tasks repetitively. In contrast, each construction site is unique and the situation on site makes a very challenging places for robots. Furthermore, investments in robotics come with high upfront costs, such as research and development. In a sector where most companies are small subcontractors operating on low profit margins due to widely used "lowest price practices" in tendering, the needed capital investments are still considered significantly high (for example, top 100 UK construction companies had an average profit margin of just 1.5% in 2017). Therefore, only a few big construction firms can allocate resources to test new technologies. There are also safety and regulatory issues related to the risks of an unmanned, autonomous robot going to work on a busy construction site, which becomes another barrier to the use of robots in construction. Finally, weak innovation culture prevalent in the construction industry, skill gaps of construction workers and a common aversion to perform tasks alongside robots are disadvantageous for successful adoption of robotic technologies in this sector.

Although current studies identified concerns from industry players regarding the readiness and effectiveness of robotic technology to be adopted in construction, the level of innovation expected in this field in the next few years is considerably promising, and in the coming years, it is expected to see more companies using this technology as part of their daily business. According to ABB Robotics' internal analyses of the market potential for robotic automation, there will be double-digit growth rates in key construction sectors, including precast and 3D printing, over the next decade.

Workers safety, Connected construction site

Context

Construction sector is, by its nature, high-risk area of work, as employment in construction companies means regularly working at height, being expose to electrical hazards, vibrations, noise, and airborne particles, close proximity to heavy equipment. According to the European Union information agency for occupational safety and health (EU-OSHA), “More construction workers are killed, injured or suffer ill-health than in any other industry”.



Every year more than 1,000 workers are killed and over 800,000 workers are injured, with others suffering from dermatitis, asbestosis or musculoskeletal disorders.

Moreover, injuries from accidents together with musculoskeletal disorders caused by poor manual handling (e.g., lifting, lowering, pushing and carrying), repetitive tasks and/or static postures, contribute to hundreds of thousands of lost working days every year, and can be life-changing for those they affect.

Construction workers are also at increased risk for lower work ability and lower health status which may shorten their working careers.

To prevent these health issues, many different types of occupational health and safety measures are implemented. Technological innovation plays a vital role in enhancing

those actions and launching new ways of risk mitigation. Nevertheless, it must be introduced while being adapted to the sector's actual needs. As stated by Hilti, "done right, it can make sites both safer and more efficient, with productivity gains helping boost profitability and supporting further investment in new technology".

It is also worth mentioning that the complexity and dynamics of the construction sector, leads to large differences within and between individuals in their exposure to work-related risk factors and accompanying health problems.

First, such exposure differs among different professions within the construction industry. Moreover, big variation also exists between individual construction workers, and this depends on work tasks, colleagues working at the same worksite and weather conditions. Laborers susceptibility to the health and safety risks may also depend on their experience and know-how, as unskilled workers tend to have lower knowledge and awareness of working practices.

Construction sites vary in timeline, size, and spaces. Workers move from one place to another depending on the stage of the project and the required competences. Therefore, the exposure to work-related factors and health problems may differ across worksites and during working days. Working at worksites is often related to working outdoors, which means weather conditions are a critical factor in construction workers' working environment. Construction work often must be done in extreme heat or cold, in windy, rainy, snowy, or foggy weather or at night. They are exposed to different types of risks, depending on the geographic region, season, duration of time spent outside and type of tasks performed.

The construction industry is also very diverse, composed of companies ranging from multinational corporations to self-employed workers, working on projects from demolition to infrastructure delivery.

Health and safety issues are highly regulated by national and international laws. In Europe, the main laws governing occupational safety and health at work are Directive 89/391 (the OSH "Framework Directive"), and Directive 92/57/EEC – temporary or mobile construction sites of 24 June 1992 on the implementation of minimum safety and health requirements at temporary or mobile construction sites (eighth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC).

They go along with other regulations related to the use of work equipment (2009/104/EC), use of personal protective equipment (89/656/EEC), noise (2003/10/EC), manual handling of loads (90/269/EEC), vibration (2002/44/EC), or construction products (89/106/EEC).

Lack of training

As mentioned above, construction workers exposure to health and safety risks may be related to lack of relevant knowledge and awareness. It is especially the case of Small and Medium-sized Enterprises (SME) which account for more than 99% of all construction companies in Europe. It is worth mentioning, that the recent study

conducted in the UK has found that the majority of fatal incidents in the construction sector involve small businesses because larger schemes are generally better controlled than most small projects.

Due to the time and budget constraints, SME workers, as well as self-employed contractors in the construction sites, have less knowledge of existing health problems in the industry. They are not fully aware of the hazards and mitigating steps needed to prevent injury at the place of work. Moreover, this small and medium-sized companies are often less willing to invest in effective preventive measures.

The potential technology solutions to address this challenge, already being implemented by some of the stakeholders, include mobile apps, Virtual and Augmented Reality for training, for example of heavy equipment operators etc.

Lack of soft skills and communication

Many times, construction workers are afraid of communicating, or are unable to do it. Focusing on solving this problem, by data monitoring through wearable devices, apps, etc. can lead to building trust and having a mechanism where workers feel they can raise issues with a supervisor without blame. It is also about educating supervisors about the importance of having an ongoing frank and open dialogue with workers about what practices are working well, how they are monitored and reported, and what could be done better.

Chemical substances

Chemical risk factors are often airborne and can appear as vapours, dust, mist, fumes, and gases. Therefore, exposure usually occurs by inhalation, although some airborne hazards may settle on and be absorbed through the intact skin (e.g., pesticides and some organic solvents). These substances include a wide range of materials, such as such as asbestos, wood dust and crystalline silica-based products.

The exposure on such risks may provoke serious health problems such as skin and respiratory diseases. More than 15% of the construction workers have contact with dangerous substances, including rough materials. This can cause occupational skin problems such as redness, dryness and itching of the skin, and may lead to such diseases as skin allergies or neurologic disorders. The skin may become cracked, scaly, thickened and swollen. Furthermore, blisters and occupational dermatitis may develop.

Moreover, 32% of the construction workers are exposed to fumes and vapours at least half of their working time, which may lead to considerable damage to the lungs and may even cause the development of other respiratory diseases such as asbestosis, silicosis, bronchitis and cancer.

It is worth mentioning that the exposure on chemical materials is a risk shared by workers operating not only on the construction sites, but along the whole value chain. It also varies depending on the situation in each EU Member State. For example, while

removing asbestos from the construction sector, including already built infrastructure, is one of the main concerns in Spain, Poland addressed this topic years ago, becoming one of the pioneers in solving this problem.

There is a wide range of technological solutions which may help construction sector in reducing workers' exposure on chemical substances, including drones and smart sensors for improved air, land control and monitoring of other working conditions, wearables for monitoring of dust exposure in real time, etc.

Psychosocial risk factors

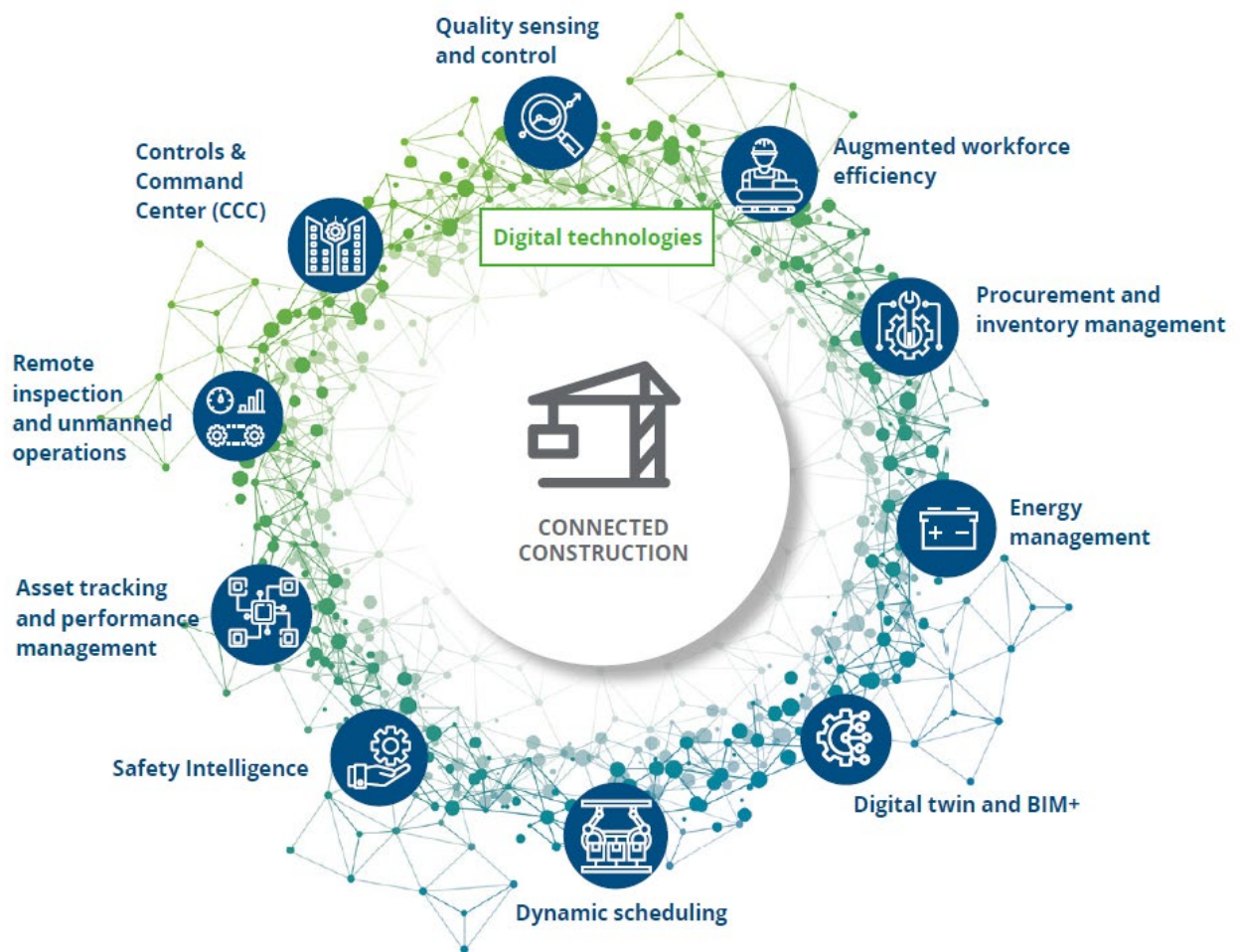
The construction sector has one of the highest incident rates of psychosocial health problems such as stress, fatigue and burnout. Workers face more and more work-related stress at the worksite due to budget limitations of construction projects, time pressure, low job autonomy and/or low social support from the supervisor. For example, a study among bricklayers demonstrated the following prevalence of self-reported mental health effects: depression (18%), high need for recovery after work (14%), post-traumatic stress disorder (11%) and distress (5%). Moreover, psychosocial risk factors might be associated with musculoskeletal symptoms and non-fatal accidents at construction sites.

Psychosocial risk prevention needs holistic and institutional response. Nevertheless, there are various technologies which may be used to help construction companies in addressing the effects, such as AI applications for tiredness awareness, mobile technologies tool to monitor construction workers' fatigue and stress, solutions for identifying the level of satisfaction of communication between workers, to measure the effectiveness of their work, etc. Another area for potential technology applications is related to monitoring of drug, alcohol and other substances consumption, which may be used by workers to address psychosocial risks they face at work.

Connected construction site

According to Deloitte connected construction site is an ecosystem of connected job sites, machines, and workers that enhances operational effectiveness and safety" to create the "smart, connected job sites of the future." It is about bringing people, information, and processes together by using a wide range of technologies, such as robotics, wearables, Artificial Intelligence, photonics, Augmented Reality, etc.

Connected construction site approach provides a framework for open communication, facilitating strong collaboration between multiple stakeholders, transparency and control of worked performed along the whole value chain, and data-driven decision-making.



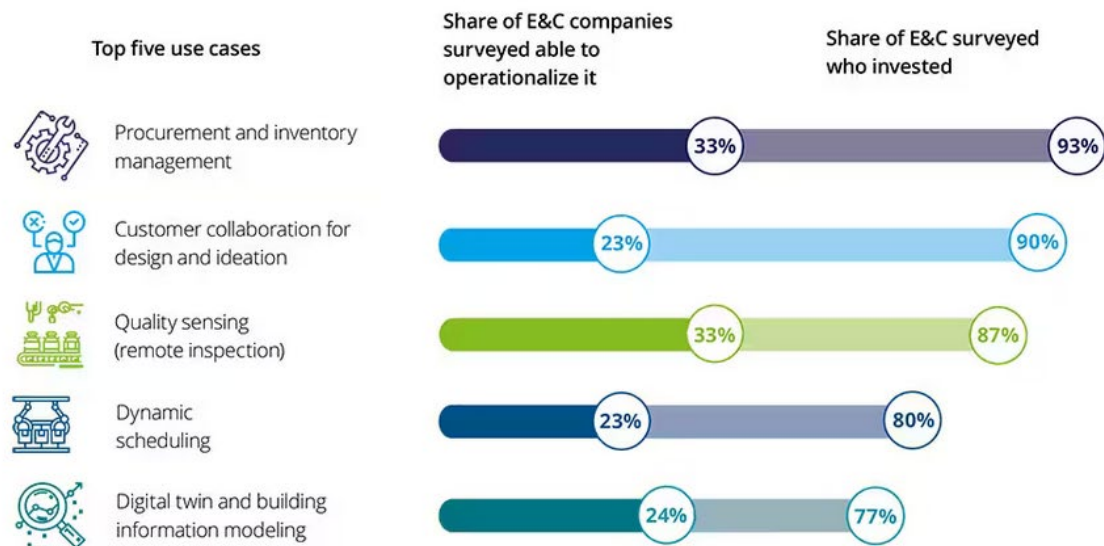
The picture above represents several connected construction use cases based on Smart Manufacturing Ecosystem Study conducted by Deloitte and MAPI in 2020.

Poor innovation culture

Although the use of technology offers new business opportunities, reduces risks and costs, while improving quality of work, many construction companies, especially in the Small and Medium Enterprises segment, prefer traditional methods and tools. They lack knowledge on existing solutions and their applications for the construction sector, and/or capabilities to integrate those technologies into their processes. They still perceive investment in new tech as of low profitability.

Moreover, another obstacle preventing construction companies in exploring innovative technologies is language barrier – many construction workers, including executives, know only their national language, and do not speak in English.

Most of the innovations introduced to the industry, come from big companies which investments has grown in the recent years. Nevertheless even in their case, only one third technological solutions are operationalize according to Deloitte survey:



It is worth mentioning that more than 70% of the solutions operationalized come from partnerships established with external stakeholders, highlighting the added value of alliances to improve efficiency and quality of construction processes.

Lack of digitalization of administration processes

Poor innovation culture factor applies not only to the private sector. One of the main challenges identified by the working group organized by Secpho was the lack of digital tools for process documentation in case of public administration operating in some European countries. With documents available only in the paper form, all administration procedures were extended over time, decelerating construction processes.

Traceability

Whereas traceability is well-established concept in the building sector, it concerns only documentation. The applications of technology solutions related to tracking materials utilized along the value chain are still only randomly used.

BIM, Construction monitoring

BIM represents the solution found by the construction industry to achieve the energy efficiency and risk reduction targets outlined by the new European policy - the Renovation Wave.

To achieve the proposed targets, the traditional processes related to the design, construction and operation of buildings must be renewed through the digital approach and the complete transformation of the construction field. The most important step in the digitization of the construction field is the adoption of the construction information management process using building information modeling (BIM).

Once the BIM methodology is adopted by all factors involved in the processes, profound transformations can be implemented in the field of construction. The construction and operation of constructions together with the production of materials and equipment required for construction would achieve the desired level of sustainability.

The governments of European countries are at various stages of the adoption of BIM. The problem of construction and the construction industry is quite similar in all member countries and that is why the effort to adopt and implement digitization and especially management using BIM must be standardized at the European level.

The stages, actors, tools and technologies of the BIM process are already defined and adopted at the level of each state. The specific details (updating/changing regulations) that allow the appropriate application in accordance with the type of construction, site specifics and type of investment represents a huge effort to develop

The coordinated approach of this effort at the European level for the types of constructions under the care of public administrations would lead to the standardization and consolidation of construction and operation practices, something useful for a common market. Spreading examples of good practice at European level and raising the level of all countries in terms of the efficiency of public investments are desirable.

The development of a common language and tools for managing construction information ensures an efficient construction and operation of construction processes. Informed decision-making and management of public funds are enhanced by the standardization and transparency of available databases in the form of well-ordered and organized digital ledgers.

Problems identified in the focus groups:

- The reluctance to change of professionals in any field is well known. The field of construction, being a very old one, is prone to the rejection of changes.
- The lack of digital skills useful for the BIM process among the working staff makes it difficult to adopt new technologies.
- Countries where the economy has been centralized and where training and research are underfunded have a slow rate of development and implementation of digitization. This is due to the fact that specialists and professionals are not in the habit of voluntary involvement

in regulatory and standardization activities, also authorities are not helping these activities with grants.

A modern classification system for the construction industry, according to ISO 12006, would be very useful for BIM implementation. The British Classification System – Uniclass is one such modern system and allows both human and computer/robot use. The adoption of Uniclass at the European level would constitute a wise decision that would allow the standardization of processes in all construction companies as well as within the manufacturers of construction materials and equipment.

Building Information Modelling (BIM) is about information modelling and management in the construction industry. BIM can be used in all sectors of construction (e.g. railway or waterways etc.) and related usage (e.g.: simulation, augmented reality, or digital twins etc.) in order to achieve meaningful, open and structured data that can be used within or across projects and asset management activities in different countries and throughout the asset life cycle.

All governments can support implementation of high-level strategies such as EU Twin strategy: Green Growth and digitalization in the construction ecosystem. Digitalization is identified as an enabler to drive the desired changes in the industry. Digitalization is the adoption, or increase in the use, of digital technology by an entity such as an organization, industry sector or country.

BIM is the process of management of information related to constructions and represents the essence of the digital transformation of the industry. Based on the rigorous process of information management, other tools and concepts can develop that improve energy efficiency targets and risk reduction.

Building Information Modelling (BIM) is seen as being as a part of the solution to the management of the information during the design, construction, and operational phases of the asset lifecycle. The development of BIM is advancing rapidly and requires the application of common standards to ensure future compatibility of information exchange and use.

The ultimate benefits of widespread adoption of BIM are likely to include greater efficiency, predictability, efficient use of materials, reduced operational impacts and better buildability and quality.

The introduction of Building Information Modelling (BIM) represents the construction sector's progress towards digitalization. It is undisputed that the wider use of technology, digital processes, automation, and higher-skilled workers contribute greatly to the economic, social and environmental future.

Current practices and studies show how traditional processes repeatedly experience dramatic information loss, especially in the steps between design, construction, and operational stages. Processes that are merely digitized are often supported by additional manual processes to build and rebuild information.

Therefore:

- Construction cost is increased by splitting up of processes and lack of communication.
- Without a common digital terminology, there are often significant communication errors and loss of information.
- The same information is often re-entered several times in different systems before the building is handed over to owner organization.
- Same information is also re-created several times by different software packages and even then, it rarely reaches the end user of the asset or operator!

Building Information Modelling (BIM) is a way of structuring information about infrastructure and buildings. BIM refers to the use of a shared digital representation of a built asset to facilitate the construction process (including buildings, bridges, roads, process plants etc.) to facilitate design, construction, and operation processes to form a reliable basis for decisions.

The resulting information model can be visualized as a virtual representation of the real asset and can report object properties and relations. BIM gives a better understanding of complex building information and supports many digital tools for effective information handling.

Good information management is a precondition to tackle lean design and construction, digital access to maintenance of projects as well as product information during facility management or operation.

The possible benefits outlined above will only be achieved through the wide-spread adoption of digitalization on all construction projects. Therefore, adoption needs to be at scale, with a skilled workforce equipped with the digital competences and capacity to operate across the value chain, and across projects of differing size, complexity, and type.

This capacity building is only possible through a consistent way of working that removes or reduces the transaction cost of re-learning from one project to the next.

With a digitalized construction process, loss of information between processes and/or stages can be eliminated or at least strongly reduced. This requires the development and implementation of an open and interoperable BIM-model, supported by standards used in digital platforms across the European construction industry.

Digitalization of the construction sector also requires the ability to exchange information about products that are incorporated into buildings and infrastructure assets, including the materials from which they are constructed as well as the more complex products and systems which are incorporated into buildings and assets to make them safe, comfortable, and fit for purpose.

In Europe, construction products declare the performance according to harmonized specifications or standards mandated by the Commission, according to the Construction Products Regulation. Manufacturers, when covered by harmonized specifications or standards, must declare the performance according to the rules included in the standard or specification. EU will use the performance indicators included in these standards to promote the single market and to ensure a common declaration of the information of construction products.

BIM has been gaining traction in the construction industry worldwide due to its potential to improve the quality and efficiency of construction projects. In the EU, many countries have recognized the benefits of BIM and have been implementing strategies to encourage its adoption.

In 2018, the European Commission launched the EU BIM Task Group, which aims to promote the use of BIM across the EU member states. The Task Group developed a BIM Roadmap for the EU, which outlines a series of actions to be taken by EU member states to increase the use of BIM in construction projects.

In recent years, Europe has seen significant BIM growth in their AEC industries. Architects, contractors, and constructors have shown varied BIM implementation in education, planning, and the building phases of public and private projects.

In addition, some EU member states have already implemented BIM mandates for public sector construction projects. For example, in the United Kingdom, BIM Level 2 is mandatory

for all centrally procured government projects since 2016 and BIM Level 3 has also been introduced as a long-term goal.

Other countries such as Germany and France have also developed national strategies to promote the use of BIM:

- Germany: Since 2017, BIM has been mandatory for all new construction projects of the federal government.
- France: A national strategy for BIM was introduced in 2015, and BIM has been mandatory for all public sector projects since 2017.
- Finland: BIM has been mandatory for public sector projects since 2017.
- Norway: BIM has been mandatory for public sector projects since 2010.
- Denmark: BIM has been mandatory for public sector projects since 2007.

There are also EU member states where the adoption of BIM is still relatively low. For example, a 2019 report by the European Commission found that the adoption of BIM was at an early stage in many Eastern and Southern European countries. The level of adoption may vary depending on their policies, resources, and market conditions.

The adoption of BIM in the EU construction industry will continue to increase in 2023, driven by government initiatives, market demand, and the potential benefits of digitalization in the construction sector.

It's worth noting that the specific details of the BIM mandates can vary among different countries, including the level of BIM required, the types of projects covered, and the implementation timeline.

The introduction in Europe of common practice and operating methods and information management using BIM will support the visions for sustainable growth based on better resource efficiency through data sharing in the construction industry, with the following benefits and priorities:

Benefits:

- Harmonize a European wide common strategic approach for the introduction of BIM in a highly fragmented construction sector while actively including small and medium sized enterprises.
- Enable the wide-spread and secure adoption of digitalized processes on mainstream construction projects with a skilled workforce equipped with the digital competences and capacity to operate across the value chain and across projects of differing size, complexity and type.
- Help and facilitate the adaptation to a sustainable built environment – one that supports the challenges of climate change and the need for a circular economy by improving resource efficiency of construction products and materials.
- Greater productivity of the sector – delivering more facilities for the same or less expenditure.
- Improve output quality of public and private assets and improve the value for money of public and private sector investment and service delivery in operation.
- Support improvements in team working and collaboration; leading to a stronger and digitally skilled sector attracting talent and investment.
- Increase the competitiveness of the European Construction sector (e.g. engineering firms, contractors, designers and product manufacturers) in their world-wide activities.
- Deliver efficiencies for client organizations regarding requirements of legacy systems.

- Facilitate secure information exchange between client's asset management systems and contractors/designers' systems through increased interoperability.
- Deliver efficiencies for contractors and manufacturers through standardized product selection and ordering processes.
- Increase certainty for construction clients to achieve their asset objectives and improvements in briefing because of improvements in post occupation evaluations.
- Provide a common understanding regarding the design of built environment between owners, operators and users, designers, contractors, and manufacturers of construction products.
- Facilitate secure exchange of information about construction services between stakeholders.
- Facilitate the marketing and use of construction products and offsite assemblies.
- Provide a common basis for research and development in the construction sector.
- Allow the preparation of common design aids and software packages.

Priorities:

- Ensure that the pace of transformation allows the sector and all members of the value chain to adapt to the changes and to grow capacity.
- Facilitate the adoption of a security-minded approach that supports use of digital technologies and greater collaboration while continuing to protect and manage sensitive information.
- Understand existing activities and practice in use within the European market.

The European Interoperability Framework is a commonly agreed approach to the delivery of European public services in an interoperable manner. It defines basic interoperability guidelines in the form of common principles, models and recommendations.

Efficient interoperability requires a set of standards and implementation, that include:

- A standardized way to store and exchange data models and implement them in software packages securely where necessary.
- A common understanding of terminology and data-semantic structure.
- An agreed set of information delivery specifications to support the needs of the information recipient.

Efficient object-based interoperability is supported by three sets of standards:

- Process standards to specify how to describe and manage the required information supporting a given process.
- Data Model standards to specify data structure for entities, geometry, and related properties as well as classification for exchanging data models. The data model ensures exchange of object based information.
- Data Dictionary standards to specify data structure for defining data-semantic concepts (entity, property, classification) and relations between them.

It is not possible to move directly from a traditional modelling approach towards an open BIM approach. The change must be managed progressively.

To evaluate which level of BIM is reached, indicators have been introduced. These indicators measure four aspects: the content, the digitalization, the interoperability, and the collaboration.

Currently the use of BIM is heavily dependent on national methodologies, and it is applied to isolated projects individually. As and when stakeholders become fully conversant with the underlying principles, they will be able to converge towards integrated models and databases.

Further help is needed for professional bodies/organizations and clusters in the effort for standardizing the process for information modelling, exchange, and management of information.

Support Data Dictionaries

To ensure one common digital language for the construction ecosystem in Europe, standards are not enough. Machine-readable dictionaries for properties are needed to ensure interoperability.

Actions must be carried by professional organizations:

- Support harmonization of European classification tables.
- Harmonize the description of construction product property sets.
- Extend interoperability between data dictionaries.
- Improve the organization and structure content for data dictionaries.
- Seek feedback to improve standards for data dictionaries.

Information Delivery Specifications

Guidelines that describe how to capture and integrate construction processes, and business practice will be delivered. Professional organization shall provide detailed specifications regarding the information that any user fulfilling a particular role would need to provide at a particular point within an asset's life cycle.

Actions must be carried by professional organizations:

- Further develop frameworks for BIM guidelines
- Detail and develop methods for use case applications
- Support and consider practical implementation of energy assessment requirements
- Support and consider practical implementation of lifecycle cost and carbon assessment
- Support asset management and operation.
- Support digital efficiency in statutory approval with planning and regulatory authorities.

Digital Twins for the built environment

A digital twin is seen as a virtual representation that serves as the real-time digital counterpart of a physical object. The development of a BIM-based Digital Twin Environment (DTE) could optimize the enabler between the planned (As-planned) and the realized object (As-built) to optimize it.

Professional organizations will deliver guidelines to structure the information for digital twins applied to the built environment, considering methodologies and formats to define, describe, exchange, monitor, record and securely handle digital twin's data and its related processes.

ANNEX 6: FAQ (regularly updated)

1. I'm an SME owner and don't receive a salary. Can my effort within the funded activity also be funded?

Yes, of course. In this case we make use of the Marie Skłodowska-Curie action guidelines under the Horizon Europe Work Programme 2023-2024 (can be downloaded [here](#)).

You need to determine the days you worked on the funded activity and your daily rate. Days worked have to be justified with a time-sheet (same applies for all persons on the project). The daily rate is the monthly living allowance of €5,080 / for example 18 days = €282.22 multiplied by the **country-specific correction coefficient** of your home country.

Calculation example for Austria: €5,080 / 18 days * 1.0643 = €300.00 daily rate

Please select the appropriate coefficient from the following list:

| Country code | Country coefficient EU Member States | Country code | Country coefficient Third Countries | Country code | Country coefficient Third Countries |
|--------------|--------------------------------------|--------------|-------------------------------------|--------------|-------------------------------------|
| AT | 106,3% | AE | 94,0% | CO | 67,6% |
| BE | 100,0% | AL | 59,0% | CR | 77,6% |
| BG | 54,8% | AM | 77,7% | CU | 82,5% |
| CY | 77,5% | AO | 130,0% | CV | 69,6% |
| CZ | 79,1% | AR | 62,5% | GW | 87,2% |
| DE | 98,3% | BO | 100,9% | DO | 61,4% |
| DK | 132,0% | AZ | 82,1% | DZ | 67,9% |
| EE | 80,3% | BA | 63,9% | EC | 79,4% |
| EL | 81,6% | BB | 112,8% | EG | 67,4% |
| ES | 91,3% | BD | 81,2% | ER | 120,4% |
| FI | 119,5% | BF | 95,0% | ET | 81,9% |
| FR | 116,4% | BI | 81,3% | FJ | 73,5% |
| HR | 75,5% | BJ | 91,9% | FO | 132,0% |
| HU | 72,0% | BO | 83,9% | GA | 107,9% |
| IE | 119,5% | BR | 84,7% | GE | 62,2% |
| IT | 97,4% | BW | 62,9% | GH | 73,9% |
| LT | 72,8% | BY | 66,8% | GM | 68,8% |
| LU | 100,0% | BZ | 79,9% | GN | 84,2% |
| LV | 76,0% | CA | 95,2% | GT | 87,3% |
| MT | 88,1% | CD | 151,9% | GW | 81,9% |
| NL | 109,6% | CF | 109,3% | GY | 71,7% |
| PL | 70,5% | CG | 117,3% | HK | 115,4% |
| PT | 84,3% | CH | 128,6% | HN | 77,4% |
| RO | 65,4% | CI | 94,6% | HT | 85,0% |
| SE | 125,4% | CL | 69,5% | ID | 73,0% |
| SI | 83,3% | CM | 87,8% | IL | 107,2% |
| SK | 78,1% | CN | 90,0% | IN | 73,8% |

| Country code | Country coefficient Third Countries | Country code | Country coefficient Third Countries | Country code | Country coefficient Third Countries |
|--------------|-------------------------------------|--------------|-------------------------------------|--------------|-------------------------------------|
| IS | 130,5% | MY | 67,2% | SV | 72,2% |
| JM | 84,4% | MZ | 71,7% | SZ | 61,3% |
| JO | 98,8% | NA | 66,9% | TD | 100,1% |
| JP | 103,3% | NC | 107,4% | TG | 82,8% |
| KE | 85,6% | NE | 80,0% | TH | 78,8% |
| KG | 73,7% | NG | 85,2% | TJ | 58,4% |
| KH | 78,6% | NI | 67,3% | TL | 88,7% |
| KM | 75,7% | NO | 128,7% | TM | 82,9% |
| KR | 95,5% | NP | 87,8% | TN | 67,4% |
| KZ | 71,9% | NZ | 98,9% | TR | 64,5% |
| LA | 89,8% | PA | 76,8% | TT | 81,8% |
| LB | 116,2% | PE | 88,0% | TW | 84,7% |
| LI | 128,6% | PG | 99,8% | TZ | 67,9% |
| LK | 77,4% | PH | 81,3% | UA | 68,5% |
| LR | 149,6% | PK | 54,8% | UG | 67,2% |
| LS | 56,2% | PS | 112,5% | UK | 136,9% |
| MA | 72,6% | PY | 63,0% | US | 102,3% |
| MD | 63,2% | RS | 57,7% | UY | 89,7% |
| ME | 61,6% | RU | 97,3% | UZ | 68,0% |
| MG | 85,6% | RW | 81,6% | VE | 139,2% |
| MK | 50,7% | SA | 83,4% | VN | 61,3% |
| ML | 90,0% | SB | 112,7% | VU | 104,8% |
| MM | 67,0% | SD | 107,8% | WS | 82,2% |
| MR | 68,1% | SG | 124,4% | XK | 70,2% |
| MU | 73,3% | SL | 107,1% | YE | 104,4% |
| MW | 60,9% | SN | 98,4% | ZA | 55,3% |
| MX | 60,3% | SR | 69,1% | ZM | 74,8% |
| | | | | ZW | 98,3% |

2. Can you guarantee that I won't have to disclose any of my ideas in case I receive financial support?

Yes, absolutely - all sensitive information related to your business will be kept strictly confidential! The AEC EUROCLUSTER partners signed a **Non-Disclosure Agreement** which forbids them and the evaluators to discuss, forward or use any of the information you provide in your application or during subsequent funded activities (project, training, trade fair or similar).

Therefore, your business secrets are protected - you only have to be ready for some general communication measures in case you are awarded for funding, e.g., a **Success Story** so that AEC EUROCLUSTER can present their beneficiaries to the world! Such communication actions will be limited to presentation of company, people behind and basic info you want to share about your business and development! Moreover, you can be sure that there won't be any surprises: if you are selected for funding first thing to do is sit together and draft the next steps including for example communication activities.

3. What if I'm funded for a third-country trade fair mission and don't manage to achieve a cooperation agreement with a foreign partner?

On your mission to one of the four pre-selected trade fairs you will be accompanied by an AEC EUROCLUSTER consortium partner. He will guide you, assist in arranging business meetings and other opportunities to present yourself. During the fair each SME (not depending on the number of staff it sends to the event) has to attend at least 10 B2B meetings with potential partners from third-countries. Travel costs will be eligible even if you don't achieve a formal memorandum of understanding as long as you put efforts in reaching out to foreign organisations by meeting them.

4. Some Hungarian SMEs are not eligible for funding. Can you clarify which?

Hungarian applicants should not be excluded from participating in the Open Calls but provide a self-declaration are not part of the entities listed in the link below.

The EU Council Implementing Decision 2022/2506 stipulates that **legal commitments must not be entered into with any public interest trusts established on the basis of the Hungarian Act IX of 2021 or any entity maintained by such a public interest trust**. This applies **as of 16 December 2022** for as long as the measures are in place. This means that it is prohibited to enter into legal commitments with such entities involving Union funding. This prohibition applies to the entire chain of Union financing.

No further legal commitments involving Union funding can be entered into by you or any other beneficiaries (or affiliated entities) in your grant with third parties concerned by this decision. This concerns legal commitments involving Union funding related to e.g.: the purchase of goods, works or services; subcontracting; **financial support to third parties**; equipment renting or leasing; personnel seconded against payment. More on that you can find at [Frequently Asked Questions](#). It is progressively updated as soon as further guidance is available. You can find an indicative – non-exhaustive – list of affected entities (i.e. public interest trusts and entities maintained by them) under this [link](#).