# Application for support

## 1.1 General

Project name: EU-MAT
Application id: 482582
Case id: 20370282

Application call: 1.1 Smart specialization, research and innovation
Responsible organisation: Interreg Aurora

## 1.2 Lead partner EU

Name: Karelia Ammattikorkeakoulu Oy
Tikkarinne 9
80200 JOENSUU
Finland

Org. No: 2454377-1
Employees: XXX

**Workplace**

Name: Karelia Ammattikorkeakoulu Oy
Postal address:
Tikkarinne 9
80200 JOENSUU

Workplace No.: 1
Visitors address:
Tikkarinne 9
80200 JOENSUU
Region: Joensuu

**Name of legal representative**

RDI Director Ms. Anne Ilvonen

**VAT-number (Optional)**

FI24543771

**Is your organisation entitled to recover VAT based on national legislation for the activities implemented in the project?**

No

**Lead partner motivation and contribution**

Karelia UAS (KUAS) operates in North Karelia, Finland, engaging in regional innovation ecosystems and global networks. KUAS's 2030 strategy includes five key areas: education and competence development, internationalization, sustainable well-being, smart specialization, and carbon-neutral solutions- with a focus on circular economy research, both regionally and globally. KUAS's research group involved in this project is extensively engaged in researching low carbon construction in both building and city scale in cooperation with City of Joensuu. The research group's recent projects, i.e., PuuHyvä (ERDF), KIRA CIRCULARIS (ERDF), Smart and climate-wise construction (ERDF), Sustainable Building Technologies (YM), specifically focused on circular and sustainable solutions for the construction sector. KUAS will lead the EU-MAT project with significant contribution to one of the key outcomes- the material mining method, aiming to facilitate circularity of building materials in construction.

## 1.3 Project partner EU

Name: RISE Research Institutes of Sweden AB

Org. No: 556464-6874
Employees: XXX

Postal address:
BOX 857
501 15 BORÅS
Sverige

**Workplace**

Name:

Workplace no: 25334392

Postal address:
LABORATORGRÄND 2 C
931 77 SKELLEFTEÅ

Visitors address:
LABORATORGRÄND 2
931 77 SKELLEFTEÅ
Region: Skellefteå

**Name of legal representative**
Marco Lucisano, Senior Vice President for Division Built Environment

**VAT-number (Optional)**
SE556464687401

**Is your organisation entitled to recover VAT based on national legislation for the activities implemented in the project?**
Yes

**Partner motivation and contribution**
Research Institutes of Sweden (RISE) is an independent, state-owned research institute. RISE's mission is to be an innovation partner, and contribute to developing technologies, products, services, and processes that in turn contribute to global sustainability and a responsible competitive business community. RISE has approximately 31300 employees and more than 130 test environments. The Wood Technology Research unit at RISE has been actively involved in projects related to circularity including design for disassembly, reuse of material, and development of circular methods to decrease the construction industry's climate impacts. InFutUReWood, DUET, FÅTT projects are just a few to mention. The aim of this project will be in line with the current strategies and long-term goals of the company and the unit.

Name: Aalto University Foundation sr

Org. No: 2228357-4
Employees: XXX

Postal address:
P.O. BOX 13000
FI-00076 Aalto
Finland

**Workplace**

Name: School of Chemical and Metallurgical Engineering

Workplace no: 2

Postal address:
Kemistintie 1
02150 Espoo

Visitors address:
Kemistintie 1
02150 Espoo
Region: Esbo

**Name of legal representative**
Kristiina Kruus, Dean of Chemical Engineering

**VAT-number (Optional)**
FI22283574

**Is your organisation entitled to recover VAT based on national**

**legislation for the activities implemented in the project?**
Yes

**Partner motivation and contribution**
Aalto University (Espoo, FI), is a multidisciplinary university formed in 2010 from the merger of three former universities in the Helsinki Metropolitan area. Aalto's participation in the project will be from the Wood Material Technology group, headed by Mark Hughes. The group has been involved in many cascading projects for over a decade, including CaReWood (WoodWisdom), InFutUReWood (Forest Value), DUET (Bioeconomy in the North2), CircWood (Finnish Ministry of the Environment -YM), ProWoodBuild (YM) and most recently TiReX (Forest Value 2) and published the results extensively. EU-MAT aligns with the focus of the groups research activities. Aalto will participate with their knowledge about material flows, wood material intensities of buildings, demolition wood quality and modelling the future availability of recovered timber. Furthermore, they will participate in assessing the properties of demolition wood and the design, manufacture and testing of circular wood product solutions.

### 1.4 Lead partner Norway

Name: UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET
Postboks 6050 Stakkevollan
9037 TROMSØ
Norge

Org. No: 970422528

Employees: XXX

**Workplace**
Name: UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET UIT CAMPUS NARVIK
Postal address:
Postboks 385
8505 NARVIK

Workplace No.: 974884860

Visitors address:
Lodve Langes gate 2
8514 NARVIK
Region: Narvik

**Name of legal representative**
Department manager Ph.D. Raymond Riise

**VAT-number (Optional)**
970422528MVA

**Is your organisation entitled to recover VAT based on national legislation for the activities implemented in the project?**
Yes

**Lead partner motivation and contribution**
The Arctic University of Norway (UiT) is a medium-sized research university and have approx. 4000 employees and 18 000 students. The engineering faculty (IVT) has education at all levels (bachelor, master and Ph.D.). The faculty stands foremost in the development of new teaching methods and pedagogy. IVT have close cooperation with universities and institutes in the North financed by eq. Interreg, Nordforsk, Horizon and National programs. The IBEM institute have several big research projects with SINTEF and Norwegian industry and collaborating in several projects with Swedish and Finish universities and business. We are also part of several business clusters and have several industrial cooperation agreements. Increasing the competence level in the industry based on relevant research is one of UiT main priorities and to be part of a cross-border

academia and industry cooperation in the North is within the strategy for building new international activities and research projects.

**Project partner Norway**

## 1.5 Payment information

Type of payment method: BIC/IBAN
Account number: OKOYFIHH FI68 5770 0520 2808 16

## 1.6 Project information

**Project title**

EU-MAT: Effective Urban Material Mining in Cities

**Project type**

Regular project

**Projektets startdatum**

2024-12-31

**Projektets slutdatum**

2027-12-30

**Programme sub-area**

Aurora

**What are the common territorial challenge(s) that will be tackled by the project?**

The global economy's use of secondary materials dropped from 9.1% in 2018 to 7.2% in 2023a 21% decline in five years. This project focuses on improving circular construction in northern cities, where low circularity rate combined with sparse populations create challenges for efficient usage of materials. Accurate predictions of material quality and quantity from demolished buildings are essential to improve reuse in new structures and facilitate cross-border market development.

The EU's Energy Performance of Buildings Directive (EPBD) mandates significant energy reductions in buildings, emphasizing the need for renovations and better use of demolition waste. Non-residential buildings must renovate the worst-performing 16% by 2030 and 26% by 2033. This legislation highlights the need for renovations and optimizing waste material use from demolitions, addressing the broader issue of efficient, circular building material usage.

Finland aimed to reuse 70% of building and demolition waste by 2020, but the current rate is under 60%. Most of this waste (85%) comes from repairs and demolitions, with 15% from new buildings. In a circular economy, demolished buildings serve as material banks, but challenges remain: reclaimed materials often lack the CE marking required by EU regulations (ym.fi). Norways Climate Change Act targets a 90-95% reduction in greenhouse gas emissions by 2050. Reusing construction waste, such as low-carbon concrete, is key, potentially saving up to 120 kg of $CO_2$ per m3. In 2022, Norway generated 2.11 million tonnes of construction waste, with 40% land-filled, 47% recycled, and 13% treated, possibly including reuse (sbb.no). At 2.4%, Norway's circularity rate, which was released in 2021, is below global average (8.6%). According to

Sweden's very first Circularity Gap Report, Swedes consume more than twice as many materials as the global average. At 3.4%, Sweden's circularity metric reflects its current cultural, economic and geographic realities.

### Why is cross-border cooperation needed to achieve project objectives and results?

Cross-border cooperation is vital for this project as it tackles the challenges of circular material usage in sparsely populated northern cities, which share similar issues regarding material circularity. In these areas, long transportation distances can increase costs and emissions, so re-utilization of recovered building materials locally is both environmentally and economically beneficial. Localized reprocessing not only reduces emissions but also creates jobs, contributing to the local economy. Buildings are hybrids, composed of various materials, making it necessary to understand the variety and quality of resources they contain to maximize reuse. The project's objective to develop a mining method adaptable to northern cities, and create new products for a broader market, is not achievable by working solely within national borders.
To overcome these challenges, the project structure includes 5 core work packages (WPs) led by partnering organizations (Annex 01) designed to support simultaneous collaboration with clear short-term deliverables. Three main pillars of cross-border cooperation are:

1) Sharing best practices: Research organizations from FI, SE and NOR will collaborate to analyze major construction materials (e.g., wood and concrete)
2) Engaging local stakeholders: International workshops will bring together municipalities, local MSMEs, and SMEs to gather feedback and expand market reach
3) Involving students in an international competition: This competition will drive innovation and disseminate ideas across borders, with students and experts working together on real-world circular economy challenge

The projects stages combine innovative student ideas with expert design/analysis, while engaging cross-border municipal, SMEs and stakeholders in feedback collection phase, combining the integration logistics of developed mining method and new reclaimed-material products to ensure that results are relevant and scalable across the region.

### Select the project's main target group

Public sector

### Specification of the target group and their involvement in project planning

The municipalities are the main target group in the EU-MAT project, with the active commitment for collaboration and demonstrating a strong interest in advancing the circularity of building materials. The commitment from the City of Joensuu is explicit, confirming active participation in the research consortium and project (Annex 02). This commitment is vital for the success of the project, as it involves cooperating with the demolition projects in Kotilahti by the City of Joensuu.

The City of Joensuu's involvement in the project includes participating in meetings, facilitating real time data collection of demolition projects, providing valuable feedback, and serving as a case study site during the development and testing of the urban material mining method. The city's ambitious goal of becoming carbon-neutral by 2025 aligns with the project's objectives, creating a synergistic collaboration. The commitment from the City of Joensuu underscores its recognition of the project's potential to contribute to sustainable solutions for the circulation of construction materials, thereby facilitating the transition towards a climate-wise built environment.

UiT and RISE contributes to the mining method development by collecting larger dataset from municipalities in Norway and Sweden. All the municipalities stand to benefit significantly from the project's outcomes, which aim to help municipalities align better with the UN SDGs 7, 9, 11 & 12.

Apart from the municipalities, EU-MAT involves the local companies as another target group to develop and implement new business models. Using existing tools, i.e., "Circular Compass" (Omställningslyftet - Cirkulär Kompass | RISE), we will involve the local companies in discussing the current State, vision, and pathway Forward. This will offer a structured space to explore and develop specific circular business models, combining different knowledge in NOR, FI, and SE.

### Which synergies with past or current EU and other projects, initiatives, strategies and/or policies will the project make use of?

According to the EU waste directive (2008/98/EC), the priority is to prevent the generation of waste, and immediately after that, the second thing to aim for is the recycling and reuse of products and materials. This is to reduce both the amount of waste and carbon dioxide emissions. The transition to a circular economy requires switching to low-carbon production and reducing resource consumption. The proposed EU-MAT project aligns with and builds upon past and current EU projects committed to serve the green transition, contributing to advancing sustainability in construction materials.

The EU-MAT project aligns with past and current EU initiatives such as InFutUReWood and Aalto's "ProWoodBuild" project, leveraging insights and methodologies developed in these initiatives. InFutUReWood focuses on innovative wood use in construction, sharing synergies with EU-MAT's exploration of new product possibilities from reclaimed building materials. Aalto's project addresses the longevity of wooden buildings, providing valuable insights that can inform the durability and sustainability aspects of EU-MAT's urban material mining method. The EU-MAT project, however, distinguishes itself by emphasizing city-scale data mining and spatial modeling, enabling a comprehensive analysis of building material circularity. Additionally, the proposed project differs from the Interreg Aurora-funded NOWA project, which focuses on Nordic waste management vision, indicating a contrasting emphasis on waste management strategies rather than the urban material mining and circularity of construction materials targeted by EU-MAT. The latter aligns more closely with the sustainable construction and resource efficiency objectives of the circular economy within the construction industry. Moreover, the collaboration with municipalities aligns with the European Commission's emphasis on involving local authorities in sustainability initiatives.

### Project overall objective

The main objective of the 'EU-MAT: Effective Urban Material Mining in Cities' project is to develop and implement sustainable methods for managing and reusing building construction materials in cities. By utilizing advanced material analysis, tailored mining techniques, and innovative product design, we aim to minimize waste, optimize resource recovery, and promote circular economy practices within the construction and demolition sectors. The project aligns very well with the program objective 1.1. Smart specialization, research and innovation, as it combines research infrastructures from Finland, Sweden and Norway to develop the method for material mining and new products from reclaimed materials. The cross-border stakeholder engagement, regulatory analysis, and collaborative pilot projects will significantly help in overcoming cross-border regulatory barriers and ensure the practical applicability of its findings across diverse urban contexts in northern cities across the globe.

### Ecological sustainable development

The EU-MAT project contributes to SDG 12: Responsible Consumption and Production by enhancing circularity in construction materials, reducing waste, and minimizing the use of virgin resources. Through activities like material mining and product development from reclaimed materials, the project supports SDG 13: Climate Action by lowering the environmental footprint of construction and promoting sustainable building practices. By focusing on the reuse and recycling of materials, it helps conserve natural ecosystems and aligns with SDG 15: Life on Land, protecting biodiversity through reduced extraction of raw materials.

## Social sustainable development

The project addresses SDG 11: Sustainable Cities and Communities by actively involving municipalities like Joensuu and Skellefteå in the development of a circular material mining method, ensuring local governance's role in sustainable urban planning. It also aligns with SDG 4: Quality Education by offering student competitions and learning opportunities, supporting knowledge-sharing on material circularity. Involving local communities and stakeholders, the project supports SDG 8: Decent Work and Economic Growth, facilitating experts to get jobs in green sectors and increasing social cohesion through sustainable practices.

## Economical sustainable development

The project aligns with SDG 9: Industry, Innovation, and Infrastructure by driving innovation in material reuse and building product development, creating pathways for new business models and technologies. Through workshops and SME engagement, it encourages sustainable industrial growth and supports SDG 7: Affordable and Clean Energy by reducing energy-intensive material production. By offering new market opportunities for local companies in reclaimed materials, the project fosters economic resilience and growth, particularly in sparsely built northern regions.

## Exit strategy

The exit strategy for the 'EU-MAT: Effective Urban Material Mining in Cities' project is designed to ensures long-term impact, sustainability and scalability of its outcomes. This will be achieved through capacity building, industry partnerships, continued research, and community engagement. Knowledge and expertise gained during the project will be transferred to local communities, businesses, and educational institutions via workshops, conferences and online platforms. These initiatives aim to support a culture of circularity in construction, including the development of business plans, the establishment of production and recycling-hubs, and integrating the knowledge into educational curricula.

Research findings will be leveraged for future collaborations, building on the tools, methodologies and relationships developed. This will involve connecting with ongoing research efforts at respective project partner/institution and seeking opportunities for further funding through EU programs like Horizon Europe. Continued community engagement will ensure that the social benefits of the project are maintained and scaled, creating long-lasting value for the involved communities.

By partnering with industry leaders, EU-MAT will facilitate the commercialization of new tools and products, ensuring their evolution and relevance in the market even after the project concludes. The developed physical products from reclaimed materials, designed for disassembly and reuse, will be commercialized by industry partners, with further development and testing to ensure market readiness.

Additionally, the mining method developed in the project, as well as the experiences gathered through testing, will be published through partner organization and international databases to encourage global adoption. KUAS will be responsible for the long-term storage of project data, along with ongoing monitoring and evaluation, ensuring the project's sustained impact and adaptability to future needs.

## Project summary

The 'EU-MAT: Effective Urban Material Mining in Cities' project addresses the low material circularity in construction across the northern regions of Finland, Sweden, and Norway, where logistical challenges and vast distances hinder efficient material reuse. One of the key barriers cited for not utilizing used building materials in a materials cascade, is concern and a lack of information about the availability and quality of these resources, making it difficult to match potential supply with new building projects. To overcome this specific obstacle, the project aims to develop an innovative urban material mining method that can accurately assess the quantity and quality of reusable materials from demolitions. Through cross-border collaboration, the project will leverage material flow analysis, spatial modeling, and machine learning to create a

mining method adaptable to northern cities. Especially in more sparsely populated areas, where transportation distances can be large, the re-utilization of recovered building products in new local construction projects can save considerably on transport and associated emissions. Moreover, localized reprocessing can create jobs helping strengthen the local economy.

Another major challenge addressed by EU-MAT is that buildings are hybrids, composed of many different materials and building products and there is lack of innovative solutions for new products using hybrid materials. EU-MAT will engage students and expert designs with local businesses to produce new building products to expand future re-usage scenarios for the reclaimed materials. Effectively reusing or recycling building products in this way will help reduce the impacts from the extraction of virgin materials as well as land-filling of construction and demolition waste, such as pollution, habit loss, and carbon emissions and thereby help protect biodiversity and ecosystem services.

### How will the project partnership be structured?

As the coordinating institution for the EU-MAT project, KUAS will implement a comprehensive organizational and coordination strategy to ensure the project's successful execution. This strategy includes following the proposed project roadmap (Annex 03) that outlines goals, milestones, and specific tasks for each partner. Efficient communication channels will be established through online tools (i.e., Microsoft Teams) and regular meetings every 03 months amongst the partners to maintain seamless information flow about the progress of the WPs. The project researchers (PRs) will attend monthly meetings to discuss and collaborate on the research activities. Monitoring mechanisms include regular progress reports and evaluations by individual partnering organizations regarding respective WP led by them, will be employed to track progress, while overall quality assurance processes will be monitored by KUAS so that the planned outcomes from each of WPs are tracked. Risk management strategies will proactively address potential challenges by developing contingency measures. The mutual understanding of partnership and individual responsibilities, as the cooperation agreement amongst the partners will be stored inside the common database of the project consortium. Project personnel will be able to share their knowledge and expertise using the common database (KUAS's OneDrive) to efficiently share know-hows in relevant areas. The project will also support a culture of flexibility, adaptability, and open communication, enabling partners to adjust to changing conditions. Finally, structured conflict resolution mechanisms will follow the guidelines addressed in the EU-MAT collaboration agreement document which will be made amongst the partners upon receiving the funding (the document shall be kept as project documentation by KUAS) to resolve disputes promptly and maintain a positive collaboration environment.

### How will the financial management of the project be handled?

In the EU-MAT project, KUAS, as the lead partner, is responsible for managing the financial flows within the EU partners of the consortium. Interreg Aurora provides funding to the EU lead (KUAS), which then disperses the allocated amounts to the project partners in Finland and Sweden. Norwegian partners receive their share directly from Norway's national funds, as outlined by Interreg Aurora regulations.

Financial reporting is conducted every four months, with funds released based on the expenditures reported by the consortium. Each partner must maintain clear financial records and submit accurate reports to Karelia UAS. These reports are compiled and submitted to Interreg Aurora. If funds are unspent or incorrectly reported, reclaims may be initiated, requiring corrective action or repayment. Partners adhere to programme guidelines, undergo compliance checks, and provide necessary documentation to demonstrate alignment with programme requirements.

The whole budget is calculated based on project months (PMs) from each organization for respective WPs. KUAS with 36 PMs leading the overall project coordination, strategic planning, quality assurance, risk management and developing the material mining method. Aalto has 38 PMs for leading the circularity analysis, contributing to material flow calculations, developing the material mining method and collaborating on building product development. RISE allocates 36 PMs for leading building product development, engaging companies, and overseeing physical testing of end-use products. Finally, UiT also allocates 36 PMs for leading the integration logistics of the developed mining method and new products from reclaimed materials in FI, SE

and NOR. Municipalities from FI, SE and NOR are associated partners providing essential local data for tool development and participating in testing the tool's applicability.

### How will you communicate your project?

EU-MAT will communicate its project activities in compliance with Interreg Auroras publicity requirements across all five work packages (WPs). The WP5 is specifically created to communicate the project activities internally amongst the project consortium, respective organizations official platform and international community. WP5 will oversee dissemination through international student competition, conferences, project presentations, and engagement with local SMEs and municipalities to ensure the projects results are communicated to wider audiences, companies and expert communities. The consortium and involved municipalities from FI, SE and NOR will actively participate internal meetings, interviews, presentations, media appearances both locally and internationally.

A project website will be created by KUAS to publish detailed articles, and project news will be shared on social media with the Interreg Aurora logo prominently displayed, ensuring visibility of EU co-funding. The project will prominently feature the Interreg Aurora programme logo on all printed and digital materials, including the project website, social media channels, student competition materials, SME workshop content, and conference presentations. Each participating organization, including Karelia UAS, Aalto University, RISE, and UiT, will publish regular short reports on their official websites and communication channels, acknowledging the financial support from Interreg Aurora. The project will provide regular updates on the projects progress and outcomes on its dedicated subpage hosted on the Interreg Aurora website. A final workshop and webinar will be held to present the projects results, ensuring long-term knowledge transfer and broader visibility.

## 1.7 Project activities

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| 1 - WP 01: Circularity Analysis of Building Materials | WP1 aims to assess the current and future quantity of materials contained in the building stock and determine the recoverable amount after the dismantling or demolition of a building. Buildings store significant amounts of highly valuable materials, which could be utilized in place of primary resources if they could be effectively recovered from building renovations and demolitions, and their condition assessed for future reuse or recycling potential in a materials cascade. This WP builds on the earlier research conducted by Nasiri et al. (2023, 2022), and lays the foundation for municipality/regional/national level material stock and flow model through qualitative and quantitative assessment of existing materials using certain criteria (i.e., building type, built year, floor area and height). WP1 | 2024-12-31 - 2027-12-30 | 275,186 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | has 03 main tasks assigned with 38 project months (PMs) during the timeline of 2025-2027. The tasks are: 1. Materials intensity (MI) calculation (18 PMs), 2. Quantity and quality of demolition materials (6 PMs), and 3. Developing the Stock and flow model (6 PMs). These tasks are designed in a consecutive manner, where the earlier task will build the foundation for the next task and also produce short-term deliverables to be shared with the interconnected tasks from other WPs, where 6 PMs are allocated for joint activities. The first stage of WP1 focuses on determining the MI coefficients for selected building types. MI provides a value for the average amount (mass) of a certain building material found in particular building typology and construction year. The MI coefficient's applicability will be tested in real case study buildings (3 different types) through case study building analysis in cooperation with KUAS and City of Joensuu's Kotilahti project (WP2.1). The findings will be utilized for WP1.2 and developing the mining method with KUAS (WP2.2, 2 PMs) and new product idea development with RISE (WP3.1, 4 PMs). All the outputs will contribute to dissemination (WP5.3). | | |
| **1.1** - Materials intensity | Buildings consist of various structural materials and products (e.g., reinforced concrete, brick, stone, solid timber, engineered wood composites and panels, steel, etc.) and products used in non-structural parts (e.g., gypsum boards, plastic films, polymeric foams, rock wool insulation). The bulk of the materials are to be found in the structural parts of buildings, comprising the foundations, walls, floors, and roof structure, as well as internal partition walls etc. The amounts and array of building | 2024-12-31 - 2027-12-30 | 120,376 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | products/materials will also vary depending upon building typology and when the building was constructed. For example, log construction of the early part of the 20th century gave way to lightweight timber framing and reinforced concrete has come to dominate the construction of multi-story block of flats. To determine the material potentially salvageable from particular building built in a certain era, it is necessary to understand what materials and their quantities are typically found. The aim is to determine material intensity (MI) coefficients for selected building types. MI provides a value for the average amount (mass) of a certain building material found in particular building typology and construction year.<br><br>Based on methods developed previously (Nasiri et al, 2023), the materials intensity of selected buildings will be assessed. The selected buildings will be modelled, and a material take-out carried out. This will provide overall values for the quantity of materials of interest, principally timber and concrete. From these values, MI can be calculated by dividing the mass by the gross floor area (GFA) to give a value of the mass of material per unit GFA. The modeling approach will be complemented by other techniques such as those based on scanning. The material intensity of buildings, especially relating to timber, could also include not just overall volumetric values, but could be more granular, e.g., product types / dimensions / and location in building. | | |
| **1.2** - Quantity and quality of demolition materials | The MI calculations in Task 1.1 provide estimate of the total amount of materials and product installed in a building. This figure will however differ from the amount of materials that can be recovered from the demolition or | 2024-12-31 - 2027-12-30 | 92,938 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | dismantling of a building. During demolition the use of heavy machinery, frequently causes damage to the materials, resulting in reduced dimensions in case of timber, more impurities in concrete and, often, overall lower quality. Careful dismantling such as systemic demolition, where practicable can help to retain dimensions and quality, arguably helping to make reuse and high-level recycling more likely. The aim of this task is to study the quantity (dimensions of recovered materials) and quality (difference in the quality of recovered material vs that of virgin materials) of secondary resources that can be recovered from building demolition and dismantling. The quantity and quality of wood material arising from demolitions and yields (recovery factors) of different 'grades' will be established. This would include possible allocation approaches (e.g., for wood products this might be direct reuse or recycling to different end use scenarios  laminated boards, particleboard, energy). This would build on work carried out in projects such as InFutUReWood and DUET as well as the ongoing TiReX and CircBoost projects. The methods employed would include demolition site surveys, interviews, scrutiny of technical documentation and plans, if available; sampling during demolition will be carried out as well, with full analysis of the recovered materials being carried out at the partners' labs. | | |
| 1.3 - Stock and flow model. | The MI assessment undertaken in Task 2.1 and the quality analysis on Task 2.2 provide information at building level for average buildings. In Task 2.3, the MI coefficients determined in 2.1 will be applied to building production statistics to determine the material and building products entering buildings and the | 2024-12-31 - 2027-12-30 | 61,872 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | building stock on an annual basis. By applying different mathematical functions, representing the probability of building survival, to buildings in the building stock, it is possible to estimate the out flow of material, at least at national, regional or municipality level. Based on previous research (Nasiri et al 2022), a materials stock and flow analysis will be carried out to predict the volumes and quality of building products becoming available at national level. This model will be based on the aforementioned bottom-up statistical approaches, though due to some limitations of the approach, other approaches to investigate the building stock metabolism, e.g., using imaging approaches, will be explored. The methods employed will use statistical data obtained from national statistics and will make use of an existing model executed in the Python environment develop by Nasiri et al. (in preparation). The output from this model will serve as the input to the tool to be developed in Work Package 3. | | |
| 2 - WP 02: Buildings as material stock & mining | WP2 is dedicated to developing an effective mining method for recovering materials from buildings undergoing renovation or demolition. In Task 2.1, building-specific case studies are conducted in collaboration with the City of Joensuus Kotilahti project, where real-time data on material flow is collected and compared to initial estimates based on Aalto Universitys material intensity (MI) coefficient analysis. This step focuses on minimizing estimation errors and understanding the usability of recovered materials by examining buildings construction year, material quality, and quantity. The insights from these case studies will help refine the MI co-efficient and develop the material tracing | 2024-12-31 - 2027-12-30 | 433,780 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | approach to be applied in northern cities. Additionally, it will set the foundation for a systematic approach to material flow analysis, which will be scaled in the following stages of WP2.<br><br>In Task 2.2, the mining method is developed by combining real-time and open-source data, GIS-based building location analysis, and transportation network proximity, all aimed at optimizing material circularity. This data-driven method is further enhanced with machine learning models developed with UiT, allowing for city-wide material stock analysis and predictive capabilities. In Task 2.3, the mining method is piloted using datasets from the municipalities of Skellefteå and Sortland to validate its applicability and gather feedback. The municipalities active involvement in testing and refining the tool will help ensure its practical use in future material recovery efforts. The results and feedback will be consolidated to improve the method, preparing it for further user-interface development and broader regional applications in future. The results will be shared with the scientific community, companies and wider audience through scientific articles, reports, presentations in workshops contributing to WP5. | | |
| 2.1 - Building case specific analysis | This phase involves creating the initial framework and methodology for real-time data collection for material mining in the later phase. This task includes:<br><br>Building-Specific Studies:<br><br>This includes case study building analysis to derive real-time data of material flow and compare with the initial estimated data based on the analysis from Aalto University. The city of Joensuu will collaborate in this phase with the | 2024-12-31 - 2027-12-30 | 137,348 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | ongoing KotiLahti project. The focus is to conduct case studies on selected buildings to analyze, calculate and compare the percentage of usable materials to assess the theoretical calculation error as much as possible. This will help minimizing the error of material estimation in larger datasets.<br><br>Data Collection and Preparation:<br><br>By extending the material quantity and quality analysis by Aalto University, real time data of the case study buildings is utilized as a systematic approach for analyzing the realtime applicability of the MI co-efficient developed by Aalto, as an approach of material traceability in existing buildings of the case study cities. This includes: collection of building-specific data, including location, volume, material quality and quantity before and after demolition, construction year. We will utilize findings from previous projects like InFutUReWood and DUET for understanding the quality of wood material from demolitions and potential reuses. The focus is estimating the percentage/quantity and quality of usable materials based on building types and construction year. We will compare the identified barriers by UiT (WP5) to be applied to the selected context for effective usage of materials. | | |
| 2.2 - Development of the Mining Method | This task builds on the work of S. Keya (in preparation) with the data previously acquired from the City of Joensuu. In this stage we will obtain building and infrastructure data including building types, materials, construction years, and locations. By extending the material quantity and quality analysis by Aalto University, building locational analysis using GIS is utilized as a | 2024-12-31 - 2027-12-30 | 139,022 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | systematic approach for larger scale material traceability in existing buildings of the case study cities. This combines the earlier work, i.e., building-specific real data, location and road network based proximity analysis, MI efficient-based approach for predicting material quality and quantity. We will combine open source data and real time data for efficient mining method development.<br><br>Applying on larger dataset:<br><br>After analyzing and filtering the derived data, we will implement the mining method in the larger dataset from City of Joensuu. The objective is to validate the method by comparing results from different municipalities and adjusting the methodology based on feedback and findings. We will organize interviews and testing sessions with the City of Joensuu professionals. Finally, we will integrate findings with spatial modeling to project data with building locations and estimate material stock and flows on a regional/national scale. The method will be utilizing Machine Learning in big data analysis for city scale material stock. UiT will assist in developing machine learning models to train larger datasets for city-scale building material analysis. This will enhance the tool's predictive capabilities for effective planning and material usage optimization.<br><br>Method: Combining building scale data + Company locations + Transport networks for a holistic approach in material circularity in city scale. | | |
| **2.3** - Piloting the Method Using Data from Different Municipalities | This task includes developing and testing the demo version of the mining method, integrating machine learning and testing practical applicability using different municipality datasets. | 2024-12-31 - 2027-12-30 | 157,410 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | The demo version of the tool will utilize the material flow analysis method by Aalto University, and the building locational analysis by KUAS for the back end calculation. UiT and RISE will play a crucial role in testing the utility of the tool with the municipalities. During the pilot testing all the results, experiences and feedback from the municipalities will be collected and summarized as reports and publications.<br><br>Piloting and validating:<br><br>The method will be tested on data collected from municipalities in Sweden and Norway. The datasets will be collected and purged for testing the mining method by UiT and RISE in parallel. This stage will summarize the applicability and scope for further development for the user-interface development in future. | | |
| 3 - WP03: Development of Circular Building Products | Circular design of building elements is a key strategy of circular economy for the construction industry and built environment, aiming to keep materials in a closed loop as long as possible. While circular concepts have gained significant attention, the design and end-of-life stages are often overlooked compared to other phases of the material life cycle. To address this gap, Design for Disassembly and Reuse (DfD/R) highlights the importance of designing building elements with future deconstruction and reuse in mind, ensuring that products can be dismantled without damage.<br><br>Following cradle-to-cradle and closed loop models, this work package aligns with ISO 20887:2020 which provides principles, requirements, and guidance for the design of buildings and civil engineering works to facilitate disassembly and adaptability. The focus of WP3 | 2024-12-31 - 2027-12-30 | 114,788 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | is the development of circular building products made from reclaimed materials, ensuring that these products can be efficiently disassembled and reused at the end of their life cycle. The developed products will further be analyzed based on principles of ISO 20887:2020. Mechanical tests will also be performed to ensure the developed products performance after their first life cycle. | | |
| 3.1 - Expert Design of Circular Building Products for Disassembly and Reuse | In this task, a measurement system will be developed based on the guidelines from ISO 20887 to assess the strengths and weaknesses of the building products generated in WP 3.1. This system will evaluate the products potential for future disassembly without causing damage to the adjacent materials or elements. To align with closed-loop material models and strategies, one of the building products from WP 3.1 will be selected for further development and optimization.<br><br>The improvement process will involve integrating seven disassembly principles of ISO 20887 into the design of the selected product to ensure its effective and safe future disassembly. A comparison will be made between the products initial design and an improved version that features a higher degree of disassembly at the end-of-life stage.<br><br>The outcome of this task will be a future adaptive designed building product made from reused timber, designed specifically for easy, safe, and effective disassembly. In addition, guidelines will be developed to illustrate how various design parameters contribute to closing the material loop in future life cycles of the product. | 2024-12-31 - 2027-12-30 | 49,394 |
| 3.2 - Development of | In this WP the innovative circular | 2024-12-31 | 49,650 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| Product | building product identified during workshops and selected for development and improvement in WP 3.2 will be fully developed with a focus on disassembly, following the principles of ISO 20887. This full-scale product will be manufactured by our industry partner for further investigations and testing. RISE will coordinate closely with the industry partner throughout the development process. The outcome of this task will be a full-size product, designed for easy disassembly, which will proceed to the testing stage in WP 3.3. | - 2027-12-30 | |
| 3.3 - Mechanical Tests | To ensure the performance of the designed building product their mechanical stability will be evaluated by technical tests performed on the developed product prototypes built together with the industry partners. The testing will be performed at RISE facilities in Skellefteå. The testing methodology can be summarized as performing appropriate test methods based on standards, disassembly of products, reassembly, and performing the selected test method once again or more if needed. The procedure will evaluate and ensure the mechanical performance of elements after their first life cycle when they are disassembled without any damages and are ready to be moved to or used in their next place of use. The outcomes of this task will be technical reports on the mechanical properties of the product, recommendations for improving the circular design of the developed product, and guidelines on its dis- and reassembly process. | 2024-12-31 - 2027-12-30 | 15,744 |
| 4 - WP 04: Integration logistics | The integration process plays a critical role in the success of applicability of any novel technology and digital tool. Integration logistics, which is the work package (WP) 04 of EU-MAT project, will include the locality of | 2024-12-31 - 2027-12-30 | 173,287 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | planned urban material mining tool considering the aspect of various regulation in the Aurora cross-border region of Norway, Sweden, and Finland. The initial layers of the digital tool are quantity and quality of the building material, type and age of structure, developed within WP1; as well as transport networks and availability within WP2. Furthermore, WP2 deals with developing the mining method using spatial modelling, while WP3 provides the testing of data and generated method's applicability. This WP investigates and develops the final layer of the digital tool, which is the locality, implying cross-border policy comparison and integration between the Aurora region of Norway, Sweden, and Finland. The regulation is observed from the environmental aspect, recycling and certification of recycled materials, as well as transport aspect including possibilities of cross-border exchange of the recycled materials. The layers represent input information about the urban landscape of the observed municipalities and background information such as urban planning and regulation. Since the urban structure is observed on a large scale, generated big data can serve to develop a machine learning model for classification and prediction. Machine learning will be used to classify urban zones based on various categories. Furthermore, development of models for prediction of material intensity will be attempted. Finally, integration of the digital tool and machine learning model implies the final tests and validation. The validation of the mining method and machine learning model on larger dataset will be performed applying the information generated from the demolition activities within the project | | |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | currently performed in Sortland municipality in Northern Norway. | | |
| **4.1** - Cross-border regulation - Locality | EU-MAT project is based in the Aurora region comprehending the northern regions of Norway, Sweden, and Finland. Practical implementation of the developed digital tool may be enabled only after the detailed investigation of the policy and regulation from the three countries of Aurora region. The observed policies will include guidelines for the demolition process and types of demolition employed in the Aurora region, coupled with the regional characteristics such as harsh climate conditions and low population density. The specificity of this region is described by the sparse urban areas which in this case mostly affects the transport lengths and conditions. Furthermore, observed regulations refer to the cross-border comparison of reuse and recycling practice of the demolition waste, as well as certification of recycled materials for re-introduction into the building process. Additionally, environmental provisions of the three countries must be included, considering the planned regulation that are not yet enforced. This work represents the locality aspect of the material mining tool. Implementation of the locality layer presents a next step in the tool development, i.e., implementation of cross-border regulations regarding the recycling procedures and certification of recycled materials. | 2024-12-31 - 2027-12-30 | 40,300 |
| **4.2** - Practicality of digital tools - Pilot project in Sortland | Practicality of the material mining tool will be validated using the information obtained from the demolition site of the Nortura building located in Sortland municipality of Norway. Generated demolition waste will be used for the construction of the new Gaia Vesterålen museum in Sortland that is planned to contain 95% of recycled materials. | 2024-12-31 - 2027-12-30 | 63,008 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | Building demolition and subsequent construction is led by Sortland municipality in the frame of CircBoost project (HORIZON Europe), as one of the projects Pilots. The municipality is the main stakeholder in the Pilot project, and as such, is a participant of every stage of the selective demolition process from the administrative and technical preparation, to recycling and storage of waste materials. The pre-demolition stage includes the environmental mapping of the Nortura building, site hazard assessment, production of tender documentation with the details of the selective demolition and contracting the demolition company. The building will be subjected to selective (partial) demolition, meaning that firstly the hazardous materials will be stripped off according to Norwegian regulation, followed by careful dismantling of elements planned for recycle/reuse, and finally mechanical demolition of unusable (contaminated) concrete and other elements. Throughout this process, generated information will be used to validate the material mining tool and machine learning model. | | |
| **4.3** - Machine Learning Models | The first stage of development of artificial intelligence by B. Widrow and M. Hoff (Stanford, 1959) marked the beginning of a new era of technology. The conference held in Trieste, Italy in 1984 opened a discussion on the topic of transforming brain functions onto a mathematical level. Johannesma introduced concepts for the analysis of neural responses to external stimuli, which would be used for an objective definition of receptive fields. However, the development was gradual until Ng and Dean created a network that learned to recognize a high-level concept (cat or no cat) in 2012. Extensive work followed, making machine | 2024-12-31 - 2027-12-30 | 69,979 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | learning technology approachable and usable in many different areas. Artificial neural networks (ANNs) present one of the most used machine learning techniques. It is based on the theory of connectionism, which was first proposed during the 1940s to simulate processing of the human brain. However, the concept was not widely used until the development of information technology, which allowed its reopening and further deployment. Currently, ANNs serve for classification, i.e., the prediction of a categorical value, or regression, i.e., the prediction of a numerical value. The basic concept of ANNs is grounded in the learning of patterns from the presented examples in a supervised or unsupervised manner, in other words, with or without the target values, respectively.<br><br>Development of machine learning models will be attempted for classification of buildings within different urban areas. Several models will be made to find the optimal algorithm to classify structures based on the data collected and processed within work packages 1, 2, 3, and 4. Additionally, development of regression models for prediction of available materials for reuse/recycle will be attempted. Planned models include ANNs, however, other techniques will be applied if the results show that some other technique would be more fitting. | | |
| 5 - WP05: Circular Innovation Workshop and Knowledge Dissemination | WP5 aims to communicate the project's goals, achievements, and innovations to a diverse audience, while faciliating stakeholder engagement, collaboration, and the adoption of circular economy principles in construction. This WP is designed to maximize the impact of the project by ensuring that knowledge is shared | 2024-12-31 - 2027-12-30 | 189,317 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | effectively and stakeholders are actively involved in shaping the project outcomes. WP5 consists of the following key tasks: student competition, workshop and dissemination. Karelia UAS, in collaboration with Aalto University and UiT, will organize a student competition aimed at designing innovative building products from recovered materials. This competition encourages students to explore how salvaged materials can be repurposed into sustainable products through research and prototype development. Additionally, a series of hybrid workshops will engage local SMEs, municipalities, and stakeholders from Finland, Sweden, and Norway to explore and develop circular business models using tools like the "Circular Compass." These workshops will facilitate cross-border collaboration, allowing participants to share insights and refine project outcomes, including student prototypes. Dissemination of the project's results will be achieved through scientific publications, social media, websites, conferences, and local media, ensuring broad visibility and impact. Interreg Auroras visibility guidelines will be followed, and all findings, including the mining method and developed circular models, will be shared with municipalities and SMEs to encourage long-term adoption and sustainability. | | |
| 5.1 - Student competition | Karelia UAS, in collaboration with Aalto University and UiT, will host a student competition aimed at designing innovative building products from recovered materials. The competition will focus on circular construction principles, where students will explore how materials salvaged from the demolition of old buildings can be reused or repurposed into sustainable, | 2024-12-31 - 2027-12-30 | 26,590 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | functional, and marketable building products. The teachers from Karelia UAS will actively organize the competition and jury board will include experts from all partnering organizations.<br><br>Objective: The main goal of the competition is to encourage students to think creatively and critically about how recovered materials can be integrated into modern construction. Participants will be tasked with identifying potential uses for salvaged materials and developing new building product prototypes that can meet sustainability, functionality, and aesthetic standards.<br><br>Phases of the Competition:<br><br>Phase 1: Material Research and Conceptualization (Online)<br>Task: Students will research materials and marketplaces for recovered material inventory from the demolition in partnering countries and explore their potential in modern construction.<br>Deliverable: Each team will submit a report identifying the materials' properties, potential challenges, and innovative reuse possibilities.<br><br>Phase 2: Prototype Design (1 week intensive workshop at Karelia UAS with students)<br>Task: Based on their research, teams will design a prototype of a building product made from the recovered materials. This product could range from structural components (e.g., beams, panels) to interior elements (e.g., insulation, decorative finishes).<br>Deliverable: Teams will present detailed sketches, CAD models, or 3D printed models of their designs, along with a description of how the product contributes to circular construction practices. | | |
| 5.2 - International | This task focuses on engaging the | 2024-12-31 | 87,955 |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| Workshop | local SMEs, municipalities and stakeholders for more in-depth discussions with partners. It will benefit the project to include a number of workshops on circular business models. Using tools such as the "Circular Compass" (Omställningslyftet - Cirkulär Kompass \| RISE) and together talk about Current State, Vision, and Pathway Forward) 2-3 workshops will be organized during project time to offer a structured space to explore and develop specific circular business models, combining our different knowledge in Norway, Finland and Sweden.<br><br>Adding more workshops will also provide a platform to strengthen collaboration, share insights, and help partners learn from each other's experiences while navigating the challenges of adopting circular practices. These workshops will be held in hybrid mode, ensuring accessibility for all partners regardless of location, reducing costs, and encouraging broader participation. This will help align all partners around a common vision to achieve the projects goals. In summary, these workshops will maximize the project's impact, enhance cooperation, and ensure that the outcomes are both meaningful and actionable for everyone involved.<br><br>Objectives of the workshops:<br><br>Present student-designed and expert-developed building prototypes using recovered materials.<br>Facilitate discussions between industry professionals, academics, and students on the commercial potential and scalability of the designs.<br>Collect feedback from companies to refine and further develop the prototypes for real-world applications. | - 2027-12-30 | |

| Workpackages / Activities | Description | Start date – End date | Cost |
|---|---|---|---|
| | Promote cross-border collaboration between Finnish, Swedish, and Norwegian stakeholders in circular construction. | | |
| 5.3 - Dissemination | The dissemination plan for the EU-MAT project focuses on effectively communicating the project's goals, progress, and results to a diverse audience, including municipalities, SMEs, academia, policy-makers, and the general public. The dissemination will be achieved through multiple channels such as scientific publications, project websites, social media platforms, international conferences, and workshops. Regular updates will be provided on partner websites, and the project website will feature news, downloadable reports, and key developments. Social media will engage a broader audience with real-time updates, while local news media in Finland, Sweden, and Norway will highlight the projects milestones and societal impact. Workshops and international events, including the student competition and SMEs engagements, will offer interactive platforms for sharing knowledge and gathering feedback. Compliance with Interreg Auroras visibility requirements, such as using the appropriate logos and displaying mandatory posters, will ensure transparency and recognition of EU funding. The dissemination will also include final reports and media campaigns summarizing the projects outcomes, with the goal of encouraging the adoption of the mining method by municipalities and SMEs, contributing to a sustainable, circular economy for building materials. | 2024-12-31 - 2027-12-30 | 74,772 |

## 1.8 Indicators

**Output indicators**

| | | |
|---|---|---|
| Applications submitted to EU | The EU-MAT consortium is | Startvalue: *N/A* |

| | | |
|---|---|---|
| programmes | well-suited to contribute to the Horizon Europe calls focusing on circularity and recovery of high-quality secondary raw materials from buildings (i.e., HORIZON-CL5-2024-D4-02-04).<br><br>The Horizon call aims to achieve long-term impacts in reducing the environmental footprint of the construction sector and advancing the circular economy. The EU-MAT consortiums work packages are designed with a clear focus on sustainability, business engagement, and creating lasting solutions for circular material usage. The development of scalable tools and prototypes, combined with a strong dissemination strategy, ensures that the consortiums outcomes can contribute to widespread adoption and impact in the construction industry across Europe. The existing WPs in EU-MAT which can be adapted for widespread utilization in Europe are:<br><br>1. Detailed calculation and prediction of material flow<br>2. Spatial modelling and machine learning integration in regional material resourcing<br>3. Innovation in Product Development<br>4. Cross-Border and Multi-Stakeholder Collaboration<br>5. Sustainable and low-emission renovation and construction of future buildings<br><br>In summary, the EU-MAT consortium is well-positioned to contribute successfully different Horizon Europe calls similar to HORIZON-CL5-2024-D4-02-04 through its focus on circularity, digital tools for material recovery, cross-border collaboration, and innovation in sustainable building products. The consortium's comprehensive approach to recovering and reusing materials from buildings aligns with the calls goals, making it a strong | Targetvalue: 1<br>Unit: Applications |

| | | |
|---|---|---|
| | candidate for funding under Horizon Europe. | |
| Research organisations participating in joint research projects | In the EU-MAT project, four key research organizations- KUAS, UiT, Aalto, and RISE are not only collaborating within the project itself but also actively participating in other parallel research initiatives with additional partners in other projects. These ongoing projects with external research organizations expand the network of collaboration, leading to a total of approximately 30 research organizations participating in joint research efforts during the timeline of 2025-2027.<br><br>KUAS, Aalto, UiT, and RISE are involved in various other research collaborations that complement the work being done in EU-MAT. For instance, their ongoing projects related to circular economy, material recovery, and sustainable construction practices contribute additional data, expertise, and innovative methods to the EU-MAT framework. This creates an enriched, cross-disciplinary environment where knowledge from multiple research projects is shared, accelerating innovation.<br><br>These parallel research projects allow EU-MAT to leverage findings from broader research networks, increasing the project's potential for developing scalable solutions and enhancing its long-term impact. This active participation also enables these research institutions to apply insights gained from EU-MAT in their other ongoing initiatives, creating a two-way flow of information that benefits both EU-MAT and the larger research community. | Startvalue: *N/A*<br>Targetvalue: 30<br>Unit: Research organisations |
| Enterprises cooperating with research organisations | It is estimated that around 20 enterprises will cooperate with research organizations during the EU-MAT project through their participation in | Startvalue: *N/A*<br>Targetvalue: 20<br>Unit: Enterprises |

| | | |
|---|---|---|
| | international workshops held in Finland, Sweden, and Norway, as part of WP4.2, 4.3 and 5.2. These workshops are designed to foster collaboration between academia and industry in the fields of circular economy, material recovery, and sustainable construction.<br><br>The workshops will serve as platforms where companies can engage directly with research institutions such as KUAS, Aalto, UiT, and RISE. Through these interactions, enterprises will share their industry expertise and learn from cutting-edge research methods developed by the academic partners. This collaboration will support businesses in adopting the innovative solutions from the EU-MAT project, including the mining method and new building products made from reclaimed materials.<br><br>This estimated cooperation will integrate enterprises into the research process, enabling them to provide real-time feedback, test prototypes, and explore opportunities to scale the solutions. Such engagement ensures that the project outcomes are both commercially viable and applicable across different regions and industries. | |
| Jointly developed solutions | The four developed solutions are joint efforts, created through collaboration among multiple project partners, including KUAS, Aalto, UiT, and municipalities such as Joensuu, Skellefteå, and Sortland. These solutions are the result of shared expertise and resources, combining knowledge from different fields such as material science, circular construction, and regional planning.<br><br>1. Stock and flow model for building-level material assessment: This solution is jointly developed by KUAS, Aalto, and UiT through the integration of material intensity coefficients, real- | Startvalue: *N/A*<br>Targetvalue: 4<br>Unit: Solutions |

| | | |
|---|---|---|
| | time data from building case studies, and regional data analysis from Finland, Sweden, and Norway. The model reflects the collaborative input across borders to assess materials available in the built environment.<br><br>2. Demo version of the mining method: This solution builds on shared research from the partners, integrating methods from Aalto's material quality analysis, Joensuu City and other municipalities case data, and UiT's machine learning models. It is piloted in multiple regions (Finland, Sweden, Norway), with feedback and data shared among the partners to refine and validate the method.<br><br>3. Integration logistics summary for FI+SE+NOR: This joint logistical framework combines the expertise of each partner to outline effective processes for material transportation and coordination across regions, ensuring seamless material flow between the three countries and aligning with national regulations and practices.<br><br>4. Innovative building products from reclaimed materials: This solution is the result of student competitions and workshops hosted by KUAS in collaboration with Aalto, UiT, and RISE, where students and professionals work together to design and prototype products. The recovered materials from demolition case studies are used in these prototypes, making it a cross-border, interdisciplinary collaboration. | |

**Result indicators**

| | | |
|---|---|---|
| Number of approved applications to EU programmes | | Startvalue:<br>Targetvalue: 1<br>Unit: Applications |
| Small and medium-size enterprises (SMEs) introducing product or | As per the WP4, at least 01 company will collaborate with RISE in the new product | Startvalue:<br>Targetvalue: 1<br>Unit: Enterprises |

| | | |
|---|---|---|
| process innovation | innovation from reclaimed materials within the EU-MAT project time frame. This company, collaborating closely with RISE, will focus on developing a building product made from reclaimed materials. As part of WP5, the innovation process will also involve feedback collection from companies during international workshops. Finally WP4 includes physical product development, testing, and refinement, ensuring that the product meets sustainability, functionality, and market demand criteria.<br><br>Through joint research and development efforts with RISE, the company will be able to leverage the cutting-edge circular construction methods developed in the project, including the mining method and material traceability innovations. The goal is to ensure that developed products can be adapted for market introduction in future. | |
| Solutions taken up or up-scaled by organisations | The material mining method, as developed in the EU-MAT project, offers a long-term solution for sustainable resource management by enabling the recovery, reuse, and repurposing of valuable materials from demolished or renovated buildings. During the project timeline, cities such as Joensuu, Skellefteå, and Sortland will actively test and apply this method, demonstrating its practicality and scalability. This will lay the foundation for these municipalities to continue utilizing the mining method beyond the project's conclusion. By incorporating real-time data collection, material stock and flow models, and collaboration with local stakeholders, these cities can create a self-sustaining system for resource optimization. The method enables them to minimize reliance on primary raw materials, reduce environmental impact, and lower construction costs, all | Startvalue:<br>Targetvalue: 1<br>Unit: Solutions |

| | | |
|---|---|---|
| | while promoting circular economy principles. This successful testing phase allows municipalities to upscale the solution across other regions or sectors, fostering cross-sector cooperation, innovation in building practices, and alignment with long-term sustainability goals. By continuing its implementation, the mining method can be fully integrated into regional strategies, contributing to sustainable urban development in the future. | |

## 1.9 Budget EU

**Costs**

| Cost categories | Karelia Ammattikorkeakoulu Oy | Aalto University Foundation sr | RISE Research Institutes of Sweden AB | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Staff cost: WP3 Expert 2- WP3-5 | 0 | 0 | 19,715 | | | | | | | **19,715** |
| Staff cost: WP3 Expert 1- All WPs | 0 | 0 | 38,160 | | | | | | | **38,160** |
| Staff cost: WP1 Expert 2 - Activity 2.2 and 2.3, WP 2, 5.3, WP5 | 0 | 8,327 | 0 | | | | | | | **8,327** |
| Staff cost: WP3 Expert 3- All WPs | 0 | 0 | 59,752 | | | | | | | **59,752** |
| Staff cost: WP2 Expert 1 - Activity 2.1, 5.2, 5.3 | 90,000 | 0 | 0 | | | | | | | **90,000** |
| Staff cost: WP3 Expert 6- WP5 | 0 | 0 | 5,143 | | | | | | | **5,143** |
| Staff cost: WP3 leader- all activities | 0 | 0 | 42,667 | | | | | | | **42,667** |
| Staff cost: WP1 Expert 1- Activity 1.1, 1.2, 1.3, 5.3 | 0 | 133,122 | 0 | | | | | | | **133,122** |
| Staff cost: WP1 leader- all activities | 0 | 20,036 | 0 | | | | | | | **20,036** |
| Staff cost: Communication expert - all WPs | 16,650 | 0 | 0 | | | | | | | **16,650** |
| Staff cost: Teachers - 5.1 | 6,618 | 0 | 0 | | | | | | | **6,618** |
| Staff cost: WP3 Expert 5- WP5 | 0 | 0 | 9,528 | | | | | | | **9,528** |
| Staff cost: Project leader- Management All WP:s and activity for 2.2, 2.3, 5.1, 5.3 | 234,000 | 0 | 0 | | | | | | | **234,000** |
| Staff cost: WP3 Expert 4- WP3 | 0 | 0 | 14,108 | | | | | | | **14,108** |
| Staff cost: WP1 Expert 3 | 0 | 20,036 | 0 | | | | | | | **20,036** |
| Other costs 40% | 138,907 | 72,608 | 75,629 | | | | | | | **287,144** |
| **Sum costs** | **486,175** | **254,129** | **264,702** | | | | | | | **1,005,006** |
| **Deduction of project income** | | | | | | | | | | |
| **Total deduction** | | | | | | | | | | |
| **Total costs** | **486,175** | **254,129** | **264,702** | | | | | | | **1,005,006** |
| **Sum total costs** | **486,175** | **254,129** | **264,702** | | | | | | | **1,005,006** |

**Co-financing**

| Financier | Karelia Ammattikorkeakoulu Oy | Aalto University Foundation sr | RISE Research Institutes of Sweden AB | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Public co-financing** | | | | | | | | | | |
| Regional council of Lapland: The Regional council of Lapland has been contacted about the co-financing for Finnish partners. Total 70% of the non-EU share is estimated to be asked from the Regional council of Lapland. The received share will be divided between KUAS and Aalto | 119,113 | 62,261 | 0 | | | | | | | **181,374** |
| Region Västerbotten: Region Västerbotten has been contacted for 50% of the co-financing share from the 35% non-EU funded share for RISE | 0 | 0 | 46,324 | | | | | | | **46,324** |
| Region Norrbotten: Region Norrbotten has been contacted for 50% of the co-financing share from the 35% non-EU funded share for RISE | 0 | 0 | 46,323 | | | | | | | **46,323** |
| **Total public co-financing** | **119,113** | **62,261** | **92,647** | | | | | | | **274,021** |
| **Total all public co-financing methods** | **119,113** | **62,261** | **92,647** | | | | | | | **274,021** |
| **Private co-financing** | | | | | | | | | | |
| Karelia UAS: KUAS will be responsible for the remaining share of co-financing apart from the considered portion from Lapin Liitto. In | 51,048 | 0 | 0 | | | | | | | **51,048** |

| Financier | Karelia Ammattikorkeakoulu Oy | Aalto University Foundation sr | RISE Research Institutes of Sweden AB | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| this case, the estimated share is 30% of the non-EU share. | | | | | | | | | | |
| Aalto University: Aalto will be responsible for the remaining share of co-financing apart from the considered portion from Lapin Liitto dispersed via KUAS. In this case, the estimated share is 30% of the non-EU share. | 0 | 26,683 | 0 | | | | | | | **26,683** |
| **Total private co-financing** | **51,048** | **26,683** | **0** | | | | | | | **77,731** |
| **Total all private co-financing methods** | **51,048** | **26,683** | **0** | | | | | | | **77,731** |
| **Total public and private co-financing** | **170,161** | **88,944** | **92,647** | | | | | | | **351,752** |

**Support**

| Financing | Karelia Ammattikorkeakoulu Oy | Aalto University Foundation sr | RISE Research Institutes of Sweden AB | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Total financing | 316,014 | 165,185 | 172,055 | | | | | | | **653,254** |

**Support and financing**

| | Karelia Ammattikorkeakoulu Oy | Aalto University Foundation sr | RISE Research Institutes of Sweden AB | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Total financing | 486,175 | 254,129 | 264,702 | | | | | | | **1,005,006** |

**Compilation**

| | Karelia Ammattikorkeakoulu Oy | Aalto University Foundation sr | RISE Research Institutes of Sweden AB | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Sum | 486,175 | 254,129 | 264,702 | | | | | | | **1,005,006** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| total costs | | | | | | | | | | |
| Sum co-financing | 170,161 | 88,944 | 92,647 | | | | | | | **351,752** |
| Applied support | 316,014 | 165,185 | 172,055 | | | | | | | **653,254** |
| Support share | 65.00% | 65.00% | 65.00% | | | | | | | **65.00%** |

| | |
|---|---|
| Support share of actual costs | 65.00% |
| Support share of total costs | 65.00% |
| Support share of financing base for support | 65.00% |
| Support share of total financing | 65.00% |
| Support share of other public co-financing | 27.27% |
| Support share of public co-financing | 92.27% |
| Support share of private co-financing | 7.73% |

## 1.10 Norwegian budget

**Costs**

| Cost categories | UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Staff cost: Expert 3 | 34,020 | | | | | | | | | **34,020** |
| Staff cost: Expert 1 | 44,291 | | | | | | | | | **44,291** |
| Staff cost: Expert 2 | 30,811 | | | | | | | | | **30,811** |
| Staff cost: Expert 4 | 20,412 | | | | | | | | | **20,412** |
| Other costs 40% | 51,814 | | | | | | | | | **51,814** |
| **Sum costs** | **181,348** | | | | | | | | | **181,348** |
| **Deduction of project income** | | | | | | | | | | |
| **Total deduction** | | | | | | | | | | |
| **Total costs** | **181,348** | | | | | | | | | **181,348** |
| | | | | | | | | | | |
| | | | | | | | | | | **0** |
| **Sum total costs** | **181,348** | | | | | | | | | **181,348** |

**Financing**

| Financier | UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Public financing** | | | | | | | | | | |
| **Total public financing** | | | | | | | | | | **0** |
| **Total all public financing methods** | | | | | | | | | | **0** |
| **Private financing** | | | | | | | | | | |
| UiT: | 90,674 | | | | | | | | | **90,674** |
| **Total private financing** | **90,674** | | | | | | | | | **90,674** |
| **Total all private financing methods** | **90,674** | | | | | | | | | **90,674** |
| **Total public and private financing** | **90,674** | | | | | | | | | **90,674** |

**Support**

| Financing | UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Applied support | 90,674 | | | | | | | | | **90,674** |

**Support and financing**

| | UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Total financing | 181,348 | | | | | | | | | **181,348** |

**Compilation**

| | UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Sum total costs | 181,348 | | | | | | | | | **181,348** |
| Sum co-financing | 90,674 | | | | | | | | | **90,674** |
| Applied support | 90,674 | | | | | | | | | **90,674** |
| Support share | 50.00% | | | | | | | | | **50.00%** |

| | |
|---|---|
| Support share of actual costs | 50.00% |
| Support share of total costs | 50.00% |
| Support share of financing base for support | 50.00% |
| Support share of total financing | 50.00% |
| Support share of other public co-financing | 0.00% |
| Support share of public co-financing | 50.00% |
| Support share of private co-financing | 50.00% |

## 1.11 Contacts

| | |
|---|---|
| Name: | Karin Sandberg |
| Organisation: | RISE Research Institutes of Sweden AB |
| Phone: | |
| Mobile phone: | |
| E-mail address: | karin.sandberg@ri.se |
| Role: | Project leader |
| Published in Projektbanken: | |
| Name: | Leif-Gunnar Hanssen |
| Organisation: | UNIVERSITETET I TROMSØ - NORGES ARKTISKE UNIVERSITET |
| Phone: | |
| Mobile phone: | |
| E-mail address: | leif-gunnar.hanssen@uit.no |
| Role: | Project leader |
| Published in Projektbanken: | |
| Name: | Marja-Liisa Ruotsalainen |
| Organisation: | Karelia Ammattikorkeakoulu Oy |
| Phone: | |
| Mobile phone: | +358505970882 |
| E-mail address: | marja-liisa.ruotsalainen@karelia.fi |
| Role: | Contact person |
| Published in Projektbanken: | |
| Name: | Mark Hughes |
| Organisation: | Aalto University Foundation sr |
| Phone: | |
| Mobile phone: | |
| E-mail address: | mark.hughes@aalto.fi |
| Role: | Project leader |
| Published in Projektbanken: | |
| Name: | Shammi Keya |
| Organisation: | Karelia Ammattikorkeakoulu Oy |
| Phone: | |
| Mobile phone: | +358466182079 |
| E-mail address: | shammi.keya@karelia.fi |
| Role: | Project leader |
| Published in Projektbanken: | |
| Name: | Sissi Pyykönen |
| Organisation: | Karelia Ammattikorkeakoulu Oy |
| Phone: | |
| Mobile phone: | +358505294952 |
| E-mail address: | sissi.pyykonen@karelia.fi |
| Role: | Economy |
| Published in Projektbanken: | |

## 1.12 Documents

| | |
|---|---|
| File name: | Annex 01_ EU-MAT structure.pdf |
| Description: | The project structure, with 5 core work packages (WPs) led by partnering organizations |
| Date attached: | 2024-10-01 |
| File name: | Annex 02_ Circularity in Construction, Letter of Support, City of Joensuu, 4.9.2024.pdf |
| Description: | Annex 02 contains the support letter from the City of Joensuu, Finland |
| Date attached: | 2024-09-30 |
| File name: | KUAS signing document_Nimenkirjoitusoikeudet 020924.pdf |

| | |
|---|---|
| Description: | |
| Date attached: | 2024-09-30 |
| File name: | Letter of confirmation of signature EU-MAT - UiT.pdf |
| Description: | Letter of confirmation of signature - UiT |
| Date attached: | 2024-10-01 |
| File name: | Annex 03_ Roadmap.pdf |
| Description: | Annex 03 illustrates the whole project timeline starting from 2025 till 2027, different planned activities under the five WPs, sub-tasks and respective short-term deliverables leading towards the long-term deliverables for each WP. |
| Date attached: | 2024-10-01 |
| File name: | EU-MAT Idea Presentation.pdf |
| Description: | The document presents the main idea of the EU-MAT project and illustrates how effective circular usage of construction materials in cities is planned through different activities inside the project. |
| Date attached: | 2024-10-01 |
| File name: | Originalansökan |
| Description: | Inkommen originalansökan - Maskinläsbart format |
| Date attached: | 2024-10-03 |