ERA•MIN 3

RAW MATERIALS
FOR THE SUSTAINABLE DEVELOPMENT
AND THE CIRCULAR ECONOMY

ERA-MIN3
2020-2025

Continue strengthening the mineral raw materials community through the coordination of research and innovation programmes on non-fuel and non-food raw materials (metallic, construction, and industrial minerals).

Deliverable D3.5
Joint Selection List of the Projects to be Funded

(Public report)

Date: 15th March 2022

This project has received funding under Grant agreement nº 101003575. Funding Scheme ERA-NET Cofund

E R A•M I N 3

RAW MATERIALS FOR THE SUSTAINABLE DEVELOPMENT AND THE CIRCULAR ECONOMY

Acronym: ERA-MIN3
Title: Raw Materials for the Sustainable Development and the Circular Economy
Grant Agreement number: 101003575
Funding scheme: ERA-NET COFUND
Start date: 1st December 2020
Duration: 60 months

Deliverable D3.5
Joint Selection List of the Projects to be Funded

WP 3: Evaluation and proposal selection for the co-funded call
Task 3.5: Funding Decisions and use of the EC top-up
Task Leader: FCT
Lead beneficiary: FCT
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Author(s): Pedro Ferreira, Stefano Amaral and Dina Carrilho
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ERA-MIN3 comprises a progressive, innovative and flexible pan-European network of 24 public research funding organisations from **16 EU MS countries** (BNSF – Bulgaria; TA CR – Czech Republic; Business Finland – Finland; ETAg – Estonia; ADEME – France; ANR – France; JÜLICH – Germany; GSI – Ireland; MUR – Italy; NCBR – Poland; FCT – Portugal; UEFISCDI – Romania; CDTI – Spain; AEI – Spain; SAS – Slovakia; MIZS – Slovenia; Vinnova – Sweden), **3 EU MS regions** (Hermesfond – Belgium/Flanders; FWO – Belgium/Flanders; SPW – Belgium/Wallonia; CFNA – Spain/Navarra), **one EU Associated country** (TUBITAK – Turkey), and **two non-EU countries** (PRIMA-Québec- Canada; DSI - South Africa).

Built on the experience of the EU project ERA-MIN (2011-2015) and ERA-MIN 2 (2016-2021), ERA-MIN3 aims to support the objectives of the European Innovation Partnership on Raw Materials (EIP RM), the EU Raw Materials Initiative and further develop the raw materials (RM) sector in Europe through funding of transnational research and innovation (R&I) activities, fully aligned with initiatives to support the EU's transition to a Circular Economy in many fields, such as the Circular Economy Action plan, the Battery Action Plan, and the European Green Deal, by moreover answering to the United Nations Sustainable Development Goals. This will be achieved through one EU co-funded call for R&I proposals in 2021, one additional call in 2023 and a potential third one, designed and developed specifically for the non-fuel, non-food raw materials sector.

ERA-MIN3 scope of the joint transnational calls is needs-driven research on non-fuel, non-food raw materials (**metallic, construction and industrial minerals**) that clearly demonstrate potential to promote the sustainable and responsible supply, exploration, extraction, processing technologies, production, consumption and recycling of primary and secondary minerals and metals, as well as substitution of critical raw materials, in a circular economy. There is a focus on resource efficient production and recycling that has low environmental impact and is economically feasible in the short-term. A crucial challenge is to consider societal impact and public perception, health and safety issues related to the different stages of the whole raw materials value chain. New business models and digital technologies will be crucial for transferring research results to the market.

Publishable summary:

This report summarises the list of the 22 projects selected for funding under ERA-MIN Joint Call 2021 co-funded by the European Commission. It includes the call statistics, the data on each project and the publishable abstracts. All these information is public and available at the ERA-MIN website.

Content

Introduction

The ERA-MIN Joint Call 2021 on "*Raw materials for sustainable development and the circular economy*" is a two-stage submission procedure and is the EU co-funded Call for proposals organised by ERA-MIN3 which began on the 1st December 2020.

The present report is a summary of the 22 R&I projects that were selected and recommended for funding. It also includes the overall statistics of the call from the submitted pre-proposals up to the final successful 22 recommended for funding, including the main call topic and sub-topics addressed by the proposals.

The joint selection list of the projects to be funded and the call statistics prepared by task leader will be published on the ERA-MIN website and on the websites of the participating funding organisations.

ERA-MIN Joint Call 2021 was open on 15th January 2021. The scope of the Joint Call is needs-driven research on non-fuel, non-food raw materials (primary and secondary minerals and metals) addressing one or several areas of the circular economy.

The call began with a total of 146 pre-proposals out of which 142 met the Call eligibility criteria. After the consensus meetings of the Call Steering Committee (CSC) to finalise the stage 1 pre-proposal assessment, a list of 48 eligible pre-proposals that met the score thresholds were invited to submit a full proposal for Stage 2.

The eligibility check was performed to verify the compliance of the pre-proposals with the eligibility criteria of the Call as described in the Call Text. Additionally, the funding organisations as members of the CSC performed the eligibility check according to their national/regional funding regulations, in parallel with the scientific assessment of pre-proposals. As a result, 39 pre-proposals were declared not eligible by the national/regional assessment; 59 eligible pre-proposals were rejected and were not invited to stage 2 and finally, 48 eligible pre-proposals were selected to stage 2. Of these, an additional 3 were also deemed not eligible for stage 2 full-proposal, which produced a final number of full-proposals of 45 for a centralised scientific assessment.

2. Call Statistics

The ERA-MIN Joint Call 2021 was focused on needs-driven on non-fuel, non-food raw materials research addressing one or several areas of the circular economy.
The five main call topics were based on the challenges and priorities identified in the ERA MIN Research Agenda:

1. Supply of raw materials from exploration and mining
    1.1. Exploration
    1.2. Mining operations
    1.3. Mine closure and reclamation
2. Circular Design
    2.1. Product design for increased raw material efficiency
    2.2. Product design for reuse or extended durability of product

2.3. Product design to promote recycling
2.4. Product design for critical materials substitution

3. **Processing, Production and Remanufacturing**
   3.1. Increase resource efficiency in resource intensive production processes
   3.2. Increase resource efficiency through recycling of residues or manufacturing of used products and components
   3.3. Increase resource efficiency using information and communication technologies (ICT)
4. **Recycling and Re-use of End-of-Life products and assets**
   4.1. End-of-life products collection and (reverse) logistics
   4.2. End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation
   4.3. Reuse, repair, refurbishing, repurposing and remanufacturing of End of Life products
   4.4. Recovery of raw materials from End-of-life products
   4.5. Recovery of raw materials from End-of-life immovable assets
   4.6. Increase recycling or reuse through information and communication technologies (ICT)
5. **Cross-cutting topics**
   5.1. New business models (implementing circular economy aspects)
   5.2. Improvement of methods or data for environmental impact assessment
   5.3. Social acceptance and trust/public perception of raw materials
   5.4. Health and safety issues

The ERA-MIN3 the funding organisations have jointly agreed and elaborated the final versions of the call topics based on the ERA-MIN 2 topics as well on Raw Materials policy documents. Finally, the call topics were in line with the integrated strategy proposed in the EU Raw Materials Initiative, the Strategic Implementation Plan of the European Innovation Partnership on Raw Materials, the EU Circular Economy Package, the Battery Action Plan as well as with the ERA-MIN Research Agenda.

2.1 Pre- and Full-Proposals Submission Statistics

The Joint Call was a two-stage evaluation process, with the submission of 146 pre-proposals during stage 1 that were scientifically assessed and submitted to an eligibility check for compliance with the national/regional regulations. After Stage 1 evaluation, 48 pre-proposals were invited to submit a full-proposal during stage 2. On the full-proposal deadline, 46 full-proposals were submitted out of which one was not considered eligible for funding and thus, 45 full proposals were submitted to a centralized independent international scientific assessment.

In stage 1, of the total of 146 pre-proposals submitted, 49% were participated by universities or by research organizations (academia), whereas 42% of the participants in pre-proposals were enterprises, the remaining 9% derive from the option Others.

In stage 2 submission, considering **45** full-proposals, the involvement of applicants coming from academia raises to 51%. This raise is done at the cost of the participation whose origin is the option Others (Figure 1).

The 146 pre-proposals submitted in stage 1 involved a total of **892** applicants. In total, the proposal's costs were €151 million and the requested funding was €116 million (Figure 2) which exceeds almost 6 times de call budget of €19.5 million.

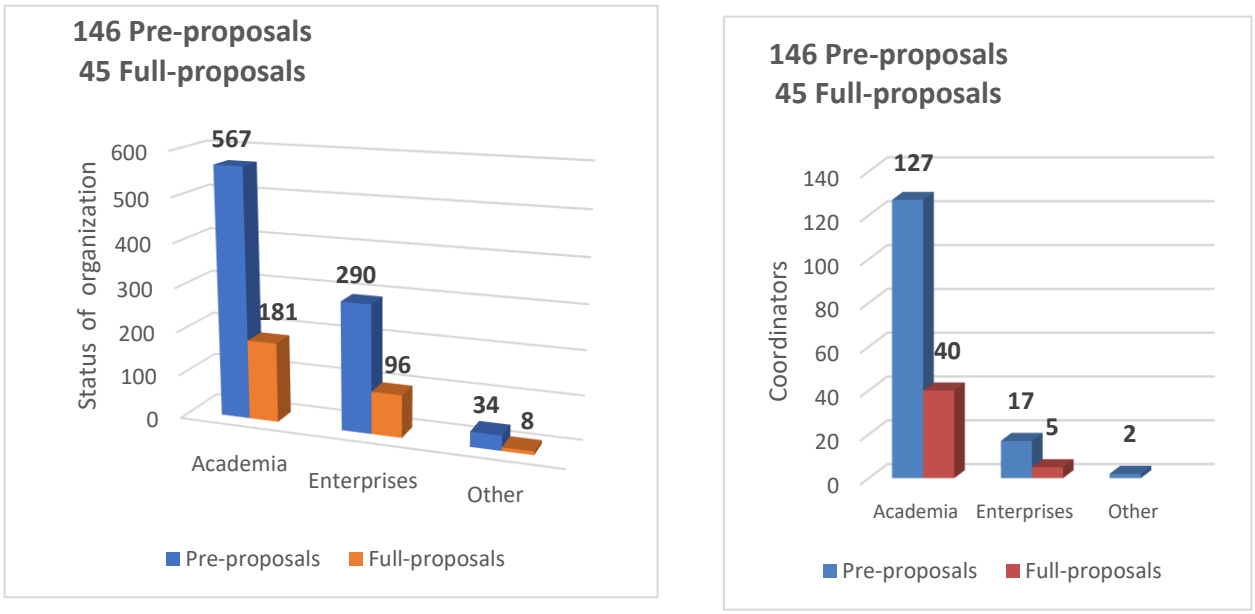


Figure 1 - Participation in the pre- and full-proposals by status of organisation.

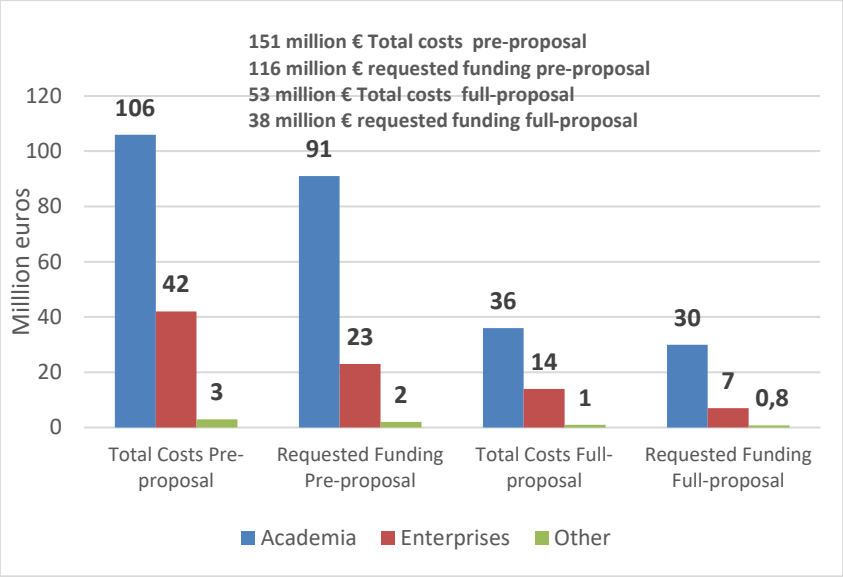


Figure 2: Total costs and requested funding in Euros by status of organisation in pre-proposals and full-proposals.

By comparing the total costs and requested funding of pre-proposals with full-proposals, there is a decrease of approximately one third from pre-proposals to full- proposals.

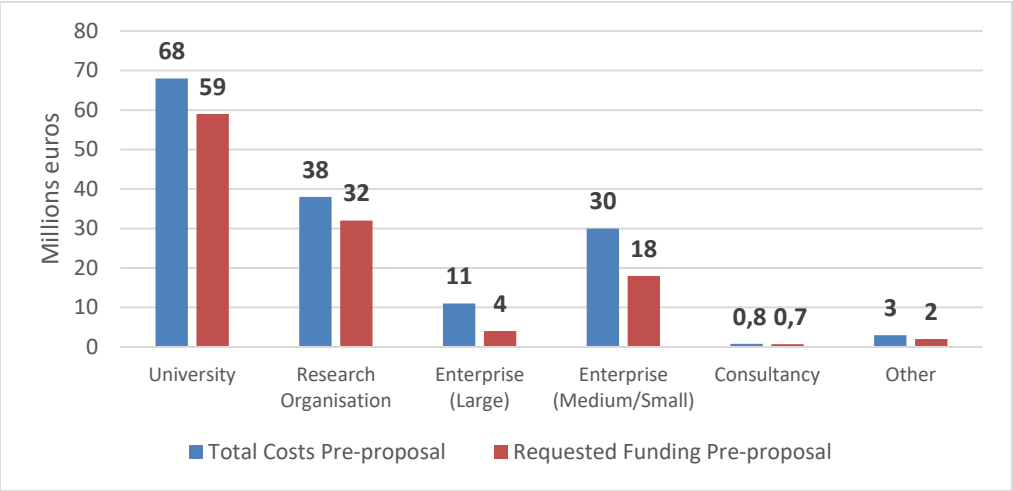


Figure 3: Total costs and requested funding by type of organisation in stage 1 (pre-proposals).

When analyzing the total costs and requested funding by type of organization, it is confirmed that the academia is supported almost 100% whereas enterprises participate with more than 50% of own funds in pre-proposals (Figure 3) and in full-proposals (Figure 4).

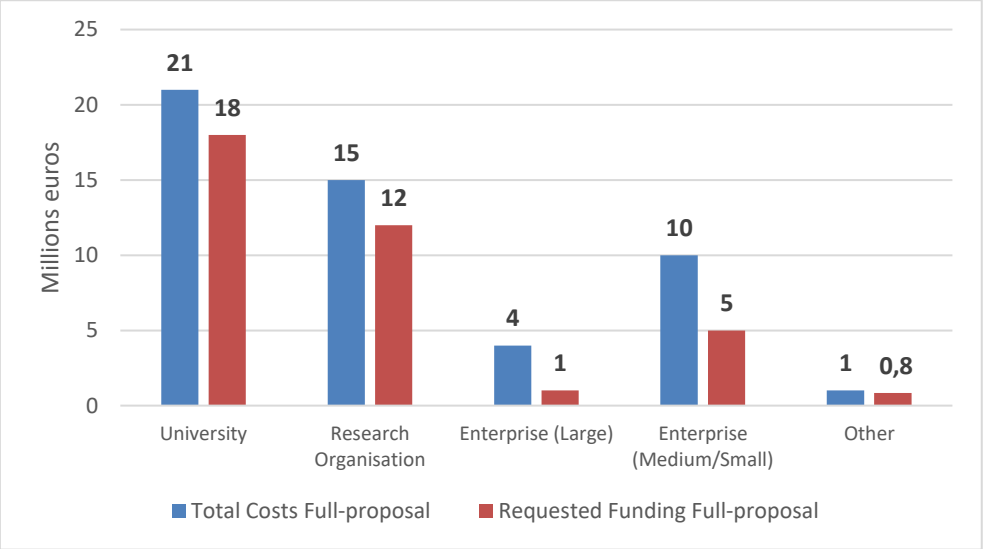


Figure 4: Distribution of total costs and requested funding of applicants by type of organisation in stage 2.

In Figure 5, the distribution of the pre and full-proposals by funding organisation/country or region is presented. There were applicants committed for project activities with own funds from countries not participating in the Call, namely Austria, Brazil, Canada (not Québec), Greece, Morocco, Norway, Peru, Switzerland, United Kingdom and USA. Some applicants own funded ended up not participating in full-proposals and were from Austria, Alberta province of Canada (not Quebec), Greece and Norway.

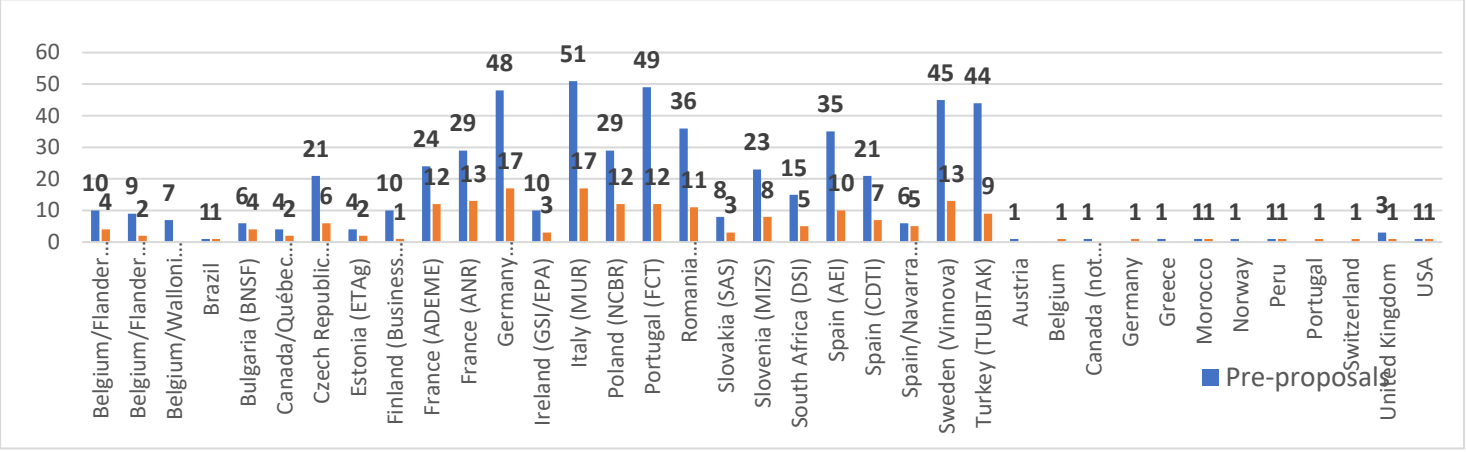


Figure 5: Number of Pre and Full-proposals per country/region and funding organization.

Figure 6 shows the percentage of pre and full-proposals submitted by main call topic. Topic #4 was the one with more proposals involved in both stages and topic #5 the one with fewer applications.

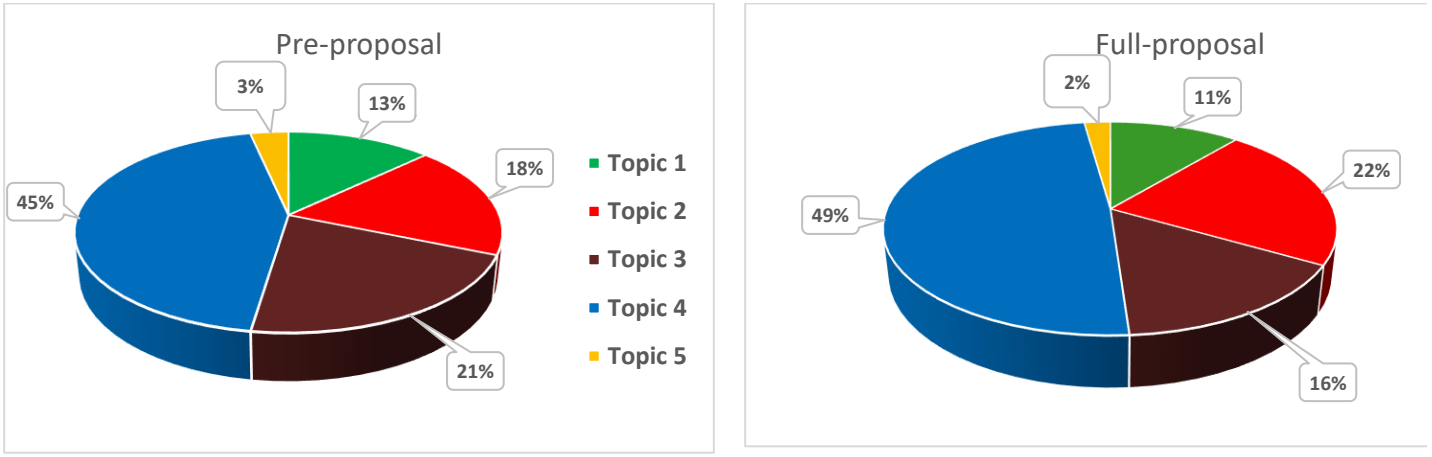


Figure 6: Distribution of pre and full-proposals by main call topic.

Below, in Figures 7 and 8, is displayed the choice of main call topics by country in stages 1 and 2. It's possible to see that in both in stages 1 and 2, topic 5 was not selected by all countries. On the other hand, topic 4 was at the top of selections.

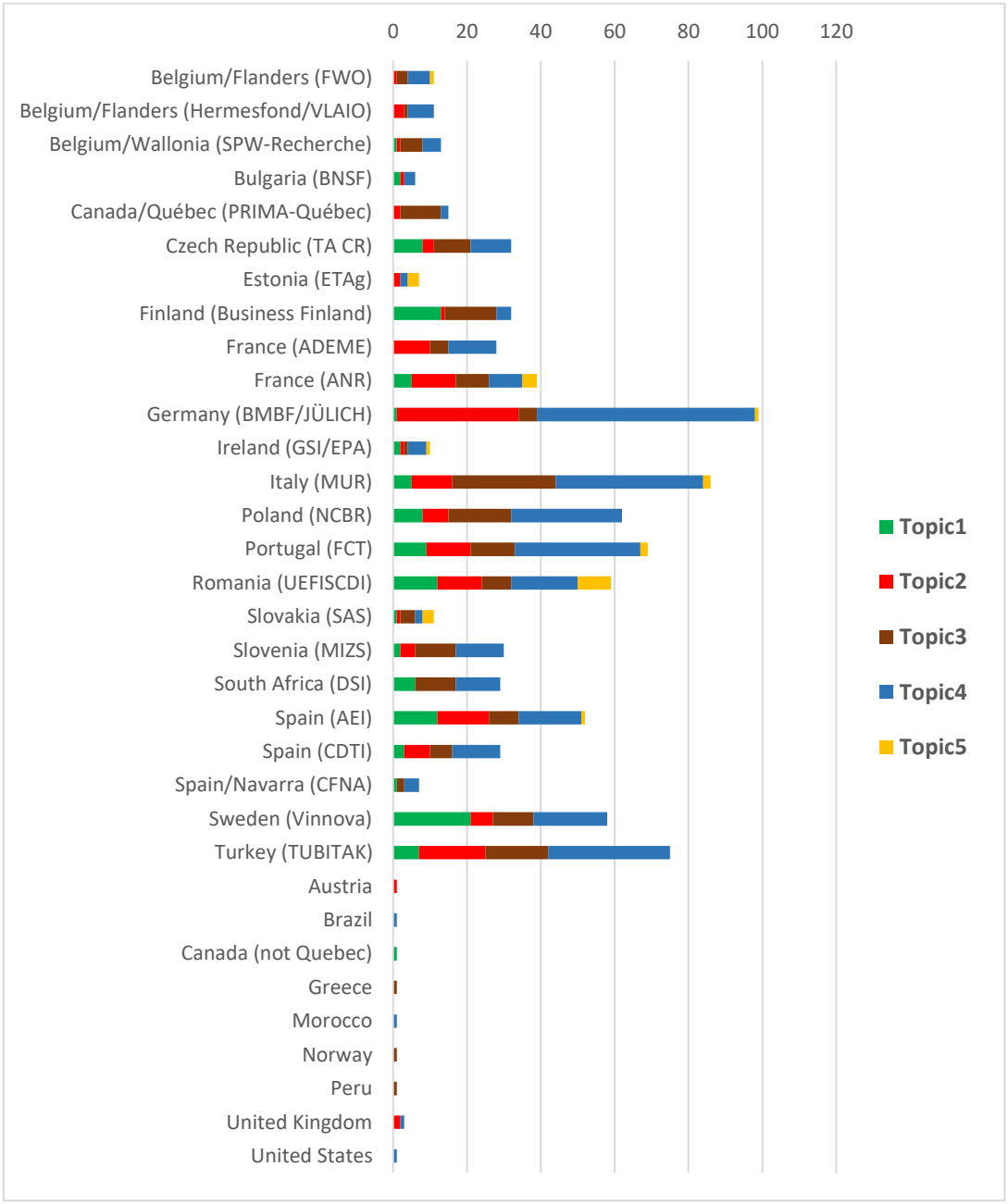


Figure 7: Topics addressed in pre-proposals by country/region.

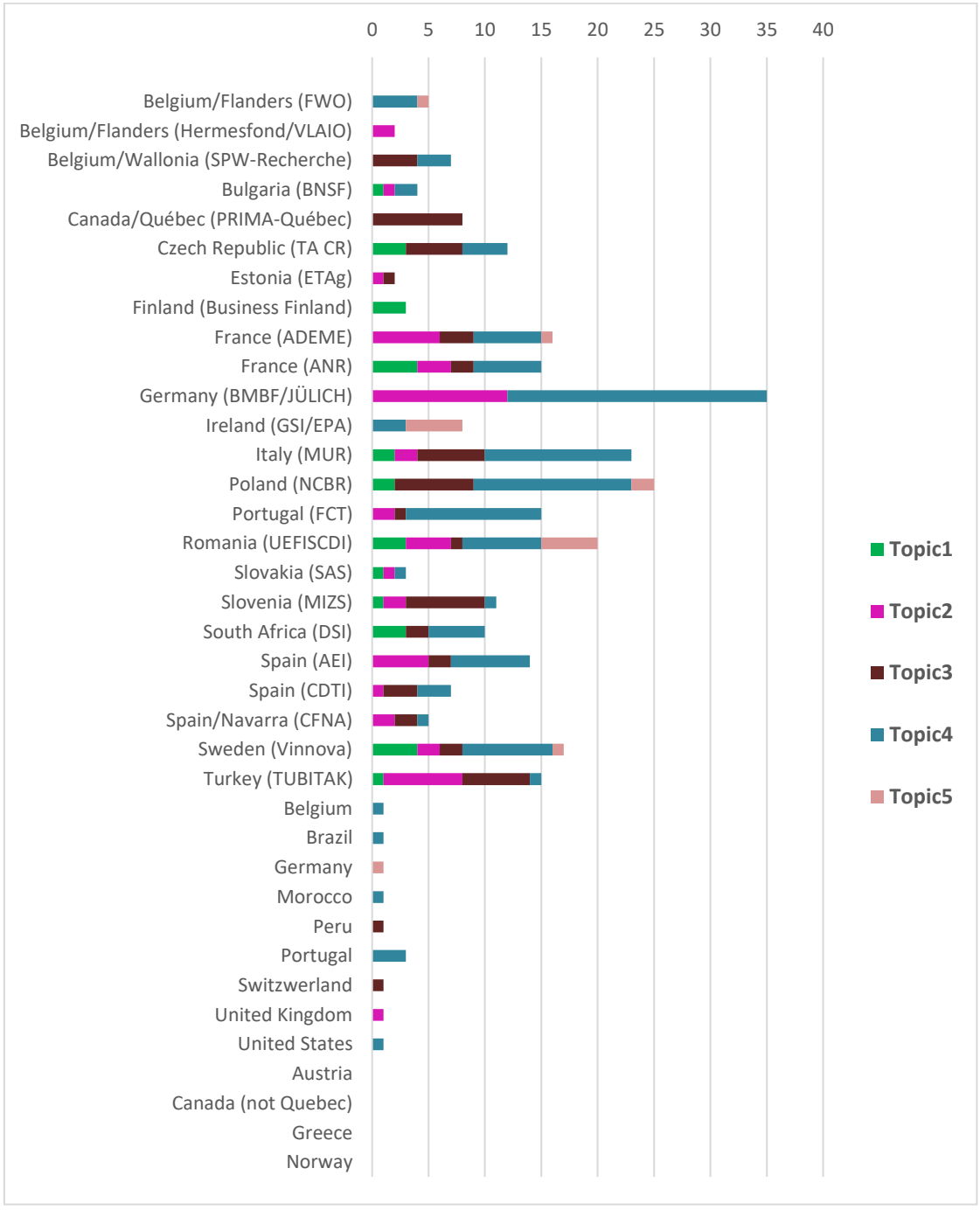


Figure 8: Main call topics addressed in full-proposals by country/region.

2.2. Funded Projects Statistics

After decision of the CSC, based on the binding ranking list and available public funding, a total of 22 transnational R&I projects, out of 45 eligible peer-reviewed full-proposals, were selected and recommended for funding. These projects involve a total of 154 beneficiaries of which 95 were from

university and research organizations and 56 were enterprises (36%). The total allocated public funding was €18.5 million Euro and the total projects' costs were €27.3 million.

Figure 9 shows the distribution of consortia coordinators and partners by status of organization. 20 out of 22 funded projects are coordinated by academia and the other 2 projects are coordinated by enterprises.

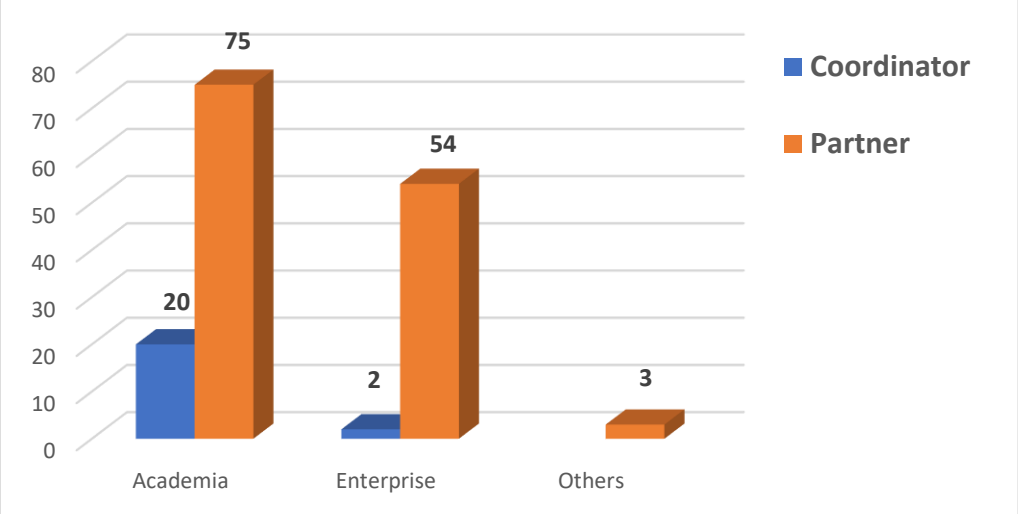


Figure 9 – Distribution of coordinators and partners in funded projects by type of organisation.

Figure 10 compares the total project costs with the requested funding of academia and enterprises and we can conclude that there is an investment of own funding of about €8 million of which half is done by academia and another half by the enterprises which usually are only funded by approximately 50%.

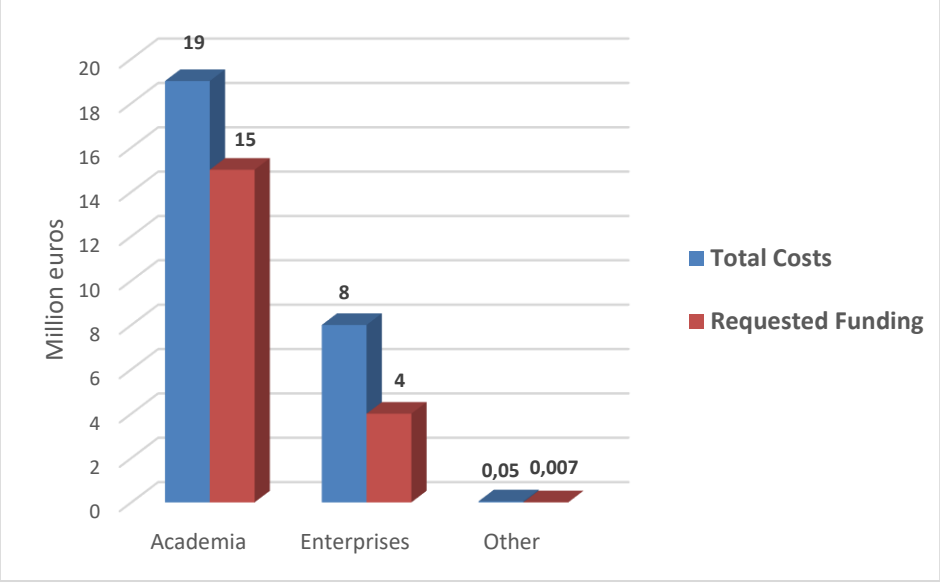
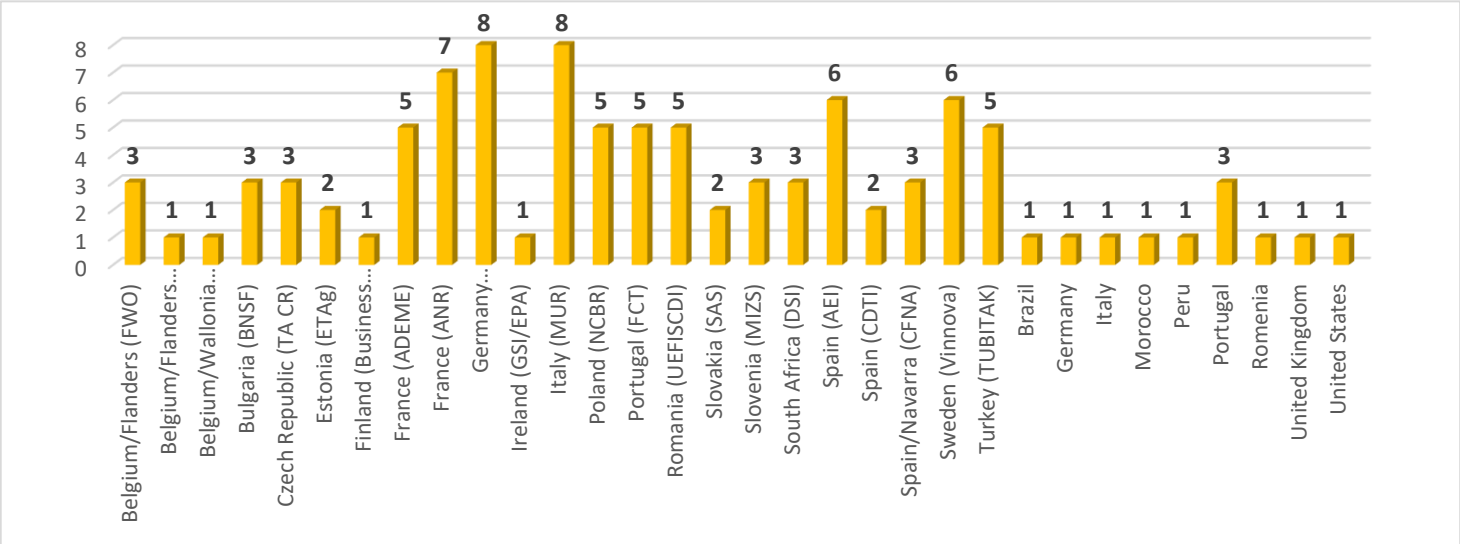


Figure 10 - Distribution of total costs and requested funding (in million Euros) in funded projects by status of organization.

The number of transnational projects supported by each funding organization from a country or region is presented in Figure 11. Italy (MUR) and Germany (BMBF/Julich) support the highest number of



projects (8), followed by France/ANR (7) and Portugal (7). Several projects have the participation of self funded partners either from countries participating in ERA-MIN, namely, enterprises from Germany and Portugal or from other countries which are not ERA-MIN partners – Brazil, Morocco, Peru, the United Kingdom and the United States.

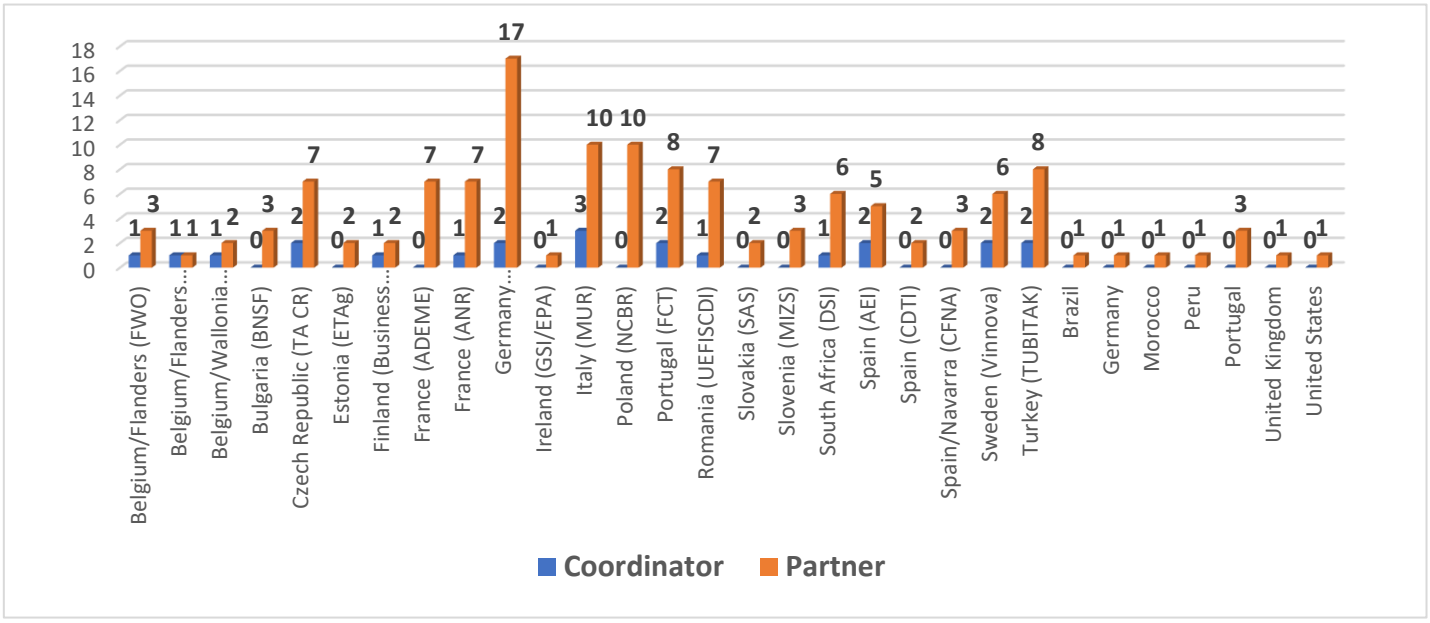


Figure 11 - Distribution of funded projects per country/region and funding organization (if applicable).

Figure 12 shows that Italy is coordinating the higher number of projects (3), followed by the Czech Republic (2), Germany (2), Portugal (2), Spain/AEI (2), Sweden (2) and Turkey (2) coordinating 2 projects each.

Figure 12: – Distribution of coordinators and partners in funded projects.

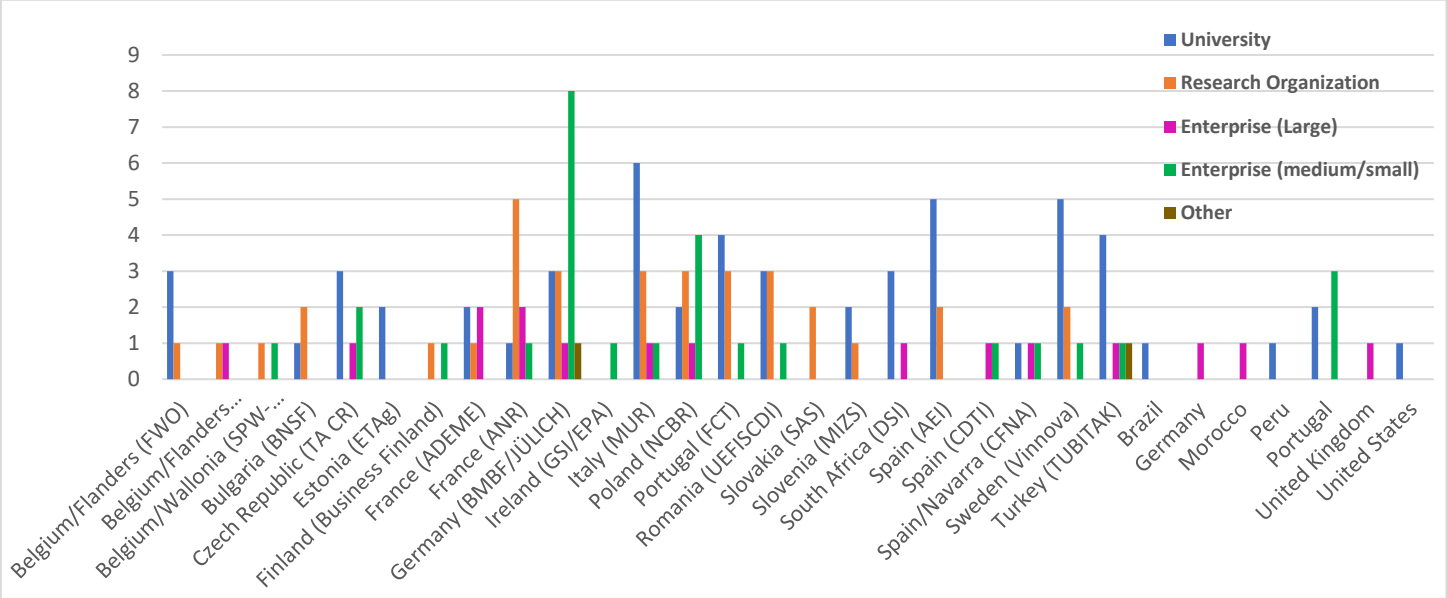


Figure 13 shows that university, research organizations and medium and small enterprises correspond to the higher number of beneficiaries, and in Germany, it stands out the component of medium and small enterprises as the dominant beneficiary since Germany requested that at least one enterprise would be an applicant. Germany is also the only country that incorporates applicants from all types of organisations.

Figure 13: Distribution of beneficiaries by type of organization in each country/region.

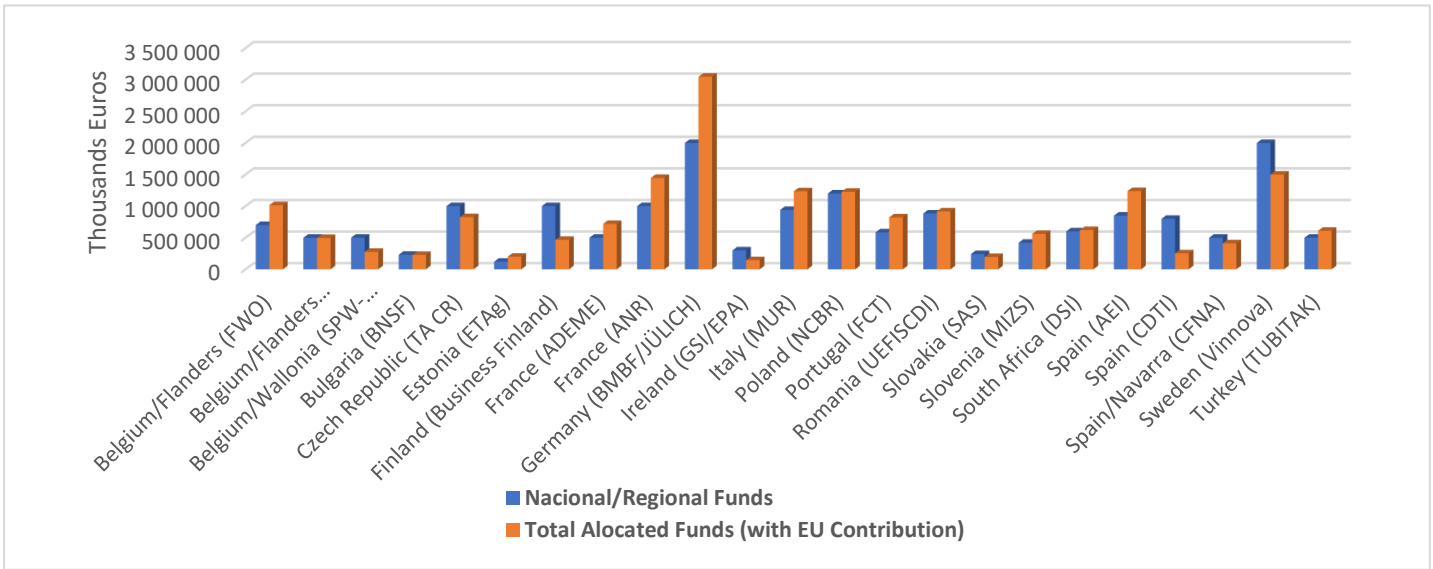


Figure 14 shows that Germany, France, Belgium/Flanders/FWO, Portugal, Slovenia, Spain/AEI, Estonia and Italy are beneficiaries of EU funds whereas other funding organisations from Belgium/Wallonia,

Czech Republic, Finland, Ireland, Spain/CDTI, Spain/Navarra and Sweden did not exhaust their committed budget.

Figure 14: Comparison of total allocated funding (including EU contribution) with national/regional committed funds.

The funding for the 22 selected projects was supported by 23 public research and innovation funding organizations of 15 EU countries, 3 EU regions, 1 EU Associated Country and 1 non-EU country (South Africa). Only PRIMA-Québec did not support any project due to exhaustion of funds of public funds.

All thematic areas of the Joint call 2021 were addressed by the 22 funded R&I projects (Figure 15).

Four projects (AI-COSTSQO, FUTURE, PEGMAT and SEEMS DEEP) have focused on main call topic 1 – "*Supply of raw materials from exploration and mining*" and sub-topics: "Exploration" and "Mining operations".

Five projects (2BoSS, Cider, CO2TREAT, POTASSIAL and RecMine) focused on main call Topic 2 – "Circular Design" and covered all the sub-topics of this topic. These projects also addressed sub-topics of other main topics, namely: Sub-Topics 3.1: Increase resource efficiency in resource intensive production processes; 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components; 4.4: Recovery of raw materials from End-of-life products; 5.2: Improvement of methods or data for environmental impact assessment and 5.4: Health safety issues were also addressed.

Three projects (TailingR32Green, PHOSTER, ABtomat) have selected topic 3 – "*Processing, Production and Remanufacturing*" as their main call topic. The selected sub-topics were also from other main topics as follows: 1.2: Mining operations; 1.3: Mine closure and reclamation; 2.3: Product design to promote recycling; 2.4: Product design for critical materials substitution; 3.1; 3.2; 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products; 5.1: New business models (implementing circular economy aspects); 5.2: Improvement of methods or data for environmental impact assessment; and 5.4: Health and safety issues.

Nine projects (ACROBAT, INN4MIN, MW4REMAM, PG2CRM, PHIGO, Rendering3D, Recycl3D, RecycleBIM and RecyLIB) addressed topic 4 - "Recycling of End-of-Life products and assets" as the main call topic and sub-topics: 2.1: Product design for increased raw material efficiency; 2.2: Product design for reuse or extended durability of products; 2.3; 2.4; 4.3; 4.4; 4.5: Recovery of raw materials from End-of-life immovable assets and 4.6: Increase recycling or reuse through information and communication technologies (ICT) were all selected.

Only one project (Scandere) selected topic 5: Cross-cutting topics as main call topic. Selecting also sub-topic 5.1: New business models (implementing circular economy aspects).

However, sub-topics of cross-cutting topics were addressed in other projects (Figure 16).

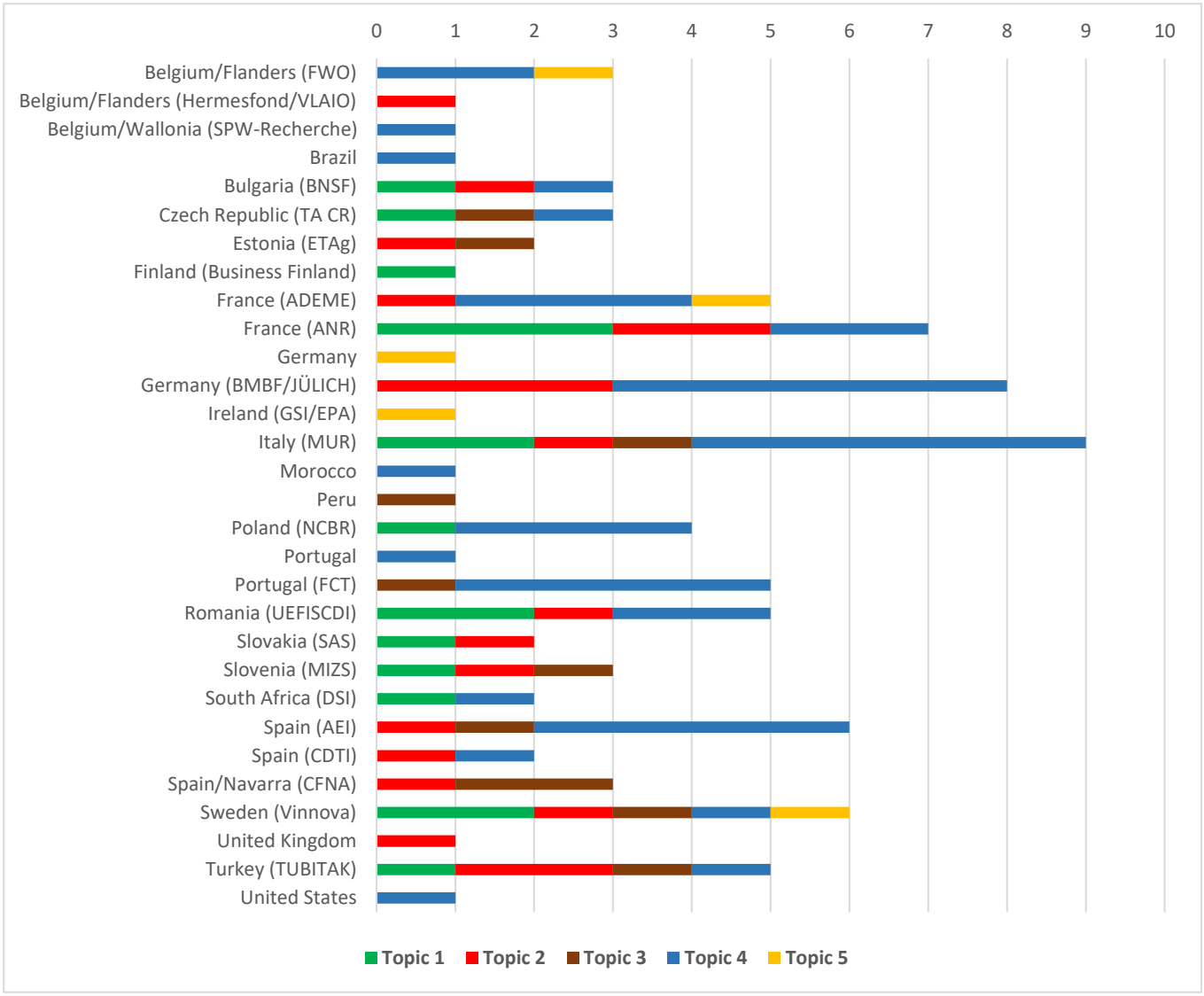


Figure 15: Topics addressed by funded projects by country/region.

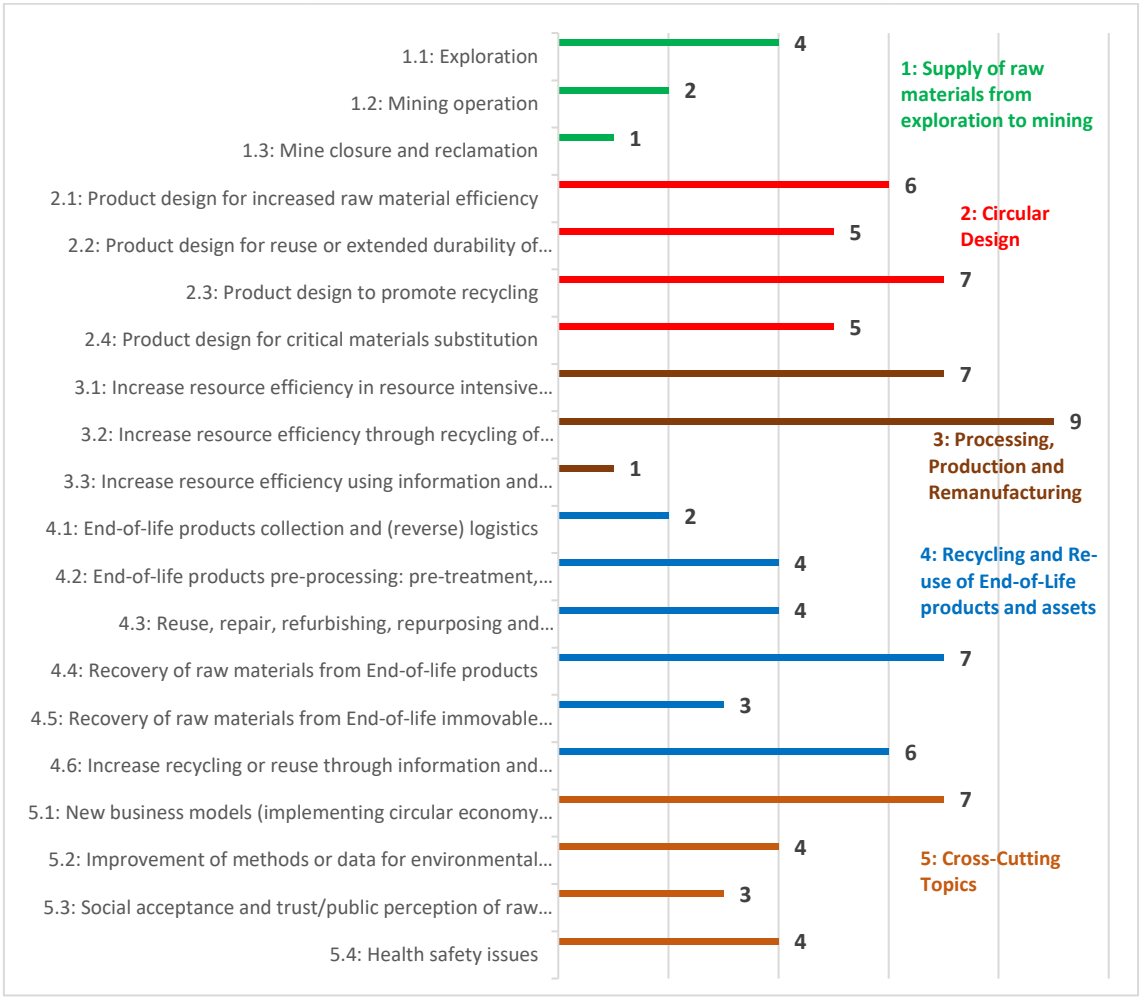


Figure 16: Sub-topics addressed by the 22 funded projects.

3.PUBLISHABLE SUMMARIES OF FUNDED PROJECTS

Topic 1 - supply of raw materials from exploration and mining

Project acronym	**AI-COSTSQO**
Project title	Artificial Intelligence and Combined Survey Techniques for Stone Quarries Optimization
Main topic	Topic 1: Supply of raw materials from exploration to mining
Sub-topics	Sub-Topic 1.1: Exploration, Sub-Topic 1.2: Mining operations, Sub-Topic 5.1: New business models (implementing circular economy aspects)
Keywords	Stone Quarries, DFN Model, Artificial Intelligence, Process Optimization, Computer Graphics
Publishable abstract	AI-COSTSQO partners come together to create an eco-efficient and sustainable stone exploitation by using non-invasive survey, optimize production, reducing waste, energy and water usage. Thus, the degree of negative social effects of mining activities, which have increased in recent years, will also be reduced. The interest area of the project will cover both currently operating mines and non-operating deposits. With the project work, an effort will be made to evaluate the current situation, to predict the financial profitability of virgin deposits and the amount of waste to be produced. The project, which has an interdisciplinary character, consists of academic people who are experts in their fields. These people have a lot of projects and academic studies related to the subject, and they are completely locking at the target. The operability of the stone deposit as a rock mass is mostly assessed by the presence of discontinuities. Our project will be primarily the basis on the modelling of the existence of these using Analytical, Mathematical, Statistical, Machine Learning and Big Data solutions. In addition, realistic survey methods will be used as mainly data. The innovative model will be created combining several approaches, like calculating the maximum cuboid volumes that fit into natural polyhedrons and the orientation of the cutting grid, considering discontinuities and planning to cut directions and spatial position of general planning of quarry using block dimension distributions. In this concept, six work packages have been designed and distributed to the partners according to their specialisation. Although there is no exact data for natural stone quarries recovery rates, it is well known these rates may be decreased to about 10% in many quarries. We believe that the project outcomes, combined innovative survey methods and new optimization algorithms, will significantly improve the recovery rates and decrease waste production in stone quarries.
Coordinator (partner 1) and consortium partners	1. BAY E Bilişim Danışmanlık Eğitim Bilgisayar Sanayi ve Ticaret Limited Şirketi (Turkey) 2. Geological Institute of Romania; University of Petrosani (Romania) 3. Faculty of Information Studies in Novo mesto (Slovenia) 4. UNIBO - University of Bologna (Italy) 5. Geological Institute of Romania (Romania)
Project duration	36 Months
Total Costs	679,092 €
Total Requested Funding	598,972 €

Project acronym	**FUTURE**
Project title	Fiber-optic sensing and uav-platform techniques for innovative mineral exploration
Main topic	Topic 1: Supply of raw materials from exploration to mining
Sub-topics	Sub-Topic 1.1: Exploration
Keywords	Minerals, Innovation, Seismics, DAS, UAV
Publishable abstract	New metal and mineral resources must be discovered to supply the raw materials for emerging technologies and the push for decarbonisation (e.g., wind and solar energy, fast rechargeable batteries with high power-density, fuel cells) and to meet the expectations of billions of people in the developing world for higher living standards. The geological conditions of both Europe and Africa have proven potential to host resources of target metals and minerals. These include, but are not limited to, critical raw materials, which are usually found as associate minerals. However, the mineral exploration sector must improve its capability to image the subsurface: penetration depth, sensitivity and resolution must be increased, while the environmental impact and cost must be reduced. The FUTURE project seeks to develop innovative, environmentally friendly and cost-effective technologies for deep exploration, primarily in the challenging in-mine environment. We plan to develop a prototype system that will allow long-duration synchronized data acquisition on the surface, in mine tunnels, and in boreholes. We will extend the capabilities of well-established surface and borehole fiber-optic DAS and wireless sensing technologies to allow imaging using mode-converted signals and make more accurate near-surface static corrections and characterizations. The high-resolution UAV-Mag-EM surveys will help to optimally orientate a new seismic profile to study the lateral extent of the deposits and possible major fault systems in the area in 3D. We anticipate that the FUTURE project will advance high-resolution imaging and modeling of the host rock and any mineralization between tunnels and the surface, and in the down-dip direction. We will demonstrate these technologies using two exploration targets, viz. iron-oxide deposit (in Sweden), and gold-bearing conglomerates (reefs) overlain by volcanic rocks with contrasting density and seismic velocity (in South Africa)
Coordinator (partner 1) and consortium partners	1. University of the Witwatersrand, Johannesburg (South Africa) 2. Uppsala University (Sweden) 3. Geological Survey of Sweden (Sweden) 4. Politecnico di Torino (Italy) 5. Nordic Iron Ore AB (Sweden) 6. South Deep Gold Mine (South Africa) 7. University of Venda (South Africa) 8. Sercel Innovation (France)
Project duration	24 Months
Total Costs	1.164,571 €
Total Requested Funding	732,236 €

Project acronym	**PEGMAT**
Project title	Evolved magmatic and pegmatitic systems as sources of critical raw materials and industrial minerals
Main topic	Topic 1: Supply of raw materials from exploration to mining
Sub-topics	Sub-Topic 1.1: Exploration
Keywords	Pegmatite, granite, rare elements, critical raw materials, industrial minerals
Publishable abstract	Rare metal granites (RMG) and pegmatites typically show a strong enrichment in various metals and critical raw materials (CRM; e.g. Li, Ta, Nb, Sn, W, Be, Cs and REEs) and industrial minerals that are of great interest for Europe. Variscan orogeny in Europe produced multiple districts of RMG, related greisens and pegmatites; in the Carpathian-Balkan area, it is illustrated by I- to S-type granites and rare-element pegmatites with uncertain origin. Also, some Permian granites show promising rare-metal potential. The area potential for CRM is still weakly explored. The PEGMAT project aims to: (i) identify the pegmatites and RMG in the studied area and assess their geological features; (ii) understand processes and structural constraints leading to their formation; (iii) assess raw material content evolution in time and understand their distribution; (iv) characterize internal processes of their formation; (v) determine areas with high potential for exploration. The work planned includes (i) review of available data; (ii) field work, detailed mapping and sampling; (iii) characterization and age dating of the main bodies, including bulk and mineral composition; (v) advanced 3D modelling; (vi) assessment of metallogenic processes; (vii) evaluation of usability of minerals at selected localities. All research institution partners will be involved in all tasks of the project; industrial partners will be involved especially in the applied usability study and field work. Expected project outcomes and benefits include enhanced knowledge on deposits of CRM, new knowledge on deposit-forming processes, new regional data available for both research and industry, transfer of knowledge and experience; enhanced international cooperation. The project results will primarily serve as a base for evaluation of pegmatite and RMG potential as sources for critical metals according to the National and European Strategies for sustainable development
Coordinator (partner 1) and consortium partners	1. Masaryk University (Czech Republic) 2. Brgm (France) 3. Geological Institute of Romania (Romania) 4. Geological Institute, Bulgarian Academy of Sciences (Bulgaria) 5. G E T s.r.o; K M K GRANIT a.s. (Czech Republic) 6. Earth Science Institute Slovak Academy of Sciences (Slovakia) 7. K M K GRANIT a.s. (Czech Republic)
Project duration	36 Months
Total Costs	964,757 €
Total Requested Funding	808,892€

Project acronym	**SEEMS DEEP**
Project title	Seismic and electromagnetic methods for deep mineral exploration
Main topic	Topic 1: Supply of raw materials from exploration to mining
Sub-topics	Sub-Topic 1.1: Exploration
Keywords	Geophysics, joint interpretation, seismic, electromagnetic, exploration
Publishable abstract	SEEMS DEEP (Seismic and Electromagnetic Methods for Deep mineral exploration) is addressing the challenge of high costs of mineral exploration as well as poor success rates in discovering new deep-seated ore deposits through development of a novel workflow integrating seismic and various electromagnetic (EM) methods. Field data acquisition is planned jointly, and data processing will follow the SEEMS DEEP workflow where EM data is utilized in velocity model building for seismic reflection data while seismic data is used to constrain EM inversion. The test area of SEEMS DEEP is the Koillismaa Layered Igneous Complex in Finland that has potential to host several minerals included in the EU critical raw material list, especially battery related. SEEMS DEEP will develop geomodelling methods for battery mineral exploration and will benefit from petrophysical measurements from a 1.7 km deep drill hole. SEEMS DEEP analysis produces high confidence earth models that add more value to the exploration project than several drill holes that might miss the exploration target and provide only point like data. SEEMS DEEP will acquire seismic reflection profiles to achieve large scale information about the geological architecture of the study area, while 3D seismic and EM surveys provide more detailed information about the target. The Koillismaa deep drill hole provides geological information that will be used as a boundary condition for the EM and seismic data inversion and enables establishing empirical relations between conductivity and seismic velocity. Feedback from these surveys will help to define best practices to industry. Key innovations expected from the SEEMS DEEP project are related to optimized survey design, developments in data acquisition and improved imaging. SEEMS DEEP addresses Europe's goal for raw materials self-sufficiency by increasing the possibilities of successful discovery of new mineral deposits at greater burial depths with lower environmental impact.
Coordinator (partner 1) and consortium partners	1. Geological Survey of Finland (Finland) 2. Uppsala University (Sweden) 3. Bureau des Recherches Géologiques et Minières (France) 4. Institute of Geophysics, Polish Academy of Sciences (Poland) 5. Geopartner Geofizyka sp. z o.o. (Poland) 6. GRM-Services (Finland) 7. IRIS Instruments (France)
Project duration	36 Months
Total Costs	2.182,518 €
Total Requested Funding	1.281,758€

Topic 2: Circular Design

Project acronym	**Cider**
Project title	Circular product design for automotive components made from recycled and sustainable composite material
Main topic	Topic 2: Circular Design
Sub-topics	Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment
Keywords	recycling, composites, circular design, automotive, carbon fibre
Publishable abstract	A major milestone to achieve a circular economy is to include the product's end-of-life option into the product design. Therefore, a well functioning recycling process as well as appropriable design for recycling principles must be in place. The project Circular product Design for automotive components made from Recycled and sustainable composite material (CIDER) aims to substitute heavy steel designed automotive parts and for a higher acceptance of recycled carbon composites. This involves new approaches into the design of a semistructural automotive parts and additionally improve the recycling process as well as the Life cycle assessment of automotive parts. Hence two topics of the ERA-MIN3 call will be addressed. On the one side, CIDER will create a circular design (Topic 2.3) for semi-structural automotive parts promoting and determining the recycling process for the produced part at design stage. This will be done by the use of a 100% recyclable composite, saving CO2 in the life cycle, as well as providing a superior recycling strategy compared to conventional steel, aluminium, CFRP or GFRP approaches. The second topic is addressing the recovery of all material used for the composite parts (Topic 4.4). The recycling of all materials as well their circularity will be demonstrated to showcase that a 100% circular economy for composite structures within the automotive and transportation industry is feasible
Coordinator (partner 1) and consortium partners	1. Fraunhofer IGCV (Germany) 2. Arkema, ADEME (France) 3. AUTOTECH ENGINEERING SPAIN S.L (Spain) 4. Forward Engineerin (Germany) 5. IRT M2P (France) 6. Autefa Solutions Germany GmbH (Germany) 7. Rexhi GmbH (Germany) 8. Plastic Omnium New Energies (France) 9. Tallinn University of Technology (Estonia)
Project duration	24 Months
Total Costs	1.851,291 €
Total Requested Funding	920,432 €

Project acronym	**CO2TREAT**
Project title	Accelerated CO2 Treatment of alkaline residues for low carbon binders – CO2TREAT
Main topic	Topic 2: Circular Design
Sub-topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 5.4: Health safety issues
Keywords	Resource efficiency, carbonation, CO2 emission savings, low carbon binder, industrial residues
Publishable abstract	The main aim of the CO2TREAT project is to design resource-efficient, low-carbon binder products for durable concrete and civil engineering applications by partially substituting Portland cement with secondary resources beneficiated by treatment with CO2. The following specific objectives are defined to reach the project goal: O1: Beneficiation of 3 high-volume, alkaline industrial residues (BOF steel slag, lignite fly ash, co-combustion ash) by CO2 treatment to an intermediate product usable as supplementary cementitious material (SCM) in cement and concrete. · O2: CO2 utilisation at a rate of 25-200 kg/tonne of beneficiated residue by chemically converting CO2 captured from industrial flue gases or CO2 from the atmosphere in thermodynamically stable mineral products. · O3: Recovery of 1-2% metallic iron from BOF steel slags by comminution and physical separation. · O4: Design of 3 sustainable binders comprising the CO2 -treated products complying to national performance and durability standards for cement, concrete and civil works. · O5: Characterisation and modelling of the hydration processes of the new sustainable binders. · O6: Immobilise substances of concern (heavy metals, anions) in the beneficiated residues and the final products and applications keeping release rates below strict thresholds imposed by local environmental legislation and occupational exposure requirements. · O7: Quantification of the sustainability of the use of the CO2 -beneficiated in low-carbon cement, concrete and civil works by a TechnoEconomic Analysis (TEA) and Life Cycle Analysis (LCA) of the environmental impact. CO2TREAT aspires to contribute to meet the EU 2050 Climate change and CO2 reduction targets by designing low carbon durable products from beneficiated residues. By forging new industrial symbiosis linkages between the steel, energy and cement industries, CO2TREAT will enhance the circularity and the competitiveness of the EU energy intensive industries.
Coordinator (partner 1) and consortium partners	1. VITO (Belgium/Flanders) 2. RWTH Aachen University (Germany) 3. Slovenian National Building and Civil Engineering Institute (Slovenia) 4. ArcelorMittal Belgium (Belgium/Flanders) 5. HeidelbergCement AG (Germany) 6. Schüring-Beton GmbH (Germany)
Project duration	36 Months
Total Costs	1.537,736 €
Total Requested Funding	1.103,037 €

Project acronym	**POTASSIAL**
Project title	Zero-waste valorisation of feldspathic ores: Green application and sustainable sourcing of strategic raw materials
Main topic	Topic 2: Circular Design
Sub-topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes
Keywords	Feldspathic ores, Sustainable sourcing, Zero-waste valorisation, Advanced materials, CO2 sequestration
Publishable abstract	Feldspathic ores containing mainly K-Feldspar (KAlSi3O8) will be valorised by applying several hydro- and pyrometallurgical processes at which KCl, Al2O3 , and SiO2 will primarily be produced without generating any solid waste. Objective is to provide new resources for potash and alumina. Targets are to produce fertilizer-grade KCl, high purity Al2O3, synthetic SiO2 , Ca-Silicate, and SiC from one ore and to sequester CO2 on the same ore. Although there are many studies for K and Al2O3 recovery from feldspars and clays, there are no notable commercial attempt to date. Unlike the other KCl and Al2O3 production methods suggested in the literature, manufacturing KCl, Al2O3 , SiO2 , Ca-Silicate and SiC from the same ore without generating any waste is the novelty of this project. Thus, innovative aspect of the project is that feldspathic ores will be processed as a source of high value-added materials for the first time and with zero-waste approach, thus increasing the economic value ofthe proposed process. Also, CO2 sequestration capability of the feldispatic ores will also be verified to enhance the economic importance those types of resources. For increased raw materials efficiency, a novel, hybrid and zero-waste processing method will be put forward. This will be established by exploiting the ores, other than bauxite and natural potash ores, and by applying environmentally sensitive production processes. The project will unlock substantial volume of various raw materials from deposits that cannot be economically or environmentally exploited within or outside the EU through enabling the better efficiency of exploitation of raw materials' resources and increasing the range and yields of recovered raw materials; and push Europe to the forefront in the area of raw materials processing technologies and increase availability of recovered raw material and create added value products through reducing the amounts of industrial tailings to be disposed or landfilled.
Coordinator (partner 1) and consortium partners	1. İnönü University (Turkey) 2. Firat University (Turkey) 3. Muğla Sıtkı Koçman University (Turkey) 4. Luleå University of Technology Department of Civil, Environmental and Natural Resources Engineering (Sweden) 5. Institute of Geotechnics/Slovak Academy of Sciences (Slovakia) 6. Eti Aluminium Inc. (Turkey) 7. Element Six Inc. (United Kingdom)
Project duration	36 Months
Total Costs	694,858 €
Total Requested Funding	557,860 €

Project acronym	**RecMine**
Project title	Environmental footprint reduction through eco-friendly technologies of mine tailings recycling
Main topic	Topic 2: Circular Design
Sub-topics	Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components
Keywords	waste management, geopolymers, refractories, 3D printing, life cycle assessment
Publishable abstract	The aim of this project is the valorisation of high-volume mineral residues from mining and different industrial residues (such as coal combustion by-products (CCP) and demolition waste (DW)) for the development of (i) new geopolymers with low CO2 footprint, and (ii)advanced refractories, suitable for 3-D printing applications. This will be done through the development of two innovative processing techniques that will be able to make the mine tailings and the industrial wastes suitable for replacing the concrete based on Ordinary Portland Cement (OPC), reducing the requirements of primary raw materials, the waste generation and landfilling. It will be ensured that the developed materials (the geopolymers and the refractories) match the technical and environmental criteria for its use in steel industry or civil engineering applications and develop appropriate business models to secure profitability and sustainability. Accordingly, the overall objective of the project is to use wastes from five different European countries (Romania, Bulgaria, Portugal, Turkey and Spain) for the obtaining of new green materials, considering the advantages introduced by 3D printing method. Therefore, it is expected to obtain technological progress in the manufacture of geopolymers and refractories which use mine tailings and industrial wastes (CCP and/or DW) as raw materials, due to the presence of a SME as end-user. Moreover, knowing that the synthesis of the materials with similar characteristics (Ordinary Portland cement-based materials) involves consumption of virgin raw materials (kaolin, limestone, sand, gravel, clays) or high temperatures for curing or calcination, the project aims the improvement of currently developed materials by obtaining ambient cured geopolymers with 100% recycled raw materials and self-flowing refractories (high-temperature ceramics)with low or ultra-low cement content that are suitable for 3D-printing.
Coordinator (partner 1) and consortium partners	1. Gheorghe Asachi Technical University Iasi (Romania) 2. Universidade da Beira Interior (Portugal) 3. University of Chemical Technology and Metallurgy (Bulgaria) 4. Middle East Technical University (Turkey) 5. OBRAS Y SERVICIOS TEX, S.L. (Spain/Navarra)
Project duration	24 Months
Total Costs	623,489 €
Total Requested Funding	402,906 €

Project acronym	**2BoSS**
Project title	Toward sustainable batteries based on silicon, sulfur and bio-mass derived carbon
Main topic	Topic 2: Circular Design
Sub-topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 2.4: Product design for critical materials substitution
Keywords	energy storage, battery, silicon recycling, bio-sourced carbon, lithium-sulfur battery
Publishable abstract	The recycling of raw materials to manufacture new components, hence closing the circular economy loop, is especially critical in a fastgrowing and strategic sector such as energy storage. The sustainable production of batteries requires securing the availability of raw materials, and the use of effective strategies for their recycling. Given the intrinsic limitations of current lithium-ion batteries, a new sustainable battery technology is needed. 2BoSS will develop sustainable batteries compatible with the circular economy by: 1) validating a silicon-sulfur battery technology designed to minimize the use of CRMs, provide optimized performance, and enable the circular use of material resources. 2) validating effective recycling strategies for the separation and reuse of raw materials; 3) assessing the cost, life cycle, and environmental, health and safety impact; and 4) designing high-performance products and their scaled-up manufacturing. 2BoSS will validate a battery technology supported on a cobalt-free Li2S-based cathode and a graphite-free silicon-based anode, using nitrogen-doped carbon cloths obtained from organic waste as current collector. Besides improving performance and minimizing the use of CRMs, a key advantage of the battery technology here proposed is the easier recycling of its raw materials. 2BoSS batteries are designed to use no metal collector and to incorporate no metal additive at the cathode, anode and electrolyte, which will allow a more effective and economical separation of the two key raw materials. 2BoSS will design, validate and define the up-scaling of effective lixiviation strategies to separate and regenerate the battery key elements. Additionally, life cycle assessment and social life cycle assessment will be carried out to better understand environmental and social impacts of the developed technology along the life cycle and to provide valuable feedback to optimize their contribution to a more circular economy.
Coordinator (partner 1) and consortium partners	1. FUNDACIO INSTITUT DE RECERCA DE L'ENERGIA DE CATALUNYA (Spain) 2. Politecnico di Torino (TU Turin) (Italy) 3. Commissariat à l'énergie atomique et aux énergies alternatives (France) 4. Cleopa Gmbh (Germany)
Project duration	36 Months
Total Costs	1.002,683€
Total Requested Funding	812,453€

Topic 3: Processing, Production and Remanufacturing

Project acronym	**ABtomat**
Project title	Utilization of aluminium bearing raw materials for the production of aluminium metal, other metals and compounds
Main topic	Topic 3: Processing, Production and Remanufacturing
Sub-topics	Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products, Sub-Topic 5.1: New business models (implementing circular economy aspects), Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment
Keywords	Bauxite substitutes, Green material recovery processes, Material and Waste Circularity, Sustainable Metallurgy, Life Cycle Cost Assessment
Publishable abstract	Bauxite is the primary ore in World primary aluminium production. About 90% of global bauxite supplies are found in tropical and subtropical areas. Bauxite was announced as a critical raw material in the CRM list 2020 of the EU. Bauxite has critical importance for the sustainability of the European economy and industry. The reserve of Bauxite is declining, its quality is degrading, and availability decreasing. Importance of ensuring a sufficient and secure supply of Bauxite, or finding an adequate replacement, is key to maintaining the EU's independence and self-sufficiency. While producing alumina compounds from Bauxite, the dross and red mud are the waste-by-product from the processes. Disposal and resource utilisation of red mud is restricted due to its high alkalinity and harmful elements. ABTOMAT aims to find and assess Bauxite alternatives, considering regional characteristics in Central Europe and Turkey, focussing on the design and development of multi-products flexible metallurgical processes for Alumina, A2O3 -based compounds and Aluminium production from lowgrade raw and secondary materials. The diaspore, dross, red mud, clay, dust, and topaz are analysed. The emphasis will be placed on the holistic approaches related to the circular economy, zero-waste and Life Cycle Cost Assessment (LCCA) principles. ABTOMAT investigates the novel concepts that decrease environ. the footprint of primary aluminium production through dross utilisation as raw material and red mud as bed material, oxygen carrier and catalyst in biomass gasification to promote biomass conversion and thereby efficient recovering Fe and other metals. Further, The ABTOMAT will deliver an LCCA framework, a unique data set, and a business model to establish symbiotic multi-products production systems in the Czech Republic and Turkey. It also strengthens Sweden's climate initiatives by providing waste materials that can be used in clean energy conversion to recover valuable materials from it.
Coordinator (partner 1) and consortium partners	1. University of Chemical Technology and Metallurgy (Finland) 2. KTH Royal Institute of Technology (Sweden) 3. Istanbul Technical University (Turkey) 4. Yeditepe University (Turkey) 5. ETI Aluminyum (Turkey) 6. United Energy, a. s. (Czech Republic) 7. Bowmen Consulting, s. r. o. (Czech Republic) 8. Sokolovská uhelná, právnínástupce, a.s. (Czech Republic) 9. AV EKO Color, s. r. o. (TA CR) 10. Public University of Navarra (UPNA) (Spain/Navarra) 11. Tallinn University oftechnology (Estonia) 12. Arslan Aluminyum (Turkey)
Project duration	36 Months
Total Costs	1.193,670 €
Total Requested Funding	1.081,151 €

Project acronym	**PHOSTER**
Project title	Phosphorus and magnesium recovery from waste streams for production of highvalue renewable fertilizers
Main topic	Topic 3: Processing, Production and Remanufacturing
Sub-topics	Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components
Keywords	Critical raw materials recovery, sewage sludge, mining by-products, sustainable fertilizers, circular economy
Publishable abstract	To comply with sustainable development goals, fertilizers and related supply chains based on primary raw materials are considered a major challenge in terms of sustainability and security of supply. Similar challenges are emerging also within established waste-management practices, revolving around increasing adoption of wastewater sludge incineration across EU as well as extensive disposal of mining by products. PHOSTER tackles these challenges simultaneously and delivers a sustainable, replicable and scalable circular economy solution (TRL 4) for the recovery of secondary minerals and metals from incinerated sludge ashes and mining industry by-products to substitute primary critical raw materials (phosphate rock, phosphorus, magnesium) in the manufacturing of fertilisers. The methodology is based on an integrated assessment of the production process for high value finished product recovery aimed at optimising technical, economic, environmental, and social performance of the production process and recovered products already from the inception phase onwards. The redeveloped concept for critical material recovery on which PHOSTER focuses encompasses co-precipitation of phosphorus extracted from mono-incinerated sewage sludge and magnesium-rich mining by-products for recovery of nutrient-rich material. All relevant stakeholders (i.e., waste producers and managers, mining industry, fertiliser manufacturers, technology developers, experts in sustainability. PHOSTER aims to (i) develop a new manufacturing route for high-value secondary resources in fertiliser industry obtained from waste streams, (ii) improve the environmental performance of sewage sludge disposal by introducing a circular loop closure through sustainable recycling of phosphorus to the food chain, (ii) improve the environmental performance of involved production chains, and (iv) create locally replicable circular supply chain.
Coordinator (partner 1) and consortium partners	1. Politecnico di Milano (Italy) 2. University of Ljubljana (Slovenia) 3. Timac Agro Italia S.p.A. (Italy) 4. Magnesitas Navarras, S.A. (Spain/Navarra) 5. REA Dalmine SpA (Italy) 6. MM Spa (Italy)
Project duration	30 Months
Total Costs	747,142 €
Total Requested Funding	457,000 €

Project acronym	**TailingR32Green**
Project title	Mine tailings Reprocessing, Revalorization and Risk reduction connecting innovations in metal recovery, geopolymerization, ceramics & sealing layers
Main topic	Topic 3: Processing, Production and Remanufacturing
Sub-topics	Sub-Topic 1.2: Mining operations, Sub-Topic 1.3: Mine closure and reclamation, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 5.1: New business models (implementing circular economy aspects), Sub-Topic 5.4: Health safety issues
Keywords	Mine tailings revalorization and reuse, critical raw elements recovery, construction bricks from mine tailings, geopolymeric sealing layers, Green economy-based new business model
Publishable abstract	TailingR3 2Green ultimate goal is to develop a New Business Model based on a circular and zero-toxic approach to revalorize and reuse the mine tailings while minimizing their environmental impact. This green economy and zero toxic approach will lead to (1) the full bio-recovery of critical raw elements as REE and Co diluted in secondary sources as mine tailings, (2) the revalorization of mineral by-products as construction bricks and (3) the mine tailing sealing by in-situ geo-polymerization process to create sealing layers that will prevent the water percolation and pollutant lixiviation to the surrounding ecosystems. TailingR3 2Green approach is flexible and adaptable to the geochemical and mineralogical nature of the mine tailings, and in parallel, it has been designed to maximize the economic gain minimizing the environmental impact. The global challenge pursued by in TailingR3 2Green is easily understood if it is considered the potentials of the current inactive and active tailing deposits worldwide jointly with the increasing pressure of the critical raw elements (CRE) market. The connection of the CRE recovery, mineral by-products revalorization, and environmental impact minimization is essential to build up new economic business models that evaluate the benefits balancing the economic, societal and environmental gains of the process. The innovative and circular approach pursued in the project will have concrete and measurable direct and side impacts specifically mentioned on this call, like (1) greener mining technology development, (2) secondary CRE resources revalorization, (3) founding business parallel opportunities thanks to mineral by-products reshaping, (4) securing CRE supply for EU, and (5) gaining the trust of the society on the need of a future green-mining and its importance to secure the transition to a green-energy and circular society.
Coordinator (partner 1) and consortium partners	1. Universidad de Huelva (Spain) 2. University of Aveiro (Portugal) 3. Central University of Technology (South Africa) 4. Basque Center for Materials, Applications & Nanostructures (Spain) 5. University of the Free State (South Africa) 6. National University del Altiplano (Peru)
Project duration	36 Months
Total Costs	932,755 €
Total Requested Funding	627,911 €

Topic 4: Recycling and Re-use of End-of-Life products and assets

Project acronym	**ACROBAT**
Project title	Advanced crms Recycling from spent LFP Batteries
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT), Sub-Topic 5.1: New business models (implementing circular economy aspects), SubTopic 5.4: Health safety issues.
Keywords	End-of-life, recycling, lithium-ion batteries, lithium iron phosphate, critical raw materials
Publishable abstract	Globally, olivine-type lithium iron phosphate (LiFePO4 , LFP) batteries have gained a considerable share within the lithium ion battery (LIB) market (23-36% in 2015-2016). However, no dedicated, economically-viable, industrial-scale recycling process exists for LFP type LIBs in Europe or elsewhere. Nevertheless, LFP batteries contain three critical raw materials (CRMs), namely 0.8 wt.% lithium, 2.5 wt.% phosphorus and 16 wt.% graphite on battery cell basis. Efficient recycling of LFP LIBs is also required from an environmental point of view as the electrolyte contains toxic agents. ACROBAT aims to recycle end-of-life LFP LIBs via efficient, innovative and environmentally-friendly processes and separation techniques to recover a maximum amount of EU-CRMs as high-value products and base metals (ferrous and Cu/Al fractions). The specific ACROBAT objectives are to research, develop and validate (i) LFP-dedicated pre-treatment (i.e., shredding, mechanical separation) of EoL LFP LIBs with reduced cross-contamination; (ii) continuous, contact-free, in-line characterisation of LFP black mass; (iii) extractive recovery of electrolyte materials (i.e., conducting salts, organic solvents); (iv) recovery of graphite by froth flotation; (v) recovery of lithium as battery-grade lithium hydroxide monohydrate by HCl-based hydro-/solvo metallurgy; and (vi) direct recycling of LFP black mass by tandem hydrometallurgy-hydrothermal synthesis. The sustainability of the ACROBAT flowsheet is evaluated by a life cycle assessment. Overall, the ACROBAT consortium (VITO, ENEA, Fraunhofer ILT, KU Leuven, Accurec) aims to recover 90% of the EU-CRMs (i.e. Li, P and graphite) and recycle LFP cathode material, graphite and electrolyte, respectively up to 5.4, 6.2 and 4.4 kt/y by 2030 in Europe. This would represent an overall value of 180 M€. ACROBAT's Industrial Advisory Board (Umicore, Bebat, Sorbat and Electrocycling) will catalyse the industrial valorisation of the project results.
Coordinator (partner 1) and consortium partners	1. Vlaamse Instelling voor Technologisch Onderzoek (VITO) (Belgium/Flanders) 2. KU Leuven (Belgium/Flanders) 3. Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) (Italy) 4. Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. (Gemany) 5. Accurec Recycling GmbH (Germany)
Project duration	24 Months
Total Costs	1.548,796 €
Total Requested Funding	1.124,296 €

Project acronym	**INN4MIN**
Project title	Development of innovative and sustainable approaches applied to the recovery of gold and critical elements from ores and spent printed circuit boards
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 5.3: Social acceptance and trust/public perception of raw materials.
Keywords	Gold Processing, Sustainable and Innovative Processes, Hybrid Hydrometallurgy of Gold, Electric Pulse Fragmentation, Recycling of PCBs
Publishable abstract	INN4MIN pretends to implement a strict I&D methodology to promote best practices in the recovery of gold from ore deposits (primary resources) and printed circuit boards PCBs (secondary resources), supported by a technological monitoring plan. Innovative methods will be investigated having as main drivers the reduction of environmental impacts, improvement of mineral processing efficiency and promotion of good practices in mining industry. Ore deposits are becoming poorer and complex. PCBs exhibits a high gold content, but their availability cannot be consistent to justify the investment on a processing plant. In line with this, INN4MIN will focus on the following topics: study of innovative comminution techniques to increase gold liberation from complex ores; use of greener reagents in the froth flotation and leaching stages; development of a cost-effective device to remove sterile material from the PCBs; design a hybrid hydrometallurgical approach for gold processing from ores and PCBs; recovery of critical elements during the hydrometallurgy of gold; improve the public perception regarding the mining industry. The project will start with the preparation and characterization of the material that will be studied (WP1). Then, comminution based on EPF will be compared to the conventional comminution pathway (WP2). This would be followed by the assessment of EPF effect on subsequent separation processes, by the study of greener flotation reagents and by the development of a prototype to reject sterile material from PCBs (WP3). The hydrometallurgy of gold will be studied to develop a hybrid process based on the use of greener leaching solutions. Moreover, the feasibility of a staged leaching process to recover critical elements would be assessed (WP4). An action plan to face the public perception regarding mining industry will be implemented during the project (WP5). WP6 is devoted to the project management, ensuring the timely delivery and dissemination of the project results.
Coordinator (partner 1) and consortium partners	1. Faculty of Engineering of University of Porto (Portugal) 2. BRGM (France) 3. G.E.O.S. Ingenieurgesellschaft mbH (Germany) 4. INOVA+ Innovation for growth (Portugal) 5. National Laboratory for Energy and Geology (Portugal)
Project duration	36 Months
Total Costs	1.034,316 €
Total Requested Funding	536,858 €

Project acronym	**MW4REMAM**
Project title	Microwave enhanced recovery of rees and plastic from WEEE and re-use in Additive Manufacturing of novel magnetic components
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment, Sub-Topic 5.3: Social acceptance and trust/public perception of raw materials
Keywords	Rare Earths; Microwave technology; Liquid metal extraction; mechano-synthesis; Additive Manufacturing
Publishable abstract	Rare Earths Elements (REE) are essential materials in connected and electrical technologies, and the transition to a decarbonisation and greener economy, due to their unique properties making them suitable for use in various high tech applications. The main objective of the MW4REMAMproject is to develop an innovative technology for efficient recovery of both rare earth metals and plastics from end-of-life WEEE and urban mines. Then re-use them as raw material for fabrication of plastic-RE composite filaments and create new magnetic components via additive manufacturing. The objective is fully in line with topic 4. Recovery of raw materials from End-of-life products, sub-topic 4.The specific objectives of the project are:Elaboration of a microwave technology enabling to separate and recover plastic and REE from end-of-life NdFeB magnets in WEEE with high efficiency and low environmental impact;obtaining nano and microcrystalline RE powders using mechanochemical processing; obtaining of plastic-RE composite filaments from recycled materials and demonstrate the capabilities to be re-used in additive manufacturing of new magnetic components via fused deposition modelling technology; estimation of the environmental effect of the new technologies, in order to comply with the objectives of Green Deal; aawareness of the great public about the environmental and economic benefits of the recycling of REE from WEEE and the innovative potential of re-use in additive manufacturing of magnets. The proposed project is highly innovative at European level by the two methods that will be developed: plastic; RE recovery by microwave technology as a major step forward in economic and environmental treatment of NdFeB small magnets from WEEE and the re-use of both plastics and RE in micro/nano powders for obtaining filaments for Additive Manufacturing technology (FDM) and the re-design of new magnetic parts by AM.
Coordinator (partner 1) and consortium partners	1. FADDTORY SPRL (Belgium/Flanders) 2. Institute of Catalysis - Bulgarian Academy of Sciences (IC-BAS) (Bulgaria) 3. SIRRIS (Belgium/Wallonia) 4. Daily Sources and Research Srl (Romania) 5. National R&D Institute for Nonferrous and Rare Metals-IMNR (Romania) 6. Travelec SA (Belgium/Wallonia)
Project duration	36 Months
Total Costs	646,812 €
Total Requested Funding	553,410 €

Project acronym	**PHIGO**
Project title	Thermal Processing of P-rich ashes aiming for HIGH-GRADE PHOSPHORUS Products
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 5.1: New business models (implementing circular economy aspects)
Keywords	Phosphorus recovery, P-rich ashes, critical materials, incineration, thermal extraction
Publishable abstract	The EU phosphorus requirements are supplied by import from Mideast, Russia and China. Due to its economic importance and supply risk, the European Union included the phosphorus and phosphate rocks (PR) in the "List of critical raw materials (CRM) for the EU". Phosphorus is also difficult to be substituted. One of the most sustainable options to secure future P supply within EU is recovery of P from food production and consumption chain which is also the EU P strategy. The 1st pillar of the strategy is biowastes incineration which will enrich the P-content by 6-7 times to a P-rich fraction and at the same time produce green energy. The innovative PHIGO solution aims to optimize the incineration step (the 1st pillar of the strategy) and to develop a sustainable technology for efficient P-extraction from the P-rich ashes (the 2nd pillar of the strategy) and thereby enabling closing the P loop in the EU P-strategy. The project will be realized via a cross-discipline approach with experts in incineration processes (University of Ege with industrial actors GURES and INEVA, Turkey), material characterizations and evaluation (University of Porto, Portugal), thermal extraction processes (Swerim, Sweden and University Politehnica of Bucharest, Romania), evaluation of products, processes and zero waste approaches (GIG and PROGEO, Poland) and sustainability assessment (University of Brescia, Italy). The main contributions of the PHIGO to the Strategic Implementation Plan of the European Innovation Partnership on Raw Materials and the ERA-MIN Research Agenda include: - Recovery of critical material (CRM) P and reduced import of another CRM phosphate rock; - A sustainable EU P-strategy to secure the P need and close the P-Loop within EU. The PHIGO solution will also contribute, in the future, to a more secured food supply on a global level as PR is nonrenewable and limited primary resource and P is an indispensable element for the food industry.
Coordinator (partner 1) and consortium partners	1. Swerim (Sweden) 2. Ege University (Turkey) 3. Porto University, Faculty of Sciences (Portugal) 4. Central Mining Institute (Glowny Instytut Gornictwa) (Poland) 5. University of Brescia (Italy) 6. P.U.P.H „PROGEO" Sp. z o.o. (Poland) 7. University Politehnica of Bucharest (Romania)
Project duration	36 Months
Total Costs	1.108,109 €
Total Requested Funding	758,234 €

Project acronym	**PG2CRM**
Project title	Phosphogypsum Processing to Critical Raw Materials
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 4.4: Recovery of raw materials from End-of-life products
Keywords	Phosphogypsum, Critical Raw Materials, Rare Earth Elements, Patent, Circular Economy
Publishable abstract	More than three-quarters of phosphate fertilizers produced globally are produced using phosphoric acid as an intermediate product, leaving4–6 t low-radioactive phosphogypsum (PG) per t P2O5 produced, as relevant by-product/waste. About 85% of the 5.6–7.0 billion t PG produced globally over the lifetime of the phosphate industry are disposed of in stacks in 52 countries worldwide. The largest stacks in the EU are found in Lithuania, Poland, Spain, Greece, Bulgaria, Serbia and Kosovo, the Netherlands, Belgium, Portugal and Finland. 3-4 billion tare accessible for recovery worldwide and approximately 2 billion t are accessible for recovery in Europe. At the current rate of production, these stacks of low-radioactive material are growing by some 200 million t per year. From a regional environmental point of view, PG maybe the single most critical processing issue of fertilizer production today. The objective of the project "Phosphogypsum Processing to Critical Raw Materials" (PG2CRM) is to further develop an innovative process for REE recovery from PG that has recently been patented by the coordinator from TRL 4-5 (lab-scale experiments) which is the current state to TRL 7-8 (continues pilot plant operation). The focus will be on the comprehensive use of PG and besides the opportunity to recover REEs from it, the remaining gypsum matrix will be used as an inexpensive material in construction/sound insulation.
Coordinator (partner 1) and consortium partners	1. École des Mines de Saint-Étienne (France) 2. Freiberg University of Mining and Technology (Germany) 3. Institute of Nuclear Chemistry and Technology (Poland) 4. Universidad de Huelva (Spain) 5. NOVA.ID.FCT/ NOVA School of Science & Technology (Portugal) 6. Czech University of Life Sciences Prague (Czech Republic) 7. Biopolinex Sp. Z. o.; (Poland) 8. ALFERROCK GmbH (Germany) 9. OCP S.A. (Morocco)
Project duration	36 Months
Total Costs	2.576,988 €
Total Requested Funding	1.826,828 €

Project acronym	**RecycleBIM**
Project title	Integrated Planning and Recording Circularity of Construction Materials through Digital Modelling
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 4.5: Recovery of raw materials from End-of-life immovable assets, e.g. buildings, Sub-Topic 4.6: Increase recycling or reusethrough information and communication technologies (ICT)
Keywords	Construction Industry, BIM, Open-source tool, multi-criteria optimisation, database and case studies
Publishable abstract	The project intends to make a multi-national and multi-stakeholder effort towards the creation of an integrated framework for circularity ofraw materials of construction, leveraged on the wealth of information that is brought about by 'Building Information Modelling'. Theframework includes five main aspects: (i) development of a new methodology of survey of constructions to-be-demolished, based on state ofthe art methods (e.g. handheld laser scanning) to allow semi-automated digital twins of buildings to be created at a controlled cost; (ii)establish adequate BIM modelling rules (and information requirements) that allow the BIM model to host all the relevant information for thefull deconstruction analysis, including health and safety aspects, deconstruction phasing/techniques and quantity take off regarding thematerials available for reuse and recycling; (iii) create an IFC-based tool for multi-criteria optimisation of deconstruction strategies andmaterials, so that designers of new construction, or planners of deconstruction of 'to-be-demolished' can have their BIM models analysed ina platform that manages an integrated multi-criteria optimisation procedure for deconstruction phasing and strategies, including LCA/LCCanalysis (with distinct peculiarities when making Design for Deconstruction, or when solely planning the demolition of an existing building);(iv) strategic and optimised use of recycled demolition waste in 3D printed concrete for local digital construction practice; (v) make all theprevious developments together with a specific set of tools for Municipalities to use in their process of issuing both deconstruction and newbuilding permits based on BIM models (openBIM), as to manage better focus in municipal approvals based on traceable data, and at thesame time, keeping accurate records of material circularity at a local level (enabling global optimisation strategies at municipal level)
Coordinator (partner 1) and consortium partners	1. University of Minho (Portugal) 2. Technische Universität Darmstadt (Germany) 3. Universidade de Vigo (Spain) 4. Stellenbosch University (South Africa) 5. ACCA software S.p.A. (Italy) 6. Südhessische Wertstoffrückgewinnungs GmbH (Germany) 7. University of the Western Cape (South Africa) 8. LEZAMA DEMOLICIONES S.L. (Spain) 9. Lafarge Centre de Recherche (France) 10. Newton (Portugal) 11. Gaiurb EM (Portugal) 12. Marta Campos – Architecture (Portugal)
Project duration	36 Months
Total Costs	2.001,664 €
Total Requested Funding	1.102,492 €

Project acronym	**Recycl3D**
Project title	Recycled aggregates for 3D printed concrete structures
Main topic	Topic 4: Recycling andz Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 4.1: End-of-life products collection and (reverse) logistics, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 4.5: Recovery of raw materials from End-of-life immovable assets, e.g., buildings, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT)
Keywords	Construction & Demolition Waste, fine reycled aggregates, 3D printing, recycled concrete, additive manufacturing
Publishable abstract	Construction & Demolition Waste (CDW) represents one of the most relevant materials flows globally and ambitious goals for its management were set by the EU. Nonetheless, market uptake of recycling and recovery products from CDW is still lacking. In particular, the fine recycled aggregates (fRA) are still the most under-used component without a clear entry point into the circular economy model. The recovery/recycling of CDW can be improved by developing its use in higher-grade applications through innovation and emerging technologies. In this context, the Recycl3D (Recycled aggregates for 3D printed concrete structures) project aims at maximizing the recovery of fRA derived from CDW and valorizing it as an essential constituent in the fabrication of new concrete elements through innovative 3D printing technologies. Therefore, Recycl3D tackles the challenges of sustainability (circular economy) and innovation (additive manufacturing) of current relevance for the construction industry. The actions within Recycl3D will facilitate the entry of fRA from CDW into the circular economy value-chain and at the same time increase the material efficiency and lead to higher added value. Then, the mechanical, durability and service-life of 3D-RAC elements (considering also their recoverability and recyclability) could be consistently predicted and, consequently, the barriers for future market uptake can be addressed by designing and optimizing 3D-RAC structural prototypes and testing them in relevant environments. These outcomes will directly impact both the scientific and industrial communities at both the global/European level and the national/regional one. The project consists of Applied/Industrial Research activities in the fields of sustainable construction materials & structures and additive manufacturing performed by a carefully tailored Consortium that ensures a multidisciplinary and complementary expertise needed to significantly advance current knowledge.
Coordinator (partner 1) and consortium partners	1. University of Salerno (Italy) 2. Universitat Politècnica de Catalunya (Spain) 3. c5Lab (Portugal) 4. LNEC (Portugal) 5. West Pomeranian University of Technology in Szczecin (Poland) 6. BETOTEST POLSKA Sp. z o.o. (Poland) 7. Federal University of Rio de Janeiro (Brazil) 8. Arizona State University (USA)
Project duration	36 Months
Total Costs	1.427,580 €
Total Requested Funding	772,939 €

Project acronym	**Rendering3D**
Project title	Recycling End of Life permanent magnets by innovative sintering and 3D printing
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products
Keywords	Critical raw materials, Rare Earths magnets, Neodymium, Recovery, Recycling
Publishable	The global demand of NdFeB permanent magnets (PMs), increased enormously in these last years due to the huge production of machines in which NdFeB magnets are key components: wind turbines, electric and hybrid vehicles and others. Since the world Rare Earth (RE) market is China's controlled, one of the most promising solution for the future independence of Europe from the Chinese monopoly, is the reuse or recycle of RE-based PM from End of Life (EoF) magnets. The recent directives of the European Commission in terms of reducing dependence from imports and increased capability to produce and use raw materials, is focused on the Strategic Implementation Plan, in which one of the action areas is "Recycling of raw materials from products, buildings and infrastructure" . The present project Recycling End of Life permanent magnets by innovative sintering and 3D printing (Rendering3D) is addressed to the development of a scientific and technical base for a route to recycle EoL NdFeB PMs in order to produce new magnets with similar or even better magnetic features. It involves the controlled milling of EoL magnets to a powder, which is fed to two pipelines. The "sintering" line leads to sintered magnets while the "3D printing" line leads to 3D printed bonded magnets. These processes mainly entail mechanical processing and no costly chemical or thermal process. with large environmental footprint. are involved. The general aim outlined above requires achievement of several particular goals: Processes to optimize a protocol to achieve submicrometric high quality magnetic powders from EoL magnets for the production of different types of magnets; and Products to obtain either isotropic and anisotropic sintered magnets and 3D printed customized shape bonded magnets. Finally, this project seeks to raise the awareness of companies using permanent magnets to contribute to the recovery of these magnets in a European Circular Economy Path, totally independent from third parties.
Coordinator 1) and consortium	1. Università di Genova (Italy) 2. Consiglio Nazionale delle Ricerche – CNR (Italy) 3. NKAD PRINTERS (France) 4. University of the Basque Country UPV/EHU (Spain) 5. Universite de Paris (France)
Project duration	24 Months
Total Costs	808,135 €
Total Requested	571,720 €

Project acronym	**RecyLIB**
Project title	Direct Recycling of Lithium-Ion Batteries
Main topic	Topic 4: Recycling and Re-use of End-of-Life products and assets
Sub-topics	Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT), Sub-Topic 5.1: New business models (implementing circular economy aspects), Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment, Sub-Topic 5.3: Social acceptance and trust/public perception of raw materials, Sub-Topic 5.4: Health safety issues
Keywords	Direct recycling, remanufacturing, dry electrode coating, sustainability assessment, Lithium-Ionbattery
Publishable abstract	Motivated by the economically and ecologically intriguing perspective of utilizing up to 40 % of recycled materials in the battery production by 2050, more and more manufacturers put the integration of recycled materials on their R&D roadmaps. These activities are emphasized by the European Commission's intention to create a closed-loop economically viable supply chain. The global objective of RecyLIB is the research on a novel process chain of direct recycling of Li-ion batteries with subsequent reintegration of the recovered electrode material into new electrodes via melt manufacturing processes and the performance evaluation in battery cells. The contribution of this concept to a circular value chain will be assessed. With a work plan covering all relevant process steps for the manufacturing, testing and recycling, RecyLIB addresses the need for an integrated manufacturing process for battery electrodes utilizing battery active material recovered by a low-energy, high-yield recycling process for the direct reuse of battery active materials. Active dissemination of the project results via social media and high-impact, peer reviewed scientific journals as well as a dedicated stakeholder engagement workshop are planned. With an expected reuse of up to 25 wt% of recycled electrode material in the electrode manufacturing process and the waiver of toxic solvents without detrimental effects on the cell performance, RecyLIB will have a direct impact on the growing EU battery production ecosystem. The recovery of electrode materials with a high yield using low energy and low CO2 emission processes, enabling the recovery of Critical Raw Materials will leverage the transition towards a closed-loop circular economy in Europe. In a nutshell, the benefit of RecyLIB will be an electrode manufacturing process designed for recyclability flanked by an electrode recycling process designed for the re-manufacturability.
Coordinator (partner 1) and consortium partners	1. Fraunhofer Institute for Silicate Research ISC (Germany) 2. HUTCHINSON SA, ADEME (France) 3. Ghent University (Belgium/Flanders) 4. ImpulsTec GmbH (Germany) 5. Bavarian Research Alliance GmbH (Germany) 6. Carl Padberg Zentrifugenbau GmbH (Germany)
Project duration	36 Months
Total Costs	1.148,888€
Total Requested Funding	937,210€

Topic 5: Cross-Cutting Topics

Project acronym	**Scandere**
Project title	Scaling up a circular economy business model by new design, leaner remanufacturing, and automated material recycling technologies
Main topic	Topic 5: Cross-Cutting Topics
Sub-topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 3.3: Increase resource efficiency using information and communication technologies (ICT), Sub-Topic 4.1: End-of-life products collection and (reverse) logistics, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-ofLife products, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT), Sub-Topic 5.1: New business models (implementing circular economy aspects
Keywords	Product-as-a-service, holistic perspective, systemic design, technology, non-technological framework condition
Publishable abstract	Securing the supply of raw materials is one of Europe's biggest challenges. The Commission has identified 30 critical raw materials (CRMs), which are adopted by products in many sectors. Today, most of the products are processed in the "make-sell-use-dispose" paradigm, where original equipment manufacturers (OEMs) intend to sell a higher number of products and lose control of the products after their sales. The product-as-a-service (PaaS) model, which provides OEMs with a reverse incentive, is emerging as a promising concept in several sectors and creating a potential for increasing the CRM efficiency by a factor of two or more. However, to raise and upscale the adoption of CRM-efficient PaaS business models, a major challenge is to holistically address the inter-dependent activities occurring in different points both temporally and geographically: product design, remanufacturing, and recycling. Therefore, front runners in European industry and academia, including the need owners and solution providers, will join forces in this project to tackle this challenge taking consumer electrical and electronic equipment as an example. The objectives are to 1) create three demonstrators with improved product designs, leaner remanufacturing, optimized recycling and adapted regulations in a CRMefficient PaaS business model from the three pillars of sustainability using indicators with the lifecycle perspective and 2) improve knowledge for product design, remanufacturing, and recycling including their interplays among them in a whole CRM-efficient PaaS offering. The major outcomes will showcase three CRM-efficient PaaS offerings with enhanced sustainability as a European model to business leaders and policy makers. The major expected impacts are 1) increasing the CRM efficiency and security from the EU's interest, 2) decoupling economic growth and resource use and 3) improving innovation capacity for further enhancing CRM-efficient PaaS business models.
Coordinator (partner 1) and consortium partners	1. Linköpings Universitet (Sweden) 2. Elektrorecykling S.A. (Poland) 3. Poznan University of Technology (Poland) 4. Compliance and Risks (Ireland) 5. Katholieke Universiteit Leuven (Belgium/Flanders) 6. Institut Polytechnique de Grenoble (France) 7. BSH Hausgeräte GmbH (Germany) 8. Asociatia ECOTIC (Romania)
Project duration	36 Months
Total Costs	1.495,494 €
Total Requested Funding	1.251,224 €

4.DATA OF FUNDED PROJECTS

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 1: Supply of raw materials from exploration to mining	Sub-Topic 1.1: Exploration	FUTURE Abstract	University of the Witwatersrand, Johannesburg	South Africa (DSI)	24	1.164,571 €	732,236 €
			Uppsala University	Sweden (Vinnova)			
			Geological Survey of Sweden				
			Politecnico di Torino	Italy (MUR)			
			Nordic Iron Ore AB	Sweden (Vinnova)			
			South Deep Gold Mine	South Africa (DSI)			
			University of Venda				
			Sercel	(ANR)			
	Sub-Topic 1.1: Exploration	SEEMS DEEP Abstract	Geological Survey of Finland	Finland (BF)	36	2.182,518 €	1.281,758 €
			Uppsala University	Sweden (Vinnova)			
			Bureau des Recherches Géologiques et Minières	France (ANR)			
			Institute of Geophysics, Polish Academy of Sciences	Poland (NCBR)			
			Geopartner Geofizyka sp. z o.o.				
			GRM-Services	Finland (BF)			
			IRIS Instruments	France (ANR)			

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 1: Supply of raw materials from exploration to mining	Sub-Topic 1.1: Exploration, Sub-Topic 1.2: Mining operations, Sub-Topic 5.1: New business models (implementing circular economy aspects)	AI-COSTSQO Abstract	BAY E Bilişim Danışmanlık Eğitim Bilgisayar Sanayi ve Ticaret Limited Şirketi	Turkey (TUBITAK)	36	679,092 €	598,972 €
			University of Petrosani	Romania (UEFISCDI)			
			Faculty of Information Studies in Novo mesto	Slovenia (MIZS)			
			UNIBO - University of Bologna	Italy (MUR)			
			Geological Institute of Romania	Romania (UEFISCDI)			
	Sub-Topic 1.1: Exploration	PEGMAT Abstract	Masaryk University	Czech Republic (TA CR)	36	964,757 €	808,892 €
			Brgm	France (ANR)			
			Geological Institute of Romania	Romania (UEFISCDI)			
			Geological Institute, Bulgarian Academy of Sciences	Bulgaria (BNSF)			
			G E T s.r.o.	Czech Republic (TA CR)			
			Earth Science Institute Slovak Academy of Sciences	Slovakia (SAS)			
			K M K GRANIT a.s.	Czech Republic (TA CR)			

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 2: Circular Design	Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment	Cider Abstract	Fraunhofer IGCV	Germany (BMBF/JÜLICH)	24	1.851,291 €	920,432 €
			Arkema	France (ADEME)			
			AUTOTECH ENGINEERING SPAIN S.L	Spain (CDTI)			
			Forward Engineering	Germany (BMBF/JÜLICH)			
			IRT M2P	France (ANR)			
			Autefa Solutions Germany GmbH	Germany (BMBF/JÜLICH)			
			Rexhi GmbH				
			Plastic Omnium New Energies	France (ADEME)			
			Tallinn University of Technology	Estonia (ETAg)			
	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 2.4: Product design for critical materials substitution	2BoSS Abstract	FUNDACIO INSTITUT DE RECERCA DE L'ENERGIA DE CATALUNYA	Spain (AEI)	36	1.002,683 €	812,453 €
			Politecnico di Torino (TU Turin)	Italy (MUR)			
			Commissariat à l'énergie atomique et aux énergies alternatives	France (ANR)			
			Cleopa Gmbh	Germany (BMBF/JÜLICH)			

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 2: Circular Design	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 3.2: Increase resource efficiency through recycling of residuesor remanufacturing of used products and components, Sub-Topic 5.4: Health safety issues	CO2TREAT Abstract	VITO	Belgium/Flanders (Hermesfond/VLAIO)	36	1.537,736 €	1.103,037 €
			RWTH Aachen University	Germany (BMBF/JÜLICH)			
			Slovenian National Building and Civil Engineering Institute	Slovenia (MIZS)			
			ArcelorMittal Belgium	Belgium/Flanders (Hermesfond/VLAIO)			
			HeidelbergCement AG	Germany (BMBF/JÜLICH)			
			Schüring-Beton GmbH				
	Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components	RecMine Abstract	Gheorghe Asachi Technical University Iasi	Romania (UEFISCDI)	24	623,489 €	402,906 €
			Universidade da Beira Interior	Portugal			
			University of Chemical Technology and Metallurgy	Bulgaria (BNSF)			
			Middle East Technical University	Turkey (TUBITAK)			
			OBRAS Y SERVICIOS TEX, S.L.	Spain/Navarra (CFNA)			

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 2: Circular Design	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes	POTASSIAL Abstract	İnönü University	Turkey (TUBITAK)	36	694,858 €	557,860 €
			Firat University				
			Muğla Sıtkı Koçman University				
			Luleå University of Technology Department of Civil, Environmental and Natural Resources Engineering	Sweden (Vinnova)			
			Institute of Geotechnics/Slovak Academy of Sciences	Slovakia (SAS)			
			Eti Aluminium Inc.	Turkey (TUBITAK)			
			Element Six Inc.	The United Kingdom			
Topic 3: Processing, Production and Remanufacturing	Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components	PHOSTER Abstract	Politecnico di Milano	Italy (MUR)	30	747,142 €	457,000 €
			University of Ljubljana	Slovenia (MIZS)			
			Timac Agro Italia S.p.A.	Italy (MUR)			
			Magnesitas Navarras, S.A.	Spain/Navarra (CFNA)			
			REA Dalmine SpA	Italy			
			MM Spa				

Main call topic	Sub-topic areas	Project acronym /abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 3: Processing, Production and Remanufacturing	Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products, Sub-Topic 5.1: New business models (implementing circular economy aspects), Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment.	ABtomat Abstract	University of Chemical Technology and Metallurgy	Finland (BF)	36	1.193,670 €	1.081,151 €
			KTH Royal Institute of Technology	Sweden (Vinnova)			
			Istanbul Technical University	Turkey (TUBITAK)			
			Yeditepe University				
			ETI Aluminyum				
			United Energy, a. s.	Czech Republic (TA CR)			
			Bowmen Consulting, s. r. o.				
			Sokolovská uhelná, právní nástupce, a.s.				
			AV EKO Color, s. r. o				
			Public University of Navarra (UPNA)	Spain/Navarra (CFNA)			
			Tallinn University of Technology	Estonia (ETAg)			
			Arslan Aluminyum	Turkey (TUBITAK)			

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 3: Processing, Production and Remanufacturing	Sub-Topic 1.2: Mining operations, Sub-Topic 1.3: Mine closure and reclamation, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 5.1: New business models (implementing circular economy aspects), Sub-Topic 5.4: Health safety issues.	TailingR32Green Abstract	Universidad de Huelva	Spain (AEI)	36	932,755 €	627,911 €
			University of Aveiro	Portugal (FCT)			
			Central University of Technology	South Africa (DSI)			
			Basque Center for Materials, Applications & Nanostructures	Spain (AEI)			
			University of the Free State	South Africa (DSI)			
			National University del Altiplano	Peru			

Main call topic	Sub-topic areas	Project acronym /abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 4: Recycling and Re-use of End-of-Life products and assets	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 5.1: New business models (implementing circular economy aspects)	PHIGO Abstract	Swerim	Sweden (Vinnova)	36	1.108,109 €	758,234 €
			Ege University	Turkey (TUBITAK)			
			Porto University, Faculty of Sciences	Portugal			
			Central Mining Institute (Glowny Instytut Gornictwa)	Poland (NCBR)			
			University of Brescia	Italy			
			P.U.P.H „PROGEO" Sp. z o.o.	Poland (NCBR)			
			University Politehnica of Bucharest	Romania (UEFISCDI)			
	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 4.1: End-of-life products collection and (reverse) logistics, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 4.5: Recovery of raw materials from End-of-life immovable assets, e.g. buildings, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT)	Recycl3D Abstract	Univerisity of Salerno	Italy (MUR)	36	1.427,580 €	772,939 €
			Universitat Politècnica de Catalunya	Spain (AEI)			
			c5Lab	Portugal (FCT)			
			LNEC				
			West Pomeranian University of Technology in Szczecin	Poland (NCBR)			
			BETOTEST POLSKA Sp. z o.o.				
			Federal University of Rio de Janeiro	Brazil			
			Arizona State University	USA			

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Topic 4: Recycling and Re-use of End-of-Life products and assets	Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 5.3: Social acceptance and trust/public perception of raw materials	INN4MIN Abstract	Faculty of Engineering of University of Porto	Portugal (FCT)	36	1.034,316 €	536,858 €
			BRGM	France (ANR)			
			G.E.O.S. Ingenieurgesellschaft mbH	Germany (BMBF/JÜLICH)			
			INOVA+ Innovation for growth	Portugal (FCT)			
			National Laboratory for Energy and Geology	Portugal (FCT)			
	Sub-Topic 4.5: Recovery of raw materials from End-of-life immovable assets, e.g. buildings, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT)	RecycleBIM Abstract	University of Minho	Portugal (FCT)	36	2.001,664 €	1.102,492 €
			Technische Universität Darmstadt	Germany (BMBF/JÜLICH)			
			Universidade de Vigo	Spain (AEI)			
			Stellenbosch University	South Africa (DSI)			
			ACCA software S.p.A.	Italy (MUR)			
			Südhessische Wertstoffrückgewinnungs GmbH	Germany (BMBF/JÜLICH)			
			University of the Western Cape	South Africa (DSI)			
			LEZAMA DEMOLICIONES S.L.	Spain (CDTI)			
			Lafarge Centre de Recherche	France (ADEME)			
			Newton	Portugal			
			Gaiurb EM				
			Marta Campos - Architecture				

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Topic 4: Recycling and Re-use of End-of-Life products and assets	Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products	Rendering3D Abstract	Università di Genova	Italy (MUR)	24	808,135 €	571,720 €
			Consiglio Nazionale delle Ricerche - CNR				
			NKAD PRINTERS	France (ADEME)			
			University of the Basque Country UPV/EHU	Spain (AEI)			
			Universite de Paris	France (ADEME)			
	Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT), Sub-Topic 5.1: New business models (implementing circular economy aspects), SubTopic 5.4: Health safety issues	ACROBAT Abstract	Vlaamse Instelling voor Technologisch Onderzoek (VITO)	Belgium/Flanders (FWO)	24	1.548,796 €	1.124,296 €
			KU Leuven				
			Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)	Italy (MUR)			
			Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	Germany (BMBF/JÜLICH)			
			Accurec Recycling GmbH				
	Sub-Topic 4.4: Recovery of raw materials from End-of-life products	PG2CRM Abstract	École des Mines de Saint-Étienne	France (ANR)	36	2.576,988 €	1.826,828 €
			Freiberg University of Mining and Technology	Germany (BMBF/JÜLICH)			
			Institute of Nuclear Chemistry and Technology	Poland (NCBR)			
			Universidad de Huelva	Spain (AEI)			
			NOVA.ID.FCT/ NOVA School of Science & Technology	Portugal (FCT)			
			Czech University of Life Sciences Prague	Czech Republic (TA CR)			
			Biopolinex Sp. Z. o. o.	Poland (NCBR)			
			ALFERROCK GmbH	Germany			
			OCP S.A.	Morocco			

Main call topic	Sub-topic areas	Project acronym/abstract	Coordinator (partner 1) and consortium partners	Participating countries - Funding organisations	Duration (Months)	Total costs	Requested funding
Topic 4: Recycling and Re-use of End-of-Life products and assets	Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 3.1: Increase resource efficiency in resource intensive production processes, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-of-Life products, Sub-Topic 4.4: Recovery of raw materials from End-of-life products, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT), Sub-Topic 5.1: New business models (implementing circular economy aspects), Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment, Sub-Topic 5.3: Social acceptance and trust/public perception of raw materials, Sub-Topic 5.4: Health safety issues	RecyLIB Abstract	Fraunhofer Institute for Silicate Research ISC	Germany (BMBF/JÜLICH)	36	1.148,888 €	937,210 €
			HUTCHINSON SA	France (ADEME)			
			Ghent University	Belgium/Flanders (FWO)			
			ImpulsTec GmbH	Germany (BMBF/JÜLICH)			
			Bavarian Research Alliance GmbH	Germany			
			Carl Padberg Zentrifugenbau GmbH				

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Topic 4: Recycling and Re-use of End-of-Life products and assets	Sub-Topic 2.4: Product design for critical materials substitution, Sub-Topic 5.2: Improvement of methods or data for environmental impact assessment, Sub-Topic 5.3: Social acceptance and trust/public perception of raw materials	MW4REMAM Abstract	FADDTORY SPRL	Belgium/Wallonia (SPW-Recherche)	36	646,812 €	553,410 €
			Institute of Catalysis - Bulgarian Academy of Sciences (IC-BAS)	Bulgaria (BNSF)			
			SIRRIS	Belgium/Wallonia (SPW-Recherche)			
			Daily Sources and Research Srl	Romania (UEFISCDI)			
			National R&D Institute for Nonferrous and Rare Metals-IMNR				
			Travelec SA	Belgium/Wallonia (SPW-Recherche)			
Topic 5: Cross-Cutting Topics	Sub-Topic 2.1: Product design for increased raw material efficiency, Sub-Topic 2.2: Product design for reuse or extended durability of products, Sub-Topic 2.3: Product design to promote recycling, Sub-Topic 3.2: Increase resource efficiency through recycling of residues or remanufacturing of used products and components, Sub-Topic 3.3: Increase resource efficiency using information and communication technologies (ICT), Sub-Topic 4.1: End-of-life products collection and (reverse) logistics, Sub-Topic 4.2: End-of-life products pre-processing: pre-treatment, dismantling, sorting, characterisation, Sub-Topic 4.3: Reuse, repair, refurbishing, repurposing and remanufacturing of End-ofLife products, Sub-Topic 4.6: Increase recycling or reuse through information and communication technologies (ICT), Sub-Topic 5.1: New business models (implementing circular economy aspects.	Scandere Abstract	Linköpings Universitet	Sweden (Vinnova)	36	1.495,494 €	1.251,224 €
			Elektrorecykling S.A.	Poland (NCBR)			
			Poznan University of Technology	Poland (NCBR)			
			Compliance and Risks	Ireland (GSI/EPA)			
			Katholieke Universiteit Leuven	Belgium/Flanders (FWO)			
			Institut Polytechnique de Grenoble	France (ADEME)			
			BSH Hausgeräte GmbH	Germany			
			Asociatia ECOTIC	Romania