ROADMAP MATERIALS FOR BUILDING and CONSTRUCTION
(March 2024)

LOW CARBON CONSTRUCTION Horizon 2024-2030		RESOURCE EFFICIENCY Horizon 2024-2030	
Resources & Materials	**Products & Processes**	**Resources & Materials**	**Products & Processes**
Development of low-carbon resources and materials (e.g. carbon negative binders based on mineral carbonation, low-carbon binders and alternative cements, calcined clays, alkali-activated materials, low-carbon bricks green steel, bio-based materials) that are key for a more sustainable construction industry.	*Focus on the decarbonization of production processes (e.g. electrification) of building materials and products, and on the development of novel materials and products related to heating and cooling (e.g. insulation, light-weight, energy storage).*	*Upgrading of alternative resources and waste streams into clean, high- quality resources and materials for the building and construction sector, preferably with beneficial properties such as low-carbon, low-maintenance, high durability, self-healing, long lifespan, and easy recyclable or reusable.*	*Development of products and processes allowing for an increased rate of industrialization (e.g. prefabrication, modularity, standardization) allowing for an efficient construction, deconstruction or demolition process. Newly developed products preferably have an improved durability (e.g. longer service life, high strength, low maintenance) or contribute to combat the effects of climate change (e.g. heat and moisture buffering, rain absorbing).*

ENABLERS (sustainable construction)	
Tools	*Development and refinement of tools and models evaluating the technical properties/quality/durability of materials and/or products or the sustainability/circularity of building applications.*
Digitalization	*Several digital solutions (e.g. BIM, material passports, robotization, IoT, AI applications, Industry 5.0 and digital twins) will also make their way into the building and construction sector and should be further developed, improved, validated and implemented to support the overall sustainability goals.*
Regulation, standardization and technical specifications	*Focus on performance- based standardization and workable End-of-Waste criteria is crucial to support the transition towards a more sustainable construction sector adopting European and International legislation and frameworks such as the Construction Product Regulation (CPR), the European Green Deal and the ETS Regulation.*

Figure 1 Diagram Roadmap Building & Construction

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Application domain	Focus domain	Main research topics	*References and targets*			Funding instr. 2024-2027		Funding instr. 2028-2030	
			Ref 2023	Target 2027	Target 2030	SBO	ICON	SBO	ICON
Low carbon construction	Construction materials and their associated products and systems that (1) facilitate a lower carbon impact and other environmental indicators and (2) improve building energy performance and energy efficiency (more sustainable materials and products with reduced embodied carbon and reduced embodied energy).	Low-carbon cement and binders (e.g. calcined clays); alkali-activated cement; carbon negative binders (e.g. mineral carbonation) and SCMs	Actual SotA	Binder components with climate impact < 300 kg CO_2 eq. per ton binder during production resulting in equivalent technical performance of the end product(s) in which the binders are used	Binder components with climate impact < 200 kg CO_2 eq. per ton binder during production resulting in equivalent technical performance of the end product(s) in which the binders are used	(green)	(green)	(green)	(green)
		Low-carbon concrete and concrete building components	Actual SotA	15% reduction in climate change impact (kg CO_2 eq. per kg) on component level during production with equivalent technical performance	30% reduction in climate change impact (kg CO_2 eq. per kg) on component level during production with equivalent technical performance	(green)	(green)	(orange)	(green)
		Low carbon construction materials (such as steel, asphalt and bitumen, bricks, biobased construction materials and others)	Actual SotA	15% reduction in climate change impact (kg CO_2 eq. per kg) on component level during production with equivalent technical performance	30% reduction in climate change impact (kg CO_2 eq. per kg) on component level during production with equivalent technical performance	(orange)	(green)	(red)	(green)
		Highly efficient insulation materials and materials for thermal energy storage and/or heat exchangers	Actual SotA	15% improvement in performance (insulation) with equal climate change impact during production or 15% reduction in climate change impact during production with equivalent performance	30% improvement in performance (insulation) with equal climate change impact during production or 30% reduction in climate change impact during production with equivalent performance	(green)	(green)	(orange)	(green)
Resource efficiency	Construction materials and associated products that (1) anticipate growing scarcity of primary raw materials using (upgraded and cleaned) secondary raw materials (2) have an improved durability and (3) can contribute to combat the effects of climate change.	Upgrading alternative resources and waste streams into clean, high-quality resources and materials for the building and construction sector (urban mining)	Current situation as defined by active "user certificates" handed out by OVAM and/or the current standards	Treatment allowing at least 20% use of alternative resources in highgrade applications with equivalent or improved environmental impact and/or circularity	Treatment allowing at least 30% use of alternative resources in highgrade applications with equivalent or improved environmental impact and/or circularity	(orange)	(green)	(red)	(green)
		Novel materials/products with a greatly reduced material consumption coupled to superior performance (i.e. ultra-high strength, lightweight)	Actual SotA	Reduction in primary material consumption of at least 20% resulting in equivalent or improved environmental impact and/or circularity and with equivalent or improved technical performance.	Reduction in primary material consumption of at least 30% resulting in equivalent or improved environmental impact and/or circularity and with equivalent or improved technical performance.	(green)	(green)	(green)	(green)
		Building products, components, and processes (prefabricated building elements) allowing for an increased rate of industrialisation such as prefabrication, modularity, disassembly, high-quality reuse or recyclability and limited maintenance (increased sustainability/ circularity)	Actual SotA	Design for full circularity: all components should be recycable or reused after disassembly. Increase in disasssembly speed of at least 15%.	Design for full circularity: all components should be recycable or reused after disassembly. Increase in disasssembly speed of at least 30%.	(green)	(green)	(orange)	(green)
		Multifunctional materials having an improved durability (longer lifespan, limited maintenance) or contributing to combat the effects of climate change	Actual SotA	Increase in lifespan of at least 15% or 15% decrease in maintenance efforts/cycles, without decreasing potential of EoL scenarios	Increase in lifespan of at least 30% or 30% decrease in maintenance efforts/cycles, without decreasing potential of EoL scenarios	(green)	(green)	(green)	(green)

Figure 2 Roadmap Building & Construction - Detailed Diagram Low Carbon and Resource Efficient Building and Construction

(blue)	Too early, insuficient industrial interest
(green)	Relevant instrument
(orange)	Relevant instrument but timing is becoming critical
(red)	Too late to start development

ROADMAP MATERIALS FOR BUILDING and CONSTRUCTION
(March 2024)

Enablers	Aim	Main research topics	Reference and targets			Funding instr. 2024-2027		Funding instr. 2028-2030	
			Ref 2023	Target 2027	Target 2030	SBO	ICON	SBO	ICON
Tools	A more competitive construction ecosystem that is better able to face challenges such as sustainability and productivity, by the implementation of (1) novel tools, (2) digital technologies and (3) a regulation/standardization allowing a performance based assessments of construction materials and their applications.	Tools en methods for technical purposes such as non-destructive measurement for performance evaluation of products and components opening up opportunities for reuse	Ref 2023	Solutions supporting the achievement of the targets mentioned above	Solutions supporting the achievement of the targets mentioned above				
		Sensors for smart functionalities, traceability, and non-intrusive automated fault detection for predictive maintenance							
		Evaluation tools and models for assessment of durability/ circularity/ environmental impacts including business models							
Digitalisation		Digital solutions for sustainable construction/deconstruction (robotisation, AI-based characterisation and/or sorting, 3D printing/additive manufacturing) and characterisation/monitoring (building information models, material passports, IoT-solutions for lifelong and real-time monitoring, digital twins)							
Regulation, standardisation and technical specifications		Development towards performance based standards facilitating the introduction of novel materials and products based on upgrade alternative resources and waste streams							

Figure 3 Roadmap Building & Construction - Detailed Diagram Enablers Building and Construction

	Too early, insuficient industrial interest
	Relevant instrument
	Relevant instrument but timing is becoming critical
	Too late to start development

1. What is the importance of the roadmap?

MateriNex's main objective is to support Flemish companies active in materials research, taking into account the EU research agenda and the Flemish government's policy priorities. A survey has shown that these needs are situated in the area of high-risk long-term research. However, a major challenge for materials research in the construction sector is that strategic research should go hand in hand with applied research and knowledge transfer. In this way, it can on the one hand reach the entire value chain of the fragmented construction sector and on the other hand also address the normative and regulatory framework aspects. The ultimate goal should not only be to invest in basic research, but also to increase adoption rates. See also part 7 Dissemination.

For each MateriNex **innovation theme**, a roadmap with horizon 2030 has been drawn up that establishes the priorities related to basic and applied research for the coming years and the funding instruments to be considered such as strategic basic research (SBO) and/or interdisciplinary cooperative research (ICON).

The roadmap will be used to organize calls for project proposals and to evaluate the submitted project proposals. However, it is a dynamic tool and will be adjusted as needed based on consultation with a broad group of stakeholders (Common Interest Group (CIG)).

2. What is this roadmap based on?

This roadmap is based on input from about 30 construction companies (including two federations) in the fall of 2023.

The importance of building materials is also reflected in several international roadmaps and reports for materials research (specifically in the construction industry), such as Strategy for the Sustainable Competitiveness of the Construction Sector and its Enterprises , Resource Efficiency Opportunities in the Building Sector, The Materials 2030 Roadmap of the Advanced Materials Initiative, the Built4People Partnership Strategic Research & Innovation Agenda 2021-2027, het Horizon Europe 2022-2027 Position Paper of the ECTP Materials and Sustainability Committee and the Global ABC Roadmap for Buildings and Construction.

3. What does this roadmap focus on?

The roadmap in Figure 1 starts from **two main application** domains for building and construction: **reducing the carbon footprint** on the one hand and **using resources efficiently** on the other hand.

In addition, the roadmap has a third horizontal pillar that we can describe as **enablers**. These are important cross-cutting challenges namely (i) **tools**, (ii) **digitalization** and (iii) **regulation, standardization and (technical) specifications**. Some of these challenges can be the subject of projects e.g., because they are very specific to the priority theme for which the roadmap was drawn up and in Flanders a substantial number of companies are active in this field and play a pioneering role. On the other hand, these cross-cutting challenges will factor into the assessment of project proposals in the application domains.

The detailed diagrams in Figures 2 and 3 estimate for each topic the supporting grant instruments considered necessary to achieve the objectives within the time frame. This uses a simple color code where green represents the relevant instruments. Blue, too early and currently limited industrial interest, and orange, relevant but critical with respect to timing, can in principle also be funded provided a good argument is provided. A red color indicates that the instrument is too late to start up.

4. What core activities are included in this roadmap?

State-of-the-art and future material challenges for the Building and Construction Industry

The construction sector lays the foundation for Flanders' basic socioeconomic needs. It provides the buildings and infrastructure needed by the rest of the economy and society. With 296,000 direct jobs and a turnover of €59 billion (FIEC key figures for 2021), the sector represents about 10% of Belgium's gross domestic product. The construction sector creates jobs not only on construction sites but also in many other sectors of the economy such as materials extraction and production, construction product manufacturing, facilities management, design, planning and project management. The construction sector itself is home to many micro-enterprises and SMEs.

In Flanders, the sector is subject to the following trends, among others:

- The need for **low-carbon and environmentally friendly** solutions (low impact)
- The need for solutions that enable **more efficient use of raw materials, energy and time**
- The need for **new functionalities and improved circularity**
- The need for materials with **high durability** (lifetime over 100 years and almost maintenance free)
- The need for better and more sustainable infrastructure to facilitate mobility ("modal shift") and connectivity
- The challenge linked to the application of **increasing material innovations** and **increasing complexity** in products, systems, buildings and infrastructures, including the symbiosis between different industrial sectors (e.g. by-product providers)
- The need for accelerated renovation of current buildings to achieve an (operationally) decarbonized building stock by 2050
- The need to catch up on digitalization
- The search for higher productivity and affordability, taking into account logistical considerations
- The need for industrialization combined with customer orientation
- The need for adapted standards and technical specifications for new innovative materials

These trends to move toward a **low-carbon, resource-efficient, more circular and data-driven future** present diverse research challenges for the construction industry. It is important to facilitate material innovations in construction and building technology in a way that ensures that both the innovation potential of building materials and construction processes are equally unlocked.

Companies in the building industry value chain (materials – products – engineering – construction – maintenance – end-of-life) often (i) cannot meet these research challenges alone and (ii) need knowledge transfer regarding emerging (building) materials technologies. Moreover, this often occurs within a context where local policies/regulations may not yet be up to date with the latest technologies. Because the building sector in Flanders has to act in an increasingly global industrial landscape in which these needs and trends are also at play, it is important to fully engage in these research challenges.

In addition to innovation in building materials, innovation in building technologies is considered critical to advancing the efficiency and feasibility of integrating clean energy technologies at the building level, contributing to the safe, clean and efficient energy challenge and reducing greenhouse gas emissions.

The Materials 2030 Roadmap highlights, among other things, the need for advanced materials for thermal energy storage and district heating and cooling and the optimization of materials for heat exchangers.

The main priorities for the Flemish players active in the research and construction sector, highlighted in the following sections, are:

- **Low-carbon construction,** with a focus on "raw materials and materials" and "products and processes"
- **Resource efficiency**, with a focus on "raw materials and materials" and "products and processes"
- The necessary **enablers** (cross-cutting research topics) that will facilitate the transition to sustainable materials for construction, namely (i) the development of specific tools (instruments), (ii) the move towards greater digitalization and (iii) the development of appropriate and supporting regulations, standards and technical specifications.

1. Low-carbon construction

Goal: Building materials and related products and systems that (1) enable lower carbon and/or environmental impacts and (2) improve the energy performance and energy efficiency of buildings (more sustainable materials and products with less embedded carbon and less embedded energy).

In the EU around 40 % of the energy is consumed in buildings and over one-third of the EU's energy-related greenhouse gas emissions come from buildings, as stated in the EU Energy Performance of Buildings Directive. Although this legislative framework, as also further implemented in Flanders, was initiated around 2010, it has been regularly updated (including in 2021) to be more ambitious towards **zero emissions and (operationally) zero carbon buildings by 2050.**

To reduce overall emissions, the sector needs to improve the **energy performance of buildings**, **reduce the carbon footprint of building materials**, **translate more policy commitments into actions**, and invest more in **energy efficiency**. These higher ambitions bring new challenges that must be addressed through research. Note that the successful implementation of energy efficiency in construction has shifted the relative importance of GHG emissions from operational to embodied in the building materials, requiring a research vision that looks at both sustainable materials with less embodied energy (i.e., low carbon), and improved energy efficiency in the use phase.

For example, concrete plays an important role in the construction industry. Concrete is, after water, the most used material by mankind. Due to its massive use, concrete production accounts for 5-8% of global anthropogenic CO_2 emissions (CEMBUREAU, 2015). Most of this is released during the production of cement. **Maximizing the use of low-carbon SCMs** (**s**upplementary **c**ementitious **m**aterials) is considered one of the most effective short-term measures to reduce CO_2 emissions. **Other low-carbon binders** with different chemical compositions are also being researched and developed, but more research is needed to overcome the various challenges in further scaling up such technologies. Another important step in decarbonization can be taken during the manufacturing process of several of these building materials by, instead of burning fossil fuels, using **green electrical energy** to achieve the high temperatures often required to activate such materials.

Work on **low-carbon cement and concrete**, as well as low-carbon **steel, asphalt and bitumen** and **low-carbon bricks**, should therefore be part of the ambitions of this roadmap. There are also other materials with potential for low-carbon construction, such as **bio-based building materials and materials from waste streams** (agricultural or otherwise) that can serve as carbon sinks.

Finally, there is still a need for more ambitious solutions in terms of **building energy efficiency**. Here, **advanced materials** related to improved energy efficiency, such as highly efficient insulation materials with improved fire resistance, load-bearing capacity, durability and recyclability or innovative materials for thermal energy storage and/or heat exchangers, could be considered, for example.

Main research topics:

- Low carbon raw materials such as low carbon cement and binders (e.g., calcined clays); alkali-activated cements; carbon negative binders (e.g., mineral carbonation) and SCMs.
- Low carbon concrete and building components (building systems and building elements).
- Low carbon steel, asphalt and bitumen, low carbon bricks and bio-based building materials.
- Highly efficient thermal insulation materials and materials for thermal energy storage and/or heat exchangers.

2. Resource efficiency

Goal: Building materials and related products that:
(1) anticipate the increasing scarcity of primary raw materials using (upgraded and cleaned) secondary raw materials
(2) have improved sustainability and
(3) can help mitigate the effects of climate change.

According to ECTP (SRIA 2021-2027), construction, together with related sectors, accounts for about half of the world's raw material use, while the construction and demolition sector accounts for 25-30% of waste generated in the EU. There are clear benefits for construction material producers and waste processors when **primary raw materials** are **replaced by secondary raw materials and alternative residues**. Due to the relatively low (added) value of building materials, the cost of raw materials is relatively more important than in other industrial sectors. Therefore, producers of building materials are more interested in replacing conventional primary raw materials or products with processed/cleaned and cheaper residues. Prices of processed residues depend greatly on their properties and application, ranging from a few euros/ton for recycled aggregates to a few euros/kg for essential constituents of high-quality products such as silica fume for high-strength concrete. Moreover, local demand, supply and legislative factors can incentivize the use of such residues (SCMs, alternative binders and fillers) for high-value applications. Other very important drivers are the global challenge to **reduce CO_2 emissions** (see low-carbon construction) and the **scarcity of specific raw materials** such as high-quality construction sand, for example.

The valorization of secondary raw materials and residues in building materials has shown that there are many successful examples of **synergies between waste processors and building material producers**. These examples have become so successful that the distinction between waste processors and material producers is becoming blurred and the extent to which business models of some building material producers depend on secondary raw materials is changing.

Resource efficiency is not limited to the use of secondary and recycled materials, it can also be achieved through **improved durability** such as: longer service life; reduced need for maintenance, reduced material consumption (high strength materials such as UHPC or steel >S460), the development of prefabricated, easily assembled and disassembled systems (reduction of failure costs and increased reusability), lightweight materials (bio-based or mineral), structures and structural systems with improved strength, products or systems that enable repair, reuse, remanufacturing or recycling, materials that enable higher industrialization rates (prefabrication, modularity, shorter blueprints to as-built cycles, additive manufacturing.

Finally, several **multifunctional material concepts** have been developed in recent years (e.g., self-healing structural concrete, smart glass panes for windows). These can inspire the development of new and even more ambitious multifunctional materials in the future, especially if these materials have improved durability or can be used to counteract the effects of climate change. Examples include new materials and structural elements with improved properties such as heat/energy and moisture buffering or resistance; noise absorption; resistance to UV rays, to flooding and other disasters; vibration damping; and antimicrobial, antifouling and slip-resistant properties.

Main research topics:

- Upgrading alternative resources and waste streams into clean, high-quality resources and materials for the building and construction industry (urban mining)
- Novel materials/products with greatly reduced material consumption coupled with superior performance (ultra-high strength, lightweight)
- Building products, components and processes that enable increasing industrialization, such as prefabrication, modularity, disassembly, high-quality reuse or recyclability and require limited maintenance (increased sustainability/circularity)
- Multi-functional materials with improved durability (longer life, reduced maintenance) or that help combat the effects of climate change

5. What cross-cutting challenges should be considered? (enablers)

This roadmap also identifies 3 **enablers** (cross-cutting challenges) that will facilitate the transition to more sustainable buildings and constructions, namely the development of specific **tools**, the move toward greater **digitalization** and the development of suitable and supporting **standards** and **regulations.**

Goal:
A more competitive construction ecosystem that is better able to address challenges such as sustainability and productivity through the implementation of (1) novel tools and resources, (2) digital technologies, and (3) a regularization/standardization that enables performance-based assessment of building materials and their applications.

TOOLS
There is a clear need for **breakthrough simulation and prediction technologies** (tools and methods) that enhance the understanding of the technical and/or environmental properties/performance of materials and buildings to make the construction industry more competitive and sustainable. Specifically, in the field of materials development (e.g., low-carbon binders), these tools can reduce the need for extensive empirical testing and thereby greatly improve and accelerate development cycles, knowledge acquisition, achieving results and implementation. In addition, **sensors** for smart functionalities, traceability, and non-intrusive automatic fault detection (for predictive maintenance) should be developed to improve the circularity of materials and components.

In the pursuit of **performance-based regulations, standardization, and technical specifications**, **quantitative methods** are needed **to evaluate the technical properties and performance** of specific materials and components. The ultimate success and adoption of technology will depend on achieving or exceeding the mechanical and operational performance levels of current mainstream technologies, which are also reflected in the various standards and norms. Note that current standards are still mostly prescription-based (i.e., based on known recipes that have proven their suitability in the past). As a result, new solutions and formulations will often only be marketed in limited volumes. Large-scale implementation is thus still often hampered by end customers who do not want to take risks and the lack of a regulatory and/or normative framework that is better tailored to new, innovative and sustainable building materials and which now only provides for a more "ad hoc" quality assurance for these specific cases. Hence the need for performance-based standards as further indicated below (see regulation, standardization and technical specifications).

The current methodologies and tools that focus on the sustainability and circularity of building applications (LCA, LCC, eco-design, design-to-construction, optimal generative design of building components and methods to predict the life span of materials and products, business and revenue models) will also need to be continuously improved to effectively integrate the innovative solutions developed.

DIGITALIZATION

Compared to other industrial sectors, the construction sector lags behind in terms of digitalization. In fact, the construction sector is considered one of the least digitalized industries. Other major industries, such as manufacturing or professional services, that have embraced digitalization have shown a productivity revolution, with labor productivity increasing three to five times. These gains may be industry-specific and may not necessarily be the same for the construction industry. Nevertheless, digital technologies and their integration into the construction sector are seen by the EU as a key element that can help address challenges such as environmental impact, resource and energy efficiency and productivity (such as the Construction 2020 strategy, the Renovation Wave and Shaping Europe's Digital Future).

Today, the importance of digitalization is increasingly recognized in the construction industry. Especially architects and engineers, but also some large construction companies and building owners, have started to use digitalization, such as the use of BIM (Building Information Management) systems. The precast sector is also using digitalized manufacturing methods (e.g., robotization). Another sector with growing interest in digitalization is the metal and recycling industry (e.g., AI-driven characterization and sorting, Industry 5.0, digital twins). Nevertheless, digitalization can benefit the entire value chain and research to keep up with digital revolutions is badly needed.

REGULATION, STANDARDIZATION AND TECHNICIAL SPECIFICATIONS

Many companies that provided input to this roadmap emphasized the need for faster evolution in the normative and regulatory framework (regulations, standards and certification). Novel solutions can only be applied to the market to a limited extent, as large-scale implementation is often hampered, on the one hand, by the lack of a regulatory and/or normative framework better suited to sustainable and innovative building materials and, on the other hand, by end customers who are averse to risk.
Moreover, technical complexity in the construction industry has increased significantly over the years, with modern technologies being implemented in highly project-based construction processes to meet increasing customer demands. Building materials play a key role in these construction processes and in the associated products and systems. The demand for sustainable and more circular building materials also requires their implementation at the level of building products/systems/processes.
Performance-based assessment of construction materials (and associated quality assessment) is being extended to the level of products and systems, as it is also the format set forth in the European Construction Products Regulation (CPR). The CPR aims to ensure that construction products can circulate freely within the single market and is currently being revised, in part to "*enable the construction ecosystem's contribution to meeting climate and sustainability goals and embrace the*

digital transformation." At the same time, the new generation of upcoming Eurocodes pay more attention to sustainable materials. However, these evolutions are slow and depend on national and regional initiatives and local habits on building materials and products.
Research on innovative/sustainable materials should, where relevant, address risks and challenges associated with the existing and future normative and regulatory framework. The role of regional government agencies as technical specifiers, for example for public infrastructure or government buildings, should also not be underestimated when it comes to the application of innovative materials and products. Creating intensive links between regional innovation and government, through channels such as PIP (Programme for Innovation Procurement) or Circular Flanders, should be strengthened. Finally, addressing standardization and regulatory challenges is not only applicable to the construction sector, but also to other sectors that need to consider a very specific normative and regulatory framework for innovation.

Main research topics:

- Tools and methods for technical purposes such as non-destructive measurement for performance evaluation of products and components opening opportunities for reuse
- Sensors for smart functionalities, traceability, and non-intrusive automated fault detection for predictive maintenance
- Evaluation tools and models for assessment of durability/circularity/environmental impacts
- Digital solutions for sustainable construction (robotization, AI-based characterization and/or sorting, additive manufacturing, building information models, material passports, IoT-solutions for lifelong and real-time monitoring, digital twins)
- Development towards performance-based standards facilitating the introduction of novel materials and products based on upgraded alternative resources and waste streams

6. Complementarity in the Flemish innovation landscape for building and construction

Several Flemish companies are active in research and development in buildings and construction. Some of them have already endorsed this roadmap. In the Flemish academic community, almost all universities and the strategic research center VITO are active in the domain.

Notwithstanding MateriNex focus on high-risk long-term research, the bridge will also be made to higher TRL (Technology Readiness Level) and production.

Alignment regarding complementarity with other funding organizations such as the spearhead clusters and the SOCs [1](as far as their ICON program is concerned) will have an important place in the functioning of MateriNex. In terms of materials for building and construction, this is primarily Flux 50, Catalisti and the Blue Cluster as far as the spearhead clusters are concerned.

7. Dissemination

The ultimate goal should not only be to invest in basic research, but also to increase adoption rates. This is certainly necessary in a sector such as building and construction in which many micro-enterprises and SMEs operate.

Dissemination will therefore be a mandatory part of any project that is approved. The rules of VLAIO will be followed.

[1] "Strategisch Onderzoekscentrum" in English: Strategic Research Center

Initially, the Common Interest Group Materials for Buildings and Construction will focus on sharing (public) research results. In terms of "next step" dissemination or dissemination across the value chain, there will be collaboration with spearhead clusters and SOCs that have complementary roadmaps.

In addition, for broad dissemination regarding this thematic priority, the VLAIO network will be used and MateriNex will provide support. In particular, there will be collaboration in this area with the relevant collective research centers.

8. Which project types and how to submit a project proposal?

With financial support from the department of EWI and commissioned by EWI and VLAIO, **VITO,** as an **independent strategic research center**, makes a team available to facilitate the management of the earmarked resources of the Fund for Innovation and Entrepreneurship to support materials research in Flanders. This is done under the name **MateriNex**.

Every year, MateriNex launches a **call** mentioning the date and modalities of the mandatory **pre-application** (for SBO and ICON) as well as the modalities and timeline to submit a full project proposal. Only project proposals that receive a GO from an **independent expert group (composed by the MateriNex team in consultation with VLAIO)** may develop and submit a full project proposal to VLAIO. This GO has a validity of max 1 year. For ICON projects, a request for partners facilitated by MateriNex can be used. Feasibility studies can be submitted at any time and have a shorter processing time. **VLAIO is responsible for the evaluation of full proposals for cSBO, ICON and feasibility studies**.

The **modalities for cSBO and ICON** projects as well as feasibility studies are defined in the respective manuals on the VLAIO website. We mention in particular:

A **cSBO** project proposal is submitted by **at least two research groups of at least one Flemish research center** (according to art. II.2 and II.3 of the Codex Higher Education). A Flemish research center is hereby defined as an organization established in the Flemish Region for research and knowledge dissemination (university, university college ("Hogeschool"), (strategic) research center. **Imec, VITO, VIB, Flanders Make, VLIZ and the Flemish scientific institutions with an endowment from the Flemish government**, can only submit a cSBO project proposal in collaboration with at least one other Flemish research center. A **Flemish university college** ("Hogeschool") always submits a cSBO project proposal in collaboration with or at least after advice from the university within the association with which it is affiliated. Flemish university colleges can only submit a project proposal in cooperation with at least one other Flemish research center.

ICON (Interdisciplinary Cooperative Research) is a project type in which an ad hoc and balanced **consortium of one or more research centers and at least three unrelated companies** develop new knowledge, which can be practically applied and thus contribute to economic and possibly broader social added value in Flanders. An ICON project consists of a business part and a research part. The Flemish industrial partners can appeal for support from the Fund for Innovation and Entrepreneurship.

Feasibility studies are studies at the beginning of an innovation trajectory, where the overall feasibility and relevance of further investments in research, development and innovation must be checked. **Applicants are companies** that have a legal personality (at the latest at the time of signing the agreement). Furthermore, the applicant company must be able to sufficiently (but not exclusively) exploit the results in Flanders. The implementation of the project may also involve cooperation with other companies and with research institutions as subcontractors.