

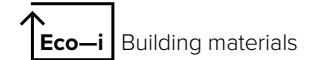
Eco—i Manual

Building materials
Supplement



GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

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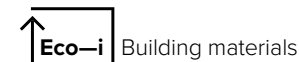
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How to use this supplement

Using the methodology presented in the Eco-innovation Manual, this supplement on building materials provides sector-specific information and guidance to service providers supporting companies in eco-innovation. It should be used alongside the Manual to provide further context at each step and examples of how the methodology, activities and templates can be applied in real life to a company in the building materials sector. The target audience of both the manual and the supplement is the service provider, typically a sustainability consultancy organisation or individual.

The Eco-innovation Manual provides further guidance on how service providers can conduct and link together the different stages of the eco-innovation process, as well as providing generic guidance, such as on how to research and engage target companies, gather data, pitch services, conduct meetings and workshops, and use the templates for assessing and documenting current and proposed operations.

Presenting the eco-innovation process through the example of a fictional company

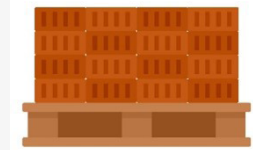
This supplement uses a learning case study of a fictional company to demonstrate how to apply the eco-innovation methodology and templates to a company in the building materials value chain. The fictional builders' merchant *GFC Building Supplies* accompanies the reader throughout the journey of the supplement, with its current practices on sustainability and position in the market assessed, followed by a process to identify and implement new business strategies, models, and projects to address sustainability hotspots.

A builders' merchant has been chosen for the example to help explore sustainability considerations for a range of materials, products, business models and value chain processes. Different roles in the value chain are considered, for example procurement, supply, manufacture and processing, design, or involvement in end-of-life activity.

Legend

Examples of application of the eco-innovation process by GFC Building Supplies is interspersed throughout this supplement.

These can be identified by use of the brick pallet icon and light grey text boxes.



Examples of application of the eco-innovation process by various companies are interspersed throughout this supplement.

These can be identified by use of blue text boxes.

List of activities with supplementary content*

PREPARE

Identify the right market for the eco-innovation services

Evaluate potential markets
PR.1

Build the right team to deliver the service

Build the right internal team
PR.2

Build the right external partnerships
PR.3

Understand the value chain sustainability hotspots, opportunities and threats

Identify sustainability hotspots across the value chain
PR.4

Identify the general opportunities and threats across the value chain
PR.5

Develop a concept for a more sustainable value chain

Develop a value chain vision
PR.6

Engage potential clients

Develop a value chain pitch
PR.7

Plan and implement engagement activities
PR.8

Gain approval from senior management to proceed

Pitch the benefits of eco-innovation to the CEO
PR.9

SET STRATEGY

Get ready for the Preliminary Assessment

Plan my data gathering strategy
ST.1

Understand the current business strategy

Interview the CEO
ST.2

Understand the current business model

Capture the current business model
ST.3

Understand the current operational performance

Do a Walk-Through Audit
ST.4

Do a workshop/ interviews with staff
ST.5

Update the sustainability hotspots
ST.6

Analyse the information I have gathered

Do a SWOT analysis
ST.7

Define the company vision and strategic goals of the new business strategy

Develop a vision for the company
ST.8

Define the strategic goals
ST.9

*Activities not covered in the supplement are faded

List of activities with supplementary content

SET BUSINESS MODEL

Define the products, markets and selling points of the new business strategy

Generate ideas for new products, markets and selling points

ST.10

Evaluate ideas for new markets, products and selling points

ST.11

Select which ideas for new markets, products and selling points to include in the strategy proposal

ST.12

Get senior management approval for the new business strategy

Do an individual/group review of the business strategy proposal

ST.13

Pitch the new business strategy to the CEO

ST.14

Consider key management issues for implementation

ST.15

Understand in more detail the performance of the company through an In-Depth Assessment

Update the data gathering strategy

BM.1

Gather additional data on the business model

BM.2

Gather additional data on operational performance

BM.3

Generating business model concepts at the big picture level

Generate business model concepts at the big picture level

BM.4

Generating ideas at the individual building block level

Generate ideas for the customer segments block

BM.5

Generate marketing ideas for the value proposition block

BM.6

Generate technical ideas for the value proposition block

BM.7

Generate ideas for the channels block

BM.8

Generate ideas for the customer relationships block

BM.9

Generate ideas for the revenue streams block

BM.10

Generate ideas for the key resources block

BM.11

Generate ideas for the key activities block

BM.12

Generate ideas for the key partnerships block

BM.13

Generate ideas for the cost structure block

BM.14

List of activities with supplementary content

BUILD ROADMAP

Evaluate the business model concepts and select one to pitch

Evaluate the benefits
BM.15

Evaluate the costs
BM.16

Evaluate the risks
BM.17

Integrate all the evaluations and make the final selection
BM.18

Get senior management approval for the new business model

Pitch the new business model to the CEO
BM.19

Build a roadmap for eco-innovation implementation

Prepare for the roadmapping workshop
BR.1

Do a roadmapping workshop with input from value chain partners
BR.2

Define and prioritise the requirements of the first project
BR.3

Get senior management approval for the implementation roadmap

Pitch the implementation roadmap to the CEO
BR.4

IMPLEMENT

Create a project plan and get it approved

Create a project plan
IM.1

Present the project plan to the Senior Management Team
IM.2

Support the implementation activities

Provide guidance and solve problems
IM.3

REVIEW

Review the performance of the first project for eco-innovation

Do a project review workshop
RE.1

Do a personal review
RE.2

Review the business model and roadmap and agree the next steps

Review the business model and roadmap
RE.3

Present the review conclusions and agree next steps with the CEO
RE.4

Introduction

Sector transformation towards more sustainable, healthier building materials

All of us are in some way linked to the activities of the building materials sector. As occupants and users of domestic, public and commercial buildings, or infrastructure such as roads and bridges, buildings and the materials they are made from are a constant in our lives, and one that produces a high environmental impact.

Urgent action is needed in the building materials sector to help tackle the climate and ecological emergency, which is a complex challenge alongside the increasing demand of a rising population. In 2021, [buildings were responsible for 37% of the world's energy-related carbon emissions and 34% of global energy demand](#). The amount of debris produced from construction, from concrete, bricks, plastics and other materials is also expanding, and [expected to reach around 2.2 billion tons annually by 2025, increasing from 1.3 billion tons in 2012](#)². A transition to more sustainable building materials and waste management practices is clearly necessary to address these impacts.

Alongside the crucial role of sustainable building materials to mitigate anthropogenic climate change, it is critical that the sector addresses its contribution to chemical pollution and health impacts. The sheer volume of chemicals in production and the pace at which they enter the market make supply chain management and regulation challenging. Consideration must also be made of the chemical effects of conventional and legacy building materials, and whilst more is becoming known about this, many materials identified as hazardous are still widely in use globally. We now spend up to 90% of our time indoors, and the long-term exposure to substances of concern in building materials is an area of growing focus for health practitioners.

Additionally, the sector has a key role to play in developing a built environment that is resilient and adapting to our already changing climate with increasing frequency and intensity of events, such as floods, droughts and heatwaves.

The Alliance for Sustainable Building Products' vision for sustainable building materials is one where they are "low embodied carbon, non-toxic, locally made and healthy in use". A truly sustainable transition must also address social challenges such as improving

gender equality in the industry, responsible working and sourcing, and the social effects of building activity on lower-income communities and regions.

Industry insights suggest that compared to other sectors, construction has been slow to embrace change. Resistance to adapt to a changing landscape has been seen in manufacturing and sourcing processes, business models used, and in the cultures of individual firms and the wider sector.

A vast scope for change

Opportunities to improve sustainability within the building materials sector are widespread, across many different material value chains. A combination of approaches can be used, addressing both production, as well as increasing efficiencies in the value chain to better design, plan, install, deconstruct, and repurpose materials and buildings. The construction sector has at times been described as 'adversarial' - the 1994 Latham Report 'Constructing the Team' identified issues in the UK with inefficient practices and inconsistent procurement, and called for improved collaboration, standardization and efficiency between companies in the value chain. Use of digital tools in this process is also expected to play a key role. At the material level, initiatives such as the development of material passports can bring a range of benefits. Digital tools that improve visibility, connectivity and oversight to manage a building's life cycle in a more sustainable way are also becoming more widely available, but are not yet fully mainstream.

Now is the time for action. The expected construction boom in emerging economies in the next decade may have very different outcomes, depending on how market transformation and government policies affect industry practice. A continued focus on deploying traditional materials and practices could lock in high energy use and carbon emissions in both the construction phase and the long lifetime of buildings' in-use phase. Improved practice around chemical management is needed to yield both short and long-term benefits. Scaling up a more sustainable approach could enable these economies to leapfrog existing practices and establish new norms, ushering in a more sustainable future for the built environment.

The role of SMEs

Small and medium-sized enterprises (SMEs) are a significant driving force of industry activity, as well as potential change. In the EU, [up to 98% of companies in the construction value chain are SMEs](#). The challenge for companies of this size to improve their sustainability is well-researched. While smaller, more agile firms may have the opportunity to innovate, they often lack the financial resources of larger firms and so find it hard to transform business models and practices, even where expertise is present.

For chemical management, this may be particularly problematic where the resource or technical capability is lacking to conduct thorough assessments, improve the provision of chemical data, and keep ahead of changing legislation. [Some guidance resources](#) have been produced that support chemical management strategies and improve safety within SMEs, but further knowledge sharing and collaboration is needed to address this issue.

Many examples of SMEs developing innovative and sustainable building materials and practices have already been seen, some of which are featured in this supplement. These include the production of new low-carbon and low-toxicity materials with the same performance as traditional ones; increased material efficiency from effective site segregation and building deconstruction; off-site assembly, and use of recycled and reclaimed materials. These and other improvements now need to see increased scale.

This supplement, part of the [UNEP Eco-innovation Manual](#), equips SMEs in the building material industry with a toolkit and methodology to embed sustainability into their business strategies and better identify new products, services and practices that can yield both sustainability and economic benefits, thus helping transform the industry.

Sustainability impacts of building materials

[The GlobalABC Roadmap for Buildings and Construction](#) identifies a global transition towards “zero-emission, efficient and resilient buildings by 2050”. The wide range of building materials in use today, with different properties, functions, and impacts, plays a key role in this transition. The Roadmap has assessed the current state of the industry, finding that choices of building materials for projects currently incorporate few life cycle assessment (LCA) and circularity decisions, and that environmental standards for materials are not widespread globally.

Whilst lower-impact, alternative materials are available, these are not yet mainstream, and policy interventions are needed to help transform the market. Several material sectors, such as cement, have produced sustainability roadmaps on a national and international level. The Roadmap identifies that the building materials industry needs to address the following issues:

- Reducing embodied carbon of building materials
- Material efficiency in extraction, production, use and at end-of-life
- Energy efficiency and decarbonisation in material production
- Further use of locally produced materials
- Tools for resource efficiency
- Increasing resilience of buildings to environmental extremes
- Incentives and finance for sustainable materials
- Training, capacity building and awareness raising

Resources

- [2022 Global Status Report for Buildings and Construction](#). UNEP, GlobalABC.
- [Transparency Market Research - Construction Waste Market: Global Industry Analysis, Size, Share, Growth, Trends and Forecast 2017-2025](#)
- BUILD UP – The European Portal for Energy Efficiency in Buildings. [Supporting digitalisation of the construction sector and SMEs, including Building Information Modelling](#)
- [Indicative Guidelines for Chemical Safety and Security in Small and Medium-sized Enterprises to Foster the Peaceful Uses of Chemistry](#). OPCW, 2021
- GlobalABC/IEA/UNEP (Global Alliance for Buildings and Construction, International Energy Agency, and the United Nations Environment Programme) (2020): GlobalABC Roadmap for Buildings and Construction: Towards a zero-emission, efficient and resilient buildings and construction sector, IEA, Paris. Available from: <https://www.iea.org/reports/globalabc-roadmap-for-buildings-and-construction-2020-2050>

Common building material profiles

Cement and concrete

Cement is the world's most widely used building material, with production accounting for around 8% of global total CO₂ emissions. Projected use, mainly in concrete, is set to increase alongside housing demand, particularly in emerging economies.

Environmental and health impacts occur at the extraction, grinding and transportation phases of the value chain, but the extensive fossil fuel inputs and direct CO₂ emissions of limestone kilns, coupled with the calcination process, is the main hotspot.

Ambitious action is needed to decarbonise cement and concrete; shorter-term measures target fuel switching, kiln efficiency and reducing clinker content.

Alternative lower carbon mixes containing blast furnace slag (GGBFS) or fly ash can achieve equal or better strength as conventional cement, although setting times may be longer.

However, these substances, as by-products from steel and coal plants, may have limited availability in the longer term, and fly ash can also contain toxic heavy metals such as mercury – this can be problematic during demolition. Improvement of carbon capture technologies will be needed beyond this to bring industry carbon emissions in line with global climate goals. Other strategies being seen to reduce clinker content and associated CO₂ emissions include the use of calcined clay, as an 'artificial' pozzolan within cement. R&D and market preparation has taken place through the [LC3 project](#), with companies such as Cementos Argos in Colombia implementing production lines for use in lower-carbon cement.

Innovative use of secondary materials such as [waste tyres](#), recycled glass and [ceramics](#), agricultural by-products (e.g. [rice husk ash](#) and [oil palm shells](#)), and increased recycled aggregates in the concrete mix are also being studied as a potential means to reduce the use of virgin resources. Improved planning and design for recovery and reuse, off-site assembly, and ambitious policy making must also play a part in reducing the impacts of this material.

A shift in the mindset of design to specify a different material (e.g. where timber frame construction is viable), or reduce the use of concrete is an important consideration to mitigate the impacts of this ubiquitous material.

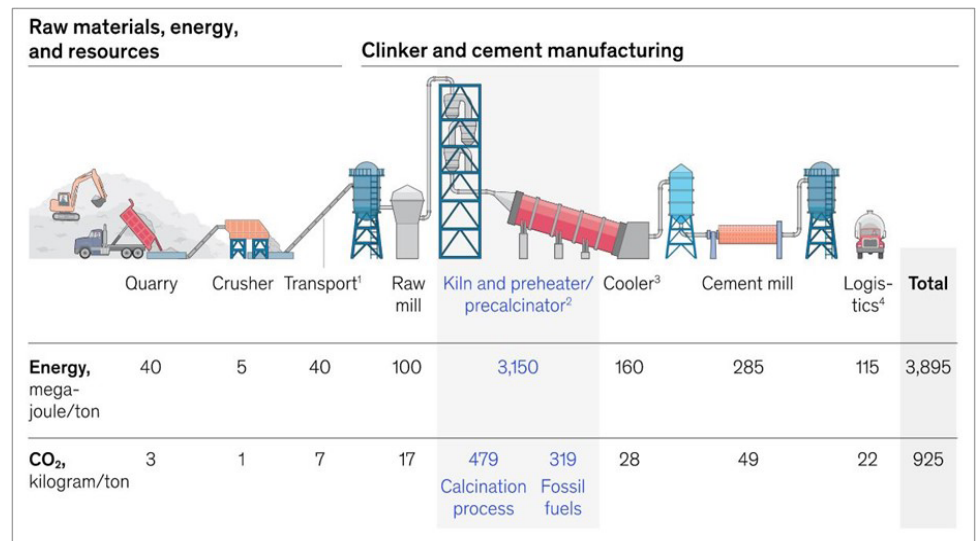


Figure 1: Breakdown of energy use and CO₂ emissions across the cement life cycle. Source: McKinsey

Table 1 - Hotspots and opportunities for eco-innovation in the cement and concrete value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> • Large-scale disruption to habitats and communities • Water, noise, and air pollution from quarrying 	<ul style="list-style-type: none"> • Improvements in responsible sourcing and biodiversity management • Greater use of secondary materials to minimise primary resource extraction
Manufacture	<ul style="list-style-type: none"> • High carbon emissions from clinker production • Water and air pollution from effluent and waste gases • Health effects from release of NO_x, SO₂, CO₂ 	<ul style="list-style-type: none"> • Improved energy efficiency, fuel switching, carbon capture and storage (CCS) • Clinker substitution; use of alternative and bio-based materials; admixtures
Transport	<ul style="list-style-type: none"> • Fossil fuel emissions from road transport 	<ul style="list-style-type: none"> • Improved logistics management and local sourcing
Use	<ul style="list-style-type: none"> • Site dust emissions and heavy metal leaching • Waste from over-ordering, incorrect mix ratios • Flooding and pollution runoff, urban island heat effect 	<ul style="list-style-type: none"> • Offsite assembly and pre-casting of concrete • Improved material efficiency through planning, design, oversight and use of Building Information Modeling (BIM) • Concrete designed for permeability or higher solar reflectance
End of life	<ul style="list-style-type: none"> • Soil contamination from landfilling • Low recovery rates of aggregates • Health and environmental effects from heavy metals and chemicals during recycling if not handled properly 	<ul style="list-style-type: none"> • Further construction and demolition waste (C&DW) collection and reuse • Improved data; material passports • Building design for dismantling and reuse of concrete structures

Resources

- Chatham House, (2018). [Making Concrete Change: Innovation in Low-carbon Cement and Concrete](#)
- IEA, (2018). [Technology Roadmap – Low-Carbon Transition in the Cement Industry](#)
- [Cement Sustainability Initiative - Biodiversity Management Plan Guidance](#)
- Construction Safety Association of Ontario, (2001). [Cement Hazards and Controls – Health Risks and Precautions in Using Portland Cement](#)
- Shanks W. et al., (2019). [How much cement can we do without? Lessons from cement material flows in the UK](#). Department of Engineering, University of Cambridge. Resources, Conservation and Recycling. Volume 141, February 2019, pp. 441-454
- Breakdown of energy use and CO₂ emissions across the cement life cycle. McKinsey. Available from: <https://www.mckinsey.com/industries/chemicals/our-insights/laying-the-foundation-for-zero-carbon-cement>

Bricks

Bricks are one of the oldest known building materials, with clay, calcium silicate and concrete commonly used. Manufacturing worldwide ranges from smaller, artisanal producers to large-scale industrial operations. The life cycle of a fired brick contains a number of opportunities to reduce its impacts. Efforts in this area have included a shift towards more efficient kilns and optimisation of electrical systems, such as power factor correction.

Unfired bricks (also known as earth masonry) offer an established, low impact option which eliminates the use of fossil fuels in production. Almost a third of the world’s population live in dwellings made from earth masonry. Markets and innovation in this area continue to develop – [in Vietnam, the unfired brick market increased by over 15% between 2015 and 2019](#). However, further efforts in developing standards and testing, policy incentives, value chain expertise with new production technologies, and scale in this sector are needed.

Reuse of bricks is common practice, but the potential for direct reuse is often low – only around 5% of bricks from demolition works are estimated to be reclaimed, with around 50% being crushed for use in hardcore and fill. Whilst specialist reclaimed brick merchants can provide a degree of assurance of the quality and strength properties, standards for reclaimed bricks are not in place. But with the appropriate level of expertise, design to improve brick recovery, due diligence and appropriate use, reclaimed bricks can help to divert demolition waste from landfill.

Table 2 - Hotspots and opportunities for eco-innovation in the bricks value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> Landscape and ecological disturbance from quarrying 	<ul style="list-style-type: none"> Choose suppliers with appropriate quarry management and rehabilitation systems Obtaining materials from alternative and recycled and secondary sources
Manufacture	<ul style="list-style-type: none"> High energy and fossil fuel use from firing and drying Waste gases (e.g. HF), black carbon, particulates 	<ul style="list-style-type: none"> Unfired brick production Improved kiln efficiency, burner technology, variable speed motors
Transport	<ul style="list-style-type: none"> High fuel use to transport heavy materials 	<ul style="list-style-type: none"> Focus on local sourcing of materials
Use	<ul style="list-style-type: none"> Particulates and dust from demolition 	<ul style="list-style-type: none"> Repair of masonry instead of demolition where possible
End of life	<ul style="list-style-type: none"> Contribution to construction and demolition waste 	<ul style="list-style-type: none"> Brick reclamation where possible Building and material design for dismantling

Resources

- Greening the Building Sector – Brick by Brick. IEA. Available from: https://iea.blob.core.windows.net/assets/imports/events/603/RituBharadwajIIP_CircularEconomy.pdf
- Dirty Stack, High Stakes: An Overview of Brick Sector in South Asia. World Bank. Available from: <https://documents1.worldbank.org/curated/en/685751588227715919/pdf/Dirty-Stacks-High-Stakes-An-Overview-of-Brick-Sector-in-South-Asia.pdf>
- Energy Efficient Clay Brick (EECB) Project. Sustainability Downloads. Available from: <https://claybrick.org/eecc-category/eecc-downloads>
- Brick kiln measurements in Colombia: Energy and emissions. Climate and Clean Air Coalition. Available from: <https://www.ccacoalition.org/en/resources/brick-kiln-measurements-colombia-energy-and-emissions>

Steel and Aluminium

Steel and Aluminium are two of the most common construction metals, used in frames, beams and reinforcing bars. Raw materials are mined and quarried; steel is made by smelting iron and refining it, either through the Blast Furnace-Basic Oxygen Furnace (BF-BOF) route, predominantly using primary material, or the Electric Arc Furnace (EAF) route, using scrap. Aluminium is produced by refining alumina from bauxite and smelting through the Bayer and Hall-Héroult processes. The metals are then further refined, alloyed, and cast into final products.

The main impacts are in extraction and production. Mining and primary production contributes to landscape degradation, and is notorious for worker exploitation. Steel production accounts for more than 9% of global carbon emissions. Production from secondary sources can reduce this; the EAF route uses around a third of the energy of BF-BOF steelmaking. Aluminium production accounts for 1% of global emissions; manufacture from recycled inputs can use a tenth of the energy of primary routes. Chemical hazards may also be seen in coating and finishing manufacture from hexavalent chromium, other heavy metals and solvents. Examples of lower impact, safer products have been seen from companies such as Industrial Louvers, who have earned a [Living Product Challenge label](#) for their aluminium sunshade product, which includes an assessment that the product achieves Red List Free status.

Steel and aluminium have benefits due to their longevity and circularity – both are fully recyclable without losing their key mechanical properties, reducing the need for further extraction and production. Reuse provides even further benefit; an [LCA study on Cleveland Steel and Tubes Ltd showed that reclamation and reuse of structural steel saved up to 96% of the carbon from producing new steel](#).

Sustainability standards and criteria have been developed by Responsible Steel and the Aluminium Stewardship Initiative (ASI) covering human and labour rights, health and safety, GHG emissions, pollution, waste, water stewardship, and biodiversity.

Resources

- Responsible Steel: <https://www.responsiblesteel.org/>
- Aluminium Stewardship Initiative (ASI): <https://aluminium-stewardship.org/>
- Gao, C. et al., (2017). Life cycle assessment of the Environment Load from Typical Chinese Steel Enterprises. Journal of Environmental Accounting and Management. Available from: <https://www.semanticscholar.org/paper/Life-Cycle-Assessment-Analysis-of-the-Environment-Gao-Zhang/ad44d26151cc72471a57104bfe8338d3f5c6c0ec>

Table 3 - Hotspots and opportunities for eco-innovation in the metals value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> • Environmental degradation, worker exploitation • Water and soil contamination from heavy metal leaching 	<ul style="list-style-type: none"> • Responsible sourcing through international standards e.g. Responsible Steel, ASI
Manufacture	<ul style="list-style-type: none"> • GHG emissions from energy-intensive processes and process CO₂ emissions 	<ul style="list-style-type: none"> • Less energy-intensive processes (EAF steelmaking and secondary production aluminium) • New technologies in zero-carbon production and heat recovery
Transport	<ul style="list-style-type: none"> • GHG emissions from transport 	<ul style="list-style-type: none"> • Shorter supply chains, low carbon transport, lightweighting of product
Use	<ul style="list-style-type: none"> • Carbon and material waste impacts of premature demolition 	<ul style="list-style-type: none"> • Design and build for long lifetimes, repair, flexible building use, dismantling, re-purposing
End of life	<ul style="list-style-type: none"> • Wasted metals from poor site waste segregation and material recovery 	<ul style="list-style-type: none"> • Improving circularity through takeback schemes, reclamation and reuse

Timber

Timber building materials include those from hardwoods and softwoods, engineered woods such as plywood and particleboard, and cross-laminated timber (CLT). Products include structural frames and beams, walls, boards, claddings and floor coverings, as well as doors and window frames. CLT can be used in load-bearing walls, floors and panels, and in some cases can replace structural concrete, masonry or steel. This can reduce embodied carbon whilst sequestering it in-use, and provides a versatile option for faster assembly and off-site construction.

The typical stages for timber product manufacture are harvesting, sawing, kiln drying, and treatment. Within this, the main sustainability hotspots are deforestation and habitat destruction, energy-intensive manufacturing, and chemicals of concern. Formaldehyde emissions, and CCA (chromated copper arsenate) preservatives (where these are still used) may pose health risks to building occupants, workers, wildlife and the environment.

Opportunities to address these include sourcing timber from certified sustainable forests with chain of custody systems (e.g. PEFC and FSC). Modified timbers are a newer innovation that works by treating softwoods (by the processes of acetylation or furfurylation, as in the branded modified timbers Accoya and Kebony), essentially altering their chemical structure to improve durability and provide properties similar to hardwoods, helping to address the impacts of deforestation and transportation related to hardwood.

Resources

- Forest Stewardship Council (FSC): <https://fsc.org/en>
- Programme for the Endorsement of Forest Certification: <https://www.pefc.org/>
- Cross-laminated (Crosslam or CLT) timber – Introduction. GreenSpec. Available from: <https://www.greenspec.co.uk/building-design/crosslam-timber-introduction>
- Columbia Forest Products, formaldehyde-free PureBond. Available from <https://www.columbiaforestproducts.com/product/purebond-hardwood-plywood/>

Table 4 - Hotspots and opportunities for eco-innovation in the timber value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> • Deforestation, biodiversity and habitat loss 	<ul style="list-style-type: none"> • Improved forest management, certification, and traceability
Manufacture	<ul style="list-style-type: none"> • High energy inputs for kiln-drying, and resin production 	<ul style="list-style-type: none"> • Energy efficiency measures, e.g. air drying, using solar kilns • Alternative treatment products; Copper Azole, Alkaline Copper Quaternary
Transport	<ul style="list-style-type: none"> • Emissions from transporting heavy materials across international supply chains • Biosecurity risks from invasive pests and diseases 	<ul style="list-style-type: none"> • Improved logistics and supply chain management
Use	<ul style="list-style-type: none"> • Toxicity of resins, preservatives and adhesives 	<ul style="list-style-type: none"> • Carbon sequestration from timber use in buildings • Off-site timber frame construction systems • Production of no-added formaldehyde (NAF) adhesives • Non-toxic physical methods of wood preservation
End of life	<ul style="list-style-type: none"> • Emissions from incineration of impregnated or preserved wood • Treated wood can be difficult to recycle 	<ul style="list-style-type: none"> • Improved labelling of chemically treated products, guidance on disposal • Take-back schemes, reclaimed products

Paints

The paints industry has seen considerable change over the past 50 years to reduce its environmental impact, but challenges still remain to be addressed. There are no safe levels of lead exposure, particularly in young children. Lead exposure can cause nervous system damage and is a likely carcinogen. The dangers have been reported since the early part of 20th century, and lead paints were phased out in the US in the 1970s. However, at the time of writing this supplement, only around [45% of countries have lead paint laws](#). The Global Alliance to Eliminate Lead Paint has been formed as a voluntary partnership to address this through regulatory action, supporting the market to develop alternatives, and raising awareness of hazards.

Efforts to transition markets away from solvent-based paints with higher levels of volatile organic compounds (VOCs) towards water-based paints are beneficial for human health and the environment. Regulatory instruments such as the EU's 'Paints Directive' have been effective to set limits and encourage industry to innovate. Testing is key to ensure a level playing field between manufacturers. The use of natural rather than synthetic materials has been seen in other applications for paint, for example [clay paints](#). These have different properties to common oil- or acrylic-based paints, with higher breathability, and the VOC content is typically lower.

The market for paints using renewable, biobased feedstocks is currently nascent, with low consumer awareness, but has great potential to reduce the GHG emissions of the production process. [Nova Institute](#) estimates that using biobased succinic acid as a feedstock could reduce GHG emissions by 50%. However, it is essential that feedstocks used are verified and do not compete with the food chain.

Resources

- Guidance on the EU 'Paints Directive' 2004/42/EC. Available from: <https://www.eurof-ins.com/media/1601/voc-in-paints-decopaint-directive-en.pdf>
- Occupational Hazards and Safety Measures Amongst the Paint Factory Workers in Lagos, Nigeria. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4147227/>
- Technical guidelines on paint reformulation for SMEs. [NCPC Serbia](#)
- Factsheet Bio-based Coatings. European Commission. Available from: <https://op.europa.eu/en/publication-detail/-/publication/49a0543b-9fc1-11ea-9d2d-01aa75ed71a1>
- Environmental Product Declaration for Crown Paints. Available from: https://www.greenbooklive.com/filelibrary/EN_15804/EPD/BREG-EN-EPD-000099_1.pdf

Table 5 - Hotspots and opportunities for eco-innovation in the paints value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> • Embodied carbon of petro-based feedstocks and solvents 	<ul style="list-style-type: none"> • Use of water-based solvents • Use of bio-based feedstocks
Manufacture	<ul style="list-style-type: none"> • Exposure of workers to solvents and heavy metals 	<ul style="list-style-type: none"> • Shift to manufacture of water-based and bio-based paints (dyes, resins)
Transport	<ul style="list-style-type: none"> • Increased embodied carbon from transport to site 	<ul style="list-style-type: none"> • Lightweighting of packaging
Use	<ul style="list-style-type: none"> • Toxicity of lead and other heavy metal containing paints • Off-gassing of VOCs • Presence of anti-microbials • Microplastic shedding from acrylic and other plastic paints 	<ul style="list-style-type: none"> • Improved intrinsic biocidal properties of bio-based paints • Paint-as-a-service and take-back business models to reduce waste • Reduced transportation impacts from paints where water is added by the customer (e.g. some mineral paints)
End of life	<ul style="list-style-type: none"> • Environmental toxicity from improper disposal 	<ul style="list-style-type: none"> • Reducing costs through take-back and paint recycling schemes

Plasterboard

Plasterboard, or drywall, is the third most widely used building material in the world. It is primarily used to line existing walls and ceilings, and create partitions. Commonly made from gypsum (calcium sulphate dihydrate) with a paper backing, the finished product can come from naturally mined material, or through a synthetic route involving flue-gas desulphurization (FGD) of coal-fired power plants or other heavy industry. Gypsum is a versatile material with high potential to be recycled, but [typical rates are currently below 10%](#). Improved circularity practices in segregation, collection, and collaboration between manufacturers, recyclers and demolishers, can maximise the material’s value and reduce its impacts.

Environmental impacts and health concerns are present at various life cycle stages. Beyond high energy and water use in construction, plasterboard is estimated to account for 15% of construction and demolition waste. In landfills, it can leach toxins and emit harmful hydrogen sulphide gases from the breakdown of gypsum. Some indoor air quality problems have also been reported in the past, and heavy metals (including mercury) may be present in synthetic gypsum.

The use of bio-composite materials can help reduce plasterboard use and address challenges of material scarcity and the effects of mining. In the UK, [Adaptavate](#) has developed a lime-based plaster that dries and sets quickly, offering high thermal performance and breathability, and reducing the need for biocides. [TYPHABOARD](#) is another innovative, bio-based material used in building boards, derived from the typha (cattail) plant seen in marshes, offering a sustainable alternative to plasterboard.

Resources

- Closed Loop Wallboard Collaborative. Available from: <https://www.buildingproductecosystems.org/closed-loop-wallboard>
- Reducing and recycling plasterboard waste on a site where space is a constraint. WRAP. Available from: <http://www.eurogypsum.org/wp-content/uploads/2015/05/N19.pdf>

Table 6 - Hotspots and opportunities for eco-innovation in the plasterboard value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> • Mining impacts and material scarcity from quarrying • Dependency on coal-fired power stations as gypsum source 	<ul style="list-style-type: none"> • Development of alternative materials; lime plaster, magnesium oxide board • Increased use of recycled materials
Manufacture	<ul style="list-style-type: none"> • High energy use for the calcination production process • Presence of heavy metals in synthetic gypsum production 	<ul style="list-style-type: none"> • Improved heat recovery in production
Transport	<ul style="list-style-type: none"> • Increased embodied carbon from transport to site 	<ul style="list-style-type: none"> • Improved connectivity and logistics management between projects • Use of bagged materials in place of board
Use	<ul style="list-style-type: none"> • Dust emissions during installation • Additives used in plasterboard production can leach during use and affect air quality 	<ul style="list-style-type: none"> • Use of more durable materials (e.g. glass fibre reinforced board) • Improved breathability of substrate to reduce mould growth
End of life	<ul style="list-style-type: none"> • Landfill emissions and leaching (H₂S, mercury) • Wastage from over-ordering • Low recycling rates 	<ul style="list-style-type: none"> • Improved use of BIM to reduce waste • On-site waste segregation and collection services

Plastics

The use of plastics in building products is widespread – [around 21% of the 47 million tonnes of plastic used in Europe are by construction](#). Common materials include polyvinyl chloride (PVC), high density polyethylene (HDPE), and expanded polystyrene (EPS) used in a range of products including windows and doors, piping, insulation, flooring and packaging. However, the building materials sector is being seen to re-evaluate its relationship with plastics; whilst they can provide useful functionality, the material has become over-used. Globally, [only 9% of plastic waste is recycled](#).

Some additive chemicals in plastics have become highly problematic as a result of their health effects on humans and wildlife, and their environmental persistence. Chemicals such as bisphenols have been described in the [Global Chemicals Outlook II](#) as ‘nearly ubiquitous’, and certain ortho-phthalates (used as a plasticiser in flooring and wallcoverings, and in adhesives, sealants and paints) are subject to concerns for human health related to toxicity for reproduction and potential as an endocrine disruptor. Beyond this, significant impacts are seen at the raw materials stage from fossil fuel use and embodied carbon of the material; from production (for example, from PVC’s precursor, the vinyl chloride monomer (VCM), [a known carcinogen](#)), micro-plastic release (of which paints are estimated to be the largest source at 1.9 Mt/year – see the resources section) and at end-of-life, where plastics can take up to 1,000 years to degrade in landfill.

Alternative strategies are needed to reduce these environmental and health hotspots, which consider designing out plastic components in buildings, alternative materials (such as cork or linoleum in flooring, or wood fibre insulation instead of EPS or XPS), as well as using greater recycled content or bio-based production routes. However, diligence is needed to ensure that bio-based feedstocks come from sustainable sources, and recycled materials are traceable and do not contain toxic contaminants.

Resources

- Plastic Paints the Environment, EA. Available from: https://www.e-a.earth/_files/ugd/425198_6f553fe5eb444350bb61b4acee3aef14.pdf
- Reducing Plastics in Construction Group. ASBP. Available from: <https://asbp.org.uk/group/plastics-in-construction>
- Global Chemicals Outlook (II). Available from: <https://www.unep.org/resources/report/global-chemicals-outlook-ii-legacies-innovative-solutions>
- OECD. Available from: <https://www.oecd.org/environment/plastic-pollution-is-growing-relentlessly-as-waste-management-and-recycling-fall-short.htm>
- Vinyl Chloride Toxicity. Available from: <https://pubmed.ncbi.nlm.nih.gov/31335054/>

Table 7 - Hotspots and opportunities for eco-innovation in the plastics value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> • Fossil fuel extraction 	<ul style="list-style-type: none"> • Development of bio-based economy for plastics • Increased use of safer, traceable recycled materials
Manufacture	<ul style="list-style-type: none"> • Effect on health of production operatives 	<ul style="list-style-type: none"> • Repurposing of waste plastic in new composite building materials
Transport	<ul style="list-style-type: none"> • Risks of spillage and release from transport of plastic pre-cursors and additives 	<ul style="list-style-type: none"> • Improved safety and labelling procedures in transport
Use	<ul style="list-style-type: none"> • Release of ortho-phthalates from flexible PVC building products • Microplastic release from paints 	<ul style="list-style-type: none"> • Use of safer plasticisers • Use of alternative materials for flooring, insulation and piping
End of life	<ul style="list-style-type: none"> • Dioxin release from incineration of PVC • Landfilling and low recycling rates 	<ul style="list-style-type: none"> • On-site waste segregation and collection services • Product design for longer lifetime

Insulation

Insulation plays a key role in improving energy efficiency and lowering carbon emissions through reducing heat loss from buildings during winter and helping maintain cooler interior temperatures during summer. Insulation products are manufactured from a variety of raw materials, including fossil-based polymers, mineral wools, natural bio-based materials, and recycled materials. Insulation products from oil-based polymers include polystyrene (EPS and XPS), phenolic foam, and polyurethane (PUR and PIR) variants. Manufacturing can be energy intensive, resulting in a high embodied carbon, as well as the risk of health hazards (e.g. from the styrene monomer, a probable carcinogen).

Insulation may contain hazardous chemicals including halogenated flame retardants, many of which are classified as persistent, bioaccumulative and/or toxic. Formaldehyde may be contained in products, which can have impacts for occupants from off-gassing. Products in existing buildings may contain asbestos; whilst this substance has been subject to

phase outs, it is still in production in some regions. Additionally, whilst ozone depleting substances are regulated under the Montreal protocol, some may also be found in blowing agents used in the manufacture of some products.

There are a wide range of insulation products from natural, bio-based and recycled materials that help reduce dependence on fossil-based materials and reduce embodied carbon while performing comparably or better in terms of energy efficiency, with the potential to offer a more circular solution. These include cellulose insulation from recycled paper, cellular glass from recycled glass, straw, wood fibre, wood wool, cork, sheep wool fibres, flax, and hemp-based solutions.

Table 8 - Hotspots and opportunities for eco-innovation in the insulation value chain

Life cycle stage	Hotspots	Opportunities
Extraction	<ul style="list-style-type: none"> Quarrying and fossil fuel use – resource and land use, air and water pollution 	<ul style="list-style-type: none"> Bio-based and recycled raw materials - sustainably cultivated and sourced
Manufacture	<ul style="list-style-type: none"> Worker exposure to hazardous chemicals, e.g. styrene, halogenated flame retardants, formaldehyde Ozone depleting substances in blowing agents Energy-intensive production and high embodied carbon of fossil-based polymers and mineral wool insulation 	<ul style="list-style-type: none"> Development of products with alternative, safer chemicals and improved data provision Increased recycled content, e.g. in glass mineral wool or plastic insulation
Transport	<ul style="list-style-type: none"> Emissions from transport to retail and construction sites 	<ul style="list-style-type: none"> Lightweight insulation options
Use	<ul style="list-style-type: none"> Leaching of styrene monomers (EPS and XPS insulation) Formaldehyde release Panel shrinkage reducing effectiveness of insulation 	<ul style="list-style-type: none"> Lower toxicity alternatives Improved design and jointing techniques
End of life	<ul style="list-style-type: none"> Halogenated flame retardants entering the environment Exposure to asbestos during demolition Chemical release from landfilling and incineration Waste from non-recyclable insulation e.g. phenolic foam 	<ul style="list-style-type: none"> Demolition site segregation enabling reclaim and reuse of insulation materials Building design for dismantling and recovery Use of more recyclable products

Chemicals of concern in building materials

Increasing focus is being placed on the health and pollution effects of substances in building materials, alongside their climate impacts. This is not a new area – the health effects of asbestos used in roofing, walls and insulation have been researched since the 1930s. The 1970s saw some of the first legislation to restrict volatile organic compounds (VOCs) in paints, and polychlorinated biphenyls (PCBs) in flame retardants found in upholstery fabric and insulation. More recently, there are increased calls for action to mitigate the effects of ‘forever chemicals’, such as the highly persistent PFAS chemical family, [which are found in a number of building materials and interior elements](#).

Chemical hotspots are encountered along the full value chain for building materials. This includes from the polluting effects of mining, to safety issues for production workers, to the effects of end-of-life disposal of building materials. The effects of many chemicals that enter the market are unknown, and in some cases may take the order of years to become apparent. A holistic, data-driven approach that considers the full value chain is recommended, and this supplement provides guidance and example resources for better chemical management processes. This includes:

- Developing chemical inventories and working with the value chain to improve information provision
- Conducting screening and assessments of existing chemicals in products, as well as for potential substitutes
- Considering alternatives, which may involve the use of an entirely different substance or material that can provide functionality in a different way

Some common groups of chemicals of concern found in building materials are listed in Table 9 (this list is non-exhaustive). Some substances within these categories are addressed by international conventions, and are phased out by laws in some countries. However, legislation and effective market surveillance is not in place everywhere to stop products with unsafe levels of chemicals from entering the market. Further, more detailed information about common chemicals of concern in the building and construction sector can be found in an extensive report on the [SAICM knowledge website](#).

Table 9 - Common types of chemicals of concern found in building materials

Substance group	Example chemicals	Containing materials/products	Associated concerns
Certain ortho-phthalates	DBP, DNOP, DiNP, DnHP, BBP, DEHP (see abbreviation list)	PVC flooring, piping, wiring	Endocrine disruptor
Certain halogenated flame retardants	PBBs, PBDEs, HBCD (see abbreviation list), Tris and other halogenated trialkylphosphates, chlorinated paraffins	Foam plastic insulation	Endocrine disruptor, carcinogen, child development
Heavy metals	Lead, cadmium, mercury, antimony	Plastic stabilisers, solder, chrome plating	Water and soil contamination, kidney and cardiovascular damage
Asbestos	Chrysotile, Amosite, Crocidolite, Tremolite, Anthophyllite, Actinolite	Insulation and fireproofing	Carcinogen, asbestosis
Volatile Organic Compounds (VOC)	Formaldehyde, benzene, toluene, xylene, methylene chloride, isocyanates	Paints and coatings, wood fibre board	Indoor air pollution, respiratory effects
Per-fluorinated alkyl substances (PFAS)	PFOA, PFOS (see abbreviation list)	Roofing coatings, weatherproof membranes, paints, carpets, adhesives and sealants, grouts, wiring	Cancer and development issues from their persistence and bioaccumulation

Table 10 - How do materials release chemicals? Source: Healthy Materials Lab

Volatilization	Off-gassing of chemicals, such as VOCs in paints
Chemical degradation	As a result of chemical or physical breakdown of materials – for example the degradation of molecules in plastics releases chemicals into the environment. Compounds may display persistence and accumulate in the environment
Abrasion	The physical release of particulates and dust from wear of a material. Substances may enter the body through inhalation or dermal absorption
Leaching	Dissolved materials that enter other media, for example water soluble compounds that may enter water sources (e.g., lead in pipes). These may be ingested through food and drink
Oxidation	Seen from burning or corrosion processes – for example incineration of PVC can release dioxins
Climate change	A changing climate affects the air we breathe, and may increase levels of pollutants (e.g., ground level ozone). This effect may be seen in both outdoor and indoor air

Circularity in the building materials industry

There is a great need for the industry to transition to a more circular economy that uses our finite resources more efficiently, whilst also being restorative and regenerative by design. Global material use, of which construction is a strong driver, is projected to increase alongside economic and population growth, with consumption of primary materials projected to approximately double from 89 gigatons (Gt) in 2017 to 167b Gt in 2060 (OECD, 2019). The World Business Council for Sustainable Development defines a circular building as one that optimises the use of resources while minimising waste throughout its whole life cycle. The building’s design, operation and deconstruction maximise value over time using:

- Durable products and services made of secondary, non-toxic, sustainably sourced, or renewable, reusable or recyclable material
- Space efficiency over time through shared occupancy, flexibility and adaptability
- Longevity, resilience, durability, easy maintenance and reparability
- Disassembly, reuse or recycling of embedded material, components and systems
- Life-cycle assessment (LCA), life-cycle costing (LCC) and readily available digital information (such as building material passports).

Improving material efficiency to meet the planet’s environmental and sustainable development needs will require ambitious policies, a shift in sectoral practices, and intensive and innovative collaboration. The OECD Global Material Resources Outlook to 2060 report highlights the great need for policies that speed the transition to secondary materials to reduce environmental impacts. Increased use of renewable, bio-based materials is also crucial to reduce dependence on conventional, non-renewable ones. New technologies are in place that are profiled in this supplement, such as bio-based building boards to replace gypsum, or hemp-lime panel construction; the challenge now is to scale these solutions and enable a shift in practices and skills in the industry.

At the building level, instead of ‘construction as usual’, practices and business models should aim to embed circularity firmly at the design stage, with a longer-term view of a building’s use, as well as how materials can best be repurposed at the end of the building’s initial lifespan.

Principle	Examples
Circular economy design	<ul style="list-style-type: none"> • Building products designed for dismantling • Building products designed for long lifetimes and upgrading • Off-site assembly • Alternatives to chemical use to facilitate recyclability
New business models	<ul style="list-style-type: none"> • Product-as-a-service (PaaS) models • Platforms to realise secondary market value of materials
Reverse cycles	<ul style="list-style-type: none"> • Reversible building design • Take-back, collection systems and logistics
Enablers and favourable system conditions	<ul style="list-style-type: none"> • Policy and financial incentives for sustainable design and reuse • Accessible material inventory and monitoring systems • Exemplar project demonstration

Table 11 - Key principles and examples of emerging practice in the building materials and construction industries. Source: [Ellen MacArthur Foundation](#)

Additionally, greater consideration of the link between chemical use and circularity is needed in the industry. The presence of certain chemicals in materials can be a barrier to material recovery and repurposing – chemicals (including ‘legacy’ chemicals) in building products can cause contamination of connected elements, or remain in recycled materials such as plastics or mineral wool.

The involvement of actors across the supply chain is critical to improve this situation. Designing and manufacturing buildings and materials that use more mechanical connections, rather than chemical ones, reduces material contamination and damage during deconstruction¹². Design for and expertise in carrying out building deconstruction can avoid the use of chemicals that inhibit circularity from the start, whilst effective on-site material segregation and recovery can enable material reuse and avoid the environmental effects of landfilling. Whilst this process requires more care and time than conventional demolition, a more circular approach can deliver financial benefits from avoided disposal charges, to realising secondary market value of reclaimed materials.

A more connected supply chain is needed to deliver a more circular vision for the building materials sector. Initiatives like the [Opalis project](#) are mapping construction sites and material sellers across different regions to enable improved material efficiency and lower transportation processes.

Resources such as the [Circular Buildings Toolkit](#) from Arup and the Ellen MacArthur Foundation provide a framework for a more circular approach to building, as well as strategies, actions and case studies to apply these principles in practice. The World Green Building Council, through the [Circularity Accelerator](#) are working to create and distribute knowledge and training resources on circularity in buildings, as well as supporting rating tools and strengthened regulation.

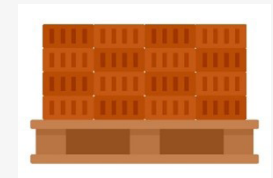


Figure 2 - The Circular Buildings Toolkit Framework. Source: Arup/Ellen MacArthur Foundation

¹² Modular Construction – Let’s Get it Right from the Start - Healthy Building Network. Available from: <https://healthybuilding.net/blog/571-modular-construction-lets-get-it-right-from-the-start>

INTRODUCTION TO GFC BUILDING SUPPLIES

GFC Building Supplies (GFC) is a small builders' merchant of just under 50 employees, which started out in 2000 as a small outfit supplying trade customers, initially specialising in the procurement and supply of cement, concrete, timber, and bricks manufactured by third party companies.



The company has since expanded its size and client base and developed an own-label product range alongside its sales of third-party materials and products. The product range now includes roofing, plasterboard, paints, flooring, insulation, windows, wall coverings, fencing, adhesives, lighting, piping, sanitaryware, plumbing supplies, plastics, chemicals, tools, fittings, and fixings. Around 90% of sales are in-country, with main trade customers based locally. However, GFC is now increasingly focusing on exports, as well as aiming to win further tenders outside of the local area to supply materials for larger public and private construction projects.

Most of GFC's domestic sales are directly to trade customers. Some of these are through contractual supply arrangements with construction and refurbishment companies, and some are secured through competitive tenders. It has one long-lasting contractual relationship with a medium-sized construction company, providing a relatively stable base of income. As well as product sales, GFC is interested in providing further services, such as logistics, digital design, repair, maintenance, and equipment hire.

In recent years, alongside partners, GFC has developed an own-brand range of ready-mix concrete and paints in response to customer needs. GFC is interested in expanding this range, exploring more environmentally friendly variants of these products, and considering opportunities to source more local materials to mitigate the risks of price increases and volatility from the import market.

GFC is based at one site which consists of an office, warehouse, workshop and yard, and retail shop. Employees work in departments covering operations, procurement, specification and design, logistics and delivery, sales and marketing, customer service and IT. The design team specialises in developing the own-brand range and specifying products for different applications. While there is some focus on new product designs and discussions with suppliers on new products, GFC has never had a formal research and development department and has no partnerships of note with external organisations in this area.

A small management team oversees operations and business development and reviews the company's strategic direction at quarterly meetings. The CEO and founder of GFC has a close working relationship with each of the team managers, and has a strong technical background, but is often more focused on supporting the sales and marketing arm of the business, as well as working at a higher-level with the operations team.

GFC has a relatively low level of staff turnover, and several employees in senior positions have been with the company since inception. The current gender balance at GFC is around a 3:1 ratio of men to women, and of the six positions on the senior management team, only one is held by a woman. GFC is seeking to improve the gender balance of the company.

GFC is well-established in the construction industry and has many longstanding relationships with suppliers, trade customers and other industry actors, with a good reputation for reliable service and product quality. GFC is also a member of their national trade body for building merchants. While GFC has maintained a strong market share in the region and is currently considering expansion to a second site, business appears to have slowed in recent years. Economic slowdown has affected the construction sector in general, and profit margins have been reducing, in part due to global increases in material costs.

GFC BUILDING SUPPLIES



COMPANY PROFILE



Figure 3 - Overview of example company GFC Building Supplies

PREPARE

Prepare to engage a company and its value chain
and build interest in the rewards of eco-innovation

PR.1

Evaluate potential markets



The first activity in the Prepare phase is to identify suitable markets and companies within the building materials sector to target with your eco-innovation services.

Devising a system to categorise and segment companies is a useful first step. This can feed into completing a sector, market, and company level analysis to identify which companies have the highest potential and appetite to address sustainability issues in their sector.

PR.1 Evaluate potential markets



BACKGROUND INFORMATION

Establishing an effective categorisation system to assess and compare building material sectors and companies can help prepare for targeting activities. At the company level, categorisation of the company's position in the value chain, geography, size of company and appetite for change can also be factored into a comparative assessment.

USING THE ISIC CLASSIFICATION SYSTEM

Categorisation based on the International Standard Industrial Classification of All Economic Activities (ISIC) taxonomy can be useful for defining sectors and companies operating within sectors. A wide range of industry trends and statistics are reported using this classification, which can assist sector analysis. For example, the report *OECD Taxonomy of Economic Activities Based on R&D Intensity* reports the level of R&D activities in different industries, providing a picture of their innovation potential.

Consultants may produce their own classification systems based on ISIC. For example, Roland Berger, in their publication *Building materials industry potential upsides in an uncertain market* classified common building materials into six main groups based on their primary ISIC category. Categorisation of this type can be used as an input to the sector, market and company analysis detailed in this section, and groups together materials which perform a similar function, and in some cases have similar sustainability issues. For example, concrete, minerals, clays and stone (industry sub-group D) have similar impacts related to raw material extraction and end of life treatment.

Table 12 - Building materials industry classification. Source: Roland Berger: *Building materials industry potential upsides in an uncertain market*

Industry sub-group	Products	Description
A	HVAC, plumbing, and electrical equipment	Includes manufacturers of refrigeration and heating equipment, hot water heaters, boilers, plumbing fixtures, blowers, fans, and electric housewares
B	Lighting and wiring	Includes manufacturers of electric lighting and wiring equipment, and those engaged in drawing and insulating of wire
C	Roofing, siding, lumber, and other materials	Includes manufacturers of millwork, structural wood members, and wood products including cabinets; roofing, siding, and decking products of various materials; and paints, miscellaneous plastics, and other materials
D	Concrete, minerals, clays, and stone	Includes producers and manufacturers of cement and concrete ingredients, concrete products, mineral products, and structural clay products
E	Glass, windows, doors, and flooring	Includes manufacturers of finished glass products, windows, interior and exterior doors, and flooring products
F	Construction metals	Includes manufacturers of steel, basic metal products, and metal hardware

PR.1 Evaluate potential markets



The ISIC categories can also be used at the company level to identify and compare similar firms. A table of ISIC sub-categorisations within the construction sector is shown in Table 13.

Table 13 – examples of ISIC building material sub-sectors

ISIC code and general description	Example of sub-sectors
C16 – Manufacture of Wood and Of Productions of Wood and Cork Except Furniture; Manufacture of Articles of Straw and Plaiting Materials	<p>C1621 – Manufacture of Veneer Sheets and Wood-Based Panels</p> <p>C1622 – Manufacture of Builders' Carpentry and Joinery</p> <p>C1623 – Manufacture of Wooden Containers (e.g. boxes and pallets)</p>
C22 – Manufacture of Rubber and Plastics Products	<p>C2219 – Manufacture of Other Rubber Products, including: rubber plates, sheets, strips, rods, tubes, pipes, hoses, etc.</p> <p>C2220 – Manufacture Of Plastic Products, including: plastic pipes, hoses, pipe fittings, doors, windows, frames, shutters, blinds, skirting boards, plastic role or tile coverings for floors, walls and ceilings, insulating fittings, components of lighting fittings,</p>
C23 – Manufacture of Other Non-Metallic Mineral Products	<p>C2310 – Manufacture of Glass And Glass Products, including: flat glass, rods, tubes, paving blocks, glass insulators and insulating fittings</p> <p>C2391 – Manufacture Of Refractory Products, including: refractory mortars, concretes, ceramics, bricks, blocks, tiles, tubes, and pipes</p> <p>C2392 – Manufacture Of Clay Building materials, including: non-refractory ceramic tiles, mosaic cubes, paving, ceramic bricks, roofing tiles, pipes, conduits, and flooring blocks</p> <p>C2394 – Manufacture of Cement, Lime and Plaster, including: clinkers and hydraulic cements such as Portland, aluminous, slag and superphosphate cements; quicklime, slaked lime and hydraulic lime; plasters of calcined gypsum or calcined sulphate</p> <p>C2399 – Manufacture of Other Non-Metallic Mineral Products Not Elsewhere Classified, including: mineral insulating materials such as slag wool, rock wool etc; worked mica and peat; articles of asphalt and asphalt-based adhesives</p>

PR.1 Evaluate potential markets



CATEGORISATION OF COMPANIES BY POSITION AND ACTIVITIES IN THE BUILDING MATERIALS VALUE CHAIN

Identifying a company's position in the building materials value chain can also feed into identifying target companies. Companies working at the same stage are likely to encounter similar sustainability challenges and hotspots. A simplified schematic of value chain is displayed in Figure 4. Companies may be involved at more than one stage of the value chain. Interventions can be made at different points to address environmental impacts.

Figure 4 - Generic building material value chain



- The **raw materials** stage includes all extraction and production processes, such as primary and secondary material sourcing for metals, petrochemicals for plastics, timber, stone, minerals, clay. Environmental and social impacts may be encountered at this stage from energy use and impacts on land, water, as well as workers' rights (for example health and safety, child labour and modern slavery).
- **Transportation** of raw materials (which also may take place at later stages) may be carried out by extraction firms or by specialist hauliers.
- **Processing and refining** of raw materials to produce the final material. By-products may be created at this stage, with potential for added value at other stages, or in other value chains. More efficient processes can also avoid creation of unnecessary by-products.
- **Manufacture** of finished building products, including packaging. This stage may impact worker health and the local environment.
- **Distribution** and sale through markets to reach the end user, such as trade or domestic consumers.
- **Installation** of building materials and products. This stage generally creates waste, e.g. from leftovers and off-cuts of materials installed and removed. Other environmental impacts from site processes may include air pollution, vegetation removal, and soil and water contamination.
- Firms providing maintenance and servicing may be involved in the **in-use phase**. Building occupants may experience chemical effects from building materials during this phase as a result of off-gassing of VOCs in paints, or exposure to endocrine-disrupting chemicals. More serious cases may be referred to as 'sick building syndrome'.
- The **end-of-life phase** may involve the firms who conducted installation, as well as specialist waste management companies. A circular approach can mitigate the impacts of this stage. To achieve this in practice, either waste is initially designed out of the building material, or it is repurposed at the end of its life.

References and resources

- *International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4*. Available from: https://unstats.un.org/unsd/publication/seriesM/seriesm_4rev4e.pdf
- *OECD Taxonomy of Economic Activities Based on R&D Intensity*. Available from: <https://doi.org/10.1787/5jlv73sqgp8r-en>
- *Building materials industry potential upsides in an uncertain market*. Roland Berger. Available from: https://www.rolandberger.com/publications/publication_pdf/roland_berger_building_industry_winners.pdf
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- *RIBA Plan of Work*. RIBA. Available from: <https://www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work>

PR.1 Evaluate potential markets



TIPS & TRICKS

TAKE A FULL VALUE CHAIN APPROACH TO ASSESSING ECO-INNOVATION OPPORTUNITIES

Consider the full value chain as part of the assessment of target sectors, markets and companies.

Co-ordinated action across the full value chain can help maximise sustainability improvements for a product, but it is necessary to ensure that assessments identify and address the stages of the value chain where the main hotspots occur.

It is also important to ensure that gains at one stage are not lost at another. For example, the impact of a new bio-based building material will be strongly affected by how well upstream companies can supply feedstock and the expertise and engagement of downstream installers using the product.

CONSIDERATION OF ENVIRONMENTAL AND SOCIAL HOTSPOTS UPSTREAM IN THE VALUE CHAIN, AT THE RAW MATERIAL EXTRACTION AND PROCESSING STAGE IS OFTEN ESSENTIAL WHEN EXPLORING ECO-INNOVATION OPPORTUNITIES

In some cases however, it may be difficult to engage with companies operating at this stage – it may not be possible to even know the origins of materials in complex supply chains with limited data flow. Additionally, where materials are imported, this can add an extra barrier to assessing hotspots and opportunities at this stage.

In these cases, to estimate hotspots, service providers may need to use generic industry figures, or develop more partnerships upstream to obtain further information.

CONSIDER REGIONAL TRENDS, VARIATIONS AND REGULATION AS PART OF MARKET EVALUATION

A wide range of factors influence the opportunity for eco-innovation in different regions and countries.

Assessment of a sector or market in the building materials sector should consider aspects such as the level and direction of regulation, national building strategies and roadmaps, current condition of infrastructure, skills of workforce, local climate, local material availability and political landscape.

National laws, building codes and key exemptions should be well researched as part of market assessments, for example the [Declaration of Protected Ancient Monuments in Sri Lanka](#).

CONSIDER OPPORTUNITIES THAT CONNECT MORE THAN ONE VALUE CHAIN

Eco-innovation opportunities may cross the value chains of different materials, often where a waste output from one can provide an input material from another, closing loops and improving circularity. For example, fly ash from steel production, or ceramic waste can be used in concrete. Opportunities for material repurposing may be available in value chains outside the building materials sector, for example in the food or agriculture sectors.

DIFFERENTIATE BETWEEN NICHE AND MASS MARKET PROJECTS TO IDENTIFY COMPANIES IN A POSITION TO DRIVE INNOVATION

Different opportunities for eco-innovation may be found between large-scale, 'mass market' construction projects, such as residential tower blocks and more niche projects, such as buildings designed for a very low environmental footprint, commercial buildings designed for a specific purpose, or those required to adhere to sustainable public procurement guidelines.

Mass market projects may present less opportunity for highly disruptive innovation, but small improvements to a process could increase impact at a large scale – for example, a change to a product formulation, process efficiency or waste management could provide large benefits. Using tools to estimate the impacts of different materials (several are mentioned in this supplement) can be a valuable input provided by the service provider in this instance.

Niche projects may provide greater opportunity to pilot more innovative materials and processes on a smaller scale and prove concepts that could have subsequent larger-scale deployment.

PR.1 Evaluate potential markets



USE ENVIRONMENTAL IMPACT DATA TO SELECT TARGET MARKETS

Whilst no universally accepted definition of 'sustainable building materials' exists, analysing a range of environmental, health and social impact data for a product's manufacture, supply, use and end-of-life can assist with identifying target companies. Comparing impacts can help form the basis of the analysis explored in this section at sector, market and company level.

Exploring a comprehensive range of impacts is recommended. Environmental data to collect can include carbon emissions, energy and water consumption (both in-use and embodied in materials), as well as toxicity, persistence and biodegradability. Potential for recovery, reuse and recycling can vary strongly between material value chains. Establishing a 'bigger picture' of the full range of associated environmental impacts is beneficial, as this can help to avoid unintended 'burden shifting' consequences of addressing one impact, only to worsen another.

It also recommended to combine environmental impact data with assessment of other relevant metrics. However, no single rating system enables a full comparison of materials across the range of impacts. For example, when considering the relative importance of impacts, it is not straightforward to compare the impacts of a material on the long-term health of building occupants or workers against the social effects of material extraction. Determining priority metrics for sector targeting should include:

- Regional considerations - for example where water scarcity is a large problem in regions, this impact may be weighted higher as a result
- Key health considerations and legislation— for example, the use of asbestos has created widespread health problems and legislation in some regions
- The level of technology readiness for a particular application – certain materials may not yet be a viable option for construction of, for example, a bridge or a high-rise apartment block
- The importance of a sector to the national economy.

Open-source tools and databases that can help compare and benchmark impacts include:

- The **ICE database**, which provides embodied carbon data on a range of common building materials.

- **Mindful Materials library** – this collates metrics on over 8,200 building products, including an environmental profile, as well as identifying those which have reduced or eliminated certain chemicals of concern as defined in a number of chemicals databases, as well as responsible sourcing considerations
- The **Construction Material Pyramid**, produced by the Centre for Industrialised Architecture (CINARK) at the Royal Danish Academy, is a concise tool that allows the user to assess top-level environmental impact of different building materials. Comparison of impacts such as Global Warming Potential (GWP) and toxicity aspects of materials can be made to inform approaches to material selection and design.
- The **Health Product Declaration (HPD) Collaborative** – providing a database of HPDs, a standardized document reporting product contents and associated health information, for products used in the built environment

Additionally, in the past few years, more benchmarks for the carbon footprint of a material are being seen in legislation, public procurement and certification schemes. Examples include:

- [Buy Clean California Act](#), which sets embodied carbon limits for procurement
- [The EU Taxonomy Compass](#), a classification system which establishes a list of environmentally sustainable economic activities and activity-specific criteria.

PR.1 Evaluate potential markets



Figure 5 - Construction Material Pyramid from CINARK, comparing the global warming potential (GWP) of different building materials in kg CO₂eq/kg



PR.1 Evaluate potential markets



LEARNING CASE STUDY OF TARGET IDENTIFICATION

Drivers and opportunities for eco-innovation vary between sectors, markets, and companies. Below is a scoring system that can be used to identify target companies, assessing the extent of the opportunity at the different levels. This is done step by step to filter out lower-priority sectors, and ultimately identify companies with the greatest potential and appetite for taking action in high-impact sectors.

The Eco-innovation Manual provides a template and an example of target identification at the three levels shown in Figure 6, resulting in the selection of 'The Tasty Tuna Company' as a target company.

Figure 6 - Process for target identification



Table 14 - Sector level analysis

No.	Question	Scoring
A1	To what extent does the sector contribute to global greenhouse gas emissions and climate change (taking into account the full life cycle of the product or service delivered by the sector)?	<ul style="list-style-type: none"> • High [2 points] • Medium [1 point] • Low [0 points]
A2	To what extent does the sector contribute to global consumption of non-renewable resources and potable water (taking into account the full life cycle of the product or service delivered by the sector)?	
A3	To what extent does the sector contribute to global pollution problems (taking into account the full life cycle of the product or service delivered by the sector)?	
A4	How important is the sector for the national economy?	
A5	To what extent has this sector been targeted by Non-Governmental Organizations (NGOs) to encourage improvements in sustainability performance?	

A – SECTOR-LEVEL ANALYSIS

The first step in target identification is to assess the different sectors within the building materials industry. The table provides five questions to assess different sectors' environmental impacts, socio-economic factors, and the existing level of and support on sustainability issues. You could complete this assessment through desk-based research, or potentially with the help of industry or public sector contacts.

Various guidance resources can be used in the assessment. For example, the [Hotspot Analysis Tool for Sustainable Consumption and Production](#) (SCP-HAT) provides [sector profiles](#) for different countries, and an overview allowing comparison of the environmental impacts of different sectors. Roadmaps and reports (such as the IEA's [aluminium report](#) or the [GCCA 2050 Net Zero roadmap](#)) enable assessment of the magnitude of sustainability hotspots, the progress of the sector in addressing hotspots against any targets set, some of the key sectoral trends, and strategies and technologies expected to be deployed.

Market insight reports (such as [this example from Mordor Intelligence](#) for paints and coatings in Sri Lanka) can support the analysis of how important a sector is to a national economy and the relative size of the economy in the sector.

PR.1 Evaluate potential markets



Additionally, analysis of how a sector may deal with upcoming legislation can also assist with this process. For example, the phase out of a substance of concern with direct relevance to a sector can be a good indicator of where opportunities for innovation may arise.

The IEA Roadmap reports that steel, cement, bricks and timber (non-certified timber causes deforestation issues) have some of the highest impacts in terms of carbon emissions. Some background information on the carbon emissions from these sectors are included in the references for this section. Example scoring for these sectors, considering a manufacturing base in Asia, could be as follows:

Table 15 - Example scoring for sector level analysis

Sector	Steel	Cement	Bricks	Timber
Comments	High levels of national manufacturing, high levels of recycling	High levels of national manufacturing, low market penetration of low-carbon alternatives	High impacts from clay extraction, few alternatives to traditional materials	Some national sourcing, some imports. Not yet a mainstream product in national construction
Questions				
A1	2	2	2	1
A2	2	2	1	2
A3	1	2	1	2
A4	2	2	1	1
A5	2	1	1	2
Total	9	9	6	8

Table 16 - Potential issues for building materials related to chemicals of concern

Material/product	Potential issues related to chemicals of concern
Paints	Presence of VOCs, heavy metals
Building plastics	Presence of high-concern phthalates
Flooring	Exposure risks from harmful intermediates and by-products in production and end-of-life phase
Roofing	Fibre/particulate release
Insulation	Presence of high-concern flame retardants, fibre/particulate release
Adhesives and sealants	Presence of VOCs

PR.1 Evaluate potential markets



B – MARKET-LEVEL ANALYSIS

A market is a group of customers requiring closely related goods or services – this step of the assessment builds on the sector level analysis by more closely defining the building material being explored for eco-innovation and its application. Having identified some target sectors in the first step, the Eco-Innovation Manual provides a further set of scoring questions at this level. Questions B1-B6 assess the likely demand for eco-innovation services in the market. Questions B7-B10 consider the knowledge and expertise of the service provider in that market, and the probability that your organisation could successfully provide this service.

Table 17 - Market level analysis

No.	Question	Scoring
B1	How strong is the growth of this market?	<ul style="list-style-type: none"> • High [2 points] • Medium [1 point] • Low [0 points]
B2	How strong is the competition in this market?	
B3	To what extent is government policy encouraging and supporting moves towards improved sustainability performance?	
B4	Is this market affected by new or forthcoming legislation?	
B5	How interested are the end customers of this market in improved sustainability performance?	
B6	Are there trends that would encourage eco-innovation in this market?	
B7	Do you have existing customers, reputation and credibility in this market?	
B8	Are the potential companies in this market similar to the types of organisation that we normally choose to work with?	
B9	Do we have the necessary sector and market knowledge within our organisation today to deliver eco-innovation services to this market?	
B10	How easy would it be to collaborate with other organisations within this market based on geographic location?	

PR.1 Evaluate potential markets



As an example, you may have identified products within the cement, steel, paints and flooring sectors to conduct market analysis on. Your scoring could be as follows:

Table 18 - Example scoring for market level analysis

Market	Ordinary Portland Cement for structural applications	Steel beams	Domestic paints	Domestic PVC flooring
Comments	Standard CEM-I formula, high clinker content	Market average product, not sourced from a low-carbon supplier	Solvent-based formulation	From supply chain with no known controls in place on production or end-of-life treatment
Questions				
B1	2	2	1	1
B2	2	1	1	1
B3	1	2	1	1
B4	1	1	2	1
B5	0	1	2	1
B6	1	1	2	1
B7	2	1	2	0
B8	1	1	2	1
B9	2	1	2	1
B10	2	1	1	0
Total	14	12	16	8

PR.1 Evaluate potential markets



The example on the previous page shows that markets within the cement and steel sectors are seeing strong growth, but barriers to improved sustainability exist due to an absence of demand-side market drivers, and low awareness and acceptance of lower-carbon alternatives. For paints, there is strong consumer pressure for the market to transform towards more sustainable products, regulations in place and new technological trends emerging. The market for PVC flooring products was deemed to have medium growth, but with fewer regulatory drivers pushing the market to transform. Assessment of the service provider's knowledge and influence in these markets also indicated a greater opportunity to affect change for cement and paint products.

At market level, more detailed consideration of the regulatory requirements on chemicals of concern can be made, as product types are often defined within the scope of regulations (for example, the EU's 'Paints Directive'). The regulatory landscape is varied between different regions with different levels of stringency and market surveillance - a building material or product placed on the market would need to adhere to minimum regional requirements. Eco-innovation projects addressing chemicals of concern would be expected to go above and beyond minimum levels, demonstrate a positive effect on health and reduced environmental toxicity compared to standard industry practice.

Maintaining awareness and the future direction of legislation, technological trends on alternatives, as well as the wider global landscape on chemicals of concern is a valuable area of knowledge for the service provider to bring to identify opportunities for eco-innovation.

Table 19 - Company level analysis

No.	Question	Scoring
C1	To what extent is sustainability an explicit and public part of the core strategy and values of the company?	<ul style="list-style-type: none"> • High [2 points] • Medium [1 point] • Low [0 points]
C2	To what extent is sustainability performance of the company's products and services part of their product marketing and positioning?	
C3	What experience and capability does the company have in innovation?	
C4	What experience and capability does the company have in managing environmental issues?	
C5	What is the position of the company in their market?	

C- COMPANY-LEVEL ANALYSIS

The final step considers the viability, experience, and appetite for eco-innovation among different companies in the target market. One way of gathering this information is by assessing a company's publicly available policies (if these exist), marketing messaging and product range through desk research. For example, does a company have strong environmental messaging that is clear, accurate and substantiated? Is messaging backed up by products that can demonstrate sustainability credentials, for example through certification?

Other ways of assessing companies may require contact with their representatives, to understand better the company culture and top management commitment to sustainability. Aspects such as the organisation's attitude to risk, speed of decision making, and in-house knowledge are also useful to consider.

The questions below can be used to compare companies within a target market:

PR.1 Evaluate potential markets



The Eco-innovation Manual provides further guidance on this step: table 1 in the PR.1 section of the manual details a series of company attributes and how these may vary between start-ups, micro enterprises, and SMEs.

An example assessment between companies in the paints market is shown below. Four paint companies are known to the service provider, including our example company GFC Building Supplies, which works with partners to produce an own-brand range of paints alongside selling other building materials.

The example company assessment indicates that GFC Building Supplies is the best target in this market. The sustainability of its paint range is considered to some degree by Sky Blue and Castle Interiors, the more established and larger suppliers, but their selling points are more geared towards product quality and functionality. Horizon Paints shows a high commitment and technical expertise in-house, as well as an appetite for innovation and a lower aversion to risk but, at this point, appears to lack the resource to fully implement the eco-innovation process.

GFC Building Supplies shows strong commitment to sustainability, and while not the market leader in paints, appears to have enough experience in environmental issues and a sufficiently strong customer base to be in a position to initiate an eco-innovation project, with potential for significant impact.

Table 20 - Example scoring for company level analysis

Company	Horizon Paints	GFC Building Supplies	Sky Blue	Castle Interiors
Comments	High levels of national manufacturing, high levels of recycling	High levels of national manufacturing, low market penetration of low-carbon alternatives	High impacts from clay extraction, few alternatives to traditional materials	Some national sourcing, some imports. Not yet a mainstream product in national construction customer market
Questions				
C1	2	2	1	1
C2	1	1	2	1
C3	2	2	1	1
C4	0	2	2	1
C5	0	1	1	2
Total	5	8	7	6

PR.1 Evaluate potential markets



References and resources

- IEA subsector reports – Iron and Steel. International Energy Agency. Available from: <https://www.iea.org/reports/iron-and-steel>
- Q&A: Why cement emissions matter for climate change. Carbon Brief. Available from: <https://www.carbonbrief.org/qa-why-cement-emissions-matter-for-climate-change/>
- A comparative study of life cycle carbon emissions and embodied energy between sun-dried bricks and fired clay bricks. Dabaieh, Heinonen, El-Mahdy and Hassan. Journal of Cleaner Production. Available from: <https://www.sciencedirect.com/science/article/pii/S0959652620330432>
- Timber Overview. World Wildlife Fund. Available from: <https://www.worldwildlife.org/industries/timber>

PR.2

Build the right internal team



In order to deliver your eco-innovation services, it is important that your team has the necessary competencies, skills and knowledge. PR.2 guides you on how to assess the current capacity of your team, identify gaps, and plan how to address these gaps. There are some key considerations when conducting this activity for services tailored to the building materials sector.

PR.2 Build the right internal team



TIPS & TRICKS

ENSURE YOUR TEAM HAS THE RIGHT SKILLS FOR THE BUILDING MATERIALS SECTOR

For your team to be able to analyse the performance of companies in the sector and implement eco-innovation, it is important it has a certain skill set and knowledge base.

This includes knowledge of different building materials, manufacturing processes, operational distribution, construction methods, demolition, and end-of-life material treatment. Having this understanding will make it easier to identify different sustainability hotspots and eco-innovation opportunities.

It is also important to understand the types of business models in the sector and the scope for creating more sustainable business models and manufacturing practices. For instance, knowledge of sustainable and circular building material business models, material substitution to reduce environmental impacts, and measures for optimizing the efficiency of manufacturing and wider operational processes.

If internal competencies are missing in key areas, external experts can be brought in to fill in gaps in knowledge and skills, and support on the delivery of projects. Strategic partnerships with other stakeholders in the sector can also be used to enhance internal expertise. Experts and strategic partnership opportunities can be identified through *PR.3 Building the right external partnerships*. It can also help to have someone within your team with direct experience of working with building material manufacturers and the construction industry. Better still, this person would have a network of contacts across the sector who can either be approached as potential clients, or as partners in project delivery.

ENSURE KNOWLEDGE GAPS ON CHEMICALS CAN BE ADDRESSED

Consultants working with companies who are aiming to address chemical hotspots may lack specific knowledge on chemicals of concern, their effects, and how to effectively substitute or avoid their use.

Expertise in chemical hotspot management is likely to always be needed and if this is not available in-house for sustainability practitioners, it may be necessary to partner with external consultants with knowledge in this area, to help avoid unintended or negative outcomes.

Other options to ensure the right level of expertise can be provided may be to encourage partnerships with academic institutions or industry experts with experience in a particular chemical-related aspect. There may be opportunities to partner with a university, or set up a secondment placement with a researcher.

Industry experts may be able to provide training and coaching to support companies in reducing impacts in this area.

Sustainability practitioners supporting this process may be able to provide examples of companies who have implemented a similar project, and facilitate partnerships and knowledge exchanges.

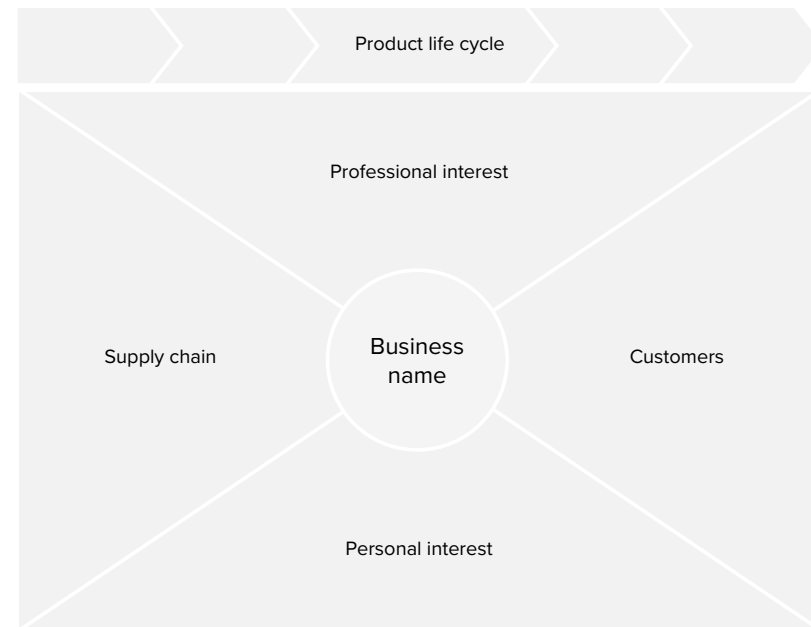
In the longer term, given the continued importance of addressing chemicals of concern, hiring chemicals management experts and further training your internal team can enable you to be an ideal service provider to companies seeking eco-innovation support in this area.

PR.3

Build the right external partnerships



Template of Life Cycle Stakeholders



A variety of external stakeholders are involved in the building material value chains. The *Life Cycle Stakeholders* template is designed to help identify these stakeholders and determine how they can be best engaged and contribute to an enabling environment for your Eco-innovation services and activities.

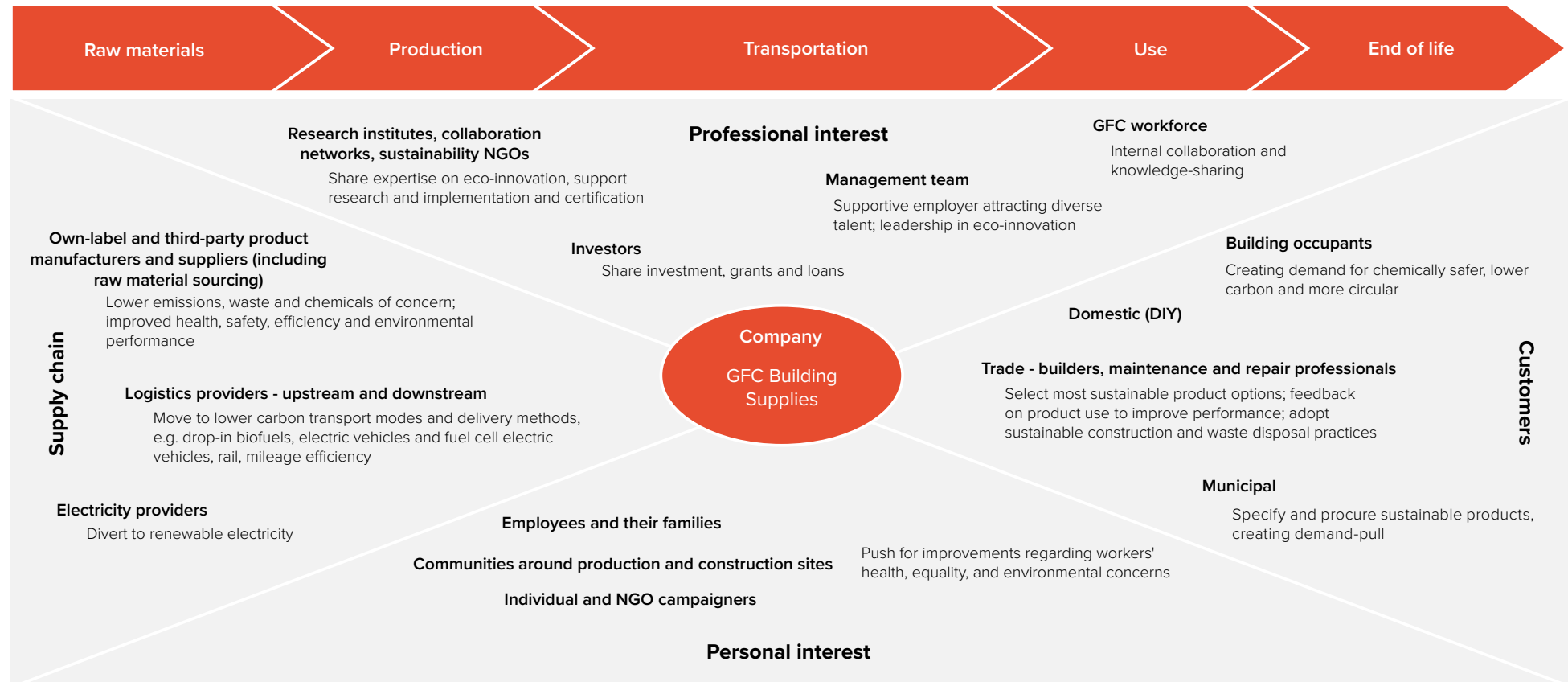
This has been completed for GFC Building Supplies, considering the stakeholders that the company may interact with throughout the full building materials life cycle.

PR.3 Build the right external partnerships



LEARNING CASE STUDY OF LIFE CYCLE STAKEHOLDERS FOR GFC BUILDING SUPPLIES

Figure 7 - Life cycle stakeholders for GFC Building Supplies



PR.3 Build the right external partnerships



BACKGROUND INFORMATION

Collaboration is essential in creating enabling environments for innovation. Upstream partnerships can help ensure ongoing, cost-effective production, and downstream actors such as retailers and the end customer must be engaged to bring a product to market. Additionally, given the limited resources of SMEs, support may be required at the R&D stage, and from actors who can help demonstrate, incentivise, and promote sustainable products and services.

SOURCES OF EXTERNAL PARTNERSHIPS IN THE BUILDING MATERIALS SECTOR

Various academic, industry, public sector and independent organisations can provide collaboration opportunities for eco-innovation service providers and implementing SMEs.

STAKEHOLDER ORGANISATIONS AND TRADE ASSOCIATIONS

Global organisations working to transform the built environment in line with the goals of the Paris Agreement and UN SDGs include the **World Green Building Council (WGBC)** and the **Global Alliance for Buildings and Construction (GlobalABC)**. Both provide partnership and collaboration platforms, and resources such as status reports, tracking tools, policy guidance and roadmaps to support governments and countries in setting targets and tracking progress, to help raise the ambition of policy and nationally determined contributions (NDCs).

National chapters of Green Building Councils, such as the **Green Building Council of Sri Lanka**, as well as other national associations promoting the use of sustainable building materials such as the **Alliance for Sustainable Building Products (ASBP)** in the UK, can be useful collaboration partners to companies seeking to embed sustainability in their operations, by providing practical support, promotion and awareness raising of best practice, and influencing policy.

The **Global Cement and Concrete Association (GCCA)** support development of lower-carbon cement formulations, self-healing and carbon sequestering concrete, lower-impact production methods, standards, design for disassembly, and improving the durability of

concrete. The organisation is seeking for their membership to account for 50% of global cement production, who must implement sustainability initiatives and targets in line with the GCCA Sustainability Charter.

The **World Business Council for Sustainable Development's (WBCSD)** work on sustainable cities includes projects on *Transforming the Built Environment* and *City-Business Collaboration*, which promote a global transition to a net zero-emissions and a resilient, future-proofed, inclusive, healthy, and circular built environment. The organisation involves stakeholders across the building value chain to support the market and develop effective standards and regulation for green building through its *Decarbonization, Digitalisation, Circular Built Environment, and Blueprint for a Sustainable Built Environment* workstreams.

ACADEMIC INSTITUTIONS AND RESEARCH PROJECTS

Sustainability research programs, which may involve industry, academia, and NGOs can provide collaboration opportunities, support resources, training, and in some cases opportunities to trial and test innovations in the building materials sector. A few examples are:

Buildings as Material Banks (BAMB) was a recent Horizon 2020 project that piloted and demonstrated circular building practices with industry and local actors. The project showcased reversible and transformable building design prototypes through its Circular Retrofit Lab and developed a database of over 300 electronic 'Material Passports' - datasets of materials used in buildings, with a value for recovery and reuse, helping incentivise further material reuse and take-back.

The Circular Construction in Regenerative Cities (CIRCUIT) project aims to bridge the implementation gap between theory, practice and policy and showcase how circular construction approaches can be replicated and scaled. The project is developing approaches to material flow analysis, setting circularity indicators and a producing a materials exchange portal. Demonstration of pre-demolition audits, and a process for material reuse with accompanying life cycle assessment (LCA) and cost assessments will take place in four European cities during the project.

PR.3 Build the right external partnerships



The **LC3** project is a collaboration between universities and research institutes in Switzerland, India and Cuba, which researches, tests and demonstrates limestone calcined clay cement, aiming to improve cost effectiveness and mainstream the material as an alternative to traditional cement. Using limestone and lower-grade clays to reduce the clinker content can reduce CO₂ emissions by around 40% compared to standard cement, without the need for high-cost modification to existing plants. The project provides training and communicates the technical, environmental and financial advantages of this innovative material to stakeholders.

MATERIAL SUPPLIERS, CONSTRUCTION SECTOR, WASTE MANAGEMENT AND CIRCULARITY SPECIALISTS

For companies seeking to implement eco-innovation in this sector, effective partnerships across the value chain will be essential to bring new products to market. Actors may include architects, designers and structural engineers who can specify a new technology, and construction firms who can use the product and demonstrate effectiveness in projects. However, this may require a departure from 'construction as usual', where cost is often the primary driver of a material's inclusion in a building project. Demonstrating the longer-term benefits of innovative building materials may help with engaging construction value chain partners.

Upstream partnerships, with raw material suppliers are often essential for eco-innovation projects to have strong impacts. Many hotspots, whether environmental in relation to raw materials used, or social in relation to the practices of material extraction, can be mitigated by effective collaboration. Putting in place such partnerships, as well as collecting data to set a baseline and identify improvements may be challenging where raw or intermediate materials are imported, but is a recommended action when mapping value chain partners.

At the end of the construction value chain, collaboration with waste management companies, salvage yards, community organisations, repair companies and furniture makers can add value by enabling reuse, repurposing, and recycling of materials and reducing end-of-life storage, transportation, and disposal costs.

Specialist organisations with practical circularity expertise are active in this area, for example **USE-IT** is a Durban-based not-for-profit company working at the local level to improve circularity and create employment. USE-IT supports SMEs in sustainable

business development, devising innovative waste solutions and by operating a database of sustainable building materials such as earth bricks, roof tiles made from post-consumer waste plastic, and flooring made from waste tyres.

External partnerships may also involve public sector actors looking for cost-effective waste management solutions. **Development Alternatives**, a social enterprise in India have worked alongside public and private sector organisations to better understand regional macro-level waste management issues. The case study of *Mapping material flows in Ahmedabad* shows how Development Alternatives' assessment helped improve waste management and reuse of aggregates in the region.

PR.3 Build the right external partnerships



CASE STUDY: MAPPING MATERIAL FLOWS IN AHMEDABAD THROUGH PARTNERSHIPS BETWEEN PUBLIC, PRIVATE AND THIRD SECTOR ORGANISATIONS

Mapping the 'eco-system' of building projects in an area, their material use and potential for repurposing can improve circularity and environmental performance. This can also provide financial benefits, by reducing costs for waste disposal and creating jobs. [Development Alternatives](#), a social enterprise based in India, has undertaken studies and provides C&D waste management, mapping and planning services, involving external partnership building with both municipalities and the private sector.

A study conducted in Ahmedabad, India, assessed the effectiveness of decentralized waste management between Ahmedabad Municipal Corporation (AMC), the waste collector and Amdavad Enviro Projects Pvt Ltd (AEC), a private sector enterprise which collects, segregates, and processes the C&D waste into new building materials such as concrete blocks.

The study found that the increased use of recycled aggregates using this approach could reduce the cost of finished products such as paving blocks by up to 15%, but that the full potential of cost reduction was not yet being realised due. This was in part the logistical challenges in utilizing the entire range of 'dump' sites; the study found that only 2 out of the 16 sites were being actively used and the location of the other sites did not yet enable cost effective transport and processing. However, the study mapped concrete block manufacturers businesses in the vicinity and found high potential demand for recycled aggregates.

It was found that awareness of companies of the potential supply and cost savings from using recycled aggregates was low. Further insights found that companies further away from stone quarries generally paid a higher price for virgin aggregates, identifying potential target customers for recycled material. Furthermore, the study identified that use of mobile crushing units could improve the cost effectiveness of processing waste and delivering to concrete block manufacturers. Partnerships with the range of external stakeholders in this study enabled improved understanding of the needs of companies, and opportunities for cost reduction, as well providing a better picture of the potential to improve material efficiency in different areas within a region. This type of activity can add value, reducing waste, providing data and insight and improving connectivity in the value chain.

REGULATORY BODIES AND TEST HOUSES

Building relationships with regulatory bodies can provide a quicker and more cost-effective route to compliance with standards and codes. A proactive approach can help uncover problems at the design stage and avoid complications further along the chain, reducing time spent auditing and checking. As well as standardised testing services, test houses can sometimes recommend how to demonstrate performance and quality for new, innovative products where test methods and harmonized standards are not yet in place. This can provide customer assurance, certification and routes to market.

References and resources

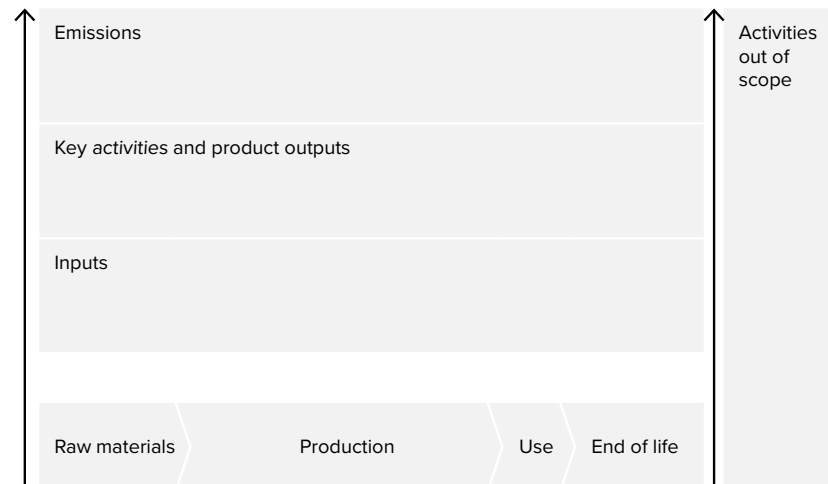
- World Green Building Council (WGBC). Available from: <https://worldgbc.org/>
- GlobalABC. Available from: <https://globalabc.org/>
- Alliance for Sustainable Building Products (ASBP). Available from: <https://asbp.org.uk/>
- Global Cement and Concrete Association (GCCA). Available from: <https://gccassociation.org/>
- Buildings as Material Banks (BAMB) project. Available from: <https://www.bamb2020.eu/>
- Circular Construction in Regenerative Cities (CIRCuiT) project. Available from: <https://www.circuit-project.eu/>
- USE-IT. Available from: <https://use-it.co.za/>
- Development Alternatives. Available from: <https://www.devalt.org/>

PR.4

Identify sustainability hotspots across the value chain



Template of Life Cycle Inventory



A key step in the eco-innovation process is to understand the value chain sustainability hotspots, opportunities and threats.

Within this, the activity PR.4 will help you to conduct hotspot identification through the Life Cycle Inventory and Life Cycle Thinking templates, which have been completed for the concrete value chain (Figure 8 and Table 21).

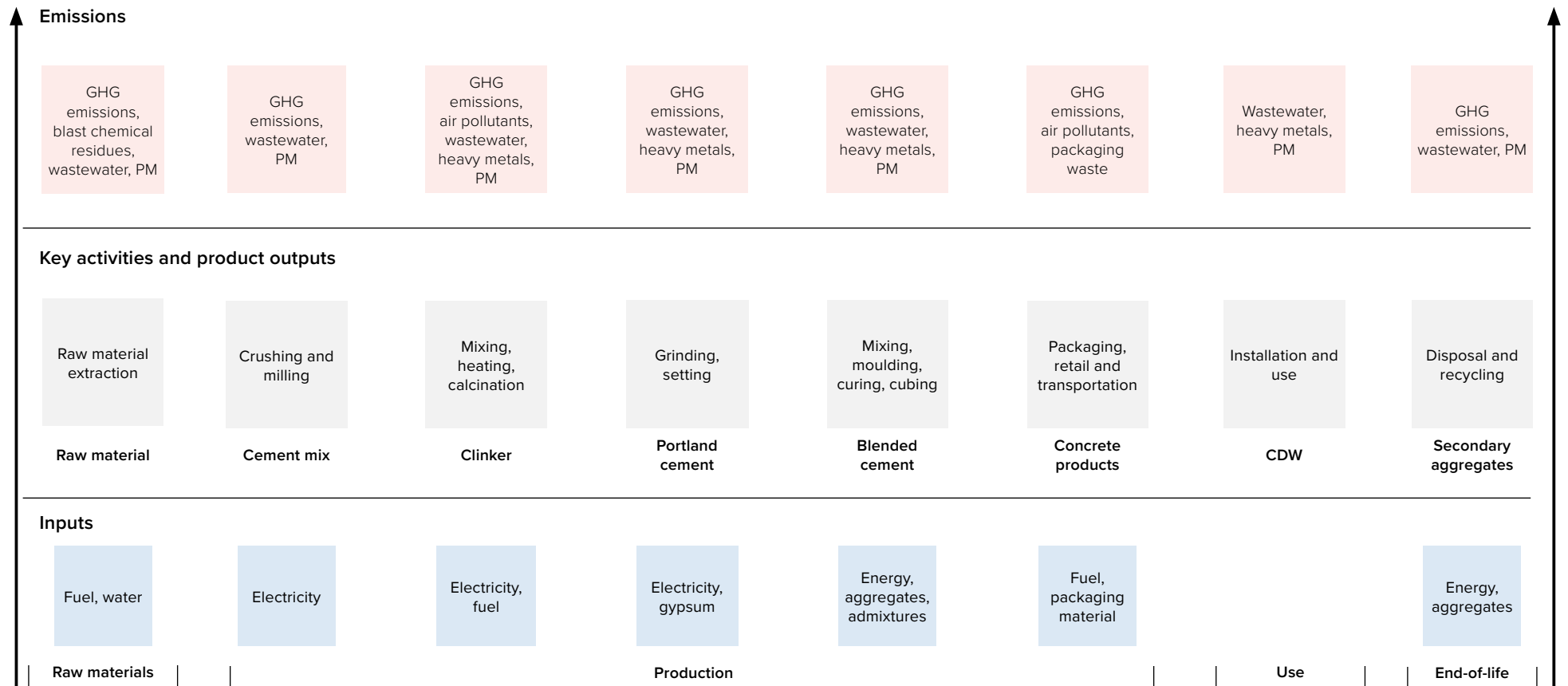
To complement this, a series of tools to identify and assess hotspots, and sustainability challenges and opportunities across the life cycle of common building materials are also explored in this section.

PR.4 Identify sustainability hotspots across the value chain



LEARNING CASE STUDY OF LIFE CYCLE INVENTORY FOR A CEMENT AND CONCRETE MANUFACTURER

Figure 8 - Life cycle Inventory for the cement and concrete value chain



PR.4 Identify sustainability hotspots across the value chain



LEARNING CASE STUDY OF LIFE CYCLE THINKING FOR A CEMENT AND CONCRETE MANUFACTURER

Table 21 - Life cycle thinking for the concrete value chain, considering environmental, social and economic sustainability impacts

Environmental, social and economic impacts rated as low (L), medium (M) and high (H), to help identify hotspots.

*H= high impact, M= medium impact, L= low impact

Phase	Activity	Inputs	Product Outputs	Emissions	Environmental Impacts		Social Impacts			Economic Impacts
					Resource use	Ecosystem quality	On workers	On consumers	On stakeholders	Profitability
Materials	Raw material extraction	Fuel, water, blasting chemicals	Raw materials	GHG emissions, wastewater, PM, Noise	Extracting finite resources (H) 'Blue' water used to wash aggregates (M)	Impact on biodiversity & land (H) Water pollution (M)	Unsafe working practices (H) Gender issues and child labour (M)		Local communities: displacement, land use disputes, pollution (H) Geopolitical conflict over natural resources (M)	Price volatility of raw materials (M) Low profit margins from saturated market (H) Rising costs of raw materials (M) Market competition (H)
Production	Concrete production	Electricity, fuel, aggregates, admixtures		GHG emissions, air pollutants, wastewater, heavy metals, PM	Fossil fuel use for electricity and heat production (H) Water, sand, limestone, gypsum (H)	Air emissions (NOx, SO2, dust) (M) Wastewater (M)	Unsafe working conditions (H) Workplace gender issues (M)		Local impact of industrial production (M) Climate change impacts of concrete production (H)	High energy costs of production (M) Cost of compliance with environmental legislation (M) Low profit margin on concrete products (M)
	Packaging, retail and transport	Fuel, packaging material		GHG emissions, air pollutants, packaging waste	Fossil-derived plastic packaging (L) Transport fuel use (M)	Low biodegradability of packaging (M) Transport emissions (NOx, SO2, PM, noise) (M)		Packaging waste (L) Impacts of increased road traffic, freight emissions (M)	Sunk costs of single use packaging (L) Proportionately high cost of transporting heavy materials (M)	

PR.4 Identify sustainability hotspots across the value chain



Phase	Activity	Inputs	Product Outputs	Emissions	Environmental Impacts		Social Impacts			Economic Impacts
					Resource use	Ecosystem quality	On workers	On consumers	On stakeholders	Profitability
Use	Installation, in-use phase	Cement and concrete materials	Complete concrete structures	Construction and demolition waste (C&DW)	Mortar, water, aggregates (H)	Site emissions, e.g. particulate matter (M)	Current tendering models driving down wages (L)	Lock-in effects to concrete as building material (H)	Higher demand for housing and buildings (M)	Low profit margin on construction projects (M)
							Exposure to harmful substances in cement (e.g. heavy metals) (M)	Maintenance and repair issues (L)	Exacerbated environmental hazards -e.g. drought, heat stress (M)	Cost increases from value chain and on-site process inefficiency (M)
End-of-life (EOL)	Disposal and recycling	Energy, aggregates	Secondary aggregates	Wastewater, PM	Loss of metals, minerals (M)	Landfill site demand (M) Heavy metal leaching (M) Water waste (M) Demolition air pollution (M)	Potential health risk for workers in construction and demolition (CDW) (M)		Increased demand for landfill sites (M)	Linear disposal fails to capture secondary market value (M) Disposal costs, e.g. landfill taxes (M) Competition from alternatives to traditional use concrete (M)

PR.4 Identify sustainability hotspots across the value chain



From the completion of the Life Cycle Thinking template for the concrete value chain (Figure 8), hotspots (significant economic, environmental, and social impacts) that might be encountered are:

- Environmental effects of raw material extraction from resource depletion and water and fuel use
- Unsafe working conditions, low wages, a lack of worker protections, low gender equality in the industry
- Exacerbated environmental hazards during lifetime of concrete including risk of flooding, downstream drought, and heat stress
- High energy intensity of production processes
- High transportation costs
- High levels of waste from production processes, in-use and at end-of-life
- Low profit margins on raw materials due to high-cost overheads and high market competition

It is important to make an objective and accurate assessment of the relative magnitude of the different hotspots encountered. For building materials, hotspots related to the end product may often be connected to upstream, raw material extraction and processing stages – these may cover all three of the environmental, social and economic hotspot categories. Opportunities to affect change at this stage of the product life cycle may be quite variable, and if there is not an effective flow of information and data from companies at this stage of the value chain, the opportunity may be limited.

Strengthening relationships with upstream companies is a key aspect of delivering effective eco-innovation projects that address key hotspots. However, it may be difficult for individual SMEs to influence the practices of upstream material suppliers to improve sustainability, particularly with larger firms, if the SME does not have substantial buying power. Governments' policy instruments may be in place to support this – examples are given in the section *Supply Chain and participation in global value chains* of the OECD paper [SMEs: Key Drivers of Green and Inclusive Growth](#) of government interventions in Korea to increase the stringency of environmental regulations for SME suppliers, and social welfare criteria could also be included in this.

SMEs may also find that their ability to influence the sustainability performance of suppliers is assisted by operating as a collective with other firms or trade bodies, to agree criteria and improve the provision of data.

References and resources

- Standards and guidance for more sustainable procurement:
 - BES 6001 - Responsible Sourcing of Construction Products. Available from: <https://www.bsigroup.com/en-GB/bes-6001-responsible-sourcing-of-construction-products/>
 - ISO 20400 – Sustainable Procurement – Guidance. Available from: <https://www.iso.org/standard/63026.html>
- Circular Built Environment Reports. One Planet Network Sustainable Buildings and Construction Programme. Available from: <https://www.oneplanetnetwork.org/programmes/sustainable-buildings-construction/cbe>
- Life-cycle inventory analysis of concrete production: a critical review. Gursel A, Masanet E, Horvath A, Stadel A. Available from: <https://doi.org/10.1016/j.cemconcomp.2014.03.005>
- SMEs: Key Drivers of Green and Inclusive Growth. OECD. Available from: https://www.oecd.org/greengrowth/GGSD_2018_SME%20Issue%20Paper_WEB.pdf

PR.4 Identify sustainability hotspots across the value chain



CLIMATE CHANGE ADAPTATION AND RESILIENCE IN THE BUILT ENVIRONMENT

With the increasing frequency and intensity of weather events being seen due to climate change, and increased urbanisation, it is crucial to recognise the role of building products in improving the resilience of the built environment. Impervious surfaces can contribute to flooding and increased water runoff, carrying pollutants from roads and industrial areas into the natural environment. In four European cities studied, for every 1% increase in area of impervious surface, flood risk is modelled to increase by up to 10% under 2.6-4.3°C of warming. In Indonesia, increased urbanisation between 2000 and 2030 is projected to increase the risk of river and coastal floods by 76-120%.

The use of permeable surface building materials can improve how water enters the ground and joins natural watercourses and aquifers, or is diverted and harvested. Permeable pavement systems can also trap and break down pollutants such as solid particles, hydrocarbons and heavy metals. China's national Sponge Cities Programme saw deployment of this technology in Wuhan, where daily precipitation reached 472.3mm in 2020 (a one-in-50-year storm is around 303mm per day) but did not lead to serious flooding or waterlogging.

Increasing temperatures and heat waves can be exacerbated by the urban heat island effect (UHI). This is caused by higher temperatures from solar radiation from surface materials and buildings, and heat from human activity and vehicles, compared to surrounding parkland and rural areas. The resultant heat stress can increase energy consumption for air conditioning, exacerbate pollution effects, and affect both human health and productivity. Depending on the extent of climate change, between ½ - ¾ of the global population are at risk of exposure to life-threatening periods of extreme heat and humidity by 2100, with mid-latitude cities likely the most affected.

A range of sustainability improvements in building products and materials can contribute to a more resilient built environment. This can include developing surface and paving materials with higher reflection, which absorb and radiate less solar energy. As well as reducing flood risks, permeable surfaces can also provide cooling when absorbed water evaporates. Energy-harvesting surfaces with embedded pipes can exchange heat from surfaces and be used elsewhere.

Beyond this, various climate-adaptive building materials are being seen with properties that change depending on conditions. This includes phase-change materials (PCMs) for passive heating and cooling and thermal regulation, shape memory alloys, thermobimetals and thermochromatic materials on building facades that can change shape or colour when heated to reflect more sunlight on hot days.

References and resources

- UNEP, (2021). [A Practical Guide to Climate-resilient Buildings and Communities](#).
- C40 Cities, (2019). [Reducing climate change impacts on new buildings](#). C40 Knowledge Hub.

PR.4 Identify sustainability hotspots across the value chain



BACKGROUND INFORMATION

ASSESSING SUSTAINABILITY IMPACTS OF BUILDING MATERIALS

Many tools and studies are available to identify environmental hotspots and opportunities to address when applying eco-innovation.

Life cycle assessment (LCA) and Environmental Product Declaration (EPD) data can quantify and compare impacts of materials and products, and may be available through supplier websites, research papers and open-source tools. Another approach to assess the impacts of materials is an environmentally extended input-output approach. Data can be used to compare materials for the same application, for example assessment of the impacts of an equivalent unit of steel, timber or concrete to be used in a building frame.

ENVIRONMENTALLY EXTENDED INPUT-OUTPUT (EEIO) ANALYSIS

Environmentally extended input-output (EEIO) models enable environmental impacts to be quantified based on monetary data. This involves linking monetary transactions for different sectors with environmental statistics information for these same sectors, enabling the environmental impact intensities to be determined such as energy use and carbon emissions intensity (kg-CO₂e per unit cost of goods).

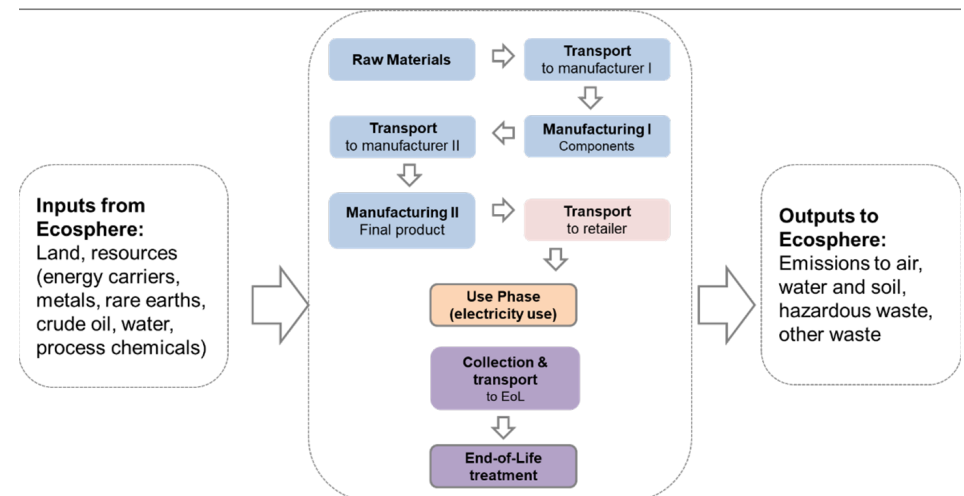
EEIO can be used as a method on its own, or in a hybrid way with LCA. The EEIO approach is generally used more at a macro level, for instance for a building as opposed to specific building material products, but in terms of products and scope 3 carbon footprinting it can be used in a hybrid way with LCAs to provide detailed impact assessments. Further information can be found in the IEA (2016) study listed in the resources below, which also compares EEIO analysis to process based LCA approach, and hybrid use of the two, providing insight on the pros and cons of these approaches.

LIFE CYCLE ASSESSMENTS (LCAs)

To determine the impacts associated with different building materials, there are different options depending on time, budget and expertise. The most comprehensive approach is to conduct a detailed life cycle assessment (LCA). This methodology for LCA is detailed in ISO 14040:2006.

This is a four-step method to evaluate the environmental impacts of systems or products, over their entire life – from production, to use, reuse, recycling or disposal (this is sometimes called 'from cradle to grave').

Figure 9 - Overview of product life cycle assessment (LCA) stages and impacts. Source: Lund University International Institute for Industrial Environmental Economics.



PR.4 Identify sustainability hotspots across the value chain



BACKGROUND INFORMATION

STEP 1: DEFINE GOALS AND SCOPE

For example, a goal may be to compare two different variants of the same product or material, or the impacts of a building using different designs and materials. A functional unit (e.g. a kg of concrete, or m² of flooring) should be established for fair comparison. System boundaries (e.g. cradle-to-gate, cradle-to-grave) define the life cycle stages that you will include in your analysis.

STEP 2: LIFE CYCLE INVENTORY (LCI)

Complete an inventory of data on all material and energy inputs, and environmental outputs (releases) associated with the product or system you are analysing.

This data can be collected directly through measurements, from peer-reviewed academic literature or specialist software (or a combination of methods). LCI databases such as [Ecoinvent](#) can help with this process, although many require payment for access.

STEP 3: LIFE CYCLE IMPACT ASSESSMENT (LCIA)

Evaluate the impacts associated with the inputs and outputs. This involves two key stages – impact category selection and classification, and characterization. With the former, you define the impacts relevant to the system or product, and assign the inventory elementary flows to these impact categories.

Common impact categories include water use, energy use, climate change (in terms of global warming potential, see the ‘Key Concept’ box), toxicity, eutrophication, ozone depleting gases, smog and solid air pollutants, and acidification. All impacts are quantified in terms of the scale of impact contribution per functional unit, so for GWP this is measured as kilogram of CO₂ equivalent per functional unit.

Figure 10 shows the results from an embodied carbon study of a light steel framed building. LCAs should consider regional aspects (carbon intensity of different national electricity grids, transportation distances), and in-use time periods of materials.

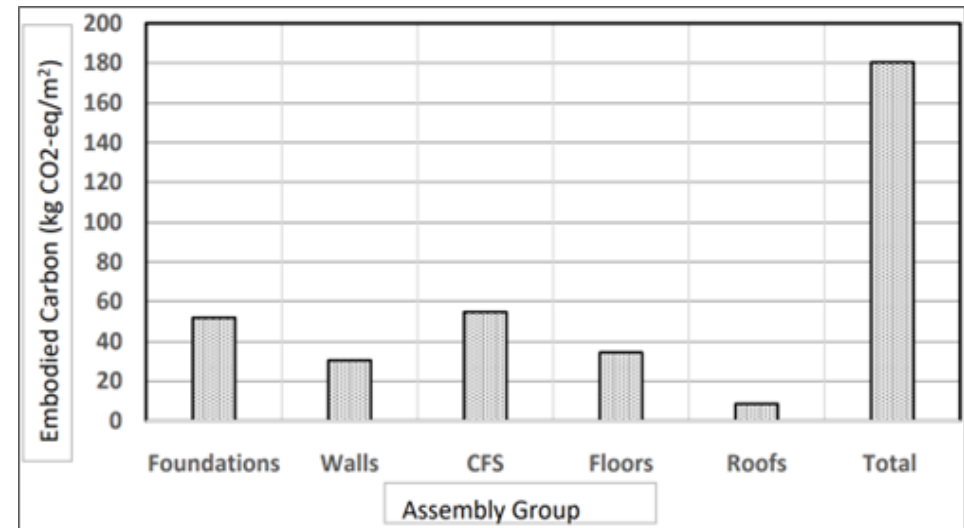


Figure 10 – Embodied carbon of components of a light steel framed building across full life cycle. Source: Abouhamad, M., Abu-Hamd, M., (2020). Life Cycle Environmental Assessment of Light Steel Framed Buildings with Cement-Based Walls and Floors. Faculty of Engineering, Cairo University. Available from: <https://bit.ly/3h4uxtY>.

STEP 4: INTERPRETATION AND EVALUATION

The final step is to interpret and evaluate your LCA to identify sustainability hotspots and potential opportunities for improvements, which can help inform priority areas for eco-innovation. It is important to recognize uncertainty and limitations related to data availability and quality, to ensure you have an accurate and complete study to inform decision making.

PR.4 Identify sustainability hotspots across the value chain



KEY CONCEPT – QUANTIFYING GLOBAL WARMING POTENTIAL (GWP)

GWP measures the emissions of various greenhouse gases causing global warming from a unit amount of a substance, accumulating over a specified time period, relative to a reference substance – carbon dioxide (CO₂). This accounts for the combined effect of the relative effectiveness of GHGs in causing warming, and the different times that GHGs remain in the atmosphere.

It is best practice to consider the cumulative forcing over 100 years, aligned with emissions ‘budgets’ to keep global warming to below 1.5°C or 2°C by 2100 (hence why frequently called GWP100). For instance, over a 100-year period, [a kilogram of methane \(CH₄\)](#), [nitrous oxide \(N₂O\)](#), and [carbon tetrafluoride \(CF₄\)](#) respectively have 28, 265 and 6630 times the [climate forcing contribution of CO₂](#). These proportions are used to quantify CO₂ equivalent of each of these substances.

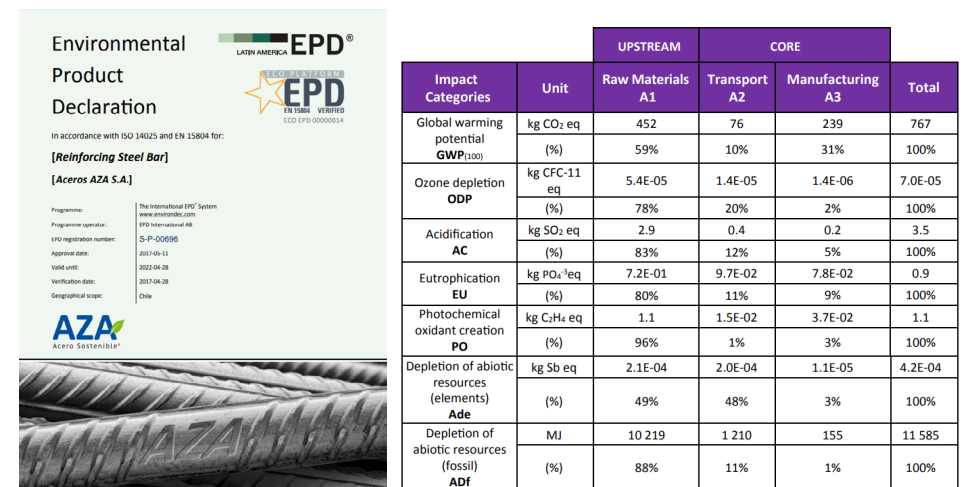
USING ENVIRONMENTAL PRODUCT DECLARATIONS TO IDENTIFY SUSTAINABILITY IMPACTS

Environmental Product Declarations (EPDs) provide a standardized means of reporting life cycle impacts, that can be used to compare materials and products. EPDs are based on ISO 14025, and European and many international EPDs also comply with EN 15804 (some are based on ISO 21930). Due to the use of different standards used in some cases, it is necessary for users to familiarise themselves with the established regional or industry practice.

Figure 11 shows estimated environmental impacts including global warming potential and hazardous waste across upstream and manufacturing activities for a declared unit (DU) of 1 tonne of steel bar product from AZA Acero.

A wide range of global EPD databases are available (e.g. [EPD India](#), [EPD Latin America](#)), often hosted by certification bodies or national institutions.

Figure 11 - Extract from AZA Acero Sustainable Environmental Product Declaration for reinforcing steel bar



PR.4 Identify sustainability hotspots across the value chain



EMBODIED CARBON TOOLS AND CALCULATORS FOR BUILDINGS

Conducting detailed LCAs and EPDs is not always feasible, so higher-level assessment methods may be needed to identify sustainability hotspots. More tools are becoming available to enable concise hotspot and improvement quantification of materials and buildings, with shareable reports to assist design and decision making.

Several of these provide embodied carbon breakdowns by life cycle stage and structural element, and performance comparisons against rating tools and other building benchmarks (e.g. embodied carbon per m²) (see tools below).

References and resources

Standards and guidance:

- Greenhouse Gas Protocol global standards. <https://ghgprotocol.org/companies-and-organizations>
- ISO 14040 Series – Environmental management – life cycle assessment
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declaration of construction products and services
- [International Energy Agency, \(2016\). Evaluation Methods of Embodied Energy CO₂eq for Building Construction \(Annex 57\).](#)

Databases:

- Global LCA Database Access Network (GLAD). <https://www.lifecycleinitiative.org/resources-2/global-lca-data-network-glad-2/>
- SCP Hotspots Analysis Tool (SCP-HAT), with country and sector profiles, including different building materials and construction. <http://scp-hat.lifecycleinitiative.org/>
- Ecoinvent LCI database. <https://www.ecoinvent.org/>

Software:

- Open LCA. <https://www.openlca.org/>
- CMLCA. <http://www.cmlca.eu/>
- Carbon Calculations over the Life Cycle of Industrial Activities. <http://www.ccalc.org.uk/>

Tools:

- Greenhouse Gas Protocol tools for GHG emissions inventories, including building products manufacture. <https://ghgprotocol.org/calculation-tools>
- One-Click LCA. <https://www.oneclicklca.com/>
- Builders for Climate Action – BEAM Estimator. <https://www.buildersforclimateaction.org/beam-estimator.html>
- Building Transparency - Embodied Carbon in Construction Calculator (EC3). <https://buildingtransparency.org/ec3>

PR.4 Identify sustainability hotspots across the value chain



INVENTORY, ASSESSMENT AND SUBSTITUTION OF CHEMICALS OF CONCERN

Identifying chemicals of concern in building materials, improving transparency of data and improving the approaches and harmonisation of regulatory landscapes is gaining increased focus in the industry. An Infohub of resources providing support on managing and reducing the impacts of chemicals of concern in building materials and products has been produced, and can be found on the [SAICM Knowledge website](#).

It is recommended that companies conduct an inventory of the chemical ingredients in their products, which can be done in-house, or with the assistance of an external expert. Provision of chemicals data along the value chain is often limited – manufacturers and retailers of finished products have in some cases reported that they do not know which substances are contained in their products.

Chemical regulations differ in scope and stringency between regions, resulting in some substances being restricted in one region, but not another. This can be problematic for procurement actors in a global supply chain. Given the sheer number of chemicals in the global marketplace (estimated at over 85,000), and the approach of most legislation to regulate individual chemicals rather than by the common risks of a group, this can be challenging. However, there are several tools and models that can be used to identify harmful substances, assess toxicity impacts, and find alternatives. Further guidance on developing an effective approach for chemical screening and inventory is given in section ST.4.

THE 'SIX CLASSES' APPROACH

When conducting inventory or assessing chemicals, procurers may encounter various claims that a product or material complies with regulations or is free of a well-known chemical of concern. A material procurer may only have the responsibility to check that an exact substance is not present on a safety data sheet or ingredient list, and may not have the expertise to make a wider assessment.

Considering the body of safety evidence related to entire classes of similar chemicals enables better risk assessment than only researching an individual substance. New substances entering the market are often not widely tested or do not have any publicly available information on their effects. As a result, applying the 'Precautionary Principle' to procurement can be highly beneficial in the case of chemicals in products.

The [Six Classes](#) approach was developed by the Green Science Policy Institute, which shares information on chemical properties, functions, and alternatives as well as working to prevent and raise awareness of 'regrettable substitution', i.e. replacing a chemical with a related chemical that might also be harmful. The Six Classes are PFAS, Antimicrobials, Flame Retardants, Bisphenols and Phthalates, Some Solvents, and Certain Metals.

Alongside taking an approach of this type, ensuring that there is more transparency in chemical data passing through the value chain is vital to improve chemical safety for production operatives, end-users and in waste management. Procurers can improve practices by asking for more data or specifying mandatory chemical disclosure in tenders, but upstream supply chain actors also have a proactive role to play to address this issue.

PR.4 Identify sustainability hotspots across the value chain



TOOLS AND RESOURCES FOR CHEMICAL ASSESSMENT AND MANAGEMENT

CHEMICAL SCREENING AND IDENTIFYING POTENTIALLY HAZARDOUS CHEMICALS IN BUILDING PRODUCTS

- Clean Production Action operate a range of tools based on an open standard used by researchers, product formulators and certifiers in the building material industry.

These include the **GreenScreen for Safer Chemicals** method, which enables safety evaluation through five 'benchmark ratings' (detailing the degree to which a chemical is considered safe based on a body of evidence, as well as identifying substances whose safety is as yet unknown).
- **The Healthy Building Network** provides a hierarchy of chemical safety ratings and considerations for a range of building materials, considering the variations within each category, with the associated assessment tool [Pharos](#).
- **The Healthy Materials Lab** provides lists of independently vetted, common building products with reduced toxic chemicals.
- The **eChemPortal** provides free public access to information on the properties of chemicals, such as toxicity, ecotoxicity, environmental fate and behaviour, exposure and use and classification and labelling.
- The **Perkins & Will** transparency list provides a database of substances of concern in building products.
- The **International Living Future Institute** compiles the 'Red List' – a database of harmful substances in building material.

Drywall Product Guidance ⓘ



HBN's Product Guidance identifies the biggest opportunities to select types of products that are safer for occupants, fence-line communities, and workers. Use the red-to-green ranking below to select safer product types by avoiding those in the red and preferring those in yellow and green.

Here is some general guidance to use when choosing drywall materials:

- ✓ Prefer drywall with the lowest amount of pre-consumer recycled content you can find.
- ✓ Look for drywall with post-consumer recycled content, and consider how your projects can separate drywall cut-offs for recycling.
- ✓ Avoid using mold resistant drywall where not needed.
- ✓ Prefer products with a CDPH emission certification.
- ✓ Use lightweight boards when possible.
- ✓ Prefer products with full disclosure of content through Health Product Declarations (HPDs).



Related Resources

[HomeFree General Spec Guidance](#)
A summary of Healthy Building Network's guidance across the main 7 product categories on HomeFree. This is a good resource to share across project teams as a supplement to the more detailed information found on the HomeFree site.

Drywall Made with Natural Gypsum	▼
Mold Resistant Drywall Made with Natural Gypsum	▼
Drywall Made with Synthetic Gypsum (FGD Gypsum)	▼
Mold Resistant Drywall Made with Synthetic Gypsum (FGD Gypsum)	▼

Figure 12 – Healthy Building Network product guidance for drywall

PR.4 Identify sustainability hotspots across the value chain



EVALUATING CHEMICAL IMPACTS

- The database output of the **USEtox Model**, produced by the Life Cycle Initiative (hosted by UNEP), helps building material suppliers and procurers evaluate their chemical impacts. This open and freely accessible tool (<https://usetox.org>) provides a sound scientific basis for comparing the environmental performance of any activity or product, which is associated with chemical emissions over the entire life cycle ([Fantke et al., 2021](#)).
- The database comprises recommended and interim characterization factors including the fate, exposure, and effect parameters. USEtox can produce results for several thousand chemicals already and form a key part of LCAs and chemical risk assessments, footprinting, risk screening and chemical substitution to support decision making for public and private stakeholders in the building materials industry. Thus, the tool is a suitable starting point for prioritizing chemicals/products and developing safer and more sustainable building materials ([Huang et al. 2022](#)).
- USEtox is constantly being improved and the next official version of the model is currently being prepared for release. This version will include an extension from 400 to 8000 non-cancer chemicals for human toxicity as well as an indicator for reproductive/developmental effects. Further, the model will now include more than 7000 chemicals for ecotoxicological impacts, based on a species sensitivity distribution (SSD) approach ([Owsianiak et al. 2022](#)). Recently, a leaflet and new user interfaces as part of a user manual have been developed for the global scientific consensus model USEtox. The new user interfaces consider chemicals in different consumer products, including building materials. All interfaces, including their use, are described at <https://manual.usetox.org>.

IDENTIFYING SAFER SUBSTITUTES AND ALTERNATIVES

- The OECD [2021 Guidance on Key Considerations for the Identification and Selection of Safer Chemical Alternatives](#) (see also sections BR2 and BR3) details approaches to substitution, assessment of alternatives and risk management.

The **OECD Substitution and Alternatives Assessment Toolbox** (SAAT) consists of four areas:

1. **Alternative Assessment Tool Selector:** Inventory of chemical hazard data assessment tools
 2. **Alternatives Assessment Frameworks:** Summary of current frameworks for assessing alternatives, as well as guidance on conducting chemical substitution or alternatives assessment
 3. **Case Studies and Other Resources:** Success stories and learning case studies, other toolkits, and product rating systems
 4. **Regulations and Restrictions:** Lists of international legislation, restrictions and substances of interest in different sectors
- Chemsec provides the [Substitute It Now \(SIN\) List](#), detailing hazardous chemicals recommended to be removed from products and supply chains, and is used by over 20,000 professionals worldwide, including in the building materials industry. The [Chemsec Marketplace](#) can then be used to identify tested alternatives that can substitute chemicals of concern in materials.
 - Additionally, the [BizNGO Chemical Alternatives Assessment Protocol](#), a 7-step framework for decision-making on chemical substitution. The protocol considers the current state of knowledge on alternatives, as well as economic and technical viability.

DECISION MAKING ON CHEMICALS MANAGEMENT

- To support a full end-to-end process, the **IOMC Toolbox** provides resources for overarching decision making in chemicals management, enabling implementation of a chemical management scheme.

EDUCATION AND TRAINING RESOURCES ON CHEMICALS OF CONCERN IN BUILDING PRODUCTS

- The **Healthy Materials Lab** provides a range of educational and training resources aimed at architects, manufacturers and practitioners and others to improve knowledge, transparency and decision making related to health and chemical aspects of building materials.

PR.4 Identify sustainability hotspots across the value chain



References and resources

- SAICM Knowledge Infohub for Chemicals in building materials. Available from: <https://saicmknowledge.org/page/buildings-infohub>
- Chemicals of Concern in the Building and Construction Sector. UN Environment Programme. Available from: <https://saicmknowledge.org/library/chemicals-concern-building-and-construction-sector>
- GreenScreen Assessment Registry. Available from: <https://registry.greenscreenchemicals.org/>
- Heathy Building Network. Available from: <https://healthybuilding.net/>
- Healthy Materials Lab – Material Collections. Available from: <https://healthymaterialslab.org/material-collections>
- eChemPortal. Available from: <https://www.echemportal.org/>
- Perkins & Will Transparency List. Available from: <https://transparency.perkinswill.com/lists/precautionary-list>
- International Living Future Institute 'Red List'. Available from: <https://living-future.org/red-list/>
- USEtox® Model – Life Cycle Initiative. Available from: <https://www.lifecycleinitiative.org/applying-lca/usetox/>
- Chemsec – SIN List – Available from: <https://sinlist.chemsec.org/>
- BizNGO Chemical Alternatives Assessment Protocol. Available from: <https://www.bizngo.org/alternatives-assessment/chemical-alternatives-assessment-protocol>
- OECD IOMC Toolbox. Available from: <https://iomctoolbox.org/>
- Healthy Materials Lab. Available from: <https://healthymaterialslab.org/>

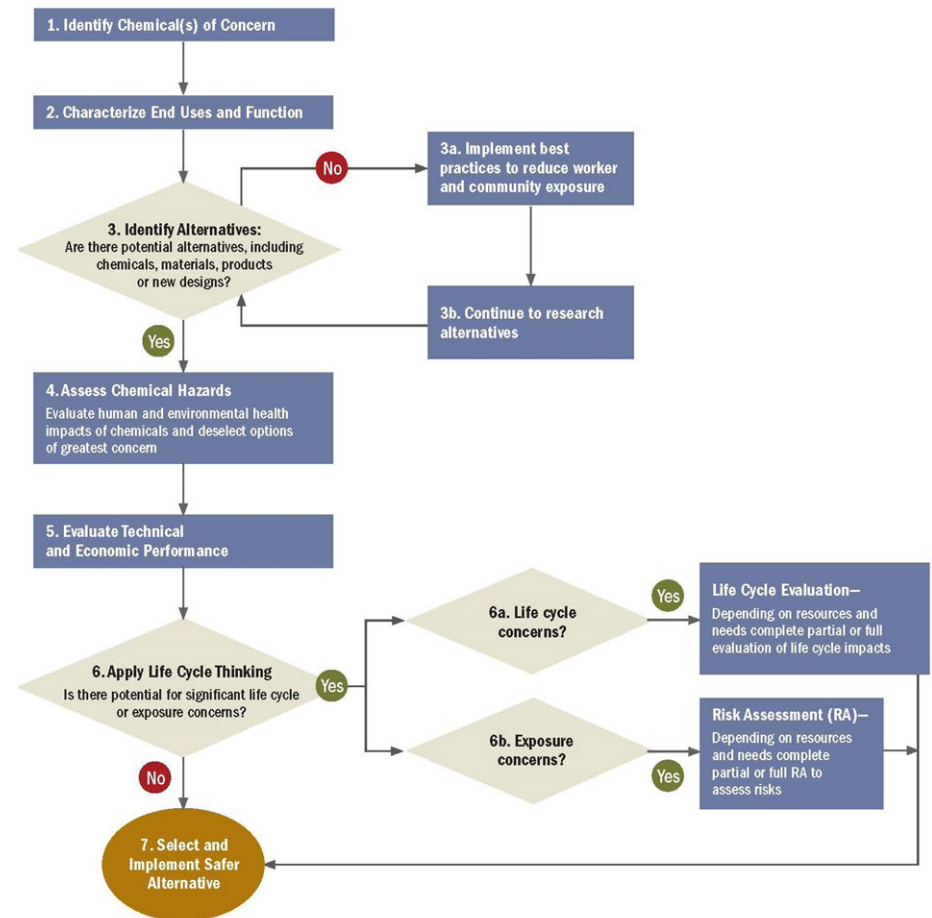


Figure 13 - Extract from BizNGO Chemical Alternatives Assessment Protocol (v.1.1) (pp.5): Screening Logic for Selecting Safer Alternatives to Chemicals of Concern to Human Health or the Environment

PR.5

Identify the general opportunities and threats across the value chain



Template of PESTEL

	Definition	Prompting questions
Political		
Economic		
Social		
Technological		
Environmental		
Legal		

Now that you have identified the sustainability-related threats and opportunities, PR.5 will help you identify other sources of threats and opportunities (that are not directly linked to sustainability issues) in your value chain.

PR.5 Identify the general opportunities and threats across the value chain



TIPS & TRICKS

ASSESS THE FUTURE DIRECTION OF CODES, STANDARDS, LEGISLATION AND POLICY

Changes in legislation – for example, amendments to building regulations and phasing out of materials and products for environmental reasons – are sometimes seen as a threat to established working practices in the construction sector.

But looking ahead and understanding the likely direction of legislation is essential in preparing for the future and identifying new opportunities. Providers of sustainability consulting services can add great value to companies exploring eco-innovation by having in-depth knowledge of regulations, policies and standards. Early assessment of the direction of legislation, and developing short, medium- and long-term roadmaps for changes to products or development of new ones is essential to maintaining a competitive or early-mover advantage.

Considering global regulatory trends, as a whole and where legislation has been more ambitious in one region ahead of others, can provide a valuable insight into the future trajectory of regulations.

With material quality being such an essential aspect of the building materials sector, it is vital that sustainability consultants understand the key quality and safety issues around a product market. This may require developing further technical understanding around a material, its related quality standards and test methods, and use cases which may present threats and opportunities when bringing innovative products and services to market.

Government policies can greatly support eco-innovation in building materials and products, such as through mechanisms and measures for financing, demonstrating, and scaling-up sustainable production and business operations. This includes incentives, subsidies and tax exemptions, grants, and public-private partnerships.

Tracking the direction and regularly reviewing the current frameworks of supportive policy measures can enable eco-innovation opportunities to be capitalized on.

National government websites, and international information hubs can be useful resources for evaluating past and present policies and regulations in place, and locating policy roadmaps to inform about what is on the horizon. See resources section for information on sustainability legislation and policy.

CONSIDER HUMAN-CENTRIC AND 'MACRO' SOCIAL TRENDS

Understanding and staying ahead of social trends can provide an opportunity for construction companies to develop specialisms that provide a competitive advantage.

For example, with increased urbanization, at the same time as growing awareness of sustainability issues, ambition is being shown at the city-level towards improving sustainability, where decision making can outpace national legislation.

For example, the '[15-minute city](#)' concept, established by the Mayor of Paris, Anne Hidalgo, aims to encourage more self-sufficient communities, great availability of amenities and greater space for walking and cycling.

Understanding the intended direction of planning for a city or municipality can help building materials companies to prepare to provide the products and services required for the specific buildings and infrastructure needs of the inhabitants.

The COVID-19 pandemic has also affected the building materials sector. This includes the widespread transition to home working and reduction in the use of buildings as workplaces, as well as increased reliance on more local materials resulting from disruption in the global supply chain.

PR.5 Identify the general opportunities and threats across the value chain



CASE STUDY: [SAVROC TRIPLEHARD](#)

The use of hexavalent chromium, Cr(VI), solutions in the production process for chrome plating has been dominant for years. There are serious concerns about the safety of Cr(VI) for production workers, as well as soil and groundwater contamination from industrial sites. Since September 2017, EU legislation has further restricted its use, with permits for use required under the REACH chemicals compliance regulation.

The industry has been slow to adapt to substitutes such as Cr(III). This is mainly due to lack of familiarity and the perceived higher cost of switching production lines away from the established Cr(VI) production.

Savroc, a Finnish producer of coatings, has developed TripleHard that replaces Cr(VI) with Cr(III), which removes the use of acids in the production phase. By taking a proactive approach to product development that stays ahead of upcoming legislation, the company has gained a first-mover advantage. Alongside being able to demonstrate a differentiated, more sustainable product for customers, Savroc was able to reduce operating costs in a number of areas:

- As all chemicals used are REACH approved, permits for Cr(VI) and authorization fees are not required
- Wastewater management costs are reduced
- New process is more energy efficient and requires reduced air ventilation systems
- Reduced compliance and health and safety resource needed

References and resources – Information on legislation and policies for building material sustainability and eco-innovation

- UNEP Global Chemical Regulations database. <https://chemreg.net/un-landing-page/>
- SAICM Knowledge Hub, Country Profiles includes details on chemicals legislation, laws and policies. <https://saicmknowledge.org/countryprofiles>
- International Energy Agency (IEA) Policies Database. <https://iea.org/policies/about>. Includes filters to find policies on building materials sustainability.
- OECD chemical safety and biosafety. <https://oecd.org/chemicalsafety/>. Hub of information on global chemical legislation, including interactive map.
- Chemical Inspection and Regulation Service (CIRS). <https://www.cirs-reach.com/>. Information source on chemical policy and legislation.
- Chemical Watch. <https://home.chemicalwatch.com/>. Chemical legislation information, analysis and news.
- California Proposition 65 List. <https://oehha.ca.gov/proposition-65/proposition-65-list>

PR.5 Identify the general opportunities and threats across the value chain



LEARNING CASE STUDY OF PESTEL

The PESTEL analysis framework can help you identify general opportunities and threats for the value chain and company emerging from the external environment of the company, and evaluating the timescales, likelihood and impacts of these issues and changes. Table 22 shows a PESTEL analysis completed for a company in the building materials sector.

Table 22 - PESTEL analysis for the building materials sector

Heading	Description of issue/trend	Source or example	Time scale (0-6/7-24/24+ months)	Impact (1= very low, 5= very high)	Likelihood (1= very unlikely, 5= certain)	Significance (Impact x Likelihood)
Political	Geopolitical issues related to raw material supply	Raw Materials and International Relations. Security and Peace	0-24+ months	2	3	6
	Lack of policies and incentives to support construction sector	Challenges faced by the construction industry in Sri Lanka: perspective of clients and contractors	0-24+ months	4	4	16
Economic	Price volatility of raw materials for construction industry	McKinsey. Resource Revolution: Tracking global commodity markets	0-24+ months	4	4	16
	Population growth and rising middle class, increasing demand for building materials	BSRIA: Demographics - how a changing population is transforming the built environment	12-24+ months	4	5	20
Social	Effect of COVID-19 on building material supply chain	PWC: Supply Chain – Mitigating the impact of COVID-19 and building long term resilience	0-12 months	4	5	20
	Gender inequality issues across construction and building sectors	ILO: Baseline Study to Assess Gender Disparities in Construction Sector Jobs	0-24+ months	2	4	8
Technological	Further automation of construction	McKinsey: The impact and opportunities of automation in construction	12-24+ months	3	3	9

PR.5 Identify the general opportunities and threats across the value chain



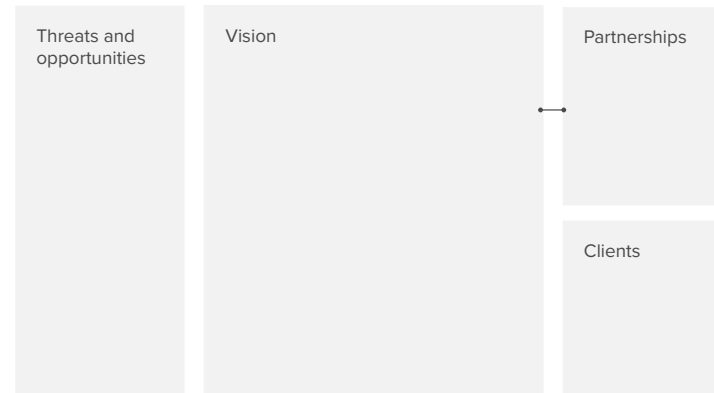
Heading	Description of issue/trend	Source or example	Time scale (0-6/7-24/24+ months)	Impact (1= very low, 5= very high)	Likelihood (1= very unlikely, 5= certain)	Significance (Impact x Likelihood)
Environmental	High proportion of global carbon emissions from building sector	IEA. Global Statue Report for Buildings and Construction 2019	0-24+ months	4	4	16
	High waste generation from construction sector	International Conference on Solid Waste Management. Construction Waste – Potentials and Constraints, S.E. Sapuay International Journal of Environmental Research and Public Health. Waste Mismanagement in Developing Countries: A Review of Global Issues.	0-24+ months	4	4	16
Legal	Regulations on Chemicals of Concern in different regions	Chemical Inspection and Regulation Service – 2016 Global Chemical Regulations Outlook	0-24+ months	2	4	8
	Changing health and safety legislation	UNECE joins global coalition to improve fire safety in buildings through industry standards International Fire Safety Standards	0-12 months	4	3	12

PR.6

Develop a value chain vision



Template of Value Chain Vision



Having assessed both sustainability and the more general hotspots within the building materials industry, the following section illustrates a 'value chain vision' for a more sustainable building materials sector, representing an improved future landscape, which also seeks to address financial and social challenges for the industry.

This is followed by exploring a detailed learning case study for the cement and concrete value chain, which GFC Building Supplies operates within.

PR.6 Develop a value chain vision



An example of a value chain vision for building materials, considering a future situation where many of the hotspots and threats have been addressed, and opportunities realised, is outlined below, with the template of Value Chain Vision completed for cement and concrete in Figure 14.

LEARNING CASE STUDY OF A VALUE CHAIN VISION FOR BUILDING MATERIALS

The building materials industry is successful, profitable, and growing strong in both domestic and international markets. At the same time, it has managed to address a range of sustainability issues. This is demonstrated in the below areas:

- The industry has also made great strides globally in identifying and eliminating certain chemicals of concern from products, with a decrease seen in negative human health impacts. This is in part from effective policy to phase out harmful substances and inherently less healthy materials, and incentivise the take-up of alternatives.
- Focus on the embodied carbon of materials is now mainstream across the value chain. Use of tools to assess the footprint of materials and the design of buildings as a whole are commonplace among designers and architects, and understood by contractors, with materials and products widely available that can reduce this impact.
- Innovative products such as natural fibre plasterboards and biobased paints have entered mainstream markets, with health benefits promoted alongside their environmental credentials.
- Improved product durability is leading to reduced waste and increased customer satisfaction. Circular business models are becoming mainstream, such as those that support modularity and dismantling of buildings and their materials, as well as 'Product-as-a-service' business models, with businesses realising the value of creating long-term customer relationships and developing a better understanding of how to ensure that their products are high performing and long lasting.
- Building materials are being more widely designed and deployed to support built environment resilience and adaptation to climate change, helping future-proof the built environment.
- The amount of data available for building products is vastly increased and accessible globally, through further publishing of material databases and the introduction of material passports.
- Sustainability knowledge is greatly increased across the value chain. Industry staff and customers are receiving clear guidance and training to support the transition to new types of material.
- The industry is also becoming more resilient to rising energy costs through low and zero-carbon processing techniques in value chains. More companies are reducing the energy intensity of manufacturing and choosing to source energy from renewable energy suppliers.
- Value chain risks related to sustainability are being increasingly managed through improved supplier mapping, industry due diligence, and collaborations. A combination of new regulations and customer pressure has improved sustainable and responsible sourcing of raw materials.
- The industry has made substantial progress in addressing gender and racial equity issues, including addressing gender pay gaps, providing equal opportunities, and increasing diversity in leadership positions.
- The role of the local community is considered in multiple ways. This includes addressing health and environmental effects from manufacture, building sites and end-of-life processes. Additionally, the local community is further engaged in sustainable material use and practices, from promotion of better local circularity initiatives, to championing effective local knowledge in material selection and building techniques.

PR.6 Develop a value chain vision



Figure 14 - Learning case study of a value chain vision – cement and concrete

THREATS

Cement has high embodied carbon.

Aggregate extraction from quarries disturbs the environment and is energy intensive.

Energy and water intensity of the production phase.

COVID-19 pandemic causing economic slowdown and industry stagnation, yet opportunity to reset business strategies, products and business models to be successful when market operations return, and become more sustainable.

Concrete can increase flooding and heat stress, which will become a greater problem with climate change (regardless of extent of future mitigation).

OPPORTUNITIES

The building materials industry is being required by national governments to reduce carbon emissions in line with national targets.

Adoption of green building standards is leading to more companies specifying concrete products with lower embodied carbon.

VISION

The cement and concrete industry is successful, profitable and strong in both domestic and international markets, whilst achieving highly improved levels of sustainability.

The high embodied carbon of cement and concrete has been substantially reduced through changes in manufacturing practices, specifically:

- Manufacturers reduce clinker content in cement and replace with alternatives to reduce embodied carbon
- Cement plants are now more efficient thanks to modern equipment
- There has been a shift towards alternative and renewable fuels and electricity sources
- Novel low-carbon cements now have a large market share.

These changes in the industry have helped cement and concrete companies respond to the increasing market demand and regulatory requirements for lower-carbon concrete products. Companies in the cement and concrete industry have also diversified their product portfolios to include sustainable alternative materials for certain applications, such as limecrete and hempcrete.

The industry is giving increased focus to developing resilience in the built environment. Products such as permeable pavements and concrete with high solar transmittance are in increased use for surfacing and building exteriors.

Water management has been improved by the industry by further use of closed-loop water recycling systems and improved effluent treatment.

Circularity improvements have been seen, reducing construction and demolition waste being sent to landfill, with increased collection and reuse of aggregates, lowering embodied carbon and energy use and primary material extraction from quarries.

PARTNERSHIPS

- Research institutes
- Central government departments
- Local authorities
- Cement and concrete manufacturers
- Builders' merchants
- Waste management companies
- Industry consortiums

CLIENTS

- Cement and concrete product manufacturers and retailers
- House builders
- Municipalities requiring public buildings and infrastructure
- Building end-users

PR.7

Develop a value chain pitch



Having developed a vision for a more sustainable cement and concrete value chain, the next step is to tailor this to pitch to a target company within that value chain. The pitch should effectively communicate the importance of sustainability action for this material type, and how you can support the company to address this area.

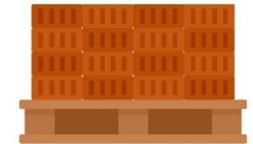
The next section provides an example of a value chain pitch made to GFC Building Supplies for its paint range.

PR.7 Develop a value chain pitch



LEARNING CASE STUDY OF A VALUE CHAIN PITCH FOR GFC BUILDING SUPPLIES

Figure 15 - Value chain pitch to engage GFC Building Supplies on eco-innovation in the paints value chain



THREATS

Health effects of solvent-based paints, microbials and other substances, and legislative direction to remove from markets. Reputational risks and market position from a slow transition to healthier paint.

Supply chain disruption from COVID-19 causing price rises and ingredient shortages.

OPPORTUNITIES

Development of early-mover advantage and expertise in new product formulations and feedstocks.

Paint take-back and recycling service offering.

Paint as a service schemes with clients for large-scale contracts.

Product differentiation by developing paints for niche applications and building surfaces.

Use of novel and local materials as paint ingredients.

Cost saving opportunities from waste reduction.

KEY MESSAGES

Within the building materials industry, paints are a high contributor to environmental impacts, related to carbon emissions from the use of fossil-based feedstocks, and from water contamination issues from disposal.

Increased focus is also being placed on health aspects, with consumers demanding low-VOC products that do not negatively impact indoor air quality, and removal of lead-based formulations from the market.

The direction of legislation is moving towards paints with lower VOC emissions and safer chemical ingredients, with more public sector tenders specifying sustainable procurement criteria and greater transparency.

We have a proven methodology to support the implementation of eco innovation that we can use to help you. This includes:

- Partnership development with innovative companies and research institutions piloting novel formulations
- Market analysis of competitors
- Support to engage test houses and building rating scheme operators to help with routes to certification or inclusion in building rating schemes

COMPANY

GFC Building Supplies - CEO of company

MARKET

Paint suppliers in country

PR.7 Develop a value chain pitch



TIPS & TRICKS

PROVIDE RELEVANT EXAMPLES AND INSPIRATION

Inspire change by showcasing examples of similar companies that have successfully adopted eco-innovation, including examples of how they overcame challenges associated with changes to their business models practices.

Providing case studies of successful eco-innovation projects from competitors, backed up by top-level performance data, statistics and customer feedback can contribute to developing a compelling business case for implementing eco-innovation in the company's business model.

HIGHLIGHT SHORTER-TERM OR LOWER RISK OPPORTUNITIES

Focusing on how eco innovation could open up new business opportunities in the short term for example specific industry demand linked to new building standards, as this is more likely to attract the attention of the CEO. This may include providing an overview of projects requiring lower or no capital investment, in areas of high expertise for the company.

An initial assessment of this type of opportunity can a useful precursor to the subsequent SWOT and TOWS analysis presented in section ST.7.

IDENTIFY OPPORTUNITIES TO TAKE ADVANTAGE OF SUSTAINABILITY POLICIES AND FINANCIAL INCENTIVES

Companies may not be fully aware of the opportunities presented by government policies or incentive mechanisms. Targeted support can help them to understand the requirements and finer detail of sustainability-based policy instruments, or tender specifications that could lead to further business opportunities. Where these are in place, companies can seek to align with sustainable public procurement criteria – tender specifications may require materials to meet thresholds on carbon footprint, proportion of recycled or reclaimed materials, sourcing distances, in-use performance or the avoidance of particular substances. Partnering with construction companies seeking to achieve a high score on a rating system by offering sustainable products may provide this opportunity to suppliers of building products and materials.

Companies developing eco-innovation projects may also benefit from financial instruments in the private sector. Despite some increased capital costs from more sustainable materials compared to conventional ones, greener buildings should deliver lower operational costs, asset appreciation and increased rental income generation, reducing the lending risks for banks. Whilst green mortgage products are fairly new and a further evidence base is needed, these are being increasingly seen from a number of major banks. These are likely to rely on eco-labels or existing building assessment tools such as LEED, national programmes such as the [GREENSL® RATING SYSTEM](#) in Sri Lanka, or IFC's [Edge](#) tool, designed for middle-income and emerging markets. In turn, this is expected to create further demand for more sustainable building materials, strengthening the business case for eco-innovation.

References and resources

- Sustainable Building Finance: Supporting green mortgage development in Sri Lanka. UNEP Finance Initiative, 2021. Available from: <https://saicmknowledge.org/sites/default/files/publications/Sustainable%20Building%20Finance-supporting%20green%20mortgage%20development%20in%20Sri%20Lanka%202.pdf>

PR.8

Plan and implement engagement activities



The Prepare phase up to this point has enabled you to understand the main challenges facing the building materials sector, and how these relate to firms of different sizes in the value chain.

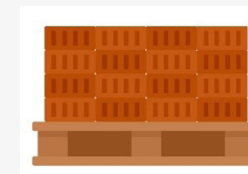
You will now start to engage companies in your target market, identify their specific needs, and get them interested in your eco-innovation services.

PR.8 Plan and implement engagement activities



LEARNING CASE STUDY OF COMPANY ENGAGEMENT PLANNING FOR GFC BUILDING SUPPLIES

GFC Building Supplies has been selected as a target company for eco-innovation following a regional review of building materials companies, as shown in PR1. Through initial contact and research of the company, a profile has been developed to enable better understanding of the opportunities and barriers to implementation of eco-innovation that may exist.



COMPANY PROFILE – GFC BUILDING SUPPLIES

- The company has a diverse portfolio of business interests and income streams, across multiple product markets and types of construction project they engage with
- Experienced staff with have a large bank of technical knowledge on building materials, with some knowledge of sustainability aspects
- The company has established processes and internal quality systems, and a strong reputation with various construction sector actors, including main contractors
- Few external collaborations are currently in place
- Senior management is fairly risk-averse, but recognises the need for changes in the industry, working practices and culture
- The company structure is relatively flat, enabling fast decision making and transparency
- The construction sector is currently expanding at the national level, but with concerns related to material supply and a high dependency on the import market. The need to improve innovation has been highlighted, but innovative products and practices have yet to be proven at scale.

Table 23 - Staff breakdown at GFC Building Supplies

Permanent staff	Number
CEO	1
Senior management team – department heads	5
Sales and product buyers	6
Product development	3
Warehouse, workshop and production staff	5
Logistics and delivery	4
Business development	3
Marketing	4
Retail shop	4

PR.8 Plan and implement engagement activities



Permanent staff	Number
Accounting and finance	3
Quality and compliance	2
Human resources (HR)	2
IT	2
Administration	3
Total	47

BUSINESS OPERATIONS

- GFC Building Supplies sell mainly third-party building products, with a small own-brand range
- The majority of the business is geared towards trade sales, maintaining existing business and improving procurement to increase margins
- The Business Development team maintains existing client relationships, but also tracks new sector trends and targets niche projects and tenders. These include public sector and social housing contracts, including those with sustainable procurement policy (SPP) in place
- The product development team are responsible for specifying and production of the own-brand product range.
- One specialist staff member in this team works on formulations for the own brand range, with scope to improve the performance and reduce production cost of the range
- GFC Building Supplies are also exploring new service-based offerings related to repair and equipment leasing.

A pitch to the CEO has been developed in section PR7. However, initial discussions suggest that that engagement with other staff and departments is also possible, despite a limited window of opportunity due to the time pressures faced by the business.

OPPORTUNITIES AND STRATEGIES FOR ENGAGEMENT WITH OTHER STAFF COULD INCLUDE:

- Discussions with the head of finance regarding the different profit margins on products, materials, and services
- Interviews with buyers on market and technological trends related to particular building materials
- Workshop with front line retail and logistics staff on industry trends and customer feedback on products
- Interview with Head of Operations on the varying overheads encountered by the business
- Develop questionnaire for HR department on opportunities to increase the gender balance, training, and worker retention in the industry
- Discussion with New Product Development manager on current opportunities for product innovation
- Interview with account managers on split of new and repeat business
- Discussion with sales and product buyers to establish the level of sustainability knowledge in the team and any procedures or criteria in place to assess sustainability attributes of products and materials procured

PR.8 Plan and implement engagement activities



TIPS & TRICKS

CONDUCT A COMPANY SKILLS GAP ANALYSIS TO IDENTIFY EFFECTIVE ENGAGEMENT ACTIVITIES

Understanding internal processes and procedures, the main areas of expertise in a company, available resources and organisational culture can feed into a gap analysis of needs for support to eco-innovation strategies, and plan effective engagement activities.

Sustainability consultants can bring specialist knowledge through activities such as:

- Carbon footprinting, impact assessment and future scenario mapping of products and services
- Material flow analysis of processes and operations
- Competitor analysis
- Health and safety, equipment, energy, and water use audits

EMPLOY A FLEXIBLE AND EFFICIENT APPROACH WHEN ENGAGING COMPANIES IN CHALLENGING CIRCUMSTANCES

The COVID-19 pandemic resulted in a challenging period for many businesses, with disruption to supply chains, and reduced demand for products and services. Other challenging circumstances such as those explored in the PESTEL analysis in PR.5 may be encountered. During these times, SMEs may perceive difficulties in prioritising or implementing eco-innovation strategies. Companies and consultants providing support in this area may have to adapt their practices to make engagement more efficient and productive, and consider eco-innovation strategies that may fit better with the current market conditions.

For example, strategies that reduce cost and have potential for shorter payback may be a better option in the short term – these can range from implementing energy and cost saving measures in production that may not require investment in new capital. Projects to engage with the value chain to implement circularity strategies, or hire or share equipment may reduce costs, but also enable development of new business models and product offerings that are cheaper to implement. Where import of materials is limited, as was seen during the pandemic, this could lead to companies developing knowledge and a first-mover advantage in sourcing of local materials.

Other strategies may be to engage several companies in an area of eco-innovation that could have mutual benefits. Again, in the area of circularity, collaboration can be a key strategy to reduce waste disposal costs, for example if one company can make use of another's waste, such as the examples stated previously of concrete companies using ceramic, plastic or fly-ash waste in mixes.

SMEs are often time-poor and may have limited resource for eco-innovation, so in challenging economic periods, engagement may need to be more efficient. This can be done through further use of video-conferencing, and preparing efficient summary reports that can help prioritise strategies. When selecting target companies, it is advisable to consider the degree of ownership and accountability staff members have for this type of work. For example, an employee with sustainability objectives in their job description is more likely to implement eco-innovation projects than a company who only addresses sustainability through a voluntary staff group. Moreover, leadership team support is crucial, not just from senior management and the CEO, but from company investors and owners. Your engagement activities with these key stakeholders will need to create a compelling business case that minimises or reduces risk and maximises opportunities.

References and resources

Further guidance resources on developing and implementing innovations within SMEs include:

- CFSD, (2016). Eco-Innovate! A guide to eco-innovation for SMEs and business coaches. European Commission. https://cfsd.org.uk/site-pdfs/SME_eco-innovation_guide_2nd_edition_small.pdf
- European Union, (2014). Green Action Plan for SMEs – Turning environmental challenges into business opportunities. Switch to Green Flagship Initiative. <https://www.switchtogreen.eu/green-action-plan-for-smes-turning-environmental-challenges-into-business-opportunities/>
- OECD, (2015). Environmental Policy toolkit for Greening SMEs in the EU Eastern Partnership countries. <https://www.oecd.org/environment/outreach/Greening-SMEs-policy-manual-eng.pdf>. Guidance for policymakers, but relevance for all stakeholders including service providers.
- ASEIC, Achieving eco-innovation of SMEs through Asia-Europe cooperation. http://aseic.org/aseic_data/brochure/1441019013615208292.pdf

SET STRATEGY

The aim of the SET STRATEGY phase is to use your knowledge of the company's strengths, weaknesses, opportunities and threats to propose a new business strategy that places eco-innovation at the core of the company's business strategy to ensure progress towards a sustainable future for the company.

ST.1

Plan my data-gathering strategy



Template of Data Gathering Strategy

Material, Product, service	Potential opportunities for cost leadership	Data to gather	Potential opportunities for product differentiation	Data to gather

To assess the most viable and best opportunities for eco-innovation, it is important to understand a company's position in the market, areas of expertise, organisational strengths and weaknesses, and current market opportunities.

An effective data-gathering strategy can help to achieve this. However, opportunities to collect data may be limited - a company representative may assist with this but may have time constraints.

A data-gathering strategy may also require collecting data from external sources, and independent research to assess the markets the company operates in. Essential data may include technical information and market trends, but also more qualitative data such as on company cultures, human-centric needs of buildings, and societal trends at the local, regional, and national level.

ST.1 Plan my data-gathering strategy



BACKGROUND INFORMATION

Setting a new business strategy requires collecting relevant data at the sector and market level (such as upcoming technological trends, regulatory developments, trading rules), as well as at the company level, including in their value chain to gain insights into operational strengths and weaknesses, expertise, management priorities and the financial position of the business.

Examples of this are provided on p.100 of the Eco-innovation Manual - a Preliminary Assessment of the company followed by an In-Depth Assessment is outlined. This shows how to gather data in an efficient way – at this stage of the engagement, there may be limited time for staff from the target company to engage beyond their business-as-usual activities.

However, if an effective relationship has been built, and the target company has financial resource for activities, the Preliminary Assessment, typically a remote activity, could be combined with the In-Depth Assessment through face-to-face contact with the company.

ECO-INNOVATION OPPORTUNITIES FOR COST LEADERSHIP AND PRODUCT DIFFERENTIATION

Building materials companies may prioritise cost leadership or product differentiation strategies to gain a competitive edge in the market and address sustainability hotspots. Gathering the right data can identify opportunities for both strategies.

For example, a building material supplier may achieve cost leadership by reducing the production cost of a material compared to competitors, through increased local sourcing, reduced energy cost overheads, or lower compliance costs from reduced toxicity of the product. Product differentiation in this sector could be achieved by developing innovative products or services, with better functionality and value over more established ones, or a different pricing structure.

Some building material markets have greater scope for innovation and potential differentiation, whereas others may be closer to a saturation point with lower margins. Innovation potential for building materials may also lie in service provision, particularly in relation to waste reduction and circularity, as this practice is still fairly new in this industry.

Gathering sufficiently detailed data in the following areas therefore is an effective approach:

- Number of firms in the market, market share, strengths and weaknesses, attitudes to change
- Development of product markets (cost trends, saturation, current and projected levels of innovation)
- Analysis of new innovations coming through, and their current market readiness
- Trends in customer attitudes and building design
- Trends in commodity and niche markets
- Current and future regulatory drivers.

Table 24 explores opportunities at the product and service level for where opportunities may arise in cost leadership and product differentiation. Examples of appropriate data to gather to embed eco-innovation in these strategies is included.

ST.1 Plan my data-gathering strategy



Table 24 - Opportunities for cost leadership and product differentiation strategies, and example data to gather

Material, Product, service	Potential opportunities for cost leadership	Data to gather	Potential opportunities for product differentiation	Data to gather
Cement/Concrete	<ul style="list-style-type: none"> Reduced material cost from collaborative, bulk sourcing Reduced materials cost from using recycled construction and demolition waste (CDW) 	<ul style="list-style-type: none"> Proximity of suppliers Attitudes to collaboration Proximity and types of raw materials available Relative carbon emissions from transport and processing of CDW instead of virgin materials 	<ul style="list-style-type: none"> Innovative materials with cheaper sourcing, production, transportation and waste Lightweighting product to reduce transport costs 	<ul style="list-style-type: none"> Opportunity to source innovative materials such as hemp, lime Degree to which lightweighted materials are tested and proven
Paint	<ul style="list-style-type: none"> Introducing a 'paint as a service' business model to reduce waste 	<ul style="list-style-type: none"> Details and budgets of clients' projects, opportunities to achieve scale 	<ul style="list-style-type: none"> Bio-based, non-toxic materials that provide a new functionality (e.g. improved waterproofing, biocidal and thermal properties, solar reflectance) 	<ul style="list-style-type: none"> Performance data on bio-based paints compared to conventional paints Details of partners to explore innovation (universities, start-ups)
Bricks	<ul style="list-style-type: none"> More efficient value chain management between quantity surveyor and all contractors 	<ul style="list-style-type: none"> Organisational culture and systems in place; ability of multiple value chain stakeholders to work together and use same systems 	<ul style="list-style-type: none"> Automated technology for reusing old bricks rather than crushing 	<ul style="list-style-type: none"> Details of local projects to match supply and demand for used bricks
Flooring	<ul style="list-style-type: none"> Sourcing recycled and unused material 	<ul style="list-style-type: none"> Details of local projects that may have an oversupply of material 	<ul style="list-style-type: none"> New, innovative flooring materials as an alternative to PVC 	<ul style="list-style-type: none"> Consumer attitudes to alternative materials Degree to which new materials are cost-competitive
Roofing	<ul style="list-style-type: none"> Locally sourced materials enabling cost savings from transportation and import duties 	<ul style="list-style-type: none"> Proximity and reserves of supplier Customer attitudes to alternative products 	<ul style="list-style-type: none"> Innovative roofing product incorporating solar panels, and high solar reflectance to reduce urban heat island 	<ul style="list-style-type: none"> Data on customer uptake of renewables Expected system payback times

ST.1 Plan my data-gathering strategy



Material, Product, service	Potential opportunities for cost leadership	Data to gather	Potential opportunities for product differentiation	Data to gather
Windows/doors	<ul style="list-style-type: none"> Sourcing reused or recycled frames 	<ul style="list-style-type: none"> Details of projects or companies who may be able to supply frames 	<ul style="list-style-type: none"> Innovative lifetime service and maintenance model 	<ul style="list-style-type: none"> Customers' attitudes to paying for products in this way Length of time building expected to be in service
Insulation	<ul style="list-style-type: none"> Identifying installation opportunities at large scale alongside client to enable bulk orders and reduce waste 	<ul style="list-style-type: none"> Analytics data on sites that could be retrofit at large scale 	<ul style="list-style-type: none"> Use of new, innovative materials, e.g. natural fibre, hemp-lime insulation 	<ul style="list-style-type: none"> Environmental product declarations, performance data
Lighting	<ul style="list-style-type: none"> Reduced cost of quality lighting through bulk procurement 	<ul style="list-style-type: none"> Customer lighting design requirements, opportunities for bulk demand 	<ul style="list-style-type: none"> Provide lighting-as-a-service to enable lower capital and maintenance cost to customer and establish ongoing customer relationship 	<ul style="list-style-type: none"> Typical purchase and maintenance costs of end-users over set period
Plating	<ul style="list-style-type: none"> Reduced regulatory and health & safety costs from shift away from hexavalent chromium 	<ul style="list-style-type: none"> Ability of plant to switch existing production line from Cr(VI) to Cr(III) at low cost 	<ul style="list-style-type: none"> New innovative replacement materials for chrome plating, providing longer lasting functionality 	<ul style="list-style-type: none"> Level of expertise in coatings, size of R&D function, level of access to innovative partners (universities, start-ups)
Ceramic tiles	<ul style="list-style-type: none"> Reduced production costs through more efficient firing Reduced production waste 	<ul style="list-style-type: none"> Cost/benefit analysis of new equipment Attitudes of company to change processes 	<ul style="list-style-type: none"> Use of recycled materials Lightweighting of tiles 	<ul style="list-style-type: none"> Opportunities to acquire sufficient supply of recycled materials with necessary properties Properties of new technology, tensile strength of tiles

ST.1 Plan my data-gathering strategy



Material, Product, service	Potential opportunities for cost leadership	Data to gather	Potential opportunities for product differentiation	Data to gather
Metal beams	<ul style="list-style-type: none"> Reduced production costs through use of less energy intensive production Reduced cost from sourcing reclaimed material 	<ul style="list-style-type: none"> Existing data of suppliers on energy use per unit steel output 	<ul style="list-style-type: none"> Lightweighting or use of innovative alloys 	<ul style="list-style-type: none"> Test and field trial data
Timber	<ul style="list-style-type: none"> Greater use of reclaimed or local materials 	<ul style="list-style-type: none"> Details of local companies and projects making timber available 	<ul style="list-style-type: none"> Use of modified timber in frames (e.g. acetylation or thermal treatment) 	<ul style="list-style-type: none"> Opportunities to source timber suitable for treating Consumer attitudes to new materials
Construction services	<ul style="list-style-type: none"> Reduced waste by use of digital Building Information Modelling (BIM) and effective collaboration between sub-contractors 	<ul style="list-style-type: none"> Company cultures, attitudes of value chain actors towards collaborating towards shared goal of better material efficiency 	<ul style="list-style-type: none"> Off-site assembly reducing transportation and site costs and site air emissions 	<ul style="list-style-type: none"> Details and viability of partner facilities to enable off-site assembly
Design	<ul style="list-style-type: none"> Improved design, construction and building performance through use of BIM 	<ul style="list-style-type: none"> Ability of all value chain actors involved in projects to use standardized BIM software 	<ul style="list-style-type: none"> Use of modular building design to enable end-of-life dismantling Integration of thermal mass considerations in design for passive heating and cooling Climate-adaptive building shells and constituent materials 	<ul style="list-style-type: none"> Mid- and long-term planning in local area; expected purpose and time in service of building Climate data, present and future projections
Circular construction services	<ul style="list-style-type: none"> Cost competitive offering for reclaimed materials 	<ul style="list-style-type: none"> Material flow analysis data from local area Quality testing data Material needs of local projects 	<ul style="list-style-type: none"> Online material exchange platform 	<ul style="list-style-type: none"> Products and materials from sites available for reuse across a local region

ST.1 Plan my data-gathering strategy



TIPS & TRICKS

COMPILE LISTS OF KEY SUSTAINABILITY PERFORMANCE INDICATORS OF BUILDING MATERIALS AND PRODUCTS, AND BUSINESS OPERATIONS

This can be put together from various sources. Detailed data (i.e. from LCA or EPD databases) can quantify the impacts of the different life cycle stages of materials. Data-gathering may have to be taken from a variety of sources, as many LCA databases require paid memberships. An 'LCA-light' approach can be taken by establishing the sustainability hotspots from academic and research papers, or tools such as the SCP Hotspot Analysis Tool for Sustainable Consumption and Production.

Other industry standard indicators and benchmarks can be used to assess sustainability performance. For example, the [World Steel Association](#) has developed a set of performance metrics and indicators for steel production, covering CO₂ emissions per tonne of steel output, material efficiency, and the number of employees covered by an environmental management system. The [Transition Pathway Initiative](#) (TPI) collates data for high-impact industries, including the cement, steel and aluminium sectors, showing the performance of individual companies and the reductions needed to achieve the goals of the Paris Agreement and the 1.5 degree scenario, which can enable benchmarking of suppliers.

Along with assessing more specific impacts of building materials, it is important to gather data on the sustainability impacts of the entirety of businesses. For instance, it is important to conduct operational carbon footprinting. This can be done via detailed collection of activity data and using conversion factors to calculate emissions following for example the [Greenhouse Gas Protocol](#), or be estimated at a higher level of data using tools, such as the [SME Climate Hub Business Carbon Calculator](#).

Avoided emissions from the implementation of new business strategies and models is a useful metric to track and can be calculated following current best practice from the [GHG Protocol](#) and World Resources Institute (WRI). This can follow a consequential approach that considers the emissions reduction due to certain decisions and changes compared to an assumed 'business as usual' scenario, or an attributional approach which compares, for instance, a new lower carbon product against another product (either in company's portfolio

or on wider market) for the same application. Avoided emissions data can support businesses with securing funding via bonds and incentives with financial institutions and government departments (see also section BM.17).

ST.1 Plan my data-gathering strategy



TIPS & TRICKS

UNDERSTAND HOW DIFFERENT, AND CHANGING CLIMATES AFFECT BUILDINGS AND MATERIALS

When designing innovative building materials, it is essential to consider the full extent of the conditions they will be exposed to. The properties and performance of a range of building materials, components and systems can be affected by external factors, including the setting times and strength gain of cement, moisture content of bricks (which can result in bricks shrinking or cracking if too low).

Factors also include the role of surface materials such as concrete pavements in managing heavy rainfall and reducing flooding risk, and the ability of materials to continue to perform and avoid damage from extreme weather such as storms and monsoons, exacerbated by climate change.

Lessons learned from the UNEP project [Promotion of Non-Fired Brick Production and Utilization in Vietnam](#) suggested that exporters to the market may have been less familiar with the variations in climate and weather than domestic manufacturers, as Vietnam has multiple construction climate sub-regions identified in both the North and Southern provinces of the country, with different implications for construction in that area.

Sustainable materials must be fit for purpose for the conditions they will be used in, and a strong understanding of local and regional conditions, as well as comprehensive data should be considered when developing products and services for these markets.

GATHER DATA FROM SUPPLIERS OF THE SAME PRODUCT OR MATERIAL

Manufacturers and suppliers collect a range of data related to production of building materials and products. This may range from detailed process energy use data collection as part of a formal environmental management system, to companies who are capturing very little data in this area.

However, even top-level data can be valuable for initiating improvements, for example by determining the type of equipment used in industrial processes. For example, a steel producer with only basic oxygen furnace equipment is likely to be using a lower proportion of secondary steel in products than one with electric arc furnace equipment. Conducting high-level equipment inventories can identify opportunities to invest in more efficient equipment such as variable speed drives, LED lighting and controls, and more efficient industrial fans.

Consider incentivising suppliers to collect and disclose sustainability data through soft measures such as showcasing exemplar suppliers through marketing channels and requiring data provision as part of tenders and ongoing contracts.

ST.1 Plan my data-gathering strategy



CASE STUDY: STAR GARMENT INNOVATION CENTER, COLOMBO, SRI LANKA

The [Star Garment Innovation Center](#), designed by Jordan Parnass Digital Architecture, is the first Certified Passivhaus project in South Asia, which involved the retrofit of an existing industrial building to provide a state-of-the-art combination office and industrial facility.

Effective data-gathering was key to provide an optimal solution for the needs of the business, whilst addressing sustainability aspects of the in-use phase and in building materials used. This included:

- The temperature and climatic considerations for the building
- Understanding the needs of the occupants and tasks being carried out by the business
- Carbon, fuel use and waste considerations of renovating an existing building versus demolition

Many garment factories in tropical climates suffer from high heat, humidity, noise and poor ventilation. Designing and building a solution that addressed these issues was key to improve the working conditions and overall well-being of the employees.

In addition, by applying the Passivhaus design principles and efficiency standards, annual energy use was reduced by around 60% compared to the previous factory building's performance.

Key aspects of the building design and materials included:

- Maintaining the existing steel frame and concrete slabs
- Installation of a high-performance HVAC system
- Continuous layers of insulation
- Windows and doors with high thermal performance
- Design for natural light
- Rooftop solar PV installation

Figure 16 - Star Garment Center, Sri Lanka



ST.1 Plan my data-gathering strategy



Key performance indicators (KPIs) can be used to identify and address sustainability hotspots across building material value chains, and also be developed for economic and social aspects of the business. Considering performance across the range of indicators can identify areas to prioritise action and quantify the financial benefits of eco-innovation in products and services. Some examples of relevant indicators to the building materials sector can be found in Table 25.

Table 25 – Examples of Key Performance Indicators for companies in the building materials value chain

Group of indicators	Examples of indicators			
Financial indicators	<ul style="list-style-type: none"> • Turnover/profit (by company, department, or product category) • Repeat business versus new business • Return on invested capital (ROI) • R&D: Research and Development expenditure (%) • Overhead percentage 			
Environmental indicators	Inputs <ul style="list-style-type: none"> • Amount of reused material • Recycled material from chemically safe sources • Materials procured from sustainable sources (e.g. timber from certified forestry) • Embodied energy of raw materials • Transportation impact of raw materials 	Operations <ul style="list-style-type: none"> • Carbon emissions (all scopes) • Water/energy intensity • Number of restricted substances and chemicals of concern in use • Chemical footprint monitoring • Number of employees covered by environmental management systems 	Outputs <ul style="list-style-type: none"> • Number of products sold with sustainability certifications • Building ratings scores achieved (e.g. BREAAAM, LEED) • Metrics from in-situ performance monitoring of products and projects 	Circularity <ul style="list-style-type: none"> • Material efficiency • Proportion of end-of-life waste reused or recycled • Waste disposal costs (operations, taxes, compliance, penalties)
Social indicators	<ul style="list-style-type: none"> • Assessment and management of upstream responsible sourcing and working conditions • Impact on local communities and economy • Health and safety monitoring (production staff, site operatives, building occupants) • Gender and other diversity monitoring (in company and management roles) 			
Business performance	Operational <ul style="list-style-type: none"> • Materials contracts delivered on time and budget • Lean metrics (e.g. batch cycle time, number of recurring issues, throughput, productive site time, lost-time accidents) • Employee retention 	Market <ul style="list-style-type: none"> • Market share (%) • Market perception and trust • Market growth rate 	Customer relationships <ul style="list-style-type: none"> • Customer Satisfaction Index, complains or positive reviews • Customer retention rate • Marketing effectiveness 	

ST.1 Plan my data-gathering strategy



DEVELOPING KPIS FOR USE OF CHEMICALS - MONITORING AND REPORTING THROUGH THE CHEMICAL FOOTPRINT PROJECT (CFP)

The **Chemical Footprint Project** aims to improve chemicals management by manufacturers and retailers through measuring, improving, and sharing data. A key component is the [Chemical Footprint Project Survey](#), which provides a score on current performance and identifies areas for improvement.

Questions cover the policies and strategies in place, inventory across the supply chain, footprint measurement and tracking of progress towards safer alternatives. The platform also enables verification of information provided and a means for public disclosure.

As a collaborative platform, the CFP enables companies to benchmark themselves and learn from participants, through published [annual reports](#). Companies participating in the Building Products & Furnishings category include HermanMiller, Inc, Milliken & Company, Naturepedic, Nora systems, Inc., and Steelcase.

References and resources

- World Steel Association. Available from: <https://worldsteel.org/steel-topics/sustainability/sustainability-indicators/>
- Transition Pathway Initiative Tool. Available from: <https://www.transitionpathwayinitiative.org/sectors>
- Key Performance Indicators for Sustainable Manufacturing Evaluation in Cement Industry. Amrina & Vilsa, Procedia CIRP. Available from: <https://doi.org/10.1016/j.procir.2014.07.173>
- Performance indicators for sustainability assessment of buildings, Kamali M, Hewage K. Available from: <https://open.library.ubc.ca/cIRcle/collections/52660/items/1.0076427>
- BRE. Key performance indicators (KPIs) for the construction industry. Available from: <https://www.bregroup.com/a-z/key-performance-indicators-for-the-construction-industry/>
- Star Garment Innovation Center – Sri Lanka’s first Passive House. Available from: <https://passivehouseaccelerator.com/projects/star-garment-innovation-center-sri-lanka-s-first-passive-house>
- Global LCA Data Access website. Available from: <https://www.globalcadataaccess.org/>
- Hotspot Analysis Tool for Sustainable Consumption and Production. Available from: <http://scp-hat.lifecycleinitiative.org/>
- Chemical Footprint Project. Available from: <https://www.chemicalfootprint.org/>

ST.3

Capture the current business model



After planning how to gather your data and interviewing the CEO to better understand the current business strategy (see the guidance in section ST.2 of the Eco-innovation Manual), you will now aim to get a better understanding of the target company's current business model. You can capture this using the business model canvas.

The following description of GFC Building Supplies' business model canvas was developed using the Eco-innovation Manual template and methodology, which is shown completed for GFC Building Supplies in Figure 17.

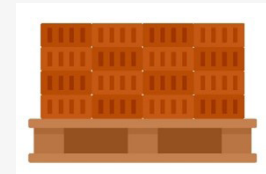
ST.3 Capture the current business model



LEARNING CASE STUDY OF BUSINESS MODEL CANVAS FOR GFC BUILDING SUPPLIES

CUSTOMER BASE

GFC Building Supplies' main customers are construction companies and installers, with some focus on bidding for public sector tenders. Project sizes and orders vary, from small jobs at the single house level to bulk orders for large-scale construction projects. GFC Building Supplies has developed several longstanding relationships with customers to enable repeat business. However, for many building materials and products, the market is competitive, and margins are often low. GFC Building Supplies retain a strong market share through a good reputation for quality and enabling a one-stop shop for almost all materials typically needed for a project. This offering is supported by its specialist in-house knowledge and excellent customer service.



SALES OPERATIONS

Sale of building materials takes two main approaches. For the most part, products are specified by the customer and GFC Building Supplies focus on sourcing good quality materials at a competitive price, through efficient procurement. Whilst an established network of suppliers is in place, the company is highly reliant on imported materials, and at times are affected by volatile prices and supply delays. Suppliers are generally selected on the basis of cost and quality, and no sustainability assessments have been carried out to date.

GFC Building Supplies has developed its own-brand range of paint and cement with partner manufacturers, and some materials sold are bespoke for the job - for example, the cement blend, type of timber, and paint may be supplied in varying formulations, sizes and quantities. In some cases, the company uses building design software to work with customers and specify the product, and carry out some processing of materials (cement mixing, timber treatment) and packaging on site.

INTERNAL PROCESSES AND COMPANY MANAGEMENT

IT systems are in place for tracking orders, stock inventory, and logistics. A customer relationship management system is in place to track clients and business opportunities. There is an all-company meeting once a month to review operations and business development, as well as a quarterly management meeting to review business performance and strategy. The sales and marketing team operate the website and produce advertisements. Some customer feedback is gathered, mainly from its trade customers.

GFC Building Supplies has a quality and compliance team in place and a process for quality checks of products sold, including those that require on-site processing. The management team tracks overhead costs and the profit margin on own-brand materials. No environmental management system or formal plan for carbon, energy, water, or waste reduction is currently in place. Additionally, whilst all legal requirements of products sold are checked by the quality team, little attention to date has been given to reducing chemicals of concern or tracking upcoming changes in legislation.

GFC Building Supplies has internally discussed improving the diversity of its workforce. A new recruitment strategy to interview more women for both entry and senior level positions has been considered at management team meetings, but a formal process has yet to be put in place.

The above narrative is summarised in the business model canvas in Figure 17.

ST.3 Capture the current business model



Figure 17 - Business model canvas - GFC Building Supplies

Key Partners	Key Activities	Key Value Propositions	Customer Relationships	Customer Segments
Product and material suppliers	Procurement of materials and products	Provision of most building material needs for trade customers in catchment area	Longstanding trade and supplier relationships	Direct customers:
Local firms conducting material processing and assembly	Product specification for customers	Specialisation in own label product range: good quality, high functionality, and (crucially) specialist knowledge on these product types	Customer service team support via website, email and phone	Retail customers (trade and DIY)
Shipping and importing firms	Development and production of own-brand range of cement, concrete, paint	Quality of service: short wait times for orders, high quality customer service and after-sales support	Dedicated account managers for wholesale B2B customer	Wholesale (construction firms, installers)
Distributors	Customer relationship management			Supply contracts
	Key Resources	Vertical differentiation in cost: slightly lower cost own-label goods than competitors, wholesale pricing model that reduces the unit cost	Channels	Indirect customers:
	Raw materials (e.g. timber, clay, limestone, shale)		Integrated Customer Relationship Management (CRM) system	Property owners and managers
	Facility, warehouse, production machinery		Website, advertising, social media	Municipalities
	Delivery fleet		Word of mouth	Businesses
	Integrated IT system for orders, inventory, production and distribution		Industry events and trade conventions	Householders
	Strong financial position (cash flow)			
	In-house technical knowledge			
Cost Structure			Revenue Streams	
Facilities		Labour	Sales of building materials (own-label and branded products)	
Wholesale products and materials		Own-brand product manufacture		
Shipping and import duties		Logistics and transportation of goods		

ST.4

Do a Walk-Through Audit



A walk-through audit can be used to evaluate the current operational performance of the target company, typically through a guided tour of operations by the company point of contact.

This is an essential step in identifying potential sustainability benefits such as finding alternatives to chemicals of concern and reducing operation carbon emissions; this exercise, along with *ST.5 Do a workshop/interview with staff* feeds into the updating of sustainability hotspots in ST.6 and SWOT analysis in ST.7 to help identify opportunities for eco-innovation.

The Eco-innovation Manual provides suggestions for planning the activity, aspects to look out for, and questions to ask the guide in the *Walk-Through Audit Guide template*. The results of this analysis of GFC Building Supplies are presented in the following learning case study.

ST.4 Do a Walk-Through Audit



LEARNING CASE STUDY

Outputs of a walk-through audit of GFC Building Supplies are shown in Figure 18. This identifies the main internal processes, overheads, and connected upstream and downstream activities in the value chain. This feeds into an initial evaluation of company strengths and weaknesses, sustainability hotspots, potential for cost saving, and initial thinking of ideas for eco-innovation projects, as shown in Table 26.

COMPILING A CHEMICALS INVENTORY

If not already in place, as part of activities related to manufacturing, procurement and material storage, it is recommended that companies compile an inventory to enable an assessment of chemicals of concern. This can underpin efforts to reduce toxicity of products and consider substitution. Existing chemical hazard lists can be accessed to assist with this, such as those included within the [Pharos Project](#). Using a recognized listing system, such as the Chemical Abstracts Service (CAS) number registry for recording substances used is recommended.

Compiling a comprehensive chemical inventory is a key first step in developing an eco-innovation project to substitute or design out a chemical of concern. An initial step is to **gather extensive data** on the chemicals contained in products. Many companies report not knowing all the chemicals used in their products, where this involves procurement of components, ingredients or intermediates that make up a finished product. Data gathering can involve surveying upstream suppliers to gather as much data as possible or conducting testing. In some cases, companies may be reluctant to pass on details of proprietary ingredients and formulations. This can be addressed by signing a confidentiality agreement, but in some cases, even providing information only on the chemical class may be beneficial to conduct screening and risk assessment.

Following this, checks of **Regulatory or Restricted Substances Lists (RSLs)** can enable companies to identify problematic or higher-risk chemicals. Lists from national or regional authorities can be complimented by some of the databases profiled in section PR.4. This can feed into preparing a **hazard assessment**, which can identify risks (such as human health and aquatic toxicity), as well as the likelihood and severity. Research papers and studies (such as those available on platforms such as [PubMed](#)) can be used alongside assessment tools. Effective and organised documentation of the chemicals assessed is a

key part of chemicals management, and internal systems and databases should be used to ensure that information is shared throughout the company. Use of the [USEtox](#) interface enables an assessment of the chemical hazard for a specific use case, which may be applicable to the company's activities.

The next step is to **assess and select safer alternatives** – again, there are open source tools available that can identify safer ‘drop-in’ substances. A case in point is the [USEtox model tool interface for building materials](#), which assesses the human and ecotoxicological impacts of chemicals in building materials while informing on risk reduction efforts and the need to select safer alternatives ([Huang et al. 2022](#)). In some cases, a better approach may be to consider if the chemical in question provides an essential function and if the product design can be adapted to omit it. Consideration of chemical safety at the design stage, and only using known substances and suppliers with good transparency can often help avoid issues later on.

Finally, **sharing safety information** with customers and in the value chain can be a valuable step in improving the amount of information available, assisting suppliers with their chemical management systems, and enabling the end user to know exactly what they are buying. Taking an active, rather than a passive approach to chemical management and communication is explored further in section BM.9, as part of developing effective customer relationships.

ST.4 Do a Walk-Through Audit



LEARNING CASE STUDY OF BUSINESS MODEL CANVAS FOR GFC BUILDING SUPPLIES

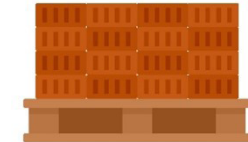
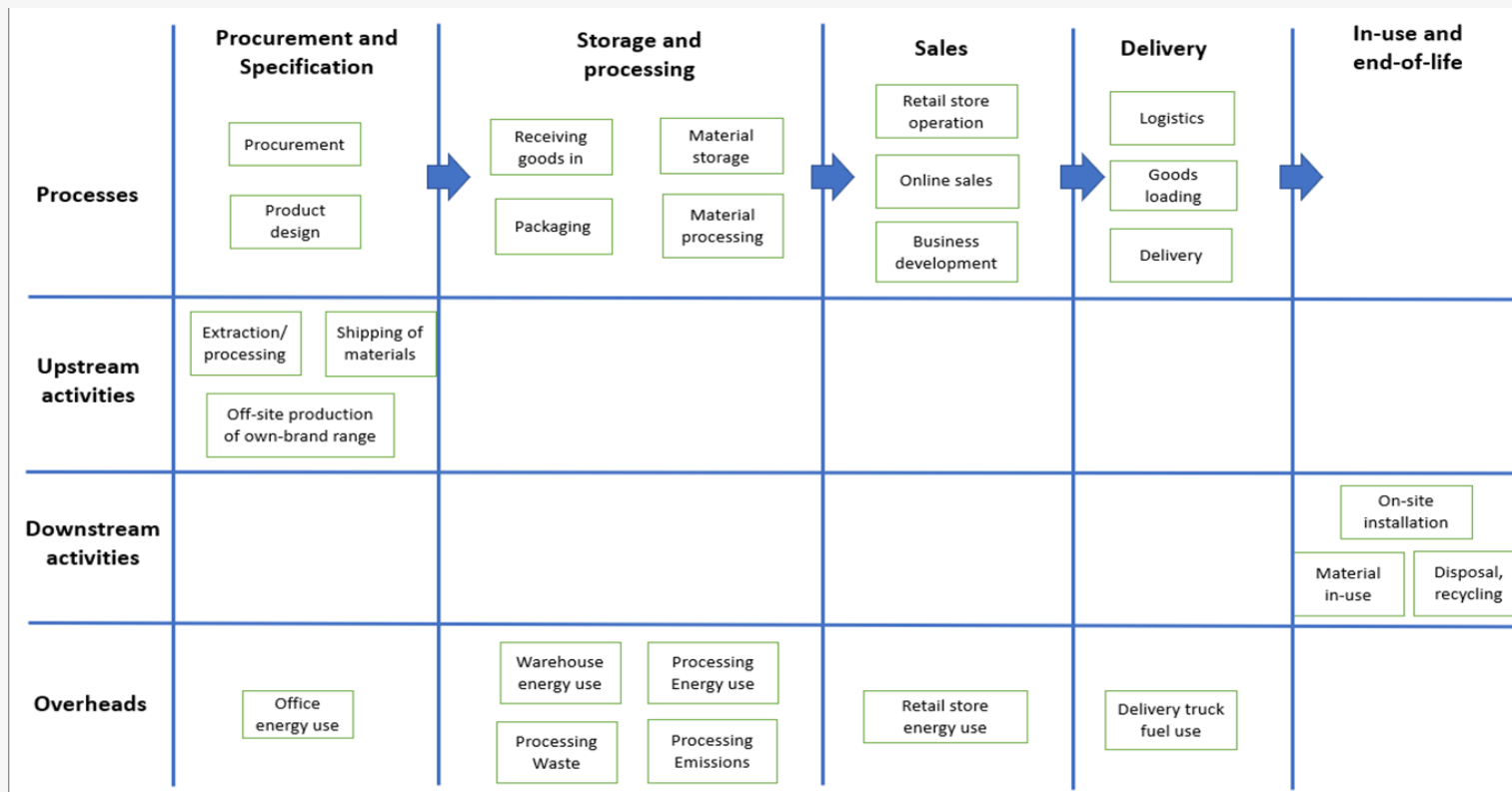


Figure 18 - Processes, overheads, upstream and downstream activities related to the operations of GFC Building Supplies



ST.4 Do a Walk-Through Audit

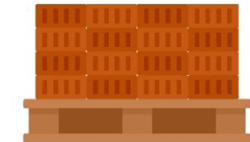


Table 26 - Learning case study of Walk-Through Audit results

<p>General aspects</p> <p>Own-brand product manufacturing happens offsite</p> <p>The site comprises a warehouse, workshop, retail shop and back office</p>	<p>Warehousing</p> <p>Large space, mainly used for storage of stock</p> <p>High energy use: inefficient lighting and HVAC</p> <p>Packaging waste identified</p>	<p>Logistics and distribution</p> <p>Older, diesel delivery trucks</p> <p>Journey planning or route optimisation not considered</p>	<p>Retail store</p> <p>Customer service team has excellent market knowledge</p> <p>No communication to customers of sustainability credentials of products</p>
<p>Design and specification</p> <p>Internal team has strong knowledge of building material properties</p> <p>Competency with BIM software</p>	<p>Workshop</p> <p>Older, inefficient machinery</p> <p>No wastewater recycling</p> <p>High emissions from processing including VOCs, PM</p>	<p>Procurement</p> <p>Procurement mainly based on cost and availability</p> <p>High dependence on import materials</p>	<p>Management</p> <p>Regular meetings to review operational efficiency and financial performance</p> <p>Flat organisation structure allowing flexibility of processes</p>
<p>Operational strengths</p> <p>Good customer service and customer relationship management (CRM) system in place</p> <p>Specialist technical knowledge of design and sales team</p> <p>IT system effective at coordinating orders, inventory, production and distribution</p> <p>Efficient internal decision-making systems</p> <p>Strong reserves and financial liquidity</p>		<p>Operational weaknesses</p> <p>Dependence on third party, import suppliers of building materials, with occasional unreliability of supply, and fluctuating prices</p> <p>High energy, water and fuel costs and waste generation from on-site processing and transportation</p> <p>High environmental impacts of building materials sold, including own-brand range</p> <p>No inventory or procedures in place to identify and log chemicals of concern</p> <p>Low profit margins on majority of products</p> <p>Few health and safety procedures for warehouse staff</p> <p>Low number of women in management roles</p>	

References and resources

- Pharos Project Hazard Lists. Available from: <https://pharosproject.net/hazard-lists>
- Chemical Abstracts Service (CAS) Registry. Available from: <https://www.cas.org/support/documentation/chemical-substances/faqs>

ST.4 Do a Walk-Through Audit



CONDUCTING MATERIAL FLOW ANALYSIS

As part of the walk-through audit process, conducting a material flow analysis of the company's operations can identify hotspots and opportunities for eco-innovation.

This can have varying scope and complexity – the system under analysis may be a single production process, or the full life cycle of a product or material, or a more complex system modelling an area and the construction sites within it to map flows of multiple materials.

A Sankey diagram can be used to map material and process flow, define inputs and outputs, and identify life cycle stages and value losses. In the context of the circular economy, this can help companies to develop closed loop systems in manufacturing and waste management.

The BAMB project paper [Circular \(de\)construction in the Superlocal project](#) conducted and assessed the deconstruction of a 100-apartment block, repurposing materials where possible. This enabled quantification of the material reuse and savings in embodied energy from avoiding the use of new materials.

Typical material flows and recovery rates for building materials in the Netherlands are shown in a macro-level Sankey diagram (see Figure 19).

References and resources

- Measuring Material Flows and Resource Productivity – The OECD Guide. Available from: <https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf>
- Sankey Diagram. From Data to Viz. Available from: <https://www.data-to-viz.com/graph/sankey.html>
- State of the art on material flow data in the built environment. Circuit Project. Available from: <https://www.circuit-project.eu/post/state-of-the-art-on-material-flow-data-in-the-built-environment-summary-report>
- Circular (de)construction in the Superlocal project – Ritzen et al. Available from: <https://iopscience.iop.org/article/10.1088/1755-1315/225/1/012048>

CASE STUDY: CONDUCTING MATERIAL FLOW ANALYSIS FOR A BRICK MANUFACTURER

The sustainability consultancy Useful Projects carried out a material flow analysis for the brick and roof tile manufacturer Wienerberger's production processes in the UK.

This identified material inputs, reuse loops and waste streams, presenting the data in a visual form by using a Sankey diagram.

Analysis of this type can identify opportunities to recover and reuse materials as part of processes, but also for energy and water, such as latent heat recovery or water recycling in production processes.

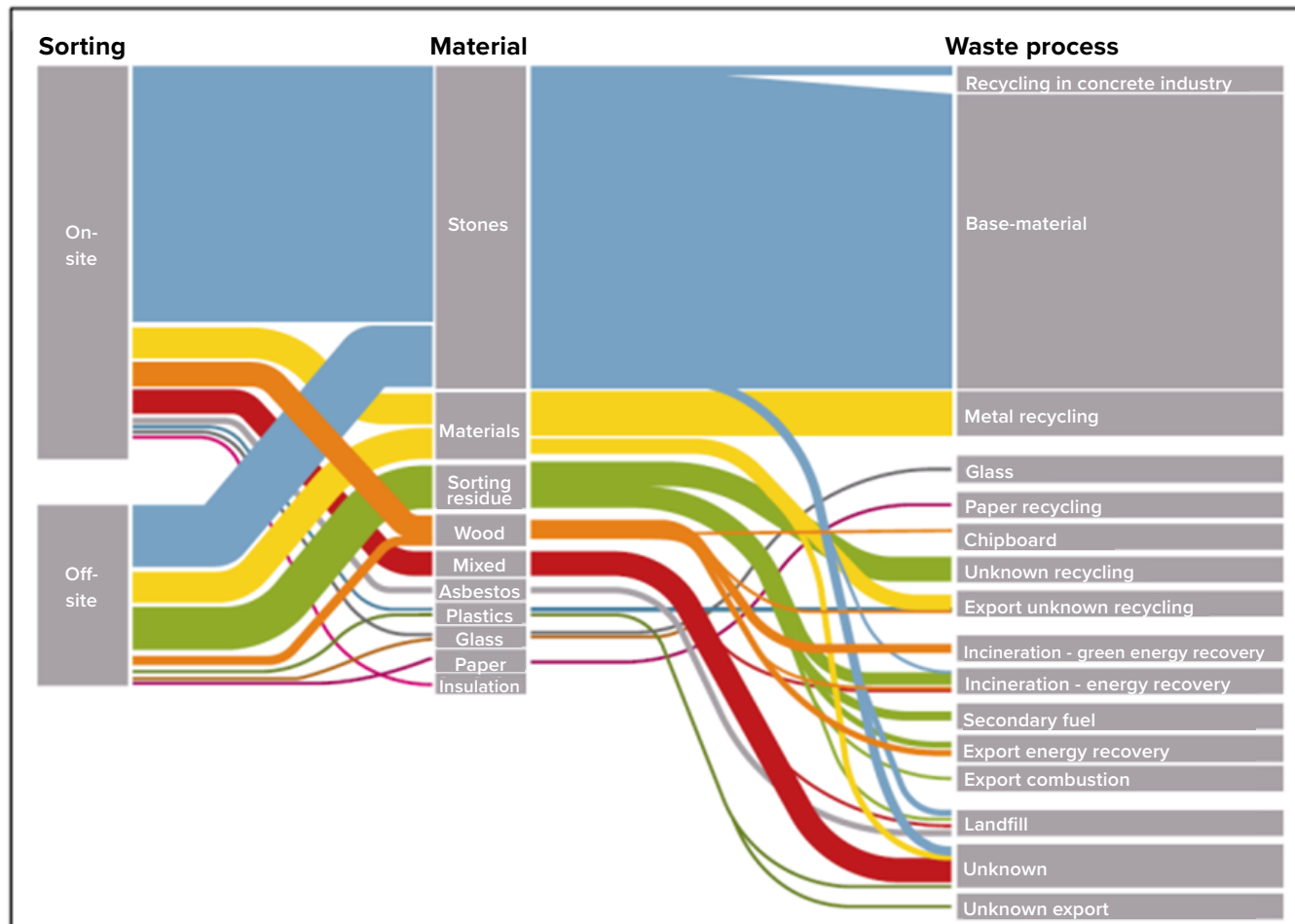
The analysis supported Wienerberger's overall sustainability strategy, and enabled specific recommendations to increase the circularity of brick production, including by identifying opportunities to use more recycled materials and reduce waste downstream in the value chain.

[Material Flow Analysis Sankey Diagram for Wienerberger Brick Factory](#)

ST.4 Do a Walk-Through Audit

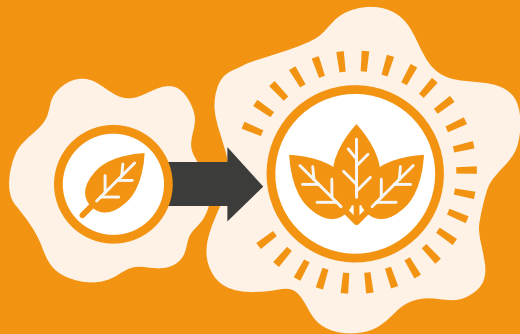


Figure 19 - Sankey diagram of flows of demolition materials in the Netherlands. Source: BAMB project



ST.6

Update the sustainability hotspots



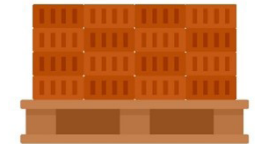
Template of Life Cycle Thinking

	Environmental impacts	Social impacts	Economic impacts
Materials			
Production			
Transportation			
Use			
End-of-life			

Following ST.4 and ST.5 (workshop/interviews with staff, detailed in the Eco-innovation Manual), this activity involves updating the sustainability hotspots analysis you conducted in PR.4 with the further company-specific information you have gathered through your analysis.

This includes updating both the *Life Cycle Inventory* and *Life Cycle Thinking* templates previously completed. Table 27 presents the *Life Cycle Thinking* analysis updated for GFC following the greater insight and understanding gained on the company.

ST.6 Update the sustainability hotspots



LEARNING CASE STUDY OF LIFE CYCLE THINKING FOR GFC BUILDING SUPPLIES

Initial data about the life cycle sustainability impacts of building materials and products should be gathered during the PREPARE phase. This can now be updated, with sustainability hotspots explored in further depth in relation to the target company, as shown in the Life Cycle Thinking template completed for GFC Building Supplies for its paint products value chain in Table 27, with updates from further exploration of hotspots including classification of high, medium and low impacts (H, M, L). Hotspots were identified for all of GFC, with the template completed for all product ranges and the findings for paints presented below. Further stakeholders and partners who can play a role in addressing hotspots can also be identified at this stage. Examples of external stakeholders who could potentially help address GFC Building Supplies' hotspots are detailed in Table 27.

Table 27 - Life Cycle Thinking template completed for GFC Building Supplies' paint value chain

*H= high impact, M= medium impact, L= low impact

Phase	Activity	Inputs	Product outputs	Emissions	Environmental Impacts		Social impacts			Economic impacts
					Resource use	Ecosystem quality	On workers	On consumers	On stakeholders	Profitability
Materials	Raw material extraction	<ul style="list-style-type: none"> Machinery Labour Fuel Vehicles Packing materials 	<ul style="list-style-type: none"> Solvents Dispersant Thickeners Binder Pigments Anti-microbial agents 	<ul style="list-style-type: none"> Transportation emissions Dust Packaging waste 	<ul style="list-style-type: none"> Consumption of natural resources (M) Non-renewable fuel (M) 	<ul style="list-style-type: none"> Air pollution (H) Waterway pollution from mining (H) 	<ul style="list-style-type: none"> Occupational safety (M) Exposure to dust and chemicals (M) 		<ul style="list-style-type: none"> Effect on local communities from material extraction (M) 	<ul style="list-style-type: none"> Effect of imports on national economy (H)
	Raw material import									
Production	Paint manufacture	<ul style="list-style-type: none"> Solvents Pigments Additives Resins Machinery Electricity 	<ul style="list-style-type: none"> Paint 	<ul style="list-style-type: none"> Dust VOCs 	<ul style="list-style-type: none"> Embodied carbon and resource use of fossil-based feedstocks (H) 	<ul style="list-style-type: none"> Pollution from wastewater disposal (H) 	<ul style="list-style-type: none"> Exposure to VOC, heavy metals, dust, fine powders (H) 		<ul style="list-style-type: none"> Effect on local community from accidents and waste discharge (M) 	
	Packaging manufacture	<ul style="list-style-type: none"> Metals Plastics Pallets Machinery Electricity 	<ul style="list-style-type: none"> Paint tins 	<ul style="list-style-type: none"> Noise 	<ul style="list-style-type: none"> Metal use (M) Plastics use (H) 			<ul style="list-style-type: none"> Exposure to dust and chemicals (L) 		<ul style="list-style-type: none"> Effect on costs from using recycled packaging materials (M)

ST.6 Update the sustainability hotspots



Phase	Activity	Inputs	Product outputs	Emissions	Environmental Impacts		Social impacts			Economic impacts
					Resource use	Ecosystem quality	On workers	On consumers	On stakeholders	Profitability
Production	Quality inspection	<ul style="list-style-type: none"> Finished paint Packaging Testing equipment Labour 	<ul style="list-style-type: none"> Quality status of materials 	<ul style="list-style-type: none"> Tested material samples 			<ul style="list-style-type: none"> Exposure to dust and chemicals (L) 	<ul style="list-style-type: none"> Improved product quality (M) 		<ul style="list-style-type: none"> Improved customer satisfaction (M) Increased profitability from waste reduction (M)
	Domestic painting	<ul style="list-style-type: none"> Paint Accessories (brushes, rollers, trays) 	<ul style="list-style-type: none"> Painted homes 	<ul style="list-style-type: none"> VOCs Heavy metals Packaging waste Waste paint from over-use Microplastics entering environment 	<ul style="list-style-type: none"> Consumption of natural resources (M) Non-renewable fuel (M) 	<ul style="list-style-type: none"> VOC emissions (H) Emissions to waterways from paint disposal (M) Microplastic emission (H) 		<ul style="list-style-type: none"> Effects from VOCs (H) Allergies (M) Heavy metal exposure (M) 		<ul style="list-style-type: none"> Increased consumer preference for healthier, low-VOC paints (H)
Use	Professional painting	<ul style="list-style-type: none"> Paint Accessories Labour Transport 	<ul style="list-style-type: none"> Painted buildings and structures 			<ul style="list-style-type: none"> Exposure to toxic substances (M) Long-term occupational exposure hazards (M) 		<ul style="list-style-type: none"> Exposure to toxic substances in public or commercial spaces (M) 	<ul style="list-style-type: none"> Effect on costs from efficient paint use (M) 	
	Disposal	<ul style="list-style-type: none"> Waste paint Cleaning solvents Waste packaging 		<ul style="list-style-type: none"> Solvents entering waterways (M) Air pollution (M) 	<ul style="list-style-type: none"> Fossil-based ingredients in cleaning agents (M) Missed opportunity to recycle/reuse packaging (H) 	<ul style="list-style-type: none"> Waterway contamination (H) 	<ul style="list-style-type: none"> Exposure to VOCs in paint cleaning products (M) Improved product quality (M) 		<ul style="list-style-type: none"> Effect on costs from recycling paint monomers (M) 	
End-of-life (EOL)										

ST.6 Update the sustainability hotspots

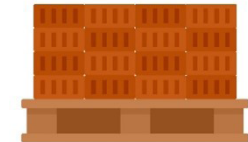


Table 28 - Sustainability hotspots for GFC Building Supplies and how stakeholders could help to address

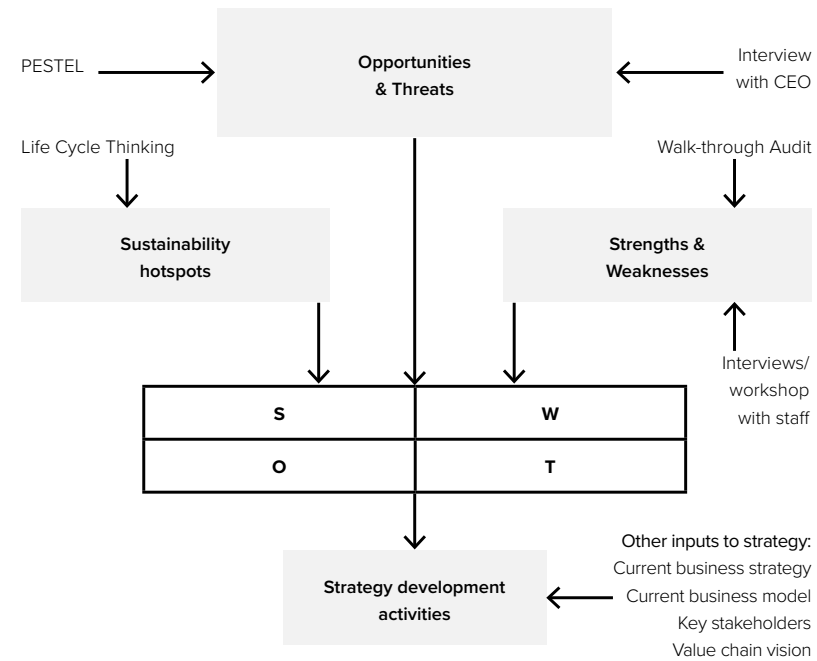
Sustainability Hotspot	Stakeholder and how they could help
Rising costs for building materials	<ul style="list-style-type: none"> Manufacturer - exploring use of alternative materials
Higher cost of alternative building materials	<ul style="list-style-type: none"> Government subsidies for high performing, more sustainable alternative materials
Growing consumer demand for more sustainable and low-energy buildings	<ul style="list-style-type: none"> Customer – willing to pay a higher price Governments – incentive schemes for high-performing buildings and grants for energy efficient retrofit of poor-performing ones
Low level of circularity in construction sector	<ul style="list-style-type: none"> Designers – embed circularity principles in products Certification bodies – encourage circularity through buildings rating systems Government – mandate more circular buildings in legislation (e.g. similarly to the European ELV Directive for vehicles) Waste management companies - providing collection services Reclamation specialists
Health and safety issues on projects	<ul style="list-style-type: none"> Industry association – agree on better safety standards in the industry Local municipality – setting and enforcing standards in local area
Low investment and acceptance for new technologies	<ul style="list-style-type: none"> University or research facility – conducting testing and demonstration of new materials Test laboratory – developing test protocols and providing certification
Supply shortages for imported raw materials	<ul style="list-style-type: none"> Waste management companies – increasing supply of secondary materials Industry associations – support the creation of secondary material certifications and promote their use in industry
Toxicity issues in production, in-use, and disposal phases	<ul style="list-style-type: none"> Manufacturer – more sustainable production process
Climate change adaptation	<ul style="list-style-type: none"> Local municipality – better urban planning for adaptation creating demand for suitable materials Property developers – designers, architects and engineers specifying climate adaptation needs

ST.7

Do a SWOT Analysis



Data sources and process for the SWOT analysis.



The next step is to carry out a SWOT (strengths, opportunities, weaknesses, threats) analysis for the company in relation to sustainability, using the data and insights gathered from the target company, considering both internal aspects, and the current external, sector conditions.

This will later feed into the development of new business strategy ideas that incorporate sustainability considerations, and ideas for new business models, projects, products and services.

An example SWOT analysis has been completed for GFC Building Supplies in Table 29, using guidance from the Eco-innovation Manual.

ST.7 Do a SWOT Analysis

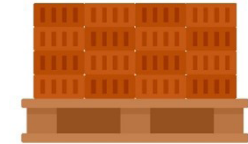


Table 29 - SWOT analysis for GFC Building Supplies

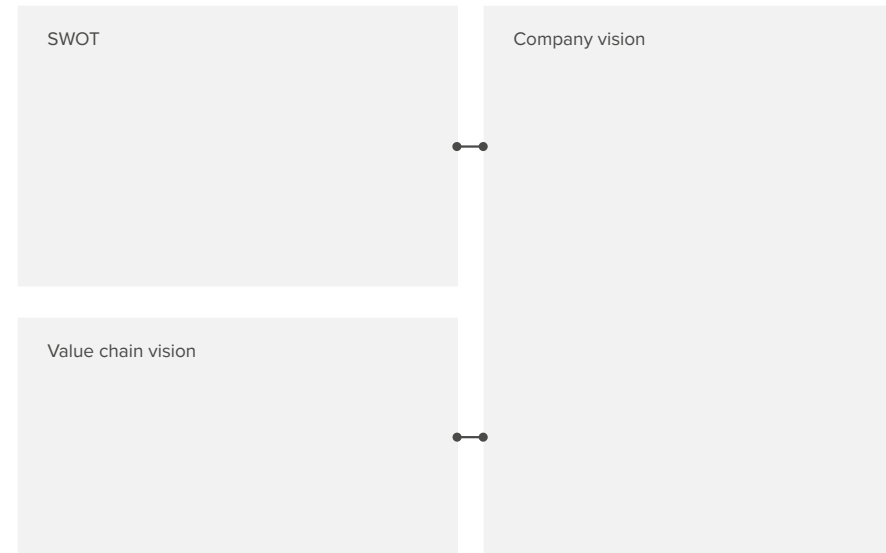
	Helpful to becoming more sustainable	Harmful to becoming more sustainable
Internal origin (attributes of the company)	<p>STRENGTHS</p> <ul style="list-style-type: none"> • Extensive industry experience, longstanding relationships and good reputation for quality • Strong in-house technical knowledge on building materials • Good customer service and relationship management system • Well-managed price model for wholesale customers to reduce cost for larger order volumes, helping secure sales deals • IT system effective at coordinating orders, inventory, production and distribution internally and amongst external partners • Good quality own label product ranges, providing more control over product specifications • Healthy cash flows and reserves • Business strategy reviewed regularly (quarterly meetings) by CEO and business area managers • Low staff turnover with established procedures in place and good process efficiency 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Dependence on third-party manufacturers of building materials; occasional unreliability of supply and fluctuating prices • Legacy products containing chemicals of concern (paints, ceramic tiles) remain in product range due to low price and consumer demand • High energy, water and fuel costs from manufacturing and transportation operations • Building material waste generation in large volumes, requiring expensive treatment and disposal • Potential health issues for workers associated with several manufacturing and on-site processes • Minimal R&D capacity in-house, or links with external partners to drive innovation
External origin (attributes of the environment)	<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Increasing demand for housing • Increased consumer demand for sustainable building materials • Secondary market value from reused and recycled materials • Technological development in sector (e.g. increased use of BIM and design software) • Rapidly changing legislation incentivising more sustainable materials 	<p>THREATS</p> <ul style="list-style-type: none"> • Rising cost of raw materials • Fuel (diesel, petrol) and electricity price increases • Competitors (local and international) offering building materials at lower price • Rapidly changing legislation requiring adaptation • Declining supply of skilled labour • Slow pace of change in sector culture • Slow uptake and acceptance of new products and technologies • Reputational risks from non-responsible sourcing

ST.8

Develop a vision for the company



Template of Company Vision



With inputs from PR.3 (*Build the right external partnerships*), PR.6 (*Develop a value chain vision*) and ST.7 (*Do a SWOT analysis*), the next activity is to develop a vision for the company aligned with the value chain vision and key strategic priorities defined in previous activities.

The output of this is a short description of the company operating with a greater focus on sustainability, completed for GFC Building Supplies below (Figure 20).

ST.8 Develop a vision for the company



LEARNING CASE STUDY OF LIFE CYCLE THINKING FOR GFC BUILDING SUPPLIES

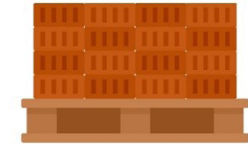


Figure 20 - Company vision for GFC Building Supplies, developed using SWOT analysis output and building materials value chain vision

SWOT

- Longstanding company experience and value chain relationships
- Strong in-house technical knowledge
- High dependency on a small number of import suppliers
- Low innovation capacity in-house
- Strong potential to develop secondary material market
- Concern on customer acceptance of new, sustainable building materials

VALUE CHAIN VISION

- Recognising and measuring the impact of the building materials sector (carbon, toxicity, waste)
- Increased collaboration to improve value chain efficiency
- Lower energy use in production
- Development of a circular economy for building materials
- Phasing out chemicals of concern
- Addressing built environment resilience (e.g. floods, heat)

COMPANY VISION

GFC Building Supplies is the leading building merchant in the region providing a one-stop solution for high quality products for projects of any size. With 20 years' experience in the sector, we understand the challenges faced in the industry today and are prepared for those in the future. Our commitment to quality, and our team's in-depth knowledge of materials, design and the market helps our customers achieve excellence in their construction projects.

The building materials industry is changing, and we are committed to being an industry leader in sustainability. We have set targets on decreasing our energy use and carbon emissions, and phasing out hazardous chemicals in products. We uphold high standards in health and safety, and through a rigorous green procurement policy we ensure our products are responsibly and ethically sourced.

We have developed an own-brand range of building products with industry-leading sustainability credentials. Our own-brand ready-mix concrete and paint products have undergone sustainability assessments and are quality tested, enabling our customers to deliver building projects with lower environment impact, and providing a healthy living or working environment.

We aim to be at the forefront of the transition to a circular economy and are currently working with our suppliers and customers to reduce waste in the value chain. Our own-brand ready-mix concrete now includes 5% recycled aggregates, and our target is to increase this to 15% by 2025. Better waste management in the industry is essential, and we seek to be part of the solution to 'closing the loop' for this material.

As an established, well-known firm in the regional building sector since 2000, GFC Building Supplies is driven to raising overall standards in the industry. Beyond our leading product range, we can work with our customers to provide design, specification and consultancy services on delivering a building project with high levels of sustainability and quality.

References and resources

- Adaptavate, UK-based sustainable plaster manufacturer – Vision and Values Statement. Available from: <https://adaptavate.com/about-us/#vision>

ST.9

Define the strategic goals



Template of TOWS

	Strengths	Weaknesses
Opportunities		
Threats		

Using the inputs from SWOT analysis, a TOWS analysis, which assesses the combinations of strengths and weaknesses with opportunities and threats, is used to identify strategy ideas (Figure 21). These new strategy ideas are then used to formulate a new set of strategic goals.

An example of this process is shown for GFC Building Supplies, with the output of a longlist of eight strategic goals identified for the company.

ST.9 Define the strategic goals



LEARNING CASE STUDY OF TOWS FOR GFC BUILDING SUPPLIES

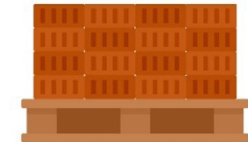


Figure 21 - TOWS analysis for GFC Building Supplies

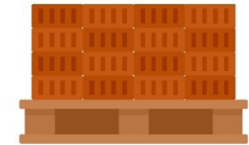
	<p>STRENGTHS</p> <ul style="list-style-type: none"> • Longstanding relationships and good reputation built with suppliers and local customer base • Strong in-house technical knowledge on materials and design • Effective CRM and IT systems • Healthy cash flows and reserves • Low staff turnover • Established procedures in place, good process efficiency 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Dependence on import suppliers for common building materials • High energy, water and fuel costs from site and transportation • Minimal R&D capacity in-house or links with innovative partners • Reputation of construction industry for inefficiency, lack of collaboration, poor safety record • Lack of experienced and skilled labour • No company processes or infrastructure for recycling • Low focus on sustainability in the industry
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Growing economy from increased demand for buildings • Consumer demand for sustainable building materials • Secondary value of waste construction materials • Trend towards more serviced building maintenance contracting • Emergence of new technologies in the sector 	<p>STRENGTHS-OPPORTUNITIES strategy ideas</p> <ul style="list-style-type: none"> • Green procurement and due-diligence strategy for raw materials and products • Use site for storage and reprocessing of secondary materials and off-site assembly • Use of IT systems and partner network to develop platforms for material reuse and more efficient logistics • Increased service-based offerings BIM, consultancy, design and training, equipment hire, repair and maintenance services 	<p>WEAKNESSES-OPPORTUNITIES strategy ideas</p> <ul style="list-style-type: none"> • Transition towards greater proportion of local raw material and product suppliers • Provide training, consultancy and safety equipment for customers as part of new service and product offering • Reduce energy use through on-site renewables, LED lighting, efficient motors and HVAC, energy management systems • Develop relationships with academic institutions, research projects and innovation hubs to develop and trial new products with enhanced functionality and cheaper production costs • Develop services for capturing value of secondary raw material

ST.9 Define the strategic goals



THREATS	STRENGTHS-THREATS strategy ideas	WEAKNESSES-THREATS strategy ideas
<ul style="list-style-type: none">• Price volatility of raw materials and products procured from manufacturers• Local competitors undercutting prices• Changing legislation on chemicals used in building materials• Saturated market for building products with low margins and low investment in innovation	<ul style="list-style-type: none">• Develop a product differentiation strategy and gain early-mover advantage from development of innovative sustainable materials• Develop innovate material solutions alongside partners to satisfy customer demand and enable product differentiation• Build partnerships with other SMEs to reduce material costs through collaborative procurement	<ul style="list-style-type: none">• Hire a sustainability advisor to work with customers to identify opportunities for improving practices and efficiency, reducing costs and improving efficiency, as well as complying with legislation• External partnerships to develop innovative products with lower toxicity to reduce compliance costs

ST.9 Define the strategic goals



LEARNING CASE STUDY OF STRATEGIC GOALS FOR GFC BUILDING SUPPLIES

Conducting the SWOT analysis for GFC Building Supplies and using the TOWS template has generated a series of strategy ideas. This seeks to harness the company's strengths and the main opportunities in the sector - growth, rising consumer demand for sustainable building materials, cost-savings from improved circularity, and emerging new technologies. Additionally, the proposed strategic goals aim to protect GFC Building Supplies against the main sector threats and operational weaknesses include increasing costs of materials, high market competition, supply chain disruption, price volatility, and environmental and health impacts of products and processes.

These ideas can be used to form the basis of a longlist of company strategic goals. Examples of these for GFC Building Supplies are set out in Table 30.

Table 30 - Learning case study of strategic goals for GFC Building Supplies

STRATEGIC GOAL #1	
What hotspot or other SWOT issues does the goal help to address?	Low company profitability
What is the desired change?	Increase revenue and profit margins
How will you know if the goal has been achieved?	Measuring overall income and costs, and on specific products
When will the change be achieved?	Within 3 years
Final formulation of the goal:	Within 3 years, revenue growth of 10% and average profit margin increased by 5%
STRATEGIC GOAL #2	
What hotspot or other SWOT issues does the goal help to address?	Market saturation for building materials
What is the desired change?	Increase the diversity of income streams and increase product differentiation
How will you know if the goal has been achieved?	Reduced reliance on fewer suppliers; new products brought into range; development of service-based offerings
When will the change be achieved?	Within 2 years
Final formulation of the goal:	Within 2 years, number of suppliers increased by 25%; development of 2 new service-based offerings
STRATEGIC GOAL #3	
What hotspot or other SWOT issues does the goal help to address?	Chemicals of concern in building products
What is the desired change?	Identify and phase out of toxic substances from products sold
How will you know if the goal has been achieved?	Substances of highest concern identified with roadmap to phase out and introduce alternatives
When will the change be achieved?	Within 2 years for products with market ready alternatives and 5 years where alternatives are still in development
Final formulation of the goal:	<ul style="list-style-type: none"> • Within 2 years, elimination of high-VOC paint, asbestos, and CCA-treated timber from the range • Within 5 years, elimination of chrome-plated products produced using Cr(VI), phthalates from plastic products, halogenated flame retardants

ST.9 Define the strategic goals



STRATEGIC GOAL #4	
What hotspot or other SWOT issues does the goal help to address?	High company climate impact
What is the desired change?	Measure and reduce scope 1, 2 and 3 carbon emissions
How will you know if the goal has been achieved?	Embodied carbon in products sold reduced; carbon emissions of operations reduced; products and services enable downstream carbon reductions
When will the change be achieved?	Within 5 years
Final formulation of the goal:	Set baseline and within 5 years reduce all company carbon emissions by 50%
STRATEGIC GOAL #5	
What hotspot or other SWOT issues does the goal help to address?	Low innovation in building materials sector
What is the desired change?	External partnerships with research and academic institutions to develop innovative products and services
How will you know if the goal has been achieved?	Return on investment from revenues from innovative products and services
When will the change be achieved?	Within 5 years
Final formulation of the goal:	Within 5 years, R&D to account for 10% of turnover with return on investment
STRATEGIC GOAL #6	
What hotspot or other SWOT issues does the goal help to address?	Working conditions impacts on health
What is the desired change?	Improved working conditions and health of employees and suppliers
How will you know if the goal has been achieved?	Set baseline of air quality, introduce dust recovery systems, monitor progress and report publicly
When will the change be achieved?	Within 2 years
Final formulation of the goal:	Within 2 years, improve working conditions of the site and setting procurement criteria for suppliers' factories, requiring setting a baseline for air quality, further reducing the dust emissions through introduction of dust recovery systems and ambient air quality monitoring
STRATEGIC GOAL #7	
What hotspot or other SWOT issues does the goal help to address?	Low market penetration of sustainable building products
What is the desired change?	In response to customer demand and gaps and market opportunities, introduce further sustainable products to the range
How will you know if the goal has been achieved?	Products have sustainability credentials independently verified and can demonstrate being cost competitive again less sustainable alternatives
When will the change be achieved?	Within 5 years
Final formulation of the goal:	Within 5 years, 3 new, certified sustainable products brought into the product range

ST.9 Define the strategic goals



STRATEGIC GOAL #8

What hotspot or other SWOT issues does the goal help to address?	Lack of circularity in building sector
What is the desired change?	Improved material recovery, lower waste
How will you know if the goal has been achieved?	Set targets for material efficiency, use of secondary materials, introduce circularity aspects into product design
When will the change be achieved?	Within 5 years
Final formulation of the goal:	Within 5 years, material and process waste reduced by 25%, increase in use of secondary materials by 25%, development of at least 3 products designed for circularity

ST.9 Define the strategic goals



EXAMPLES OF SUSTAINABILITY STRATEGIES IN THE BUILDING MATERIALS SECTOR

Companies in the building materials sector can pursue different strategies to drive eco-innovation across the value chain. Some examples to highlight are as follows:

'CIRCULAR BUILDINGS' – ROTOR DC, BELGIUM

[Rotor DC](#) (Deconstruction/Consulting) in Brussels has developed a successful business strategy around circular building services, developing a niche in this area and winning awards for its work in eco-design of buildings. Rotor DC emerged as a spin-off company of the not-for-profit organisation Rotor, which holds many years of research and insight on the second-hand building material market.

The strategy focuses on dismantling, processing, quality checking and selling salvaged components of buildings from their own projects, as well as materials sourced from collaborations with real estate companies and demolition contractors through their online sales platform.

One of the main strengths of the business model is that before deconstruction begins, Rotor DC evaluates the reclaim value potential of buildings and makes this information publicly available for prospective buyers. This helps the company act as a leader, facilitating second-hand market growth. This business model helps to reduce demolition waste, and offers vastly cheaper, quality checked building materials, with negligible environmental impacts.

From a [study by the BAMB project](#) in which the Rotor DC team were interviewed, it was found that there is large scope for growth in pursuing circularity business strategies, which are currently less established than other building sustainability areas such as energy efficiency. The study also found that a holistic approach is key, taking into account elements such as energy, water, occupant health, and material management. This approach also extends to engaging a range of stakeholders from the across the value chain, to foster early collaborative design and address a series of sustainability considerations.

From the market observed in Sweden, the study found that public sector procurement policies can drive demand and the mainstreaming of circularity practices enabling economies of scale and reduced costs. BAMB also highlight from their research that currently supply of second-hand materials exceeds demand, and there is a need to stimulate greater demand to fully realise material circularity in the sector.

Figure 22 - Building dismantling services from Rotor DC. Image from rotordc.com



ST.9 Define the strategic goals



CIRCULAR, LOCALLY PRODUCED BUILDING MATERIALS ADDRESSING THE ISSUE OF PLASTIC WASTE - GJENGE MAKERS, KENYA

[Gjenge Makers](#), based in Kenya, has brought innovative, alternative building material solutions to market that address sustainability and social issues. The company, founded by engineer and businesswoman Nzambi Matee, has developed a material technology and manufacturing process that repurposes waste plastics, mixing them with sand and moulding into durable, lightweight paving tiles and blocks for roads, parking areas and buildings.

Beginning as a start-up and now employing around 10 staff, the enterprise has developed its vision and strategy to align with UN SDGs 8, 9, 11 and 13. Gjenge Makers' vision statement outlines the need to provide sustainable building materials to the national market and beyond that are affordable and can address housing challenges. Matee's objective was to address the hotspot of plastic waste and contribute to the development of a circularity culture in the industry. The approach taken by the company reduces the disposal cost burden for businesses by collecting their waste plastics, and harnesses the opportunity to reduce production costs by essentially sourcing a free raw material, estimated to make the product 30% cheaper than equivalent concrete blocks. The company has also enabled local job creation by developing a network of over 100 waste plastic collectors. Additionally, the company strategy supports further opportunities for women in the engineering sector.

Over time, Gjenge Makers has built its expertise in collection and processing of plastics, and optimised the product formulation and manufacturing technology. This positions the company as a niche manufacturer and early adopter, providing a competitive advantage and product differentiation. Testing carried out demonstrates the blocks have greater strength than concrete, and they are certified by the Kenyan Bureau of Standards. Customer testimonials and case studies demonstrating successful installation projects are reported on the company's website.

Matee has fostered partnerships with various organisations to help increase production, including the Kenya Climate Innovation Centre, Alquity Investment Management, America's Watson Institute, Make-IT in Africa, and the iLab research and development unit at Nairobi's Strathmore University, and continues to develop relationships with local suppliers and construction firms, with expansion of the company and production planned, as well as operating in wider markets in Africa.

Matee's company has had a significant impact, having recycled over 20 tonnes of plastic waste since 2018, and winning five awards in the process, as well as being named a UNEP Young Champion of the Earth herself in 2020.

Figure 23 - Gjenge Makers founder Nambi Matee, top (image: Atlas of the Future) with paving blocks used in a residential project, below (image: gjenge.co.ke)



ST.9 Define the strategic goals



DEVELOPING A SPECIALISM IN LOWER-IMPACT, EARTH-BASED MATERIALS, ADAPTABLE TO THE LOCAL CLIMATE – ELEMENTERRE, SENEGAL

A construction sector boom is being seen in Senegal, with concrete use on the rise. As a leading innovator in compressed earth bricks, the construction firm Elementerre's BTC (blocs de terre comprimée – compressed earth bricks) materials address the hotspots of energy use and pollution from concrete and cinder block construction. Use of local materials further reduces the transportation impacts compared to concrete production, as well as contributing to local job creation.

Emphasising quality and making the product look attractive also contributes to further social acceptance of the material. Earth-based construction methods have fallen out of fashion in recent years as concrete has become inexpensive and widespread, but concrete's thermal performance is not well suited to West African high summer temperatures.

The BTC production process involves soil sifting, mixing earth with water and cement (around 8% of content), before storage and drying. The final step is compression in a manual or mechanical press into moulds to produce bricks of varying shapes and sizes, enabling a replicable process. The earth brick has a number of beneficial features, including:

- Flexible production at artisanal or industrial scale, with architectural and aesthetic quality, adaptable to different architectural forms
- High thermal resistance (4-6°C) compared to concrete block construction – in hot temperatures, earth-based materials provide improved thermal comfort and humidity regulation, removing the need for additional air conditioning
- Bricks have high sound resistance and are recyclable at end of life

At the current time, this revival in earth block manufacturing is not yet mainstream in construction, but efforts to further scale the techniques are being seen as Elementerre have carried out design and production trainings for companies in Guinea, where a similar approach to bioclimatic buildings is relevant. Elementerre are also interested in creating eco-responsible neighbourhoods to further scale up demand.

Figure 24 - Buildings constructed using ELEMENTERRE BTCs



ST.10

Generate ideas for new products, markets and selling points



Template of Products, Markets and Selling Points



At this stage you will generate new ideas for products, services, markets to operate in and selling points, in line with the new company vision and strategic goals defined in ST.8 and ST.9. An example of this is shown for GFC Building Supplies using the template in Figure 25.

ST.10 Generate Ideas for new products, markets and selling points



LEARNING CASE STUDY OF PRODUCTS, MARKETS AND SELLING POINTS FOR GFC BUILDING SUPPLIES

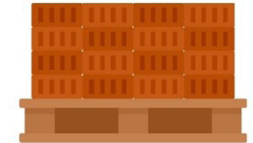


Figure 25 - GFC Building Supplies – Products, Markets and Selling Points

Company vision (ST.8)

- Leading builders merchant selling sustainable, high quality building materials
- Industry leader in development and sale of innovative, own brand sustainable building materials and associated services
- Champion of the circular economy and aiming to embed circularity in sourcing principles
- Responsible and proactive in addressing chemicals of concern in products
- Improving diversity, equity and responsible sourcing across the value chain

Strategic goals (ST.9)

- Revenue growth of 10% over next 3 years
- Diversify income streams
- Achieve targets for reduced carbon emissions and phase out of harmful chemicals
- Increased R&D focus to develop new innovative products
- Be a positive contributor to sectoral change
- Contribute to development of a circular economy in the building sector

Markets

- Local construction companies
- Large municipal supply contracts
- Export market

Products and services

- Lower-carbon ready-mix concrete
- Low-VOC, water-based paints
- Reclaimed materials
- Sustainably sourced and treated timber products
- BIM and design services
- Equipment hire
- Building deconstruction services

General ideas

- Explore opportunities for products-as-a-service (PaaS) business models (e.g. equipment and tool leasing, building maintenance contracting, lighting as a service)
- Provide material collection services for reuse and recycling
- Enter market for reclaimed materials

Selling points

- Sustainability as a selling point – helping our customers reduce their environmental and social impacts, as well as being more resilient to environmental conditions compared to using conventional building materials
- Horizontal differentiation – few competitors in the region sell our range of sustainable products
- Innovation – added value and functionality to conventional building products
- Circularity – reducing disposal and raw material costs and creating new secondary income streams

ST.10 Generate Ideas for new products, markets and selling points



BACKGROUND INFORMATION

UNDERSTAND THE PRACTICALITIES OF USING RECLAIMED MATERIALS

With the construction sector accounting for around half the use of new resources, and over a third of the waste in the EU¹¹, increased use of reclaimed materials has multiple benefits. Additionally, new innovative services, such as listing and exchange platforms, dismantling, treatment, storage, and delivery services can be developed around the reclaimed materials market, providing new income streams from prolonging the material value and reducing disposal costs. Reclaimed building materials may become available from 'same site' or 'site-to-site' reuse, or may be sourced, refurbished, and sold by specialist suppliers.

However, their use in construction is not yet common practice. There are also a number of practical considerations to mitigate unintended and detrimental effects. Incorporating circularity considerations into the building value chain may involve a learning curve for companies used to linear construction models. These include:

- **Effective early-stage planning and involvement of key stakeholders across the value chain.** Including reclaimed materials in the project specification requires an early commitment and consensus among stakeholders. Beyond the buy-in of the client and project sponsor, this may include designers, architects, quantity surveyors, suppliers, contractors, and waste management companies. The early involvement of technical experts, such as demolition and deconstruction experts who can conduct effective reclamation audits and material assessments is also recommended. Writing a reclaimed materials target into the contract and design brief is key to ensure effective oversight and commitment. This may be linked with achieving a building sustainability rating, which can help ensure the project has measurable targets on use of reclaimed materials.
- **Understanding the material properties and its reuse potential.** The viability for reuse, material availability and market maturity varies between materials. For example, bricks have one of the more established markets for reuse, but this still has challenges – their durability and structural properties (compressive strength, water absorption) need to be demonstrated as sufficient, and further processing may be required. If this requires transportation, it is estimated that once bricks travel more than 250 miles by road, their impact is greater than local manufacture of new ones. In some cases, such as timber beams, reclaimed materials may be of higher quality than typical products available on the market, but sourcing times may affect project schedules.
- **Ensuring quality and safety of materials.** Reclaimed materials will not typically carry the warranties and quality assurance that new materials hold, as standards are not in place as is required for new materials. Quality inspections by material experts will need to be carried out and documented, and engagement among the multiple partners involved in a construction project, including the client, is recommended to identify and share any risks. In some cases, tests will need to be carried out to ensure materials are fit for purpose. Reclaimed materials retailers should provide quality assurance for products sold and sourcing via this route may provide a quicker route to ensuring due diligence and easier risk management in some cases than same site or site-to-site reuse.
- **Ensuring consistency of supply.** Reclaimed building materials may not be available as readily as new ones, and early engagement with procurers may be necessary to guarantee supply of the material. Off-site storage ahead of the project start may be required in some cases.
- **Ensuring actual reduction in environmental impacts.** Using reclaimed and recycled materials reduces the demand for virgin material extraction and new production, but it is important to consider the carbon emissions from transportation and processing, as this can lead to higher embodied carbon and pollution impacts than primary production. This should be evaluated on a case-by-case basis.
- **Preparing for a flexible approach.** Using reclaimed materials may require deviations from traditional, 'construction-as-usual' approaches based on linear use models. Project schedules and design briefs may have to be subject to flexibility, depending on what materials are available. This can be underpinned by also incorporating a more flexible contracting arrangement.

¹¹ Buildings as Material Banks project: <https://www.bamb2020.eu/>

ST.10 Generate Ideas for new products, markets and selling points



- **Incorporating digital tools.** The case to use reclaimed materials in a project can be supported by calculation tools to quantify the carbon and material savings. Additionally, recording and tracking the materials used through Building Information Modelling (BIM) software can enable assessment of their potential for reuse – producing a comprehensive set of 'Material Passports' is a valuable process to enable improved design and maximise the lifetime and value of materials. and tracking the materials used through Building Information Modelling (BIM) software can enable assessment of their potential for reuse – producing a comprehensive set of 'Material Passports' is a valuable process to enable improved design and maximise the lifetime and value of materials.

UNDERSTAND THE PRACTICALITIES OF USING RECYCLED MATERIALS

Use of recycled materials in products or as a service provision can be effective eco-innovation strategies that can deliver environmental benefits. However, there are a range of considerations for different building materials to ensure that basing an eco-innovation strategy or project around increased use of recycled materials does not have detrimental, unintended consequences related to chemical safety or product quality.

- **Plastics** – various regulations are in place that prohibit the use of recycled plastic in applications that involve contact with food or potable water, e.g. water pipes. Contaminated feedstock, ineffective cleaning processes and poor waste management infrastructure can lead to health and safety issues from this material. Ensuring sufficient supply chain transparency and traceability is vital to mitigate risks of harm to production operatives, end users and the environment.
- Use of recycled **aggregates** from inert, crushed construction and demolition waste can reduce waste and the need for virgin materials, and reduce costs alongside sustainability benefits. However, care should be exercised when processing and re-using these materials in concrete mixes. Waste materials may include the remains of brick, glass and plastics, and the material composition may not be fully known, which could cause chemical safety issues, or problems with structural strength and integrity. A range of guidance and studies recommend that recycled aggregates should be used in an appropriate quantity in concrete mixes, ranging from 10-30%. Effective site waste segregation and material management can also help ensure that the risks of using this material are known and reduced.
- Recycling **gypsum board** has many benefits, improving circularity by reducing mining and transportation, and reducing its environmental impact from landfilling. In 2021 the GPDA reported that the industry achieved 9.45% post-consumer recycled content in new plasterboard. However, gypsum board recovered from demolished buildings may be contaminated with paint, and concern has been raised about the content of heavy metals and biocides in products that have not undergone rigorous QA testing, or are produced by the synthetic route. If the source of the material to be recycled is not known, testing for toxic substances may be required to ensure the recycled board is safe for production operatives and end users. This risk can be mitigated by appropriate building design for dismantling, and the use of material passports would be expected to improve the traceability of this material, and subsequently the chemical safety and recovery rates.

References and resources

- Evaluating reuse potential: Material profiles and vision for project workflow. Arup. Available from: <https://www.arup.com/perspectives/publications/research/section/evaluating-reuse-potential-materials-profiles>
- Full Circle to Reuse. Elliott Wood. Available from: <https://online.flippingbook.com/view/915371497/>
- Accelerating material reuse. Grosvenor. Available from: <https://grosvenor.com/materialreuse>
- Material Passport Guide. Orms. Available from: http://orms.co.uk/~ormscouk/wp-content/uploads/2021/05/Orms-Materials-Passports_flipbook-correct-QR.pdf
- MPA Cement Fact Sheet 6 – Use of recycled aggregates in concrete. Mineral Products Association. Available from: https://cement.mineralproducts.org/MPACement/media/Cement/Publications/Fact-Sheets/2023-02-09_FS_6-Use_of_recycled_aggs_in_concrete.pdf

ST.11

Evaluate ideas for new markets, products and selling points



Template of Products, Markets and Selling Points

Idea title _____	
Risk	Benefit
Product	Economic
Market	Environmental
Selling point	Social

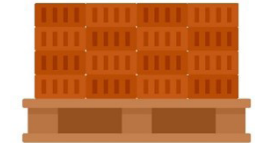
With new ideas generated for new markets, products and selling points, these can be evaluated using the process and template of Strategy Idea Evaluation in ST.11, which has been completed for the strategy idea of more sustainable own-brand ready-mix concrete for GFC in Figure 26.

The evaluation found that this idea has a medium risk rating, but has potential economic, environmental, and social benefits that fit with GFC's strategic goals.

ST.11 Evaluate ideas for new markets, products and selling points



LEARNING CASE STUDY OF STRATEGY IDEA EVALUATION FOR GFC BUILDING SUPPLIES



Idea title: Development of an own-brand ready-mix concrete with high sustainability credentials (low clinker cement, use of local materials, secondary aggregates, recyclable packaging)

Figure 26 - Strategy idea evaluation for GFC Building Supplies – development of own-brand, more sustainable ready-mix concrete

RISKS				BENEFITS		
Type of risk	Description	Existing or new?	Risk score	Type of benefit	Description	Fit with strategic goals
Products	Uncertainty of supply of secondary aggregates and lack of production scale for manufacturing	New	1	Economic	Meeting customer demand for more sustainable products	Within 5 years, 3 new, certified sustainable products brought into the product range (#7)
Market	Strong position of traditional ready-mix concrete in the market	Existing	1		Reduced raw material costs	Within 3 years, revenue growth of 10% and average profit margin increased by 5% (#1)
Selling point	Concrete marketed with sustainability credentials may be perceived as inferior to traditional products	New	2	Environmental	Lower carbon emissions from raw materials and processing; recyclable packaging	Set baseline and within 5 years reduce all company carbon emissions by 50% (#4)
		Total	4		Improved circularity	Within 5 years, material and process waste reduced by 25%, increase in use of secondary materials by 25%, development of at least 3 products designed for circularity (#8)
		Risk rating	Medium	Social	Lower dependency on quarrying; improved supplier selection process specifying appropriate health and safety policies and procedures	Within 2 years, improve working conditions of suppliers' factories by requiring setting of baseline of air quality, further reducing the dust emissions through introduction of dust recovery systems and ambient air quality monitoring (#6)

ST.12

Select which ideas for new markets, products and selling points to include in the strategy proposal



Template of Business Strategy



This activity enables the selection of which ideas you will include in the strategy proposal by evaluating them collectively.

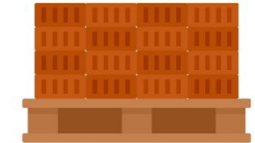
The Template of Strategy Proposal Development requires to you consider which ideas help to make the most progress towards the strategy and goals, which have the greatest benefits and lowest risk, are feasible considering market competition, and which cluster of ideas work well together.

This has been completed for GFC Building Supplies in Figure 27 for the ideas of more sustainable ready-mix concrete and paint as a service.

ST.12 Select which ideas for new markets, products and selling points to include in the strategy proposal



LEARNING CASE STUDY OF IDEAS FOR NEW MARKETS, PRODUCTS AND SELLING POINTS FOR GFC BUILDING SUPPLIES

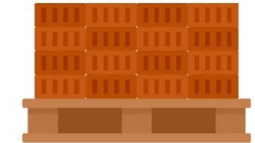


Idea title: Development of an own-brand ready-mix concrete with high sustainability credentials (low clinker cement, use of local materials, secondary aggregates, recyclable packaging) compared with paint as a service (performance-based, chemical leasing model).

Figure 27 - GFC Building Supplies Strategy Proposal Development – sustainable ready-mix concrete cement and paint as a service

<p>Idea title: Sustainable ready-mix concrete</p>		<p>Competition</p> <ul style="list-style-type: none"> Other building merchants selling traditional concrete Cheaper paints 	<p>Cluster</p> <ul style="list-style-type: none"> Both sustainable concrete and paint as a service can deliver sustainability benefits to the end customer Potential for up-sell to existing client on the same building project
<p>Product</p> <p>Lower carbon ready-mix concrete using recycled aggregates</p>	<p>Benefits of the idea</p> <ul style="list-style-type: none"> Product differentiation, contributes to waste reduction by using recycled aggregates No change needed to plant equipment or business support services 	<p>Fit with strategy and goals</p> <ul style="list-style-type: none"> Both ideas address reducing carbon of product life cycle Sustainable concrete fits with goal of bringing new innovative products to a highly competitive and saturated market Paint as a service enables reduced waste and more bulk orders Both ideas contribute to improved circularity in the industry 	
<p>Market</p> <p>Local building companies and clients with sustainability focus</p>	<p>Risks of the idea</p> <ul style="list-style-type: none"> Ensuring quality and consistency of material Reluctance of building firms to move away from traditional materials 		
<p>Selling point</p> <p>Lower carbon cement enables higher building rating scores, meets sustainable product procurement criteria</p>	<p>Risk assessment - MEDIUM</p> <ul style="list-style-type: none"> Good in-house expertise and QA processes in place Consumer base is loyal, but perceived to have some resistance to change 		

ST.12 Select which ideas for new markets, products and selling points to include in the strategy proposal



Idea title: Paint as a service		Benefits	Risks
<p>Product Providing paint in bulk in amounts tailored to the project</p> <p>Market Professional painters</p> <p>Selling point Reduced waste, ongoing customer relationships</p>	<p>Benefits of the idea</p> <ul style="list-style-type: none"> • Opportunity to use low-VOC paints on bulk projects • More predictable income and opportunity for repeat business • Reduced paint and packaging waste by painters • Opportunity to recover and reuse paint and packaging materials <p>Risks of the idea</p> <ul style="list-style-type: none"> • Customers slow to embrace new business model and enter into longer-standing arrangement • Possibility to be undercut by firms offering cheaper, low-quality paint • Requires partnership <p>Risk assessment - HIGH</p> <ul style="list-style-type: none"> • New business model for GFC to execute – different business support systems needed • Customer rejection due to perceived higher cost 	<ul style="list-style-type: none"> • Sustainable ready-mix concrete expected to demonstrate same functionality at lower cost • Opportunity to win larger public sector contracts for both materials where sustainable product procurement is in place • Paint as a service offers faster payback and improved customer retention if successful 	<ul style="list-style-type: none"> • Paint as a service requires new partnership arrangement • Companies are reluctant to try sustainable ready-mix concrete due to perceived inferior performance

ST.13

Do an Individual/ Group Review of the Business Strategy



Template of Business Strategy



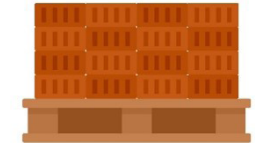
With the elements of your business strategy developed, these are then reviewed to identify any issues and inconsistencies, and the overall viability of the strategy for the company. This can be done separately or in collaboration with the company using the template for Business Strategy Review.

This considers the company vision, strategic goals, and the changes proposed to the markets, products and selling points. Sample review questions can be found on p. 178 of the Eco-innovation Manual. After performing this review, the strategy proposal can be adjusted accordingly. Figure 28 shows the Template of Business Strategy updated and adjusted for GFC Building Supplies.

ST.13 Do an Individual/ Group Review of the Business Strategy



LEARNING CASE STUDY OF BUSINESS STRATEGY FOR GFC BUILDING SUPPLIES



KEY POINTS FROM GFC BUILDING SUPPLIES' BUSINESS STRATEGY REVIEW WORKSHOP

The strategic goals set in ST.9, and the new company vision and ideas for products markets and selling points drafted in ST.10 have been reviewed in a workshop. Key findings were as follows:

- The strategic goals in the longlist are generally consistent and well-aligned. They cover sustainability hotspots and company diversity goals that GFC Building Supplies wish to address, but they may be too wide ranging. The workshop discussion suggested that the goals that align best with existing company strengths, and address the most significant threats, should be prioritised.
- Addressing the strategic goal of market saturation and low margins, income stream diversity and improving circularity aligns well with existing company expertise, processes and assets. This could result in the following changes to products and services:
 - Introducing a new own-brand ready-mix concrete product with increased use of recycled aggregates. This can be produced with existing equipment and the company has strong in-house expertise in this material. It is expected to be cost competitive with imported products. A goal for this product would be for it to meet criteria for recycled material green building ratings schemes and public sector sustainable procurement criteria in future
 - Waste material collection is considered viable from existing activities to deliver building materials to sites and there are opportunities in the local area
 - There is potential to developing a sales offering for reclaimed timber and bricks, with the existing warehouse and sales platform fit for purpose
 - Further service-based offerings have different viability. Equipment hire is deemed feasible and low risk. Providing paint as a service is considered less viable. This would require development of new business support services related to contracting and invoicing, and would require new development of partnerships with professional painters. This may be revisited in future.
- Addressing the strategic goal of reducing chemicals of concern is desired and will be necessary for certain products due to changing legislation, but is considered more challenging. The strategic goal set identifies a phase-out timetable.
 - Whilst the broad ambition of this is expected to be achievable, adjustments to the timescale for some products may not be achievable when considering the market readiness of chemical alternatives
 - Addressing this goal only through in-house resources is considered challenging - further collaboration with partners, including trade associations, regulatory bodies and test houses are expected to be needed. It was suggested to maintain this strategic goal, but regularly revisit it and update if necessary.
- Discussions with employees at the company suggested strong appetite to pursue further services around BIM and design, and identified opportunities to reduce energy use and implement water recycling on site.

ST.13 Do an Individual/ Group Review of the Business Strategy



- A commitment to responsible sourcing and supply chain auditing was considered to be missing from the initial set of strategic goals. Whilst nothing is yet in place for this, GFC Building Supplies have a staff member with some experience in this area.
- Improving diversity in the organisation has been previously raised, but with no defined measures yet in place. Hiring procedures and targets can be put in place and monitored, engaging more women at senior level, as well as in training and apprenticeship programs.

The review led to the updated Strategy Proposal in Figure 28.

ST.13 Do an Individual/ Group Review of the Business Strategy



LEARNING CASE STUDY OF PRODUCTS, MARKETS AND SELLING POINTS FOR GFC BUILDING SUPPLIES

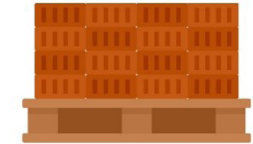


Figure 28 – Updated Strategy Proposal Development for GFC Building Supplies

Company vision

GFC Building Supplies is a leading builder’s merchant selling high quality, sustainable building materials at affordable prices for domestic and international export markets.

We work closely with our suppliers of own brand products to reduce the environmental impact of key products through developing more efficient manufacturing processes to reduce energy use, introducing recycled and secondary materials and addressing chemicals of concern. We also work with our customers to develop products that improve the resilience of the built environment, from reducing heat stress and energy demands, to flooding and water management.

Eco products such as lower-carbon concrete represent a growing proportion of our product ranges, with health benefits promoted alongside their environmental credentials. Staff and customers are receiving clear guidance and training to support the transition to new product formulations.

We are continually looking for ways to support the transition to a circular economy, for example through working with our value chain partners to recover and re-purpose a range of building materials, and develop a sales offering around reclaimed materials.

We are committed to addressing environmental and social issues in the supply chain related to responsible sourcing and have developed a policy that our suppliers must adhere to. Additionally, we aim to contribute to improved gender equity in the industry, starting by ensuring this is part of our own company’s operations and procedures.

Products and services

- Products with sustainable features and functionality
- Low-carbon cement and concrete
- Reclaimed timber and bricks
- Water based, lead-free paints
- Equipment hire
- Waste material collection
- BIM services and consultancy

Markets

- Domestic markets
- International trade customer markets
- Public sector tenders
- Sustainable and self-build market

Selling points

- Focus on sustainability of products
- Flexible products and services, tailored to customer needs
- Affordable prices
- Excellent customer service
- Working with the value chain to improve circularity and reduce disposal costs

Strategic goals

Increased sustainable product offering.

- Develop three new sustainable product types that account for 20% of sales within next three years
- New, cost competitive cement products that achieve credits in Green Building Rating Systems within three years

Diversification of income streams. Develop low-overhead equipment hire and BIM consultancy services, to be profitable in year 2.

Developing business services and championing the circular economy. Introduce three waste collection and repurposing material streams within three years

Enter the market for reclaimed materials. Develop a competitive product offering around at least three reclaimed materials

Commitment in place to remove all chemicals of concern. Compile inventory of chemicals used in business in year 1 and devise action plan for phase out by year 5.

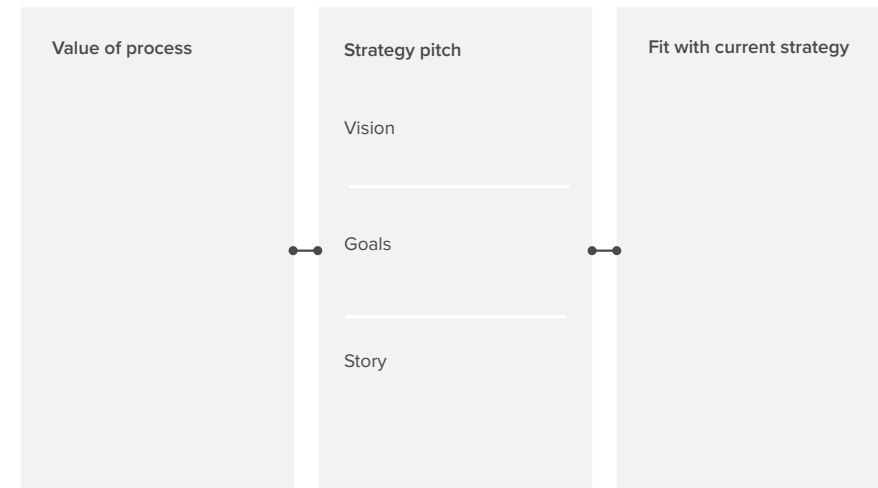
Reduced environmental impact of company operations. Measuring and reducing environmental impact by implementing an environmental management system. Set baseline in year 1, and a 5-year reduction plan for water, energy and carbon emissions

ST.14

Pitch the new business strategy to the CEO



Template of Business Strategy Pitch



Now that the company's new business strategy reviewed and established, you will finally pitch it to the CEO and Senior Management Team alongside a proposal for your eco-innovation services to facilitate strategy implementation.

To go about this, the Template of Business Strategy Pitch can be used, which has been completed for GFC in Figure 29.

ST.14 Pitch the new business strategy to the CEO



LEARNING CASE STUDY FOR GFC BUILDING SUPPLIES

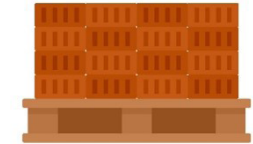


Figure 29 - Template of Business Strategy Pitch completed for GFC Building Supplies

Value of your process	Strategy pitch	Fit with current strategy
<p>Gathered data on current strategy, business model and operational performance.</p> <p>Identified specific sustainability hotspots, opportunities and threats for the company.</p> <p>SWOT and TOWS analysis of internal and external business landscape.</p> <p>Developed vision and goals linked to new products, markets and selling points.</p> <p>Specialist insights:</p> <ul style="list-style-type: none"> • sustainability assessments of product range and alternatives • market trend analysis • legislation analysis • carbon footprinting and equipment audit • material flow analysis • supplier risk assessment • partnership and capacity building. 	<p>Vision GFC is a leading builder’s merchant selling sustainable building materials with high quality at affordable prices for domestic and international export markets.</p> <p>Goals Increase our sales through aligning our product range with requirements of sustainable building certification schemes.</p> <p>Manage risks and enhance our reputation through industry partnerships and collaborations to improve environmental and human rights performance in strategic materials sourcing.</p> <p>Protect the health and wellbeing of workers in our supply chain, production sites and our customers through removing and replacing chemicals of concern, and supporting resilience to flooding and temperature control in the built environment.</p> <p>Reduce our operational costs and environmental footprint of our production sites and retail premises.</p> <p>Achieve 20% of sales from sustainable products within next three years.</p> <p>Story GFC has a strong market position but is currently struggling to expand and differentiate their offering from competitors. Building specific sustainability goals into the business strategy will help to comply with changing legislation and standards in the construction sector, while helping to manage supply chain and operational risks and costs.</p>	<p>Building knowledge and profile of sustainable products fits with strong customer service offering.</p> <p>Focusing on product innovation on own brand products where we have most influence over suppliers and product specifications.</p> <p>Reducing costs from energy use, waste and raw material sourcing.</p>

SET BUSINESS MODEL

Defining a new business model to deliver the business strategy

BM.1

Update the data-gathering strategy



In this first step of defining a new business model to deliver the business strategy, we seek to better understand the performance of the company through an In-Depth Assessment. This involves updating the data gathering strategy (BM.1), gathering additional data on the business model (BM.2) and operational performance (BM.3)

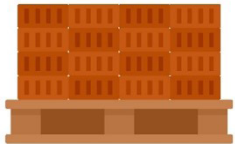
The data gathering strategy can be updated using the template provided in the Manual, and an example is completed for GFC Building Supplies (Figure 30), which considers the business strategy and the areas where further data is required.

BM.1 Update the data-gathering strategy



LEARNING CASE STUDY OF DATA-GATHERING UPDATE FOR GFC BUILDING SUPPLIES

Figure 30 - Template of Data Gathering Update for GFC Building Supplies



Business strategy

- New product: Lower embodied carbon concrete
- New selling point: Same performance from lower impact material
- Increased energy savings and improved circularity



New data

- Expected supply of recycled aggregates
- Final figure for production cost estimate
- Data from tests; setting times and strength
- Knowledge of downstream building firms to use new concrete effectively



Type of data	Do I need it?
Current company vision	✓
Current strategic goals	✓
Current products, markets and selling points	✓
Current business model	✓
Main competitors and what they offer	✓
Flow diagram of internal processes	✓
Biggest contributors to production costs	✓
Biggest contributors to materials and water consumption (for company and for value chain)	
Biggest contributors to energy consumption (for company and for value chain)	
Biggest contributors to health, safety & toxicity concerns (for company and value chain)	
Biggest contributors to social impacts (for company and for value chain)	
Sales revenue data for last three years	✓
Profit and loss data for last three years	✓
Number of employees including breakdown by role/department	✓
Details of key suppliers	✓
Details of key partners and nature of partnership	✓
Details of environmental and social management system or policies in place	
Understanding of how the company is viewed by the local community, suppliers and customers	✓
Details of the company's policies and practices to promote innovation	
Details of facilities and resources to support product research and development	
Understanding of procurement policies and practices to promote sustainability	✓
Biggest contributors to energy consumption (for company and for value chain)	
Biggest contributors to health, safety & toxicity concerns (for company and value chain)	
Biggest contributors to social impacts (for company and for value chain)	

BM.1 Update the data-gathering strategy



TIPS & TRICKS

FOCUSED DATA COLLECTION

SMEs often are time-poor, with business operations often leaving very limited time for activities that may not be considered to be revenue generating priorities. Limited time may be available to gather data and it may not be possible to get all the information desired.

To prepare for this, a brief assessment of how much time the company can be expected to devote to data provision, and the priorities for information gathering related to Eco-Innovation strategies should be documented and used as part of the interactions with the company.

Understanding the method for data provision that your contact at the target company prefers to use is key – for example this might be through a particular program or file type, verbal or written, or through a questionnaire.

Questionnaires should strike the right balance enabling an appropriate level of detail whilst also not appearing so long to complete that your contact does not fill it in, and questions should attempt to not lead responses.

COMMUNICATE THE REASONS FOR DATA COLLECTION AND POTENTIAL BENEFITS CLEARLY AND SUCCINCTLY TO THE TARGET COMPANY

Data gathering is generally much more effective if the person tasked with providing the information can link it directly to the desired outcome and tangible benefits. It is important to make the end-goal of data gathering clear to enable more efficient collection and provide an incentive for the target company to provide this information.

If time allows, building a good relationship with your contact at the target company through in person meetings or phone calls is often a more effective means of data gathering than using only email communications.

BM.3

Gather additional data on operational performance



At this stage, you should have a more in-depth understanding of the company's business model, as well as an assessment of strengths and weaknesses from the SWOT analysis in ST.7.

This activity aims to gather more detailed data on key areas of operational performance that can contribute to sound decision making on what possible new business models could consist of.

BM.3 Gather additional data on operational performance



TIPS & TRICKS

SELECT A FLAGSHIP PRODUCT FOR PERFORMING AN LCA

With many different building materials and products available, as discussed in PR.1 and PR.4, life cycle assessment (LCA) is a useful tool for prioritising action and identifying areas for improvement.

It is essential that methodology is consistent between products explored – for example one product may have its largest impact in the production phase and another in its end-of-life phase.

Ensure that LCAs compared use the same system boundaries (e.g. cradle-to-gate) and functional unit. Identifying the life cycle stages where eco-innovation can have the greatest effect is key, and this should be considered alongside the processes, strengths and competencies, partnerships, equipment, and infrastructure that the company has in place to address the hotspots and realise the benefits of a particular life cycle stage.

Strong opportunities for eco-innovation exist where there is a combination of a specialism that can address an area of high impact at a particular life cycle stage, even if this process or activity is not yet carried out by the target company.

GATHER DATA RELATED TO CHEMICALS OF CONCERN AND POTENTIAL SUBSTITUTES

At the Preliminary Assessment phase, it may still be possible to remotely gather data on the chemicals contained within building materials. Further detail can be obtained through direct contact with the company (signing confidentiality agreements may be required for this purpose).

Using tools such as the OECD Substitution and Alternatives Assessment Toolbox can provide benefit in identifying where chemicals of concern are being used and what alternatives could be specified. Additionally, the service provider can add value by providing consultancy and advice on upcoming regulatory changes and new industry trends on alternatives.

BM.4

Generate business model concepts at the big picture level



Having devised a new business strategy (ST.12 and ST.13), pitched this to the CEO (ST.14), and gathered further supporting data, this aim of this activity is to generate multiple options for business model concepts, at the 'big picture' level.

As well as being aligned and compatible with the company's strengths and weaknesses, business model concepts should also take into account any important operational considerations (for example investment in new equipment), and ensure business model concepts are compatible and feasible.

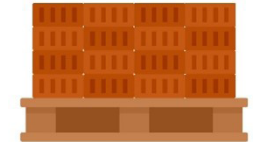
Use the Business Model Canvas (populated in ST.3 and updated in BM.2) to identify key aspects of the current business models that a new one should take into account. A 'top-down' approach involves deciding which aspects of company operations are fixed, and forming the business model ideas to address hotspots around this structure.

The example that follows considers the 'bottom-up' approach, where GFC Building Supplies takes the strategic goals identified and, considering sustainability strategies, seeks to develop new business models, and amends aspects of its business model canvas.

BM.4 Generate business model concepts at the big picture level



LEARNING CASE STUDY OF BUSINESS MODEL CANVAS FOR GFC BUILDING SUPPLIES



From reviewing its SWOT and TOWS analysis, and considering the strategic goals outlined in ST.9, GFC Building Supplies now considers various options for new business model concepts. As a company with engagement at multiple stages in the value chain, several opportunities exist to apply the company's specialist knowledge to improve circularity and address chemicals of concern. As well as adapting its own internal processes for more sustainable procurement and production, GFC Building Supplies could also develop new business model concepts involving external partners.

DEVELOPMENT OF NEW BUSINESS MODELS

Three alternative business models are set out below which GFC Building Supplies could pursue, by adapting the existing business model to achieve the company's vision of becoming a leader in sustainable building material supply and services.

Alternative Business Model #1 – “Collaborative vertical integration”

With frequent industry reports of the construction value chain operating in a fragmented way, a collaborative approach that links the needs of occupants, architects and designers, material specifiers, construction firms and waste management service providers is suggested.

The value proposition is based on fostering improved collaboration to reduce inefficiency (both in terms of processes and material use) and can develop best practice in the value chain that can be captured and replicated in future.

Additionally, the approach could enable economies of scale in material sourcing, and options for material reuse if spanning multiple projects. Better connectivity and communication between stakeholders could also enable more efficient use of on-site time.

A data gathering exercise on recent projects that GFC Building Supplies was involved in showed:

- The architect working on the project had little knowledge of low-carbon cement products
- The main contractor preferred to specify conventional cement, with cost the main driver

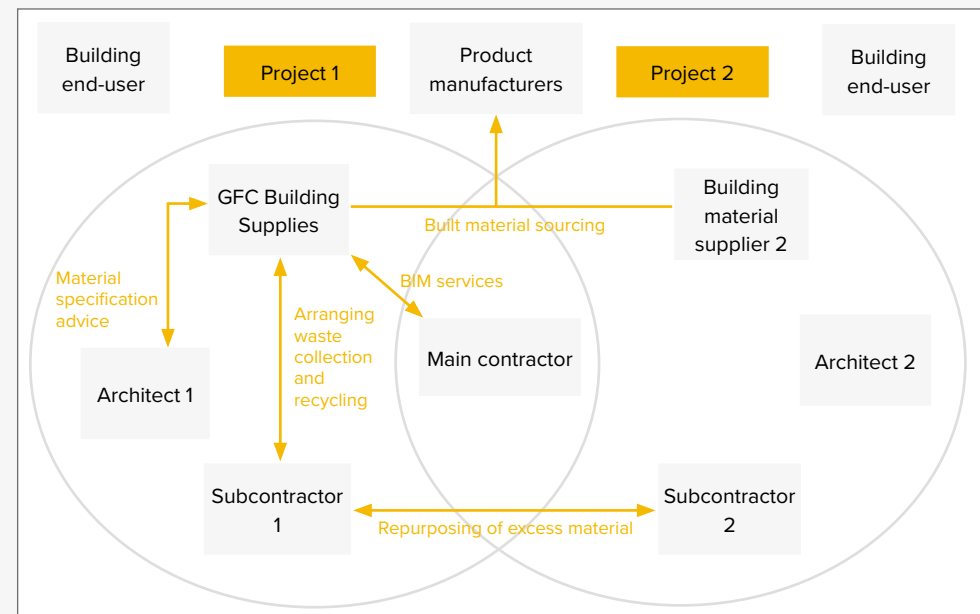


Figure 31 - schematic of facilitation of a vertically integrated approach to a construction project

BM.4 Generate business model concepts at the big picture level



- Buying greater quantities could result in a lower price for low-carbon cement, if procured alongside another similarly sized project
- High impacts in production and end-of-life phases, and safety issues were identified from using insulation with halogenated flame retardants
- High impacts were identified from using imported bricks – by procuring across two projects, use of a local supplier became more cost effective and could reduce the impact of transportation

Entering into more formal arrangements with multiple partners at different stages of the value chain could enable GFC Building Supplies to apply its expertise and expand its offering to become a services delivery company, beyond only material supply. This would fit with strategic goals of diversifying income streams, as well as further partnership building. Being part of a network of collaborating firms could also enable greater circularity of building products and processes. For example, closer linkages with on-site contractors could enable GFC Building Supplies to facilitate waste collection, repurposing and recycling and derive value from the secondary use of materials.

Alternative Business Model #2 – “Leader in sustainable products”

This business model aligns with strategic goals of reducing environmental impacts from production, responding to demand for more sustainable building materials, improving circularity, supporting resilience in the built environment, and addressing chemicals of concern. Emphasising sustainability as GFC Building Supplies’ selling point provides differentiation from most competitors in the market. This would carry the risk of being seen as more expensive, and also that some customers may not yet be familiar with sustainable, alternative building materials and may perceive these as inferior, or only for use in specialist projects. However, positioning the company as a sustainable building merchant could provide a first-mover advantage as demand for more sustainable building materials increases.

GFC Building Supplies could achieve this by ensuring all own-brand products have strong sustainability credentials and set sustainability standards for procurement of most third-party products. Certifications could be pursued to provide assurance for customers on performance. It is important to ensure that a shift towards more sustainable products is accompanied by appropriate marketing, that is clear, substantiated and avoids ‘greenwash’.

Alternative Business Model #3 – “Circular champion”

Embedding circularity within the GFC Building Supplies’ operations was identified as a business model that could provide benefits. Circularity could be enhanced through four main approaches:

1. **Product life extension.** Setting minimum lifetime criteria and guaranteeing it through the product warranty, or considering subscription-based business models. This could be considered through maintenance contracts, or applied to products such as timber, for example modified timbers such as Accoya can have a service life expectancy of over 50 years
2. **Design for dismantling (DfD).** This could be at the single product level, for example a window, light fitting or flooring system could be designed for dismantling. Increasingly, consideration is being given towards DfD for entire building sections that can both be put together and taken apart off-site
3. **Resource recovery** can exist as a service, where the company conducts demolition, dismantling, segregation, collection, processing and re-sale of end-of-life or reclaimed building materials
4. **Innovative products** made from process waste, by-products, or secondary materials from other sources (e.g. flooring made from recycled tyres), and removing chemicals that inhibit circularity.

The above business model fits with GFC Building Supplies’ strategy of introducing products that repurpose secondary material or are designed for circularity, generating cost savings through reduced waste, and avoided disposal costs and levies, and diversifying income streams through providing services.

BM.4 Generate business model concepts at the big picture level



A review of the “Circular Champion” concept identified new elements to be considered in GFC Building Supplies’ business model:

Table 31 - review of ‘Circular Champion’ business model for GFC Building Supplies

Product life extension	Value Propositions	Reduced waste disposal costs
	Customer Relationships	After sales service
	Cost Structure	Product subscription service
	Revenue streams	Aftersales service and maintenance
Design for dismantling (DfD)	Key partners	Product designers
	Value Propositions	Reduced maintenance and disposal costs
	Customer Relationships	Direct communication
	Channels	Marketing, webinars
Resource recovery	Key partners	Waste management companies, logistics/delivery firms
	Key Activities	Take back and collection
	Key Resources	Storage facilities, software tools to track material supply
	Value Propositions	Reduced waste disposal costs, job creation from material recovery and collection
	Customer Segments	Local trade and construction customers
	Revenue streams	Secondary market value of materials
Innovative products	Key partners	Academic institutions, researchers, test houses
	Key Activities	R&D on innovative, chemically safer and more circular products
	Value Propositions	Product differentiation
	Customer Relationships	Direct communication through longstanding trade and supplier relationships
	Channels	Trade associations, industry events, conferences
	Cost Structure	Innovation hub/accelerator funding

BM.4 Generate business model concepts at the big picture level



The “Circular Champion” Business model is captured in the below business model canvas, detailing the key elements to enable GFC Building Supplies to be able to offer more circular products and reduce waste. This adds some of the most important elements identified above to the existing business model canvas, which was originally captured in ST.3 and updated in activity BM, shown in blue.

Figure 32 - Example of updated Business Model Canvas for ‘Circular Champion’ business model for GFC Building Supplies

Key partners <ul style="list-style-type: none"> Product and material suppliers Local firms conducting material processing and assembly Distributors Waste management companies Test houses, academic institutions Trade associations Product designers 	Key activities <ul style="list-style-type: none"> Procurement of materials and products Product specification for customers Development and production of own-brand range of cement, concrete, paint 	<ul style="list-style-type: none"> Customer relationship management Take back activities to secure a reliable supply of material R&D and testing on more circular products Certification/recognition by building rating schemes 	Key value propositions <ul style="list-style-type: none"> Provision of most building material needs for trade customers in catchment area Specialisation in own label product range: good quality, high functionality, and (crucially) specialist knowledge on these product types Reduced maintenance and waste disposal costs Job creation from material recovery and collection Product differentiation 	Customer relationships <ul style="list-style-type: none"> Longstanding trade and supplier relationships Customer service team support via website, email and phone Dedicated account managers for wholesale B2B customer After sales service 	Customer segments <p>Direct customers</p> <ul style="list-style-type: none"> Retail customers (trade and DIY) Wholesale (construction firms, installers) Supply contracts <p>Indirect customers</p> <ul style="list-style-type: none"> Property owners and managers Municipalities Businesses Householders
Cost structure <ul style="list-style-type: none"> Facilities Wholesale products and materials Testing, marketing, management costs Product subscription service Labour 	<ul style="list-style-type: none"> Shipping and import duties Own-brand product manufacture Logistics and transportation of goods Cost of new process machinery Higher margins due to reduced material costs 	Revenue streams <ul style="list-style-type: none"> Sales of building materials (own-label and branded products) Aftersales service and maintenance Secondary material market Public procurement contracts 	<ul style="list-style-type: none"> Innovation hub/accelerator funding 		

BM.4 Generate business model concepts at the big picture level



Digital platforms to enable circularity

To accelerate more circular construction and improve resource efficiency, it is necessary to collect, index and track data about materials used, supporting a ‘buildings as material banks’ (BAMB) approach. The use of digital platforms in the building materials sector is expected significantly increase, and provide business opportunities for innovative companies as both platform providers and users. A range of digital solutions are being seen, with platforms operating at both a local and a more macro level. Examples of circularity platforms seen include:

- [Enviromate](#) – a ‘closed-loop’ marketplace to connect buyers and sellers of surplus building materials
- Rotor DC’s [recovered materials shop](#)
- [Excess materials exchange](#) – a digital matching platform that finds reuse options for companies’ materials or waste, and provides tools to create a Resources Passport, tracking and tracing, valuation, and matchmaking with potential material recipients
- [Restado](#) – a startup working throughout Germany, alongside dismantling and demolition companies, to promote the reuse of building materials
- [CCbuild](#) – a prototype national platform to stimulate the circular economy in Sweden’s building sector. The platform includes a materials marketplace, and digital services to enable inventory and value assessment for building materials, enabling users to create their own product banks and calculate climate effects from reuse.

Ensuring quality of materials is always essential when dealing with reclaimed materials, and some guidance is provided in ST.10 on the practicalities of using these resources. In the future, it is expected to see further linking of these platforms with EPDs and material passports. Capturing data on third-party testing of materials is also key to ensuring that information on quality and safety is accessible.

References and resources

- Celtic Sustainables. Specialist in eco-friendly paints, insulation and lime building products. Available from: <https://www.celticsustainables.co.uk/>
- Perks Deconstruction. Sustainability-focused deconstruction and demolition services. Available from: <https://www.perksdeconstruction.com/about>
- Materials Passports – Best Practice. Available from: https://www.bamb2020.eu/wp-content/uploads/2019/02/BAMB_MaterialsPassports_BestPractice.pdf
- Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. Rizos et al. Available from: <https://www.mdpi.com/2071-1050/8/11/1212>

BM.4 Generate business model concepts at the big picture level



BACKGROUND INFORMATION

EXISTING BUSINESS MODELS IN THE BUILDING MATERIALS INDUSTRY

Business models in the building materials industry are usually based on standard purchase and contractual agreements. Products may be sourced in bulk, following assessment of the amount of material needed for a project (for example as specified by a quantity surveyor), and often through using design and planning software. When construction projects suffer from a lack of connectivity between different subcontractors and project managers, issues may be seen with over-ordering and waste, or specifications that change from the original brief.

[Accenture](#) (2014) has identified emerging patterns of business models. These broad categories are highly relevant to the building materials industry, with the potential to enable a more efficient value chain and create new business opportunities.

BUSINESS MODEL 'PATTERNS' (ACCENTURE, 2014)

1. Circular supplies
2. Resource recovery
3. Product life extension
4. Sharing platforms
5. Products as a service

New business models may also emerge from technological developments and trends in the construction sector:

- Increased use of BIM can open up opportunities for consultancy
- Services for deconstruction, material recovery and reuse, modular and off-site construction, 3D printing
- Service-based business models – e.g. facilities management through contracts to build and maintain the asset, a particular product, use of specialist software (e.g. Lighting as a Service (LaaS), design and software as a service (SaaS))
- Digital platforms for circular construction initiatives.

References and resources

- Reinventing Your Business Model, Johnson M, Christensen C, Kagermann H, Harvard Business Review (2008). Available from: <https://hbr.org/2008/12/reinventing-your-business-model>
- Turning point for the construction industry – The disruptive impact of Building Information Modelling (BIM). Roland Berger. Available from: https://www.rolandberger.com/publications/publication_pdf/roland_berger_building_information_modeling_2017.pdf
- Circular Buildings Business Models. BAMB project. Available from: <https://www.bamb2020.eu/topics/business-models/>

BM.5

Generate ideas for the customer segments block



This step involves idea generation for customer segments to target. Some assessment of this will have already taken place as part of developing the business strategy but, as ideas for innovation are developed, the needs of customers must be closely monitored.

Conducting market research at this step is advised. The template of *Learning case study of customer research* provides a means to ensure your knowledge of customer segments is up to date, and that any barriers to customer acceptance of your eco-innovations are identified.

BM.5 Generate ideas for the customer segments block



BACKGROUND INFORMATION

Demand for sustainable building products, and wider requirements in terms of specifications of these products, vary by customer group and their needs and values. Multiple value propositions are generally needed by any business. If too few are in place, a sufficiently wide variety of customers cannot be reached. However, with too many, the business may be attempting to deal in markets where they lack specialism and a competitive edge. It is necessary to define the business' strengths and go after the specific customer segments with the greatest benefit. The size of the opportunity may vary in different segments, and some may provide higher profit margins than others.

Customer segments can be categorised into different criteria (for example by the different industry segments of commercial, industrial, infrastructure, with corresponding sub-segments), or by geography. Within these segments, different drivers and preferences exist that affect demand.

McKinsey identified six major industrial movements affecting customer needs in its 2019 article *Value creation in European building materials—where do the opportunities lie?*. These were trends towards more multifamily houses (requiring fewer materials), strong regional preferences for building materials, increasing consolidation in the market, tighter environmental regulations (carbon-emissions trading, reduced waste production), limited workforce and construction productivity, and digital disruptions across the value chain.

B2B TRADE CUSTOMERS' REQUIREMENTS

B2B trade customers may, either through their own business values or to meet regulations, require standards of sustainability performance to be met for building materials. With the latter, in order to win tenders, the trade customer might need to demonstrate that materials procured align with local or national legislative requirements, such as for chemical safety, building codes, and energy performance.

In order for the products to be valuable to the customer by helping them to win tenders, it can be important to evaluate what their end-user clients are looking for. National and sub-national legislation on building material requirements, as well as the private sector market expectations for sustainability performance of products, should be evaluated so that companies can design products that meet sustainability specifications.

B2B customers may also be affected by market trends, such as the availability of materials or labour, or societal trends that give rise to demand for different building types.

B2C AND END-USERS OF BUILDING MATERIALS

B2C customers' preferences may cover aspects such as durability, indoor air quality, aesthetic and function, and sustainability performance. In some cases, B2C customers may have more specialized needs, for example if they are involved in self-build projects.

BM.6

Generate marketing ideas for the value proposition block



To generate marketing ideas for the value proposition block for companies in the building materials value chain, some sector specific guidance is given here.

The process of using the People Planet Profit (PPP) template from the Manual to generate these ideas is illustrated for GFC Building Supplies in Figure 33, helping to identify ideas that align with these three key areas holistically.

BM.6 Generate marketing ideas for the value proposition block



TIPS & TRICKS

USE ECO-LABELS, BUILDING RATINGS SYSTEMS, TESTING AND CERTIFICATION TO COMMUNICATE VALUE OF PRODUCTS

Consider the most appropriate means of communicating the value and environmental credentials of your product or service. This may depend on the nature of the product and the audience. There may be initial challenges from the market in acceptance of new, innovative and sustainable products and services – customers who are used to more traditional materials may resist changes in product specification. In some cases, achieving a performance threshold may be required in a tender.

Gaining an Eco-label or an approval certification can provide assurance to customers or demonstrate meeting performance criteria. Schemes may be voluntary or mandatory, and vary on the level of assurance they offer, with those requiring independent, third-party, or witnessed testing generally providing greater confidence to the customer.

Working across the building value chain to specify and supply products that improve a buildings rating score can also be a useful communication tool. Offering products and services achieving thresholds for aspects such as recycled content, proportion of reclaimed materials, or avoided use of VOCs in paints can help access markets where sustainable product performance (SPP) criteria is in place, for example in some public sector tenders.

Conducting in-situ field trials or product demonstration is another approach to conveying the performance of building products or materials and can be done at large or small scale. Working with independent partners such as test houses and laboratories can add credibility to claims and monitoring data.

Funding from innovation hubs is typically required for larger scale studies, but smaller projects with well-defined objectives and a robust methodology can also provide customer assurance. Additionally, alongside collecting quantitative data, demonstration projects may aim to capture and communicate qualitative, more subjective data from occupants and operatives in areas such as ease of use, installation, or dismantling, or various health aspects.

CONDUCT TRAINING AND DEMONSTRATION ACTIVITIES TO INFORM THE VALUE CHAIN OF NEW, INNOVATIVE PRODUCTS AND SERVICES

Further training and education may be needed to increase market acceptance or where value chain actors are unfamiliar with new, innovative materials or products. Understanding the needs of building material installers and their existing practices and tools is key to this process.

Again a 'whole value chain' approach can be beneficial to building downstream relationships with installers, clients, and end users, and understand their needs.

For example, the earlier example of the Senegalese earth brick specialist ELEMENTERRE showed the need to further engage and train other construction firms to understand the properties of the material, and to demonstrate the benefits. In the UK, [Adaptavate](#), the developer of bio-based, breathable plaster products include a series of video installation guides and testimonials from installers who were new to using the material on their website.

CONSIDER CULTURAL ASPECTS AND SOCIAL ACCEPTANCE OF BUILDING MATERIALS WITHIN MARKETING

Use of earth-based construction materials can provide many sustainability benefits in some regions due to their lower impacts in production, transportation and in-use, but are not always preferred by building owners, due to unfamiliarity, aesthetic concerns, or the perception that these materials have inferior performance.

Effective marketing strategies can help to change the perception of these for a range of value chain stakeholders. A varied strategy may be needed – construction partners may require more direct contact and relationship building through training, demonstration activities and testing. Displaying exemplar projects, potentially alongside partners such as national green building councils and independent bodies, can help change the perception of end-users that the 'construction-as-usual' approach is needed. Conducting field trials or producing user testimonials of material and building performance can capture both tangible and less tangible aspects of more sustainable materials, enabling reporting of human-centric data and experiences at the single building or community level.

BM.6 Generate marketing ideas for the value proposition block



BACKGROUND INFORMATION

The International Organisation for Standardisation (ISO) has identified three broad types of voluntary labels.

Type I: Voluntary, multiple-criteria, third-party verified labelling schemes. This type of eco-label indicates the overall sustainability performance of a product, split into appropriate classes, based on life-cycle considerations. An example of this type is the EU Ecolabel scheme.

Type II: Self-declared information environmental claims, not validated by an independent, external party. An example of such a label can include manufacturers' own eco-labels, which may develop criteria and involve testing, but are not necessarily subject to external governance or oversight. Various guides exist to making effective environmental claims of a Type II nature and avoiding 'greenwashing'. It is advised that the claim is not misleading, and messaging is clear, accurate and substantiated. UNEP and ITC propose 5 fundamental and 5 aspirational principles to follow in this space in its "Guidelines for Providing Product Sustainability Information".

Type III: Voluntary reports providing multi-criteria quantified environmental data, from a Life-Cycle Assessment (LCA). This must follow the defined Product Category Rules (PCR) for a given category and must be third party verified.

According to the [Ecolabel Index](#), there are over 450 ecolabels operating in nearly 200 countries and 25 industry sectors. These labels vary in their effectiveness and quality processes followed by organisations who administer them.

A 2010 study from Duke University, *An Overview of Ecolabels and Sustainability Certifications in the Global Marketplace* looked at the effectiveness of various programs, and identified that the key principles of effective schemes were:

- Appropriate governance and impartiality in place
- Keeping pace with technological progress
- Monitoring the social and environmental effect of the programme

Therefore, it is important to be discerning in the choice of scheme or certification sought for products and consider which is the best tool to use to communicate the value of your product or service to stakeholders.

Appropriate use of eco-labels and certification is an effective tool to convey your client's products' benefits and can have a positive effect on improving the market as a whole to differentiate between good and poorly-performing products and raise the overall industry bar. Whilst regulation, and demonstration of minimum standards in safety and performance (for example the conformity that must be demonstrated for CE marking of a product) is a key pillar of the building materials sector, eco-labelling plays an important complimentary role.

CASE STUDY: USE OF BLOCKCHAIN TECHNOLOGY TO IMPROVE TRACEABILITY IN THE BUILDING MATERIALS VALUE CHAIN

The use of Radio Frequency Identification (RFID) tags and blockchain to provide a secure, distributed and decentralised ledger of data or 'digital passport' on building material products and their certification status passed along the value chain is an innovative emerging system that can increase trust and confidence in their origin (such as for timber), sustainability performance, and material circularity potential.

In terms of circularity, this can support the concept of 'buildings as material banks' whereby data is shared on material reclamation and reuse potential at the end of building lifetimes, including via material passports.

Use of this data technology trend could provide a series of sustainability and economic benefits for companies, and an area that service providers may be able to provide support on.

BM.6 Generate marketing ideas for the value proposition block



References and resources

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BM.6 Generate marketing ideas for the value proposition block



LEARNING CASE STUDY OF PEOPLE, PLANET, PROFIT FOR GFC BUILDING SUPPLIES

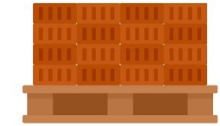
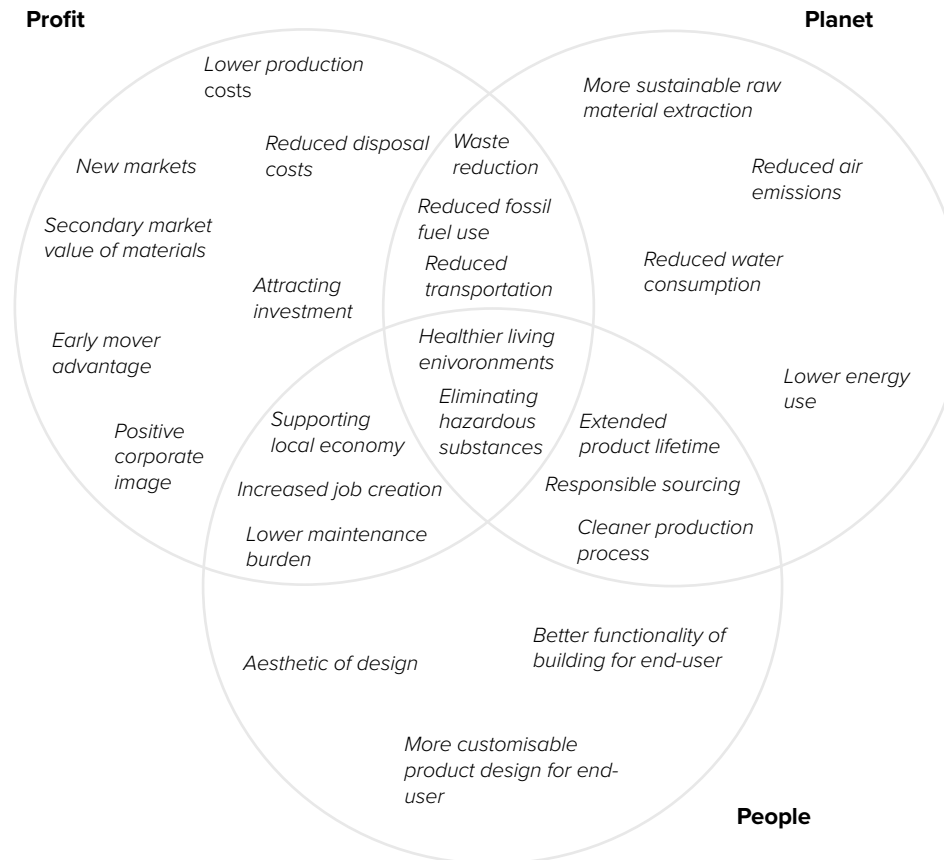


Figure 33 - People, Planet, Profit template example for GFC Building Supplies



BM.6 Generate marketing ideas for the value proposition block



CASE STUDY: JAT HOLDINGS

From going through the eco-innovation process in the project pilot, the Sri Lankan paint manufacturer [JAT Holdings](#) identified an eco-label for one of its core product ranges. The Eco-label Sri Lanka was gained in 2022 for its 'White by JAT' water-based emulsion paint.

Eco-label Sri Lanka is a third party certification operated by National Cleaner Production Centre Sri Lanka (NCPCSL), which is aligned with ISO 14024 and requires review of test reports as well as an on-site visit.

This enables JAT Holdings to provide strong assurance to customers of the product's healthier and more environmentally friendly formulation, and differentiation from solvent-based paints in the market. Additionally, this positions the company well to access markets requiring sustainability certifications.

Another project identified from going through the eco-innovation process was the production of a beneficial customer-facing tool - [a paint coverage calculator for both indoor and outdoor paints](#), enabling more efficient use of the product and reduced waste.



References and resources

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BM.9

Generate ideas for the customer relationships block



Developing eco-innovation projects may lead to a shifting relationship with existing customers, and may require a better understanding of how relationships in new customer segments can work best.

By nature, circular business models and services involving product take-back, repair, maintenance and replacement provide the opportunity for more customer contact and should enable better understanding of their needs.

Consideration should be made of the various means for enhancing customer relationships, and the company's strengths should be taken into account when generating ideas. This may be a combination of direct customer contact, or relationship building through digital channels.

BM.9 Generate marketing ideas for the the customer relationships block



BACKGROUND INFORMATION

TAKE BACK SCHEMES AND WASTE UTILISATION

The building materials sector has a significant opportunity to contribute to improved circularity, and benefit from increased value through secondary material markets. Circular business models can include repair and maintenance services and take-back schemes.

Take-back schemes are an emerging model for reducing waste disposal impacts and cost, and secondary materials can also reduce production costs. A trend towards “becoming your own waste company” is developing in various markets, including electronics and the building sector, but is not yet mainstream.

Take-back schemes can also be designed to provide incentives for return of materials. The simplest example in the building sector is the metal scrap yard, and this business type is expected to see a boost in activity as trends for ‘urban mining’ emerge and reduced extraction of raw material is needed. Effective design of building products such that they can be dismantled, and key components removed and returned can facilitate this process, enabling companies to receive back their own materials for which they are equipped to carry out secondary processing.

The environmental benefits may also be significant. Products such as insulation, gypsum board, flooring and fluorescent lighting can have human and environmental toxicity effects if disposed of through landfilling or incineration. A good example of this type of activity that utilized relationships with a range of value chain actors is the case study of the Plasterboard Sustainability Partnership in the UK. Customer relationships with end-users of buildings can also be built to facilitate initiatives of this kind (which may include facility managers, housing associations, municipalities, businesses, and private households).

References and resources

- Resource Efficient Scotland. Best Practice Guide to improving waste management on construction sites. Available from: <https://www.zerowastescotland.org.uk/resources/improving-waste-management-construction-sites>

CASE STUDY – PLASTERBOARD SUSTAINABILITY PARTNERSHIP (PSP)

The waste disposal impacts of plasterboard are significant; [Greenspec](#) estimates there are 300,000 tonnes per year of waste from ‘new’ construction waste alone (over-ordering, incorrect specification, damage and off-cuts), not to mention the vast amount of demolition waste created.

Plasterboard waste has major embodied carbon impacts and toxicity to water and land when landfilled (see the material profile section). Linear disposal methods are not even good economics - in the UK, [sending a skip of waste board to landfill will cost around £2,000](#), which can be avoided through better site segregation, recycling infrastructure, building design and more efficient ordering and material use.

The PSP has taken action, by raising awareness and convening partnerships involving the whole supply chain to help address the hotspot of material waste in the UK. As part of a dialogue with the UK Department for Environment Food and Rural Affairs, an [action plan was published](#), which including establishing recycling levels and set improvement targets. The NGO [WRAP](#), alongside industry, developed a Quality Protocol that specified recycling in accordance with the industry standard PAS 109.

Three UK manufacturers developed takeback schemes through the partnership. One of these, [Knauf](#), signed an agreement with the waste management company [Countrystyle](#) to develop a facility only a mile away from one of Knauf’s manufacturing plants, that could recycle both production waste and post-consumer plasterboard.

This voluntary initiative has led to increased recycling rates to over 45% to new plasterboard, cement and agricultural use in 2015, compared to 10 years prior when the figure was under 20%.

BM.9 Generate marketing ideas for the the customer relationships block



TIPS & TRICKS

TAKE A PROACTIVE APPROACH TO DOWNSTREAM INFORMATION FLOW AND COMMUNICATION

Improved communication in the building materials value chain can drive safety, performance and sustainability benefits related to chemical use, material efficiency, building performance, material selection and end-of-life activities. This encompasses both data, such that that on chemicals contained, or the material composition of products, as well as instructions and guidance for appropriate installation, use, maintenance, end-of-life treatment.

This may be targeted at various actors in the value chain:

- Producers of building material components, ingredients or intermediates may need to communicate effectively to the manufacturer of the finished product
- Site operatives, receiving information on how to transport and store products to ensure their performance and safety, or to ensure the right amount of material specified is used to reduce waste
- Installers who may require details for safe handling and use of products (e.g. spray insulation, concrete, adhesives and sealants)
- Building occupants, to ensure transparency of materials installed, and best practice in their use and disposal

Whilst legislation is in place in some regions on minimum legal documentation (e.g. the provision of a safety data sheet), the amount of information on chemicals provided can often be improved. Ensuring a thorough chemical inventory, as discussed in section ST.4 is an essential step to understanding the risks to workers and users of the product, but this can be built on by ensuring information is made available to downstream users. In many cases companies do not know the chemicals that are contained within their products, with the sheer complexity of supply chains and a lack of support and legislation on transparency and reporting.

However, research on *The Business Case of Knowing Chemicals in Products and Supply Chain* suggests that a more active strategy for chemical reporting has business benefits through improved customer trust and more efficient supply chain management. Tools and collaborations are being seen that can also support this process, for example the Global Minimum Transparency Standard, a tool to enable consistent information disclosure on hazardous chemicals across the product life cycle.

Some companies are being seen to provide a highly transparent approach to the end consumer regarding chemicals in building materials. For example the flooring manufacturer Tarkett features extensive information on the issue of phthalates in PVC flooring and the benefits of product take-back, as well as a wide range of documentation which includes [Material Health Statements](#), which lists all chemicals contained in the products, with accompanying safety ratings.

BM.9 Generate marketing ideas for the the customer relationships block



References and resources

- The Business Case for Knowing Chemicals in Products and Supply Chains. Clean Production Action. Available from: https://wedocs.unep.org/bitstream/handle/20.500.11822/27795/CiPBCase_EN.pdf
- Global Minimum Transparency Standard. Available from: <https://www.globalchemicaltransparency.org/>
- European Chemicals Agency – Guidance for downstream users. Available from: https://echa.europa.eu/documents/10162/2324906/du_en.pdf/9ac65ab5-e86c-405f-a44a-190ff4c36489
- Good Materials - Tarkett Sustainability Information. Available from: https://professionals.tarkett.com/en_EU/node/good-materials-9593

BM.10

Generate ideas
for the revenue
streams block



Companies should use the Template of Revenue Streams Ideas for this activity, considering the four key areas provided as well as any other areas relevant for the specific context. Figure 34 shows the template completed for GFC Building Supplies.

BM.10 Generate ideas for the revenue streams block



LEARNING CASE STUDY OF REVENUE STREAMS IDEAS FOR GFC BUILDING SUPPLIES

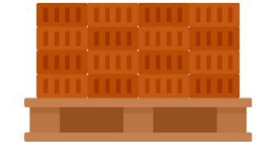


Figure 34 - GFC Building Supplies eco-innovation revenue stream ideas

REVENUE STREAMS

VALUE PROPOSITION

Maintenance contracts and services fees

- Building and product maintenance and repair services
- Offer products as services, e.g. lighting installation, maintenance and replacement, BIM/CAD software as a service

Training

- Develop training service for sustainable and socially responsible construction techniques
- Offering on building with alternative, sustainable materials
- Offering for upstream supply chain partners (e.g. sustainable extraction and manufacturing)

Licensing

- License own brand cement, concrete blocks and tiles, fired-clay bricks, paint, and timber products to companies for sale to export markets (maintain sole rights for domestic market)

Advertising

- Allow companies to advertise on our website and social media platforms
- Advertising on trucks and product packaging

Equipment hire

- Lease construction tools, equipment and machinery to customers
- Hiring space to companies for material storage or off-site assembly

Sharing platform

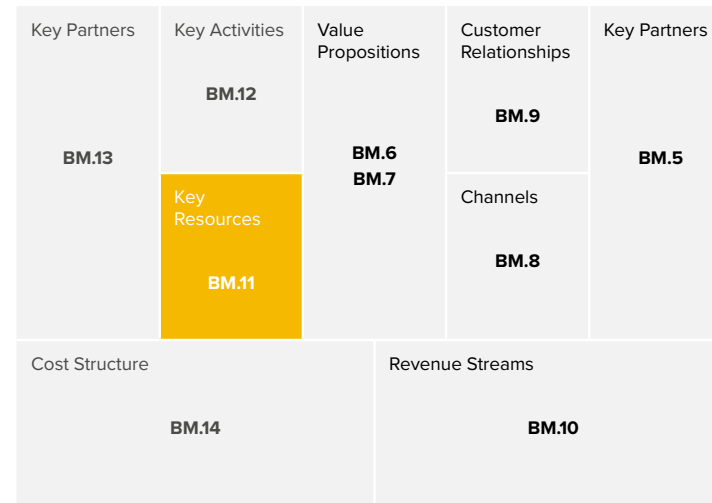
- Digital platform to map sites and connect companies supplying and with demand for reclaimed materials
- Subscription for use or 'finder's fee' for transactions made from platform

BM.11

Generate ideas
for the key
resources block



Template of Business Model Canvas



Opportunities for eco-innovation in the key resources block can be assessed by asking a range of key questions detailed in the Manual for BM.11.

You should first identify the key resources for the target company, and then work through the template to analysis and brainstorm opportunities related to each, as demonstrated for GFC Building Supplies in Figure 35.

BM.11 Generate ideas for the key resources block



BACKGROUND INFORMATION

It is important to consider target company's key resources which can support eco-innovation. Common examples and related sustainability interventions are characterized in the following list:

- **Raw materials:** Procurement of materials used in building product manufacturing, with potential for green procurement criteria for upstream suppliers.
- **Facilities and equipment:**
 - Manufacturing plants and equipment (e.g. for cement: crushers, grinding mill, preheater, cement kiln, clinker cooler, and cement silos)
 - Packaging (e.g. plastic and paper sacks, pallets, boxes and wooden crates)
 - Warehouse storage space
 - Retail stores
 - Laboratory/product testing space within manufacturing facilities, enabling new sustainable product designs to be trialed.
- **Resources consumed during operations:** Electricity, water and fuel used in material extraction, manufacturing, transportation, and retail stores operation. Area of eco-innovation action for improving resource efficiency, switching to low/zero pollutant emissions and carbon vehicles, electricity and feedstocks.
- **IT systems:** Integrated IT systems to coordinate production and procurement with sales demand, and manage logistics/deliveries, or conduct Building Information Modelling (BIM).
- **Human resources:** Technical skills and knowledge of staff, which can help develop feasible eco-innovation strategies. With the right organizational culture, where there is strong awareness of sustainability issues and potential sustainability improvements in operations, companies can foster eco-innovation.
- **Financial resources:** With healthy cash flows, a proportion of revenues can be invested in R&D, product design and operational change for eco-innovative business models. Additionally, consideration should be made of the opportunity for eco-innovation projects to attract financing from sustainable investors and government incentive schemes and bonds.
- **Customer relationships:** Sales, branding and marketing, and offer of products and services to customers. Success of eco-innovative business models can be enhanced by engaging customers on product repair, take-back and return schemes, as well as communicating the sustainability of product and services offered and the role of customers in sustainable use and disposal.

BM.11 Generate ideas for the key resources block



LEARNING CASE STUDY OF KEY RESOURCES IDEAS FOR GFC BUILDING SUPPLIES

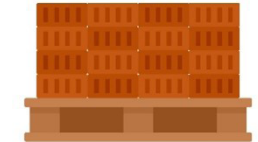


Figure 35 - GFC Building Supplies key resources ideas for eco-innovation

SWOT

- High environmental impacts and embodied carbon of building materials
- Compliance costs (health & safety, disposal, chemical use permits)
- Potential health issues for manufacturing workers
- Price volatility of energy and fuel sources
- Rising price of raw materials and building products

Additional data on the business model

Key resources

- Raw materials
- Facility, warehouse, production machinery
- Delivery fleet
- Integrated IT system for orders, inventory, production and distribution
- Financial resources and cash flow
- In-house technical knowledge

Additional data on operational performance

- Good internal processes and decision making
- Inefficiencies identified in waste generation and process equipment

Key resources

Competitive advantage

- Harnessing in-house technical knowledge to help drive eco-innovation ideas beyond competitors.
- Strong relationship with manufacturers to develop own-brand range, enabling improved sustainability of products versus competitors
- Efficient internal processes allow for rapid change of strategic direction

Gender equality

- Increase proportion of women in management roles
- Engage suppliers and partner manufacturers on improving their gender equality

Future risks

- Losing staff to rival companies
- Financial recessions affecting building sector and limiting investment in eco-innovation
- Rising cost of raw materials
- Regulation on chemicals of concern phases out certain product formulations, and material requirements for climate resilience; requires changes to production processes and machinery

Social issues

- Strong internal knowledge base on materials helps to mitigate safety concerns in production and installation
- Knowledge and relationships in value chain enables identification of responsible sourcing issues
- Relationships with local community enables an understanding of the health effects of operations
- processes and machinery

BM.12

Generate ideas
for the key
activities block



Building on previous analysis of customer preference, market opportunities and company strengths, this step aims to further define the key activities to contribute to the success of eco-innovation projects.

This involves more detailed assessment of key company activities, which may include production processes, raw material procurement, design and transportation.

BM.12 Generate ideas for the key activities block



BACKGROUND INFORMATION

Key activities in the building materials sector that can be areas for eco-innovation include:

Raw material and products procurement:

- Procuring from quarries and mines with environmental management systems addressing carbon footprinting, minimising impact during operation, site aftercare and environmental restoration, and responsible sourcing procedures in place
- Branded products with eco-labels, or clear sustainability information available

Design, R&D and training:

- Low impact materials – responsible sourcing, avoiding chemicals of concern, bio-based materials, low embodied energy, pollution and carbon
- Circular design – dismantling, repair, reuse/reclamation, remanufacturing and recycling
- Design for sustainability performance – energy efficiency, climate change adaptation and resilience
- Training staff in how to use new innovative materials and associated equipment

Production:

- Resource efficiency – water, electricity, heat, and raw materials
- Quality control – reducing wasted “off-spec” products
- Waste treatment – minimizing pollution etc; reusing and recycling off-cuts and other waste raw material generated during manufacturing

Packaging and transportation:

- Sustainable packaging, e.g. paper sacks instead of plastic for cement
- Light-weighting, low emissions vehicles, logistics efficiency

Customer Relationship Management (marketing, sales and customer service):

- Creates business case for eco-innovation if substantial customer demand can be documented/‘created’ through marketing and sales

Circular business activities:

- Closing loops through return or collection/take-back schemes, reuse/reclamation of product and materials, remanufacturing and recycling
- Facilitating closure of loops through Extended Producer Responsibility (EPR), voluntary by company or regulatory

BM.12 Generate ideas for the key activities block



WORK WITH ACADEMIC AND RESEARCH INSTITUTIONS AND TEST HOUSES TO IDENTIFY APPROPRIATE TEST METHODS AND CONDITIONS

Whilst many standardized test methods exist and are covered by ISO or national standards, for new, innovative building materials, existing test protocols may not be fully appropriate or may not fully convey the performance and value of a new material.

In Europe, EOTA have the remit to test innovative building products where harmonized standards do not yet exist to demonstrate necessary safety performance and enable a route to market.

Independent testing from accredited laboratories generally carries more weight than manufacturers' own tests, but is usually more expensive. When designing tests for products that do not yet have recognized protocols it can be valuable to have the inputs of third parties such as universities and researchers who can provide further insight into the areas to explore with testing.

Where building materials are concerned, including in-situ and human-centric tests can also be valuable to gain information about the product's performance outside of ideal laboratory conditions, and qualitative data on the experiences of how the end-users of buildings perceive products and materials.

ISO and national standards play an important role in product assurance and route to market, and where these are not in place it may be necessary to join existing standards working groups to expand scope, or develop new ones.

CASE STUDY: SUPPORTING MARKET DEVELOPMENT FOR NON-FIRED BRICK PRODUCTION IN VIETNAM

To facilitate market penetration and acceptance of new sustainable materials, it may be necessary to work directly with installers, and manufacturers to ensure that they can work effectively and safely with new materials and associated machinery. Other key value chain actors may require support and education on the viability of new materials for their construction projects.

The [UNDP project Promotion of Non-Fired Bricks](#) (NFBs) Production and Utilization in Vietnam provided a number of useful learnings in developing new, low-impact building materials, as well as developing an enabling market environment.

Beyond developing and demonstrating the technology and reduced impacts of the bricks themselves, key activities of the project included:

- Developing and demonstrating automated production lines to the wider market for manufacturing
- Providing technical assistance to investors in production equipment
- Running training sessions for construction operatives on handling, installing and understanding technical properties of NFBs
- Issuing conformity certificates for NFBs

More favourable market conditions for NFBs were developed by the project through collaborations between industry and research institutions, and effective communication and demonstration activities to increase market acceptance. As a result, the market share for NFBs was seen to increase from 15.5% to 28.5% between 2015 and 2019.

BM.13

Generate ideas for the key partnership block



Ideas for effective partnerships have been explored in previous sections (Such as *PR.3 Build the right external partnerships*), but this can be looked at in more detail in this activity, considering more specific cases.

In the building materials sector, a key partner is often a company upstream in the value chain, who may have strong influence on your ability to address a particular hotspot.

Putting partnerships into place may require overcoming challenges and relationship building. The template of Partnerships Ideas provides a means to assess these and identify strategies to put together effective collaborations.

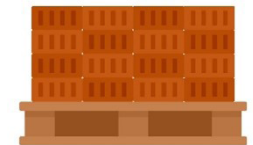
BM.13 Generate ideas for the key partnership block



BACKGROUND INFORMATION

Key partnerships that can be typically found in the building materials sector include:

- Raw material suppliers
- Delivery / logistics companies
- Distributors and wholesalers
- Core service providers, including energy companies
- Technology service providers, including equipment suppliers, IT support (e.g. data management and security), manufacturing process optimization experts etc.
- Customers (mainly trade) participating in material take-back schemes, which provides a source of reclaimed building products, and materials that can be reused and recycled in the manufacture of new products
- Government agencies (local, national and international), who can play a key role in facilitating eco-innovation amongst SMEs policy incentives and regulations
- Innovation hubs, Green Building Councils (e.g. World GBC, and national GBCs)
- Research and academic institutions for new product development and testing for quality assurance and certification.



LEARNING CASE STUDY FOR GFC BUILDING SUPPLIES

A key partner for GFC Building Supplies is its supplier of timber products, a domestic brand and manufacturer. As part of GFC Building Supplies' considerations for pursuing the alternative business models of becoming a 'leader in sustainable products', a 'circularity Champion' and generating ideas with key partners, GFC wishes to engage its timber products supplier (included in the suppliers mentioned in the business model canvas in ST.3). GFC Building Supplies represents around 15% of revenue for the timber product supplier, so has significant potential to influence product design and manufacturing, but the supplier is not dependent upon them. To engage the supplier and make the business case for sourcing all its wood from sustainable forestry sources, the benefits to the brand are emphasised by GFC Building Supplies, illustrated through best practice examples of sustainable sourcing from other leading companies in the sector.

Challenges to achieving more sustainable sourcing are then identified collaboratively, which includes a lack of knowledge about the practices of upstream timber suppliers. It is proposed to the supplier that these challenges are overcome through raw material supplier engagement strategies and setting green procurement criteria. This allows for the timber supplier to develop long-term sustainability criteria for their suppliers, and help them transition towards more sustainable practices, as well as identify existing sources of sustainable timber and alternatives to switch to.

In Malaysia, [The Green Factory](#) has identified processes for sourcing more sustainable wood, and categorised wood types considered to be more sustainable. Putting this in practice has involved partnerships with the supply chain and the Malaysian Timber Certification Council, to both improve its own sourcing, and raise awareness of sustainable forest management.

BM.14

Generate ideas for the cost structure block



New business models may require a different cost structure from those previously operated.

Cost structures such as service-based business models, or those that seek to capture secondary market value require different considerations from standard purchase terms. Additionally, a new business model may focus on reducing operational costs as the main means of increasing profitability.

The Eco-innovation Manual includes templates to evaluate different ideas for cost structures that may be needed within a particular business model.

BM.14 Generate ideas for the cost structure block



BACKGROUND INFORMATION

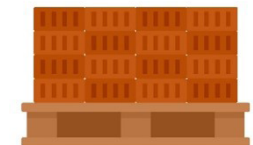
Ensuring a sound basis for the cost structure behind a business model is essential in the building materials and construction industry. The cost of building materials has been a growing concern in the industry for several years. Rising and volatile material costs can strongly affect profitability, whilst making budgeting at the design stage very difficult. Reasons for increases in material costs are varied and nuanced, but in general are related to supply shortages, government policies on trade (including tariffs) and the environment, and regulation. For example, McKinsey report that as companies shift away from coal for energy generation, that the supply of gypsum, a by-product of flue-gas desulfurization in coal plants, is set to decrease.

Uncertainty in markets for commodities and housing, and external events also plays a role. In 2020-22, the COVID-19 outbreak strongly affected global supply chains and construction markets, causing production slowdowns and shipping delays. Beyond raw materials, fuels used in production (particularly crude petroleum) and labour, as a result of supply shortages, have also seen price increases. McKinsey estimates that the typical cost of energy for a building materials company ranges between 15 and 20 percent of the total cost of goods sold.

Factoring in the potential threats is key to developing an effective cost structure for products and services. Understanding the drivers of these increases is also valuable when considering alternative materials or means of procuring less price-volatile materials, for example by accessing the secondary material market. Cost- and value-driven preferences of the end customer may also need to be taken into account.

Embracing pre-fabrication in building, using Lean design principles (involving maximising value and reduced waste from product manufacturing, greater integration between value chain actors and customers to improve the productivity and efficiency of manufacturing and delivery), and better planning for material use with BIM are three industry trends that are expected to contribute to lower building material costs in the future.

LEARNING CASE STUDY FOR GFC BUILDING SUPPLIES



Considerations of cost structure within of GFC Building Supplies' 'Circular champion' business model are as follows:

- Product life extension. GFC Building Supplies aim to offer long-lasting, but higher cost building materials, and factor in ongoing maintenance and a long warranty into the price. This has to be weighed up against the lifetime cost of cheaper materials than may need earlier replacement.
- Innovative products. Obtaining secondary materials can have a significant benefit in reducing the cost of building materials such as cement. However, the full effect this has on the material end cost must be considered – this strategy may require investment in new equipment to be able to utilise the secondary material.
- Resource recovery. Provision of this service has many aspects, for example efficiently recovered material can be collected, separated, processed and repurposed. Material values can be highly variable depending on the supporting infrastructure and technology in place to realise the secondary value. For example, whilst there has been a strong focus on the development of 'urban mining' over the past few years, separation techniques for different metals used in different products can have varying degrees of cost-effectiveness.

BM.14 Generate ideas for the cost structure block



CASE STUDY: EGG LIGHTING, SCOTLAND – LIGHTING AS A SERVICE BUSINESS MODEL

Glasgow-based SME [EGG Lighting](#) has pioneered a product-as-a-service (PaaS) and circular design approach to providing lighting to business customers, and this market is expected to grow, as the benefits – reduced waste and lower cost to the customer – are further realised. The cost structure is based on monthly subscription, based on the customer's needs to light their building.

EGG's business model and lighting system design has been developed and optimized over time. Through an initial partnership with Zero Waste Scotland's Circular Economy team, cost structure options were identified and a funded trial to validate the model with a logistics and construction company was carried out.

The business strategy aims to keep the lighting hardware in-use for as long as possible, and factor in future improvements to lighting into the design. Waste is reduced by only replacing what needs to be replaced and carrying out repair and refurbishment of fittings. Additionally, EGG utilises smart technology to track energy consumption and performance to provide optimal solutions for customers - identifying when an upgrade may be needed, and enabling diagnostics on the lighting systems to understand exactly which component may need replacing or repairing.

Subscription-based models are new to most customers used to asset ownership, and some may prefer not to enter into long-term contractual arrangements. EGG found that increased customer research and collaboration was necessary in some cases to gain buy-in. However, successful projects have demonstrated reduced lifetime costs and quick payback, and EGG found that the subscription arrangement resulted in a steadier income stream.

In terms of product design, fittings are durable, modular and upgradable, so only the LED and driver are replaced, keeping the majority of the fitting in use and enabling only the necessary component to be repaired in the event of a fault. Taking into account future improvements in LED technology that could lower operating costs for the customer, the unit can be upgraded with take-back of the replaced components. In-use, 'dynamic zone control', a smart technology that enables the lighting to sense and adapt to how the space is used is another feature incorporated in systems, which is estimated to save around 70% of the running costs of the lighting.

[For future circular innovations](#), EGG is also exploring a material passport for lighting, and a buy-back scheme to enable re-manufacture of lighting and re-sale with a warranty.



BM.14 Generate ideas for the cost structure block



References and resources

- Zero Waste Scotland – Lighting as a Service Case Study – EGG Lighting. Available from: <https://www.zerowastescotland.org.uk/case-study/egg-lighting>
- McKinsey - Value creation in European building materials—where do the opportunities lie? Available from: <https://www.mckinsey.com/business-functions/operations/our-insights/value-creation-in-european-building-materials-where-do-the-opportunities-lie>

BM.15

Evaluate the benefits



You will now evaluate the potential benefits of each business model option using the Template of Life Cycle Business Benefits, as shown for GFC Building Supplies in Table 32.

BM.15 Evaluate the benefits



LEARNING CASE STUDY OF LIFE CYCLE BUSINESS BENEFITS FOR GFC BUILDING SUPPLIES

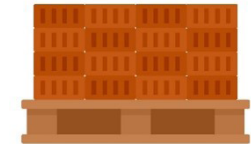


Table 32 – Life cycle Business Benefits Template for GFC Building Supplies’ business model concept: “Leader in Sustainable Products” – example of natural fibre insulation, compared to conventional insulation

	Environmental impacts (positive)	Social impacts (positive)	Emission or wastes (positive)
Materials	<ul style="list-style-type: none"> Use of renewable or recycled materials 	<ul style="list-style-type: none"> Reduced impacts of fossil fuel extraction for plastic insulation on communities 	<ul style="list-style-type: none"> Greater opportunities for local suppliers
Production	<ul style="list-style-type: none"> Avoided use of fossil fuels in production 	<ul style="list-style-type: none"> Safer production process for workers compared to synthetic materials 	
Transportation	<ul style="list-style-type: none"> More scope for local materials reducing transport impacts 	<ul style="list-style-type: none"> Reduced air pollution from transporting materials 	
Use	<ul style="list-style-type: none"> Improved comfort in home (both insulating and passive cooling) Reduced energy use from thermal performance 	<ul style="list-style-type: none"> Better building acoustics, reduced noise Reduced levels of VOC off-gassing 	<ul style="list-style-type: none"> Lower energy costs for building occupants
End-of-life	<ul style="list-style-type: none"> Recyclable and compostable Avoided toxicity impact from incineration of synthetic insulation materials 	<ul style="list-style-type: none"> Avoided negative effects on local community from plastics factory production 	<ul style="list-style-type: none"> Landfill charges avoided by using a more circular material

BM.16

Evaluate the costs

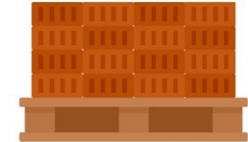


The costs of each business model are now evaluated for each business model, considering both monetary costs and effort required to implement considering the gap between the company's current business model and the desired end state.

BM.16 Evaluate the costs



LEARNING CASE STUDY OF BUSINESS MODEL CANVAS FOR GFC BUILDING SUPPLIES



GFC Building Supplies' suggested business model idea of 'Collaborative Vertical Integration' is explored in the canvas below. Digitalisation in the construction industry is expected to be a significant opportunity to add value in future, through the use of Building Information Modelling (BIM), with SMEs well placed to provide this service alongside larger industry players.

Implementing this strategy is considered viable for GFC Building Supplies given its existing expertise and strong relationships across the value chain. BIM is a relatively new area and gaining a first-mover advantage in this area is considered advantageous. GFC Building Supplies' technical team includes two staff members with the training to use BIM tools and enable this to be valorised as a service and has also discussed collaborations with architects to access further experience on design capability.

Conducting a performance gap analysis identifies the cost benefits and challenges that may be encountered to implement this new business model.

Advantages of this business model are expected to include:

- Minimal upfront investment is needed to enter this market, beyond training and licensing for GFC Building Supplies' users.
- GFC Building Supplies have a strong network of contacts in the local building sector value chain
- Certain clients have expressed a preference that a third party such as GFC Building Supplies, rather than the main contractor on the project, deliver the BIM services to ensure more impartial oversight of the project. Conducting a performance gap analysis shows some challenges that may be encountered to implement this new business model.

Considering challenges, competition from other firms may be strong, and larger construction firms, who may be targeted as customers for this, could also be attempting to develop a specialist BIM arm. These larger companies may have a competitive advantage in their IT resources, marketing capacity and existing processes and systems to liaise with multiple value chain partners.

BM.16 Evaluate the costs



The performance gap analysis is summarised below in Table 33. For each block, activities are rated using the following scale:
 - A key activity, capability, channel or resource required for the new business model is present but is below the performance required.
 + A key activity, capability, channel or resource required for the new business model is present and meets the performance required.
 No symbol against a point means that no change is required.

Table 33 – GFC Building Supplies cost evaluation of blocks within business model canvas for Collaborative Vertical Integration

Key partners	Key activities	Value propositions	Customer relationships	Customer segments
<ul style="list-style-type: none"> Architects + Product designers End-user of building + Logistics companies + Software developers - 	<ul style="list-style-type: none"> Providing BIM services across the value chain - Advising architects and contractors on sustainable building materials Bulk material sourcing + 	<ul style="list-style-type: none"> Expertise in multiple value chain areas + Improving the efficiency of processes by facilitating a more joined up approach More efficient use of materials 	<ul style="list-style-type: none"> On-site liaison + Regular progress meetings + 	<ul style="list-style-type: none"> Construction firms - Planners +
Key resources <ul style="list-style-type: none"> IT systems Training and expertise of staff + 			Channels <ul style="list-style-type: none"> CRM system Word of mouth + Marketing - 	
Cost structure <ul style="list-style-type: none"> Day rate or fixed price for project Cost of software licensing and user training 		Revenue streams <ul style="list-style-type: none"> Consultancy and analytics On-site inspection Software as a service Training Facilitating sale of secondary materials 		

BM.17

Evaluate the risks



Developing new business models and moving into new business areas carries various risks and uncertainties that must be carefully assessed.

The risk register template in Table 34 can be used for different business models under consideration. Inputs can come from a variety of sources, such as interviews, structured questionnaires or brainstorming sessions, and beyond the company's own staff, insights may come from customers, industry experts and risk specialists.

Alongside assessment of probability and impact, consideration of the company's strengths and weaknesses that have come out in the SWOT and TOWS analysis can be used to identify mitigation and contingency actions that could be taken.

Risks associated with each business model are now evaluated using the Risk Register template, as shown for GFC's potential new business model of becoming a 'Leader in Sustainable Products' (Table 34).

BM.17 Evaluate the risks



BACKGROUND INFORMATION

In practice, risks to the success of eco-innovation projects may include:

- A lack of acceptance in the market for products and services. Companies must often work to overcome norms in industry practice, and construction is widely considered to be a conservative sector. Low acceptance may also be driven by the perceived or actual higher cost of new innovative products, or by social and cultural perceptions of new materials.
- The risks from bringing new, innovative products to market bear strong consideration, if meeting regulations is complex. Companies may incur costs from conducting extra testing, or time taken to develop standards may result in missed business opportunities.
- Assessing the risk of products having performance or safety issues when installed is essential, which may carry reputational and financial burdens (in the form of fines, or having to conduct replacement works). Companies should consider mitigation aspects, such as ongoing monitoring, training of installers, and ensuring thorough testing in various environments and applications. In the case of alternative materials (such as bio-based and renewable), and reclaimed and reused products, there may be insurance barriers that need to be addressed.
- Various aspects of the market can increase the risk that a business model or project will fail. Supply and demand considerations for building materials, safety issues and other events that affect consumer confidence, the degree of market saturation for a product and the activities of competitors are examples of scenarios whose risk level and consequence should be assessed.

DE-RISKING INVESTMENT AND NEW BUSINESS MODELS AND PROJECTS

It is crucial that buildings and infrastructure are developed in a climate-compatible and sustainable way, and sustainability aspects are seeing an increasing focus in recent years for investors.

However, as many investors operate on a risk-adjusted return basis, this can make it difficult for producers of sustainable building materials to compete with conventional ones. Often public finance institutions play a critical role in de-risking newer, sustainable products and technologies. This can give a positive market signal on the direction of future policy and in turn can lead to greater private sector investment.

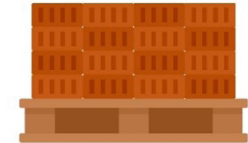
However, for sustainable building materials, this type of practice needs to increase and often requires collaborations between public and private sector organisations, such as insurance companies. Loans and funds put in place to stimulate further investment may require the involvement of several parties to spread the risks.

Eco-innovative companies deploying sustainable products may benefit from liaising with public sector financial institutions to understand how best to de-risk investment in their product or service. A continued dialogue can help government departments to develop new mechanisms for risk assessment.

In some cases, public sector investment is provided for buildings that can demonstrate high performance, contribute to avoided emissions, or achieve a particular green building rating score. Products from eco-innovative businesses may be able to contribute to this, but may need to have their product tested or included on a list of accepted technologies, which may require development of new standards and calculation methodologies.

Support may be available from innovation hubs and partners who can demonstrate effective use of the material. For example in the UK, [JP Concrete gained support from Innovate UK's 'Scaling the Edge' programme](#) for their self-healing concrete products, which helped to de-risk the venture and test it on the market. This also enabled the company to form new partnerships with architects and builders who were keen to use more sustainable materials, bringing the project more exposure to attract investment.

BM.17 Evaluate the risks



LEARNING CASE STUDY OF RISK REGISTER FOR GFC BUILDING SUPPLIES

Table 34 - Risk register for GFC Building Supplies 'Leader in Sustainable Products' business model

Risk code and name	Impact description	Probability (1- 3)	Impact (1- 3)	Score	Mitigation	Contingency	Action date	Action by
Risk 01 Lack of interest or perceived inferiority of sustainable building products from supply chain customers	<ul style="list-style-type: none"> Low sales Loss of customers to competitors Poor return on investment of new manufacturing equipment 	2	2	4	<ul style="list-style-type: none"> Develop awareness campaign More targeted marketing strategies Gain certification or eco-labels for products 	<ul style="list-style-type: none"> Maintain higher value conventional products in range and make more gradual transition to sustainability as main selling point 	6 months after launch of BM	CEO and head of marketing
Risk 02 Shortage of supply of raw materials for sustainable products	<ul style="list-style-type: none"> Increased cost of new materials Inability to keep pace with orders 	2	2	4	<ul style="list-style-type: none"> Conduct inventory with suppliers 		3 months before launch of BM	CEO and head of procurement
Risk 03 Issues with product quality compared to conventional building products	<ul style="list-style-type: none"> Loss of reputation Low sales Safety of installers and building end-users 	1	3	3	<ul style="list-style-type: none"> Consult R&D partners Conduct testing with independent bodies 	<ul style="list-style-type: none"> Identify potential higher risk components at design stage and identify substitutes 	6 months before launch of BM	CEO, head of quality, external R&D partners
Risk 04 General economic downturn results cost rather than performance as main driver of demand	<ul style="list-style-type: none"> Low sales of products with cost structure based on performance aspects 	1	2	2	<ul style="list-style-type: none"> Conduct market assessment exercise with external experts Purchase market data trend reports Promote lower lifetime costs of sustainable products 	<ul style="list-style-type: none"> Maintain conventional products in range Reduce costs of sustainable products to maintain market positioning Reduce costs elsewhere in the business 	3 months before launch of BM	CEO, business development team, head of marketing

BM.17 Evaluate the risks



Risk code and name	Impact description	Probability (1-3)	Impact (1-3)	Score	Mitigation	Contingency	Action date	Action by
Risk 05 Greater than expected market competition in sustainable products	<ul style="list-style-type: none"> Reduced sales and margins Competition for raw materials 	2	1	2	<ul style="list-style-type: none"> Conduct detailed competitor analysis 	<ul style="list-style-type: none"> Maintain higher value conventional products in range and make more gradual transition to sustainability as main selling point 	3 months before launch of BM	CEO, business development team, head of marketing development team, head of marketing

References and resources

- *Beyond the Business Case. Why you can't afford NOT to invest in a sustainable built environment.* World Green Building Council. Available from: <https://worldgbc.org/beyond-the-business-case/>
- *Financing an inclusive circular economy.* Chatham House. Available from: https://www.chathamhouse.org/sites/default/files/2021-07/2021-07-16-inclusive-circular-economy-schroder-raes_0.pdf
- *Sustainable Building Finance: Supporting green mortgage development in Sri Lanka.* United Nations Environment Programme Finance Initiative. Available from: <https://www.unepfi.org/industries/investment/sustainable-building-finance-supporting-green-mortgage-development-in-sri-lanka/>

BM.18

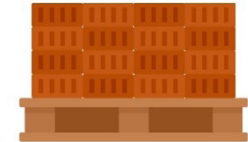
Integrate all the evaluations and make the final selection



Following activities BM15-17, you will now collate the information from these evaluations, and use this to inform your final decision on which business model(s) you will pursue. Table 35 provides an example for GFC's three proposed business models.

Overall, the business models with the greatest benefit scores are 'Leader in Sustainable Products' (24), and 'Circularity Champion' (22). 'Collaborative Vertical Integration' has a substantial benefits score (20), but the risks and costs are considered too great for GFC to pursue it.

BM.18 Integrate all the evaluations and make the final selection



LEARNING CASE STUDY OF BUSINESS MODEL EVALUATION FOR GFC BUILDING SUPPLIES

Table 35 - Business model evaluation assessment for GFC Building Supplies

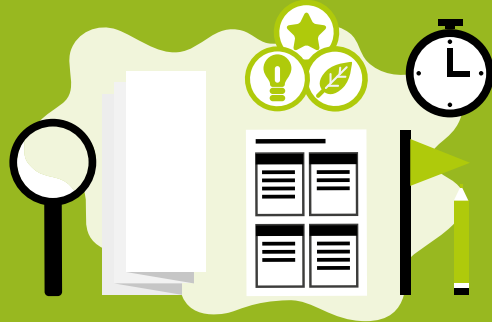
	Metric	Current situation	Business model #1 'Collaborative Vertical Integration'	Business model #2 'Leader in Sustainable Products'	Business model #3 'Circularity Champion'
Benefits	Energy intensity	2	3	4	3
	Material and water efficiency	2	4	4	5
	Human health and toxicity	2	3	3	3
	Other social issues	2	3	5	4
	Profitability	2	3	4	4
	Job creation and security	2	4	4	3
Total score		12	20	24	22
Risks	Long term risk (after mitigation actions and successful implementation)	Low	High	Medium	Low
	Implementation risk (High/Medium/Low)	(None)	High	Medium	Low
Costs	Upfront capital investment (state cost estimate)	(None)	High	Medium	Medium
	Implementation effort (High/Medium/Low)	(None)	High	High	Medium

BUILD ROADMAP

Defining a new business model to deliver
the business strategy

BR.1

Prepare for the roadmapping workshop



Template of Roadmap Development Matrix

Innovation idea title	Benefits	Capital investment	Implementation effort	Approx total cost	Implementation risk	Scheduling considerations

The first activity in building a roadmap for eco-innovation implementation is to use the *Template of Roadmap Development Matrix* to prepare for a roadmapping workshop.

This template summarises the benefits, costs, and risks of each key innovation idea, as explored for GFC in Table 36, pursuing the chosen business model components of 'Leader in Sustainable Products' and 'Circular Champion'.

Cost estimates were calculated based on the current state of GFC's business model with respect to each innovation idea, and the investment that will be needed to achieve this idea, through research conducted by the service provider.

BR.1 Prepare for the roadmapping workshop



LEARNING CASE STUDY OF ROADMAP DEVELOPMENT MATRIX FOR GFC BUILDING SUPPLIES

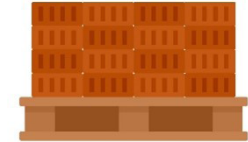


Table 36 - GFC Building Supplies Roadmap Development Matrix

Innovation idea (II) title	Benefits	Capital investment	Implementation effort	Approx. total cost and payback period	Implementation risk (high/ medium/ low)	Scheduling considerations
R&D, and product design and development (internal and through collaborative partnerships)	<ul style="list-style-type: none"> Can become pioneer in sustainable products and services offerings Gain external support in developing new eco-innovation ideas 	US \$15,000 for researching, testing and replacing components and certifying substances contained	17 person months (over 5 years)	US \$45,000-220,000, 5-year payback	High	<ul style="list-style-type: none"> When working with external partners with varied priorities and conducting R&D generally, consider need for flexibility in timescales
Take-back scheme – Reclaimed fired clay bricks, insulation material, and product packaging	<ul style="list-style-type: none"> Lower environmental impacts through maximizing resource use, reducing demand for virgin materials, diverting waste to landfill, and recycling materials (circularity benefits of slowing, narrowing and closing loops) Lower costs to company and consumer due to secondary material supply 	US \$30,000 for research and testing and additional \$30 per eco-refrigerator	6 person months (over 12 months)	US \$25,000-60,000, 2-3 years payback	Medium	<ul style="list-style-type: none"> Ensure repurposing, reclamation and recycling systems in place at partner facilities before beginning take-back system Ensure clear guidance on process given to customers
Software IT system capabilities for: product LCAs (including assessing Chemicals of Concern in products); sustainability information sharing; and Building Information Modelling (BIM) services	<ul style="list-style-type: none"> Enables product impacts to be determined, and areas for product sustainability improvements to be determined Enables transparency on sustainable product offerings Allows company to offer BIM services, potentially improving sustainability impact and diversifying revenue streams 	Free - US \$20,000 (depending on software fees for perpetual license)	4 person months	US \$1,000-5,000, 1-2 years payback	Low	<ul style="list-style-type: none"> New service offer and product information that should be communicated through marketing campaign

BR.1 Prepare for the roadmapping workshop



Innovation idea (II) title	Benefits	Capital investment	Implementation effort	Approx. total cost and payback period	Implementation risk (high/ medium/ low)	Scheduling considerations
Green Procurement Policy for all products	<ul style="list-style-type: none"> Following implementation and transition to only certified suppliers (e.g. FSC certified timber suppliers, RMI metals suppliers, instantly reduces environmental and social sustainability impacts across value chain Beneficial for assuring market of value chain sustainability 	US \$500 - 10,000	2 person months (over 6 months)	US \$100 - 12,000, 2-3 years payback	Low	<ul style="list-style-type: none"> Consider any differences in properties of sustainably sourced materials and ensure product design and production equipment compatible before transitioning to new materials
Marketing campaign to launch sustainable and circular product ranges, take back scheme, BIM services, and wider sustainable business achievements (web design, content marketing)	<ul style="list-style-type: none"> Key activity to facilitate sufficient demand for sustainable products and services 	US \$5,000 - 25,000	3 person months (over 12 months)	US \$7,500 - 30,000, 1-2 years payback	Medium	<ul style="list-style-type: none"> First establish new sustainable products and services, green procurement policy, necessary software and initial manufacturing efficiency optimization Identify marketing channels first and customer types (e.g. wholesale or retail trade customers, building project managers requiring BIM services), and consider if need for varied marketing approaches
Gender equality and diversity policy in recruitment	<ul style="list-style-type: none"> Equal opportunities for men and women across workforce 	Free - US \$2,000	1 person months	US \$200 - 2,000, payback N/A	Low	<ul style="list-style-type: none"> Ensure that the company structure and processes have been reviewed first, to understand scale and areas of business where change required Complement policy with awareness raising campaign to encourage more women to work in construction sector

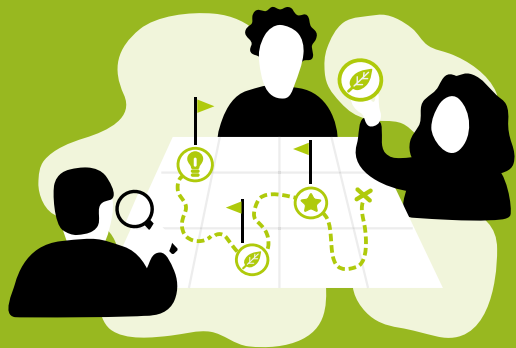
BR.1 Prepare for the roadmapping workshop



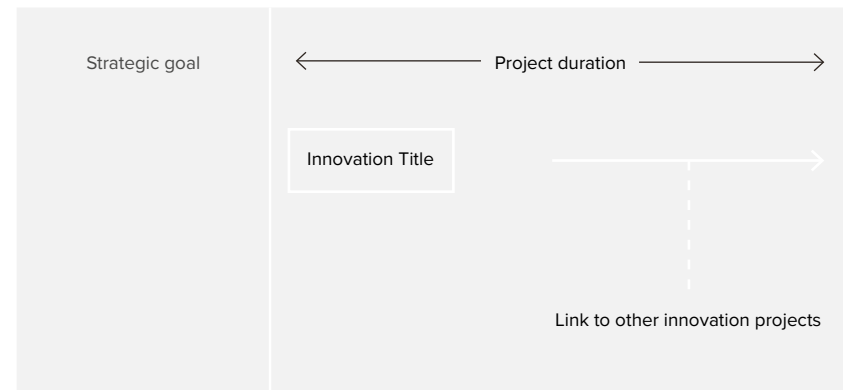
Innovation idea (II) title	Benefits	Capital investment	Implementation effort	Approx. total cost and payback period	Implementation risk (high/ medium/ low)	Scheduling considerations
Production optimization in partnership with manufacturers of own label products	<ul style="list-style-type: none"> Material efficiency improvements, thus cost-effective and lower environmental impacts including virgin resource demand and associated extraction impacts, and less waste generation Reduce pollution and waste generation, benefiting workers and wider communities 	US \$10,000 - 100,000	2-5 person months (over 3 years)	US \$10,000 - 100,000 3 years payback	Medium	<ul style="list-style-type: none"> Work closely with partner manufacturers and seek to understand viability, extent and timescale of production optimizations.

BR.2

Do a roadmapping workshop with input from value chain partners



Template of Roadmap



From the evaluation conducted in BM.18, which was then agreed in the pitch to the CEO (activity BM.19), GFC Building Supplies will gradually adapt its existing business model to include elements of both the “Leader in Sustainable Products” and “Circularity Champion” business models.

Following this decision, and the preparation done in BR.1, this activity will help to create a detailed roadmap of projects, aligned with each of the company’s strategic goals over the next 5+ years. Note that at this stage, some larger projects (those requiring over 12 months to implement) can be divided into smaller, more manageable and specific projects, while smaller projects and ideas (including those taking less than a month to implement) can be grouped together into a single project.

Taking GFC Building Supplies’ innovation ideas, a roadmap has been created by the Service Provider, with input from GFC and key value chain partners at a workshop (Figure 36).

BR.2 Do a roadmapping workshop with input from value chain partners



LEARNING CASE STUDY OF ROADMAP FOR GFC BUILDING SUPPLIES

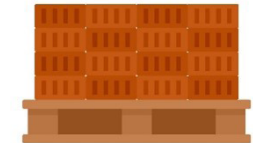


Figure 36 - Project roadmap for GFC Building Supplies

Strategic goals	TIME ➔				
Growth of revenue by 10% within 3 years	Value chain mapping	Increase customer base, product optimisation and reduce costs and overheads			
Increase supplier base by 25% within 2 years, and develop 2 new service-based offerings within 2 years	Research new and local suppliers		Establish BIM services		
Reduce all company emissions by 50% within 5 years	Mapping and measuring carbon emissions	Address 'low hanging fruit' reduction opportunities (process equipment, fleet)		Continued efforts on longer-term carbon reduction opportunities	
R&D to account for 10% of turnover within 5 years	Develop partnerships	Gain funding and develop R&D projects for sustainable building materials			
Eliminate chemicals of concern (CoC) from products within 5 years	Map CoC, identify alternatives and plan phase-out	Work with suppliers to develop alternatives, changes to production processes and testing		Switch to alternatives	
Develop at least 3 products designed for circularity within 5 years	Establish take-back schemes	Product development testing			
50% of sales to be from sustainable products within 5 years	Sustainability procurement policy		Development of own-brand sustainable products with partners		Marketing campaign for sustainable products
Representation of women in management roles to be at least 50%	Review of company structure and processes	Develop policies and training		Awareness-raising campaign to encourage more women to work in construction sector	
	Year 1	Year 2	Year 3	Year 4	Year 5

BR.2 Do a roadmapping workshop with input from value chain partners



BACKGROUND INFORMATION

CASE STUDY: CONCRETE PRODUCER ECO-INNOVATION IN SRI LANKA - SIERRA READYMIX (PVT) LTD

During the pilot phase of this eco-innovation guidance supplement, the [National Cleaner Production Centre of Sri Lanka](#) (NCPC-SL), a service provider in eco-innovation worked with the SME Sierra Readymix, a producer and supplier of readymix concrete, cement bricks and paving interlocks in Sri Lanka. Situated East of Colombo in Panagoda and comprising 44 employees, the company was founded in 2005 to provide the parent company Sierra Construction Pvt Ltd with readymix concrete, which was expanded to other customers. The company now has around a 30% share of the national market.

A range of strategy ideas were considered by Sierra Readymix and its service providers. This included increasing the use recycled aggregates and the practicalities, best practices, and existing projects demonstrating sustainable secondary materials sourcing. Tackling embodied carbon of cement supplied by partner manufacturers was also explored. This included the use of recycled aggregates while accounting for reprocessing energy and transportation distances, and the use of admixtures to maximise the content of alternative cementitious materials to carbon-intensive Portland cement and lower carbon local materials (including recycled aggregates). Key sustainability hotspots and opportunities considered also included water stewardship and efficiency, lower-impact packaging and concrete reinforcement, innovations in alternative aggregate materials, sustainable logistics initiatives, and anti-washout admixtures to prevent environmental pollution.

The eco-innovation opportunities taken forward were selected through the phases of Set Strategy, Set Business Model, and Build Roadmap. Sierra's vision and strategy is to "become a leading sustainable solutions provider in the construction sector to achieve resource circulation throughout the value chain". The final strategic goals and project roadmap for implementation below sets Sierra Readymix on a pathway for eco-innovation towards more sustainable operations and a circularity service offer.

Strategic goals	Year 1	Year 2	Year 3
Include processed waste materials as a substitute for fine aggregate (10% of the total weight)	<ul style="list-style-type: none"> Identify suitable industrial waste sources Conduct R&D activities 	<ul style="list-style-type: none"> Produce concrete and products in a pilot scale and conduct a cost benefit analysis 	<ul style="list-style-type: none"> Initiate production which incorporates waste material at commercial scale
Initiate a process to introduce a sustainable logistic initiative in the upcoming 3 months	<ul style="list-style-type: none"> Analyse the existing internal system to track vehicles 	<ul style="list-style-type: none"> Identify potential customers and partners who will require the service Initiate discussions with identified partners and introduce the concept 	<ul style="list-style-type: none"> Conduct R&D activities to expand the existing system to include other readymix manufacturers
Initiate recycling of concrete waste as a sustainable solution for the construction sector and generate revenue by end of 2022	<ul style="list-style-type: none"> Analyse the existing internal system to track vehicles Identify potential customers and partners 	<ul style="list-style-type: none"> Initiate discussions with identified partners and introduce the concept 	<ul style="list-style-type: none"> Conduct R & D activities to expand the existing system to include other readymix manufacturers

BR.2 Do a roadmapping workshop with input from value chain partners



BACKGROUND INFORMATION

PHASING OUT CHEMICALS OF CONCERN - OECD GUIDANCE ON KEY CONSIDERATIONS FOR THE IDENTIFICATION AND SELECTION OF SAFER CHEMICAL ALTERNATIVES

In 2021, OECD released a guidance document on best practices for choosing safer chemicals, which aims to advance the broader agreement on a general approach and criteria for selecting safer alternatives, emphasizing chemical substitution. There is a focus on understanding the minimum requirements needed to assess whether an alternative is safer than the product or chemical to be substituted.

Guidance focuses on four core areas for assessment of alternatives:

- 1. Determining the assessment's scope** - Defining goals and principles of assessment, selection of a shorter list of viable options. It is highly recommended that stakeholders are included in this process to capture their input and concerns.
- 2. Comparative hazard assessment** - Analysing the relative hazards of alternatives to the priority chemical for substitution.
- 3. Comparative exposure assessment** - Evaluating the relative exposure potential of alternatives compared to chemical for substitution, regardless of exposure control measures (e.g. safety equipment) over the substances life cycles.
- 4. The integration of hazard and exposure results to select a safer alternative** - Evaluate trade-offs and address uncertainties to make final decision.

BR.3

Define and prioritise the requirements of the first project



Template of Requirements Specification

Requirement specification for:					
Number or code	Requirement	Comments	Priority (MSCW)	Review date	Reviewed / Approved

Taking phase 1 of GFC's first project to phase out chemicals of concern in paint products, Table 37 shows the key requirements identified, commentary information for these requirements to be fulfilled, the priority allocation, and the date by which it should be reviewed.

BR.3 Define and prioritise the requirements of the first project



LEARNING CASE STUDY OF REQUIREMENTS SPECIFICATIONS FOR GFC BUILDING SUPPLIES

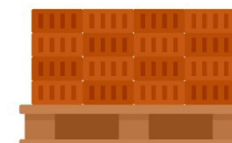


Table 37 - Requirements specification for GFC Building Supplies Project:

Chemicals of Concern in paint products – Work with suppliers on development of alternatives, changes to production processes.

Phase 1: Make a chemicals of concern phase-out plan

Number or code	Requirement	Comments	Priority (MSCW)	Review date	Reviewed/ Approved
Req01	Assess legislative requirements and market expectations on VOC content levels / phase out and implementation timescales	Legislation to consider in key markets include e.g. EU Paints Directive and REACH Regulation, U.S. National Volatile Organic Compound Emission Standards, TSCA China's limits of harmful substances of coatings (e.g. GB 38468-2019), and the adoption of lead paint regulatory restrictions in ~73 countries, including Bangladesh and Israel setting limits on lead content in paints to 90ppm. Refer to chemicals of concern lists, such as Chemsec's SIN (Substitute It Now) list, REACH restricted chemicals,	M	Within 3 years	Product development, new business development, quality and compliance, and senior management teams
Req02	Complete a chemical inventory and conduct chemical safety analysis of the product range, identifying levels of Volatile Organic Compound (VOC) content in all paints	Compile a chemical inventory safety assessment to understand current chemical toxicity impact/risk. Use key approaches such as the USEtox Model to complete this chemical risk assessment across the life cycle of the chemicals within products.	M	Within 3 years	Product development, new business development, quality and compliance, and senior management teams
Req03	Identify key sustainability standards for paints, and align R&D and product design strategy around the goal of achieving certification	Includes Green Seal standard for paints, coatings, stains, and sealers (GS-11) Identify requirements to align with compliance / performance testing requirements of key standards: Green Seal requirements cover adhesion, applicability (flow and leveling), abrasion resistance, washability (stain removal), hiding power (opacity), and impact resistance	S	Within 5 years	Product development, new business development, quality and compliance, and senior management teams

BR.3 Define and prioritise the requirements of the first project



Phase 1: Make a chemicals of concern phase-out plan

Number or code	Requirement	Comments	Priority (MSCW)	Review date	Reviewed/ Approved
Req04	Desk research of alternative paint products, and assessment of markets	Include research into VOC-free and bio-based paint types, industry leaders, alternative suppliers and regional market retailers (competition)	S	Within 5 years	Product development, new business development, and senior management teams
Req05	Desk research to develop longlist of potential partners, and carry out scoring exercise as part of selection before approaching organisations	R&D partners: Evaluate regional Universities and research institutes Downstream value chain partners: Identify agricultural companies and local producers with potential to supply bio-based feedstocks	M	Within 5 years	Product development, new business development, and senior management teams
Req06	Begin internal alternative product development	Access laboratory testing capacity (either internally or with partners). Note that alternative paint formulation may take some time and multiple iterations of the product may be needed. If pursuing substitution or alternative formulations, compile lists of existing tested alternatives e.g. from Chemsec's Marketplace, and identify other alternatives for R&D. Follow OECD Guidance on Key Considerations for the Identification and Selection of Safer Chemical Alternatives, using tools and frameworks such as GreenScreen's comparative hazard assessment, and BizNGO's 7-step Protocol (see guidance in PR.4). Conduct R&D both internally and with partners, embedding the principles of green chemistry in research objectives. Once alternatives have been developed, conduct testing	S	Within 5 years	Product development team, new business development, and senior management teams

Legend

M - MUST have this.

S - SHOULD have this if at all possible.

C - COULD have this if it does not affect anything else.

W - WON'T have this, this time, but would like in the future

BR.3 Define and prioritise the requirements of the first project



References and resources

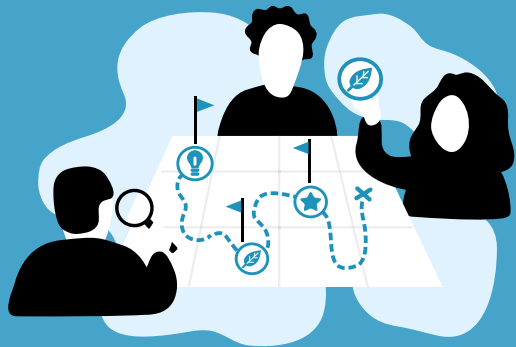
- ASTM D3960 - 05(2018). Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings. Available from: <https://www.astm.org/Standards/D3960.htm>
- ASTM D6866 – 20. Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis. Available from: <https://www.astm.org/Standards/D6866.htm>
- Legislation and BREEAM requirements for VOC content in paints in Europe. Available from: https://www.breeam.com/domrefurbmanual/content/05hea/hea_03_volatile_organic_compounds.htm
- EPA's VOC standards. Available from: <https://www.epa.gov/stationary-sources-air-pollution/consumer-products-national-volatile-organic-compound-emission>
- China's new VOC standards. Available from: <https://www.sgs.com/en/news/2020/08/safeguards-12420-chinas-standardization-administration-releases-nine-voc-standards>
- China New Chemical Substance Notification. Available from: <http://www.cirs-reach.com/news-and-articles/china-new-chemical-substance-notification-regulatory-compliance-reach-mep-decree-no7.html>
- Green Seal standard for paints. Available from: <https://www.greenseal.org/storage/standards/May2020/GS-11-3.2-Standard-2015.pdf>

IMPLEMENT

Implementing the first project for eco-innovation that will help to realise the new business strategy and business model

IM.1

Create a project plan



Template of Project Canvas

Aims and objectives	Scope	Success criteria
Milestones	Deliverables	
Actions		
Team	Stakeholders	Customers
Resources	Constraints	Risks

In the implementation phase for delivering your first eco-innovation projects, the primary area of input from the Service Provider will be in the creation of a project plan (IM.1). This involves taking the requirements of the first project defined and prioritised in BR.3 and completed the Template of Project Canvas to have a detailed plan which is then presented to the Senior Management Team in IM.2 (see Manual).

The project canvas presented in Table 38 is for GFC's first five-year project to phase out of chemicals of concern in paints, insulation and treated timber products, and bring products that use alternative materials, chemicals, and feedstocks to market.

IM.1 Create a project plan



LEARNING CASE STUDY OF PROJECT CANVAS FOR GFC BUILDING SUPPLIES

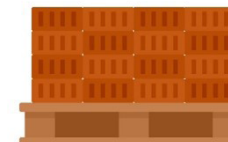
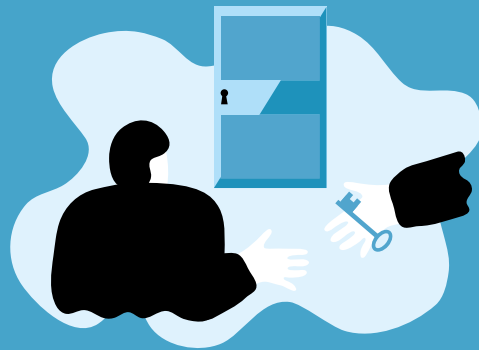


Table 38 – Project Canvas: GFC Building Supplies project working with suppliers to develop alternative building materials with phased out chemicals of concern (product ranges including paints, insulation and treated timber)

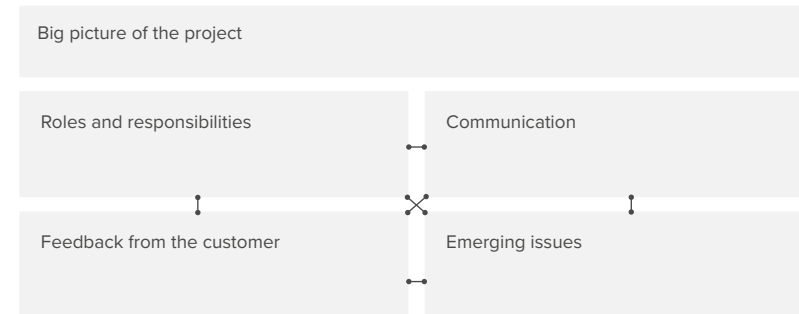
Aims and objectives Phasing out chemicals of concern in paints; working with suppliers on development of alternatives, changes to production processes		Scope Products identified are high-VOC paint, insulation containing formaldehyde, CCA-treated timber		Success criteria Bring alternative products to market with phased-out chemicals of concern that are profitable by year 5	
Year 1	Year 2	Year 3	Year 4	Year 5	Deliverables
Milestones Make phase-out plan	Secure funding and create partnerships	Complete first prototyping project	Review first project and finalise product specifications	Bring products to market	
Actions <ul style="list-style-type: none"> Map chemicals of concern in range Identify alternatives Market assessment of alternatives Develop longlist of partners, carry out scoring exercise and select, develop partnerships 	<ul style="list-style-type: none"> Identify funding sources and budget as part of financial planning Establish R&D and academic partnerships Kick-off first prototyping project 	<ul style="list-style-type: none"> Conduct prototyping project Report on results of project Agree budget for final product specification project 	<ul style="list-style-type: none"> Evaluate prototyping and make changes Conduct customer trials Conduct necessary testing (safety, quality, performance) Determine budget and business plan for new products Conduct updated competitor analysis 	<ul style="list-style-type: none"> Gain product certification Conduct marketing campaigns Gain customer feedback 	<ul style="list-style-type: none"> Bring final products to market Report on financial performance of products Plan for future product development
Team <ul style="list-style-type: none"> Production manager External paint manufacturing partner University partner Quality control 		Stakeholders <ul style="list-style-type: none"> Production team Senior management team Procurement team 		Customers <ul style="list-style-type: none"> Senior management team Trade customers End-users of buildings 	
Resources <ul style="list-style-type: none"> \$150,000 budget (funding and own resources) One production line and 2 new staff University test laboratories 		Constraints <ul style="list-style-type: none"> Availability of replacement feedstocks Expertise of production team in new techniques Capital cost of required new machinery 		Risks <ul style="list-style-type: none"> Product does not perform as intended Many competitors have entered market 	

IM.3

Provide guidance and solve problems



Template of Project Implementation



This activity helps the service provider to be prepared to provide guidance and solve problems as they emerge in the initial implementation of eco-innovation, with detailed guidance in the Manual, and additional background information relevant to building materials value chains provided below.

IM.3 Provide guidance and solve problems



This activity helps the service provider to be prepared to provide guidance and solve problems as they emerge in the initial implementation of eco-innovation, with detailed guidance in the Manual, and additional background information relevant to building materials value chains provided below.

CIRCULARITY IN BUILDING PRODUCTS

- UNEP circularity platform. <https://buildingcircularity.org/>
- Ellen MacArthur Foundation circular economy resources: <https://www.ellenmacarthurfoundation.org/circular-economy/concept>

BUILDING AND BUILDING MATERIALS ASSESSMENT AND RATING TOOLS

- ICE database with tools and resources for LCA of building materials. <https://circularecology.com/ice-database-faqs.html>
- List of Green Building Rating Tools. https://www.designingbuildings.co.uk/wiki/Green_rating_systems

USE OF BIOBASED MATERIALS

- IEA, Standards and labels related to Biobased Products. <https://www.ieabioenergy.com/wp-content/uploads/2018/10/Standards-and-Labels-related-to-Biobased-Products-2016-to-2018.pdf>
- European Bioplastics – association for bioplastics industry. <https://www.european-bioplastics.org/>

REDUCTION OF CHEMICALS OF CONCERN AND ASSESSMENT OF ALTERNATIVES

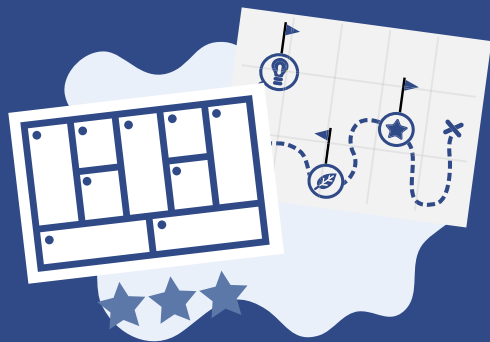
- Chem Safety Pro – Global Chemical Inventories. https://www.chemsafetypro.com/Topics/Category/Global_Chemical_Inventories.html
- Strategic Approach to International Chemicals Management (SAICM) knowledge management platform. <https://saicmknowledge.org/>

REVIEW

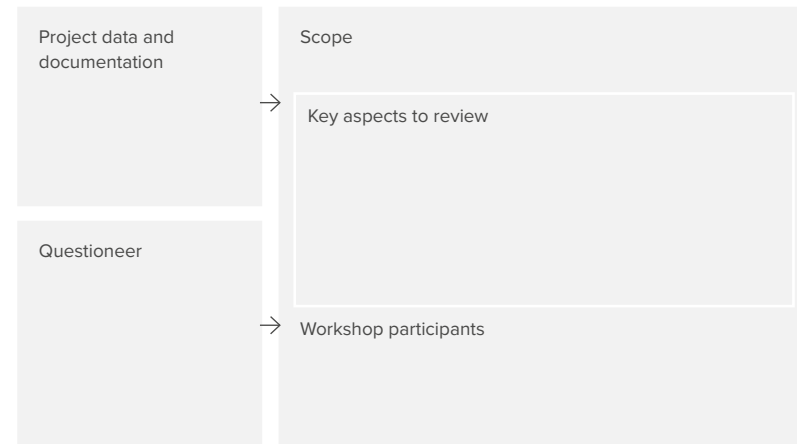
Review the performance of the first project for eco-innovation
and update the future plans of the company

RE.1

Do a project review workshop



Template of Project Review



With the first eco-innovation projects implemented, you will now review how they have performed. This allows you to assess whether existing projects need to be altered, or whether more fundamental changes need to be made to the business strategy and model in an iterative process in order to realise the full potential of eco-innovation in the business.

The first activity is to do a project review workshop using the Template of Project Review to plan for this workshop.

This has been completed for GFC's project to work with suppliers to develop alternative building materials with phased out chemicals of concern (Figure 37).

RE.1 Do a project review workshop



LEARNING CASE STUDY OF PROJECT REVIEW FOR GFC BUILDING SUPPLIES

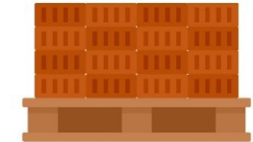


Figure 37 – GFC Building Supplies Project review: Work with suppliers to develop alternative building materials with phased out chemicals of concern

PROJECT DATA AND DOCUMENTATION

- Current progress against project delivery and budget milestones for alternative product development
- Market reports for competitor analysis
- Progress assessment against related strategic goal of phase out of chemicals of concern

SCOPE

- Scope changed as funding could not be found for a project to explore developing alternatives to CCA-treated timber. Change in plan to address this by other means
- Review questionnaire to be completed by product manager, production team, university project lead, partner manufacturer project lead

REVIEW QUESTIONNAIRE

- Do the new, alternative products have the same performance as those being replaced?
- Are new manufacturing processes identified as viable?
- Has the project helped to embed a culture of eco-innovation in the company?
- Does the project link to achieving other objectives and strategic goals (e.g. profitability, improved gender equality, improved health and safety)?
- What is the level of customer familiarity and acceptance of alternative products?
- What is the current position of associated regulation?
- How effective is the working relationship with the university and partner manufacturers?
- What aspects of the project have been the most challenging?
- Is the project expected to be on-time and on-budget?
- Are there any unintended consequences?

KEY ASPECTS TO REVIEW

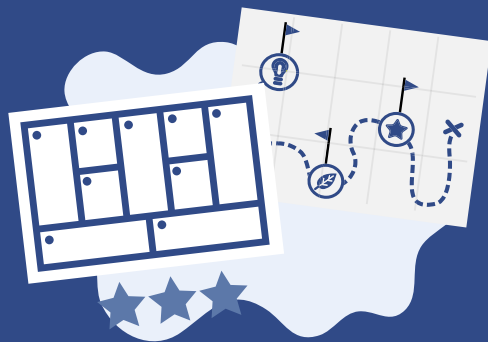
- Assessment of successes and issues with the project to date
- Assessment of working practices and effectiveness of communication
- Review issue log and risk register

WORKSHOP PARTICIPANTS

- Product manager
- 4x production operatives
- Quality manager

RE.3

Review the business model and roadmap



Template of Business Model and Roadmap Review

Results from project review	Validity of business model	Validity of roadmap	Next project for the company	
	Progress on sustainability hotspots →	New ideas to roadmap		→
	Performance gaps	Roadmap order		

With the first eco-innovation projects implemented, you will now review how they have performed. This allows you to assess whether existing projects need to be altered, or whether more fundamental changes need to be made to the business strategy and model in an iterative process in order to realise the full potential of eco-innovation in the business.

The first activity is to do a project review workshop, with the Service Provider using the Template of Project Review to plan for this workshop.

This has been completed for GFC's project to work with suppliers to develop alternative building materials with phased out chemicals of concern (Table 39).

RE.3 Review the business model and roadmap



LEARNING CASE STUDY OF PROJECT REVIEW FOR GFC BUILDING SUPPLIES

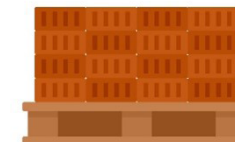


Table 39 – GFC Building Supplies Business Model and Roadmap Review of project: Work with suppliers to develop alternative building materials with phased out chemicals of concern

RESULTS FROM PROJECT REVIEW	VALIDITY OF BUSINESS MODEL	PROJECT DATA AND DOCUMENTATION
<ul style="list-style-type: none"> Some issues encountered in developing production techniques for new materials – further training recommended Several competitors entering the market for formaldehyde-free insulation Legislation changes are driving the market to adapt 	<ul style="list-style-type: none"> Positive consumer feedback on reducing chemicals of concern Some challenges and concerns from trade customers on performance and cost of sustainable materials <p>PROGRESS ON SUSTAINABILITY HOTSPOTS</p> <ul style="list-style-type: none"> Reduction in sales of high VOC paint by 10% in last year One high-VOC paint with specific functionality identified as providing strong revenue. More detailed replacement plan required for this product <p>PERFORMANCE GAPS</p> <ul style="list-style-type: none"> Current price projection for new, low VOC paint is currently higher than planned – efforts required to reduce production costs New equipment needed to conduct in-house processing tasks for water-based paint <p>VALIDITY OF ROADMAP</p> <ul style="list-style-type: none"> Concern that more resource than necessary is being used on new product development and carbon emissions goals are behind schedule <p>NEW IDEAS TO ROADMAP</p> <ul style="list-style-type: none"> Inclusion of paint tins in the take-back scheme being implemented in parallel Raising target on increase in supplier base as new products require further suppliers <p>ROADMAP ORDER</p> <ul style="list-style-type: none"> Further effort needed on reducing carbon emissions – it is identified that changing the cement formulation through more use of local suppliers and secondary materials can achieve this. Developing the take-back scheme project and supplier research to be extended. Upgrading delivery fleet to electric vehicles to be moved to year 4. 	<ul style="list-style-type: none"> Current progress against project delivery and budget milestones for alternative product development Market reports for competitor analysis Progress assessment against related strategic goal of phase out of chemicals of concern

Glossary of key terms

Marketing

the set of activities that are designed to help the company to understand the type of product it should offer to a market and communicate the benefits and value of the product to the targeted consumer. Marketing focuses on the product, promotion, price and distribution channels.

Market analysis

the activity of gathering information about the size, growth, profitability, target groups and existing products of a market, which is used to inform decision making at a strategic level. This specific activity would fall under the broader umbrella of marketing activities.

Organisation structure

the range of activities and key resources (human and financial) within the company, in addition to those relating directly to production, that are dedicated to supporting the business model. These include procurement processes, distribution, key partnerships, customer relationships and interfaces, research and development, internal communication, and revenue generation.

Partners

parties in the value chain that provide or receive value including suppliers, outsourced workers, contractors, customers, consumers, clients, members, and others (ISO 26000:2010).

Roadmap

planning tool used to support the implementation of strategies. It is made-up of a series of projects that will help to progress the organization from the company's current position towards fulfilling the organization's goals (adapted from Phaal R et al, 2007).

Stakeholder

any group or individual who can affect, or is affected by, an organization or its activities. Also, any individual or group that can help define value propositions for the organization (Stakeholder Research Associates Canada Inc., United Nations Environment Programme, AccountAbility: Stakeholder Engagement, 2005).

Supply chain

system of organizations, technology, activities, information and resources involved in moving a product or service from supplier to customer (Michael Porter 1985) are the most significant impacts in the value chain or the life cycle of a product or service system, which can be used to identify impact improvement opportunities and to prioritize impact reduction actions (UN Environment/SETAC, 2014).

Value

creating economic value (the revenue that a firm gets in return for its goods or services) in a way that also creates positive Outputs for society by addressing its needs and threats, taking into account economic, environmental and social considerations (adapted from Porter & Kramer, 2011).

Value chain

entire sequence of activities or parties that provide or receive value in the form of products or services (e.g. suppliers, outsource workers, contractors, investors, R&D, customers, consumers, members) (ISO 14001 CD2, 2013). See also Partners definition above.

Value proposition

the products or services that an organization offers to a specific market segment that the organization believes will create value for that specific market segment.

Abbreviations used in the supplement

BAMB	Building as material bank	LCA	Life cycle assessment
BBP	Benzyl butyl phthalate	LCIA	Life cycle impact analysis
BF-BOF	Blast furnace-basic oxygen furnace	NAF	No added formaldehyde
BIM	Building information modelling	NDC	Nationally determined contributions
BTC	Blocs de terre comprime	NFB	Non-fired brick
CAD	Computer aided design	NOx	Nitrogen oxide
CCA	Chromium, copper and arsenic	OECD	Organisation for Economic Co-operation and Development
CCS	Carbon capture and storage	PaaS	Product as a service
C&DW	Construction and demolition waste	PBB	Polybrominated biphenyl
CLT	Cross laminated timber	PBDE	Polybrominated diphenyl ether
CO	Carbon monoxide	PCB	Polychlorinated biphenyl
DBP	Dibutyl phthalate	PESTEL	Political, Economic, Social, Technological, Environmental, Legal
DEHP	Di (2-ethylhexyl) phthalate	PFAS	Perfluorinated alkyl substance
DiNP	Diisononyl phthalate	PFC	Perfluorinated compound
DNOP	Di-n-octyl phthalate	PFOA	Perfluorooctanoic acid
EAF	Electric arc furnace	PFOS	Perfluorooctanesulfonic acid
EEIO	Environmentally extended input-out analysis	PIR	Polyisocyanurate
EPD	Environmental product declaration	PM	Particulate matter
EPR	Extended producer responsibility	PUR	Polyurethane
EPS	Expanded polystyrene	PVC	Polyvinyl chloride
FGD	Flue gas desulphurisation	REACH	Registration, Evaluation, Authorisation and restriction of chemicals
GGBFS	Ground granulated blast furnace slag	ROI	Return on investment
GHG	Greenhouse gas	RSL	Restricted substance list
GWP	Global warming potential	SME	Small or medium sized enterprise
HBCD	Hexabromocyclododecane	SO ₂	Sulphur dioxide
ISIC	International Standard Industrial Classification	SPP	Sustainable public procurement
KPI	Key performance indicator	VOC	Volatile organic compounds
LaaS	Lighting as a service	XPS	Extruded polystyrene

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International guidelines on limits for chemical categories mentioned in the supplement

An overview of global chemical legislation can be found on the [OECD's pages on chemical safety](#). Some examples of global, regional and national legislation and associated guidance documents can be found in the below table.

Chemical category	Region	Legislation	Resource
Phthalates	European Union	REACH	Phthalate Regulations in the European Union: An Overview
		RoHS Directive	REACH Hot topics - phthalates
Halogenated flame retardants	European Union	RoHS Directive	HBM4EU Scoping document on flame retardants
	Global	Stockholm Convention	The new POPs under the Stockholm Convention
Heavy metals	European Union	REACH	Heavy Metals Regulations in the European Union: An Overview
Asbestos	Global	Various legislation in different countries	Asbestos Policies of Major International Agencies
Volatile organic compounds	European Union	European Directive 2004/42/EC	Guidance on VOC limits in the EU 'Paints Directive' - Eurofins
Per- and polyfluoroalkyl substances (PFAS)	European Union	REACH	European Chemicals Agency
	Global	Stockholm Convention	The new POPs under the Stockholm Convention
	USA	PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024	US EPA EPA's PFAS Strategic Roadmap: A Year of Progress
	Global	Various	OECD Portal on Per and Poly Fluorinated Chemicals - Risk reduction approaches and resources on alternatives