



Towards a sustainable global construction and buildings value chain

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Key messages

- The global value chain of construction and buildings has high environmental and socio-economic impacts; these impacts will shift and grow as urbanization and population increase globally and locally.
- Decisions made by stakeholders operating at early stages of the value chain affect impacts throughout the whole value chain; those operating later in the value chain have limited opportunities to reduce their impacts.
- Given the fragmentation and complexity of the value chain, policy interventions need to target regulations, finance and technology, while increasing the capacity of stakeholders to make more sustainable decisions.

As part of the [Stockholm+50](#) international meeting in June 2022, the World Business Council for Sustainable Development (WBCSD) in partnership with Stockholm Environment Institute (SEI) and the Stockholm+50 Secretariat have partnered to highlight how global value chains must change for a more sustainable future. As a contribution to this work, the Leadership Group for Industry Transition (LeadIT) Secretariat (hosted by SEI) has synthesized three influential reports, from the [Global Alliance for Buildings and Construction \(GlobalABC\)](#) and the [International Energy Agency \(IEA\)](#), the [International Resource Panel \(IRP\)](#) and [UN Environment Programme \(UNEP\)](#). This synthesis, with added insights from LeadIT research, distils the challenges that must be addressed and steps that could transform the global construction value chain.

The sustainability challenge

The world's growing global population and increasing urbanization will require better infrastructure with fewer environmental and climate impacts. Current impacts from the construction and buildings value chain need to be controlled, and in the process, these sectors must be improved, in order to meet global goals for sustainability while fulfilling future needs for infrastructure.

The construction and buildings value chain consists of planning, financing, resources-extraction, construction, retrofitting and buildings' use, maintenance, renovation and end-of-life. The sustainable transformation of the value chain is crucial for reaching the climate mitigation targets set out in the Paris Agreement. In 2018 alone, the construction and buildings sectors together accounted for over a third of final energy use and process-related carbon dioxide (CO₂) emissions globally.¹ The construction sector alone accounts for 50% of global resource extraction, making it the most material-intensive sector in the world; it contributes to a number of sustainability crises, such as biodiversity loss, water scarcity and deforestation.²

Whether through the production of new buildings or retrofitting, the construction and buildings value chain is crucial for meeting several of the UN Sustainable Development Goals (SDGs), including safe and affordable housing (SDG 11), providing infrastructure for transport and energy (SDGs 7 and 9), and water and sanitation (SDG 6). Furthermore, the construction sector also employs about 10% of the workforce in many countries² and construction-related spending accounts for 13% of global GDP and is expected to keep growing,³ especially in emerging and developing economies.⁴

The global value chain for construction and buildings connects geographically diverse locations, through global networks of extraction of natural resources, production of materials and construction worksites. The creation of value and the burden of impacts generated are unequally distributed, with high-income regions outsourcing environmental impacts of local construction to other regions of the world. Additionally, as a consequence of traded construction materials, the value created in the country of origin is relatively low compared to the final value created throughout the remainder of the value chain.⁴

The value chain of construction and buildings

In this analysis we adopt a value-chain approach to understand where major challenges and opportunities for sustainability occur in the construction and buildings sectors, and how these could be shaped through decisions made at different stages. The value chain includes constructing new buildings and retrofitting existing ones to make them more energy efficient and prolong their lifespan. Figure 1 shows the stages in which decisions are made, where resources are used, and the sustainability impacts of these activities across the entire value chain. This is

described in further detail in the subsequent sections of this brief.

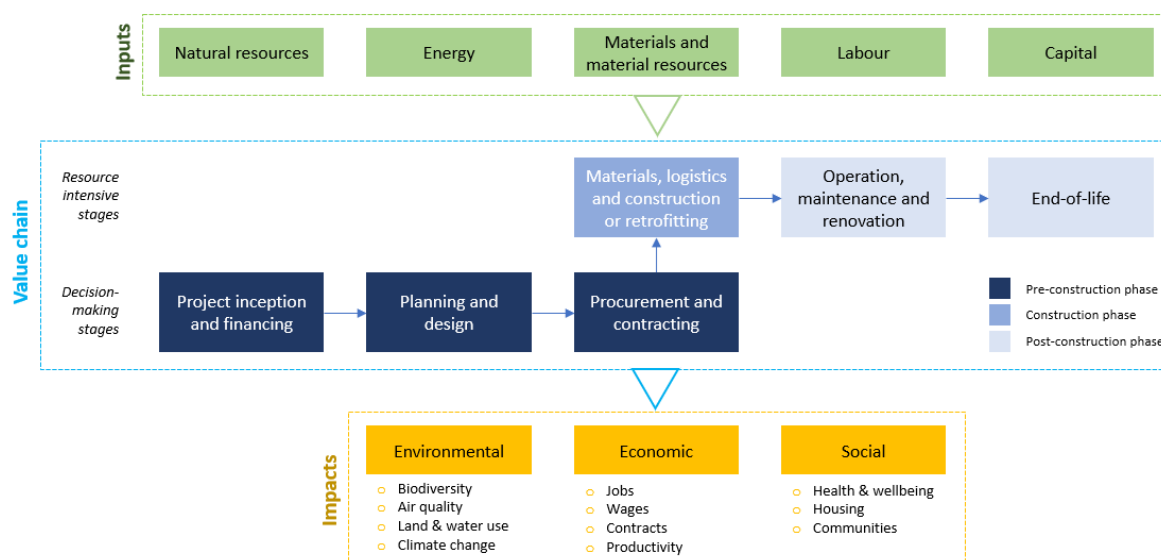


Figure 1. Simplified map of the construction and buildings value chain

Source: Adapted from UNEP 2021² and GlobalABC/IEA/UNEP 2020¹

Pre-construction: planning and finance

The first steps in the construction value chain are financing, planning, design, and commissioning. These steps happen before any resources are extracted and used for the construction, and thus have relatively low direct environmental impacts. However, the financial flows involved directly influence if, what and how construction projects take shape. Thus, these steps have major potential environmental and socio-economic impacts on the full construction value chain.

Policies and incentives embedded in procurement processes have high potential to shape the social and environmental impacts of the sector. According to the World Bank, 83% of investments in all infrastructure worldwide came from the public sector in 2017.⁵ Private investors, lenders and developers are also directly involved in the development of real estate and have the power to reduce its environmental impact, for example through energy efficiency measures and low-carbon material incentives.⁶

The financialization of the construction and buildings sectors treats property as an investment asset to the real estate sector, rather than an essential housing service. This has important socio-economic implications, which local regulation on housing and territorial planning can help shape.²

Construction: from materials to buildings

Moving from planning to completed construction requires raw materials to be extracted, processed, manufactured into construction materials, and then assembled. Connecting all these

steps is a web of logistics, moving materials from being locked up in the ground or in forests all over the globe to their final destinations in a building or other infrastructure. These steps are similar for new construction projects as well as for retrofitting, but the use of materials is significantly lower in most retrofit projects. In this section, we review the environmental, social and economic impacts of these stages of the value chain and possible intervention points to accelerate achieving sustainability of the construction value chain.

The production of construction materials – from extraction and processing of natural resources to manufacturing – is the step in the value chain that creates the most adverse environmental impacts locally in terms of deforestation, biodiversity loss, water scarcity, and pollution of water, soil and air. For example, sand extraction and wastewater production leads to water scarcity and pollution; mining to soil and water pollution; and timber use and land conversion to deforestation and biodiversity loss.²

Greenhouse gas emissions are also significant in the production of these materials. For example, total cement production is responsible for around 7% of global CO₂ emissions and steel for about 7–9%, of which around half can be attributed to construction and buildings.¹

During construction itself, land conversion causes the biggest impact. Land used for new construction often has fertile soil, meaning potentially productive agricultural land is lost. The impact on water scarcity and pollution is also highest in the construction phase.

The volume of nutrients and minerals used in construction is similar to that used in the production of construction materials. This is mainly due to the use of concrete and cement. Fossil fuel consumption is similarly high during the production of construction materials and during the construction phase.² The main resources used to connect all the various parts of the value chain, through transport logistics, are fossil-fuel based, resulting in greenhouse gas emissions. However, the amount of fossil fuels used for transport is considerably less than for production of materials and for construction.²

Crucially, the construction sector is important both from a social and economic perspective: it contributes to GDP and accounts for a sizeable proportion of the global workforce. Despite the vastness of the sector, most construction companies are small and medium-sized enterprises (SMEs). The business sector maintains a high degree of informal jobs, and informally employed construction workers face serious safety and health issues.⁸

For extraction, processing and manufacturing, the picture is slightly different depending on sector. For example, in steel and cement sectors, relatively few multinational companies produce most of these materials.⁹ The environmental impacts of extraction, processing and manufacturing of all construction materials are also closely linked with social, health and economic impacts; for example, scarcity of water, soil pollution and local air pollution all could affect health, lead to premature deaths, and lead to crop failures.^{4,10}

To decrease the negative impacts of the construction phase, consideration is needed for how materials are extracted, produced and built. For example, by increasing energy, material efficiency, circularity (i.e. consideration for value beyond end-of-life), and substituting with more sustainable materials, the environmental impact can be significantly reduced during this phase. Furthermore, retrofitting improves the lifespan and energy efficiency of the building, leading to improved environmental and social outcomes through material and energy savings, and better living conditions.¹¹

However, reaching net-zero greenhouse gas emissions in the construction phase is challenging since sectors such as steel, cement and concrete are among the hardest to decarbonize. In the steel sector, companies are mainly focusing on shifting production away from coal to using hydrogen,¹² and in the cement and concrete sectors, the main decarbonization pathway is carbon capture and storage (CCS) technology.¹³ Cutting down resource use is also necessary. For example, in the IEA Net-Zero Scenario, the use of steel and cement has to be cut in half by 2050 to align with the goals of the Paris Agreement.¹⁴

Furthermore, the global nature of moving natural resources from being locked up in the ground to final construction leads to some counterintuitive dynamics impacting the environment. Most notably, some high-income countries are outsourcing the production, and thus environmental impacts, to lower income countries. The increased extraction and production in lower-income countries is one of the drivers for the slow growth of material efficiency globally, as lower income countries in general have a lower material efficiency. This shows the difficulties in increasing material efficiency at a level in line with the Paris Agreement, such as modelled in the IEA Net-Zero Scenario and the Towards Sustainability Scenario in the World Resources Outlook 2021.⁴

The final environmental, social and economic impacts of the construction phase are determined by a multitude of decisions taken by a vast number of actors. Cost is the key determinant here, and since there is a premium to be paid for most activities with lower environmental and social impacts, these are often not chosen. For example, the premium for low-carbon steel is today around 15% to 40% and 75% to 210% for cement¹⁵, while the price of the final construction may not change a lot despite these increases, the price premiums do not incentivize sustainable choices throughout the value chain.

Post-construction: operation and end of life

The final steps in the construction value chain are the operations, maintenance, renovations, and the end-of-life of the buildings. Of all of the greenhouse gas emissions generated by the construction sector, 27% come from the energy use during the operational use phase of the building (direct and indirect emissions).¹⁶ Decarbonizing operations requires minimizing energy use and implementing low-carbon and renewable heating and cooling.

Finally, the demolition of buildings accounts for a significant proportion of global material waste generation, which can have considerable environmental impacts if not managed properly. This could be reduced by improving deconstruction processes and reuse/recycling of construction materials (e.g., steel scrap collection and cement recycling), as well as final waste disposal process.

Policy recommendations

The global value chain for construction and buildings outlined so far is fragmented and complex. Policy interventions to successfully spur a rapid and sustainable transition in the sector will need to engage and influence multiple stakeholders at different stages along the value chain, and at local, national and global scales.

This includes but is not limited to SMEs, governments, municipalities, financial institutions, multinational corporations and civil society. Despite significant socio-economic and environmental impacts arising from the construction phase of the value chain, most stakeholders operating in this phase have limited opportunities to reduce such impacts, in comparison to

stakeholders in earlier stages of the value chain whose decisions have greater bearing on impact from the whole value chain. Yet governments exert a significant influence throughout the construction value chain, as regulators, investors and planners, which raises the important role that public policy can play in the transition.

The nature of the construction and buildings value chain means that no single policy can trigger a comprehensive transformation at the pace required to meet global sustainability targets. Instead, a series of interventions will need to target the enablers of transition such as regulations, finance and technology, while increasing the capacity of stakeholders to make more sustainable decisions. Below we conclude with five high-level, interconnected areas where concerted interventions have the potential to bring about a step-change in the transition of the construction sector: transparent and systematic data, material efficiency and innovation, green public procurement, and urban planning.

Defining standards and targets using transparent and systematic data - The systematic provision of clear and robust data on operational and embodied (i.e. “whole-life”) carbon emissions and environmental impacts throughout the construction value chain will enable decision makers throughout the value chain to make better informed and sustainable decisions. It also enables the setting of standards and targets, for example for whole-life carbon emissions and environmental impacts, that can be tracked, reported and enforced.

Promoting measures to drive material efficiency and innovation - To address the environmental impacts of existing materials and processes, measures are needed that promote material efficiency and the development of innovative low-carbon alternatives. This includes funding and incentives for public and private research and development, support for demonstration projects and business incubators, funding for breakthrough technologies and SMEs, as well as standards, regulation and incentives that encourage the uptake of innovative technology and incentivize material efficiency.

Creating lead markets through green public procurement - Government expenditure on works, goods and services accounts for 14% of GDP in the EU17 and up to 30% in low-middle income countries.¹⁸ Given the significant purchasing power of the public purse, efforts to align public procurement of infrastructure with sustainability commitments can increase the development and uptake of low-carbon materials through demand creation. This can take the form of bulk procurement of low-carbon goods, setting minimum carbon and environmental specifications as part of procurement rules and setting requirements for end-of-life.

Considerations regarding urban planning for sustainability - Materials and processes are often the focus of sustainability in the construction sector yet given the rise in urbanization throughout the globe, the role of urban planning is equally instrumental. This includes consideration for the purpose of buildings and infrastructure being built, development of building standards, whether they are new builds or renovations, the former purpose of the land being used for new construction, and the development needs of communities. Urban planning can therefore influence the entire construction value chain and its socio-economic and environmental impacts.

Continued efforts towards retrofitting and energy efficiency improvements - Particularly in mature markets, retrofitting existing buildings rather than building new provides opportunities for embedding sustainability in laggard building stock, extending their lifespan, and improving living conditions for residents. Considerable progress has been made so far to improve energy efficiency, reducing energy consumption while bring environmental and social benefits. The promotion of mandatory energy efficiency standards would strengthen existing voluntary arrangements driving further progress in this area.

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