

**HABITAT AND URBAN SERVICES**

*Sector focus*



# Sustainable construction

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# Why sustainable construction? The life cycle view

Sustainable construction aims to achieve buildings and infrastructure with low environmental impacts while guaranteeing the **economic viability of the sector**. It is a new model for constructing and building public works and infrastructure, in which the **environmental impacts** related to the construction process are considered. This spans from the design and project phase, to the construction phase of the building or work, use, maintenance and until and the subsequent demolition and waste management.

Sustainable construction **aims to minimise the environmental impacts** generated during the life cycle of the building or work and includes factors such as efficient use of energy and water, the use of construction materials and natural resources that are not harmful to the environment, proper waste management and the use of renewable energies. In order to carry out sustainable construction, it is essential to perform a **life cycle analysis** (from the architectural project to the end of its useful life) and to quantify impacts such as carbon footprint or water and energy consumption.

Buildings and infrastructures need **supplies** both at the time of their **construction** and **throughout their lifespan**: water, concrete, wood, paintings, insulating materials and electric power, among many others. The extraction, processing, procurement, transport, use, maintenance and final disposal of these supplies have an impact on the environment.



These impacts are often hidden or have low traceability and are **difficult to perceive**, because their effect is made visible after a long time or because the place of consumption of these supplies is physically very far from the place of extraction and/or production. In **sustainable construction**, the challenge for professionals is to ensure that buildings meet their functional requirements while minimising their environmental impact. Sustainable construction thus takes the approaches of **circular economy**, which minimises or eliminates the existence of waste and negative impacts on the environment.

The following are examples of measures that can help reduce the environmental impact of materials used in a building:

**Figure 1.** Examples of sustainability measures applied to construction



Source: Prepared by the authors, based on data by Agenda de la Construcció Sostenible.

# Vectors of sustainable construction

Construction today is **one of the most polluting sectors of economic activity**, both because of the amount of raw materials it uses and because of CO2 emissions and waste generation. The United Nations estimates that the construction sector worldwide accounts for **40% of global energy consumption** and **25% of global water consumption**. It is therefore clear that efficient and environmentally friendly buildings need to be achieved while ensuring economic profitability.

But what are the vectors through which progress is made towards sustainable construction? Sustainable construction methods begin at the design phase of a project and continue throughout. Below are six **vectors that integrate sustainability into construction**:

## Lean construction

Although contractors make an effort to coordinate to achieve maximum efficiency in the construction process, large projects may experience delays and consequent budget imbalances, which result on more generation, consumption of more materials and increased costs, among others. Thus, lean construction is a collaborative approach in the execution of a project where all actors work together to **optimise the project and minimize waste** when possible.

Lean construction and sustainable construction aim for efficient resource use: lean construction seeks a short-term reduction of waste (not only materials) and sustainable construction goals are long-term, but the two disciplines strive for using resources efficiently and promoting integrated systems.



## Modular and prefabricated construction

Rethinking design and construction with a manufacturing mindset means overcoming traditional construction methods. Industrialised construction includes prefabrication and the methods that make design possible for manufacture and assembly. Industrial construction uses **fewer natural resources, reduces pollution and optimises the use of materials**, as construction using prefabricated parts can use any material: concrete pieces, wood or other materials of mineral or plant origin. Construction sites themselves offer **safer working conditions and reduce energy use**.

## Sustainable construction materials

In sustainable construction, materials such as wood -an almost perfect material for industrialised construction- bamboo, entire trees such as structural columns, steel or modeled sustainable concrete can be used. The first link in the sustainability chain is supply using **materials and products that have a low environmental impact**. The project team, following the new regulations, must demonstrate that products are recyclable, that they have recycled content or that they have a low impact.

Among these standards is the **environmental product declaration (EPD)**, which are assessments of the entire life cycle of products. There is currently an increase in the number of companies displaying their products' EPD.

## Tools to reduce carbon

The market has developed digital tools to measure how construction materials contribute to carbon emissions. Thanks to the sector's collaborative efforts, there are free and open access tools for calculating and reducing carbon that make the process more transparent. However, some **self-assessment by the manufacturer** of construction materials and of their products is required, and data must be displayed in such a way that they are easy to identify and read. For this reason, production companies must be able to show their offer organised and categorise their products according to the carbon they include.

Several tools have been developed in this regard, such as an **integrated carbon calculator (EC3)**, an open access platform that reveals the carbon included in construction materials. It is also worth mentioning the [ORIS](#) tool, used for **building sustainable roads**.



## Circular construction

Circular construction economy consists of applying the principles of circular economy to the activity of the sector. It addresses design and construction to **reduce, reuse and recycle** as many resources as possible. Although design is a central part of the model, construction companies can reorient construction materials and demolition products so that they are not wasted. Besides, they put into practice the reduction in origin, recovery, recycling and reuse of existing materials, as well as the purchase of used and recycled materials and products.

Specifically, circularity relates to the role of the **general contractor's** profile, as it relates to the supply and how they handles everything that is torn down or unmounted on the construction site.

## BIM and sustainable construction

Although BIM (building information model) is primarily associated with the design and pre-construction stages, it benefits all phases of the life cycle of a construction project. Processes managed with BIM increase the efficiency of a construction project and BIM projects in 4 or 5 dimensions integrate **programming** and **estimation of costs and materials**. This allows for more efficient management of order changes, for example. Additionally, 6-dimensional BIM serves the **management of installations through analysis and design**. BIM and life cycle assessments can also be integrated to automate environmental impact assessment of construction elements.

# What will be required of sustainable construction professionals?

Traditionally, the construction sector has been regarded as a **poorly qualified professional activity**, but this vision is changing thanks to digitisation, industrialisation of the constructive process and new demands for sustainability.

However, the construction sector continues to suffer from a lack of appeal -especially for young people- which results in **uncovered demands for work** and in **difficulties in growing up** as a sector. However, there is consensus that the incorporation of new technologies and procedures such as energy efficiency, for example, will be some of the vectors that will make construction more attractive and also make it more sustainable.



Thus, the promotion of sustainable construction will require that professionals acquire **new knowledge**:

- **Knowledge of energy efficiency, through platforms such as [train4sustain.eu](https://train4sustain.eu).** Restoration of buildings and public works has always been an activity closely linked to construction and for the next few years, thanks to the boost of European funds such as Next Generation -among others- a major energy rehabilitation operation for housing parks is expected, with the aim of generating major energy savings. In this context, having knowledge of energy efficiency and the elements that allow buildings to tend to lower energy spending will be key in order to respond to market demands.
- **Circular knowledge.** Knowing and adopting Circular Economy criteria becomes a competence both in the process of building and public works and in subsequent operations of maintenance and rehabilitation. It affects the provision of materials, the practice of construction techniques and the subsequent management of waste produced. With the advent of the circular economy and sustainability in our culture, a paradigm shift in construction is essential, which on top of planning the short term of the work looks beyond its completion. There are therefore opportunities for building companies that know how to move forward, adapt, position themselves and make a difference in the sustainable building market.
- **Knowledge of sustainable materials and products** (for the characteristics of their manufacturing process and/or for the role they will play in the new work or serve energy efficiency). We will have to keep abreast of the new materials that are appearing, as well as know how well they are put into work, and what the market is already offering. For example, polyethylene sheets without CFCs and PVC, drainage blankets made of recycled

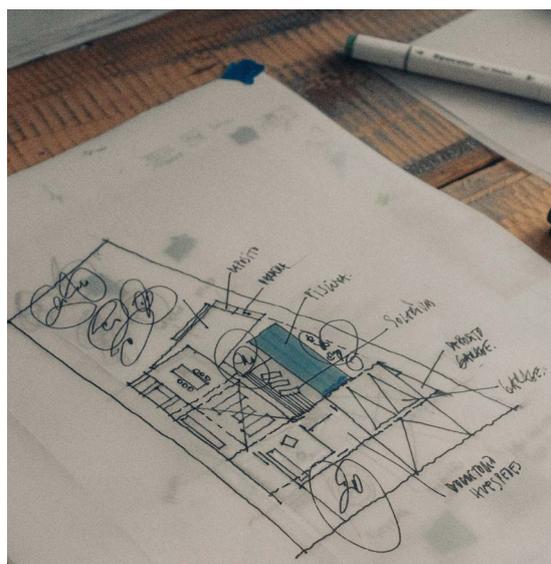
materials, recycled arids, thermal and acoustic insulations, insulating ceramic parts, ceramic parts made of biogas, prefabricated modules that reduce energy consumption in their manufacture, thermal parts and materials, and low-emissivity glasses, impermeabilization systems of covers, landscaped covers and anti-wave displays, among many others.

- **Knowledge of regulations.** Regulations have been developed which tend towards implementing sustainability criteria. These requirements are necessary for innovative public procurement. The following reference regulations are highlighted:

- **The construction of Nearly Zero Impact Buildings, which is covered by Directive 2010/31/EC on Energy Efficiency.**

Nearly Zero Impact Buildings is a challenge that the European Union has set for efficient constructions, with low energy demand and mostly covered by renewable sources.

- **Royal Decree 390/2021, of 1 June, approving the basic procedure for certification of the energy efficiency of buildings,** calls for the promotion of energy efficiency in buildings, as well as for the energy that they use to be supplied from mostly renewable sources.



- Within ecological transition policies, the Spanish **Law 7/2021 of 20 May on climate change and energy transition** should be noted, as well as the autonomous regulations that begin to develop to combat climate change. It contains sections focusing specifically on promoting sustainable construction and assessing sustainable criteria for applying for public tenders.
- **Knowledge of digitisation.** As in other economic sectors, sustainability, industrialisation and digitisation are trends that come together and are reinforced. The Institute of Technology of Construction of Catalonia notes that the low digitisation rate of construction is probably related to the fact that each of the multiple actors involved (architects, installers, builders, geology professionals, engineering professionals, promoters, landowners, among others) has worked in isolation from each other. Currently, the most important digital technology in construction is BIM, which acts as a lever to trigger digitisation. Creating digital models made up by structured data -some of which are graphically expressed by producing 3D images- is pushing other technologies and generating a digital ecosystem.

# The impact of sustainable construction on professional profiles

As stated, not only staff working in the construction site is involved in sustainable construction, but it is a **cross-cutting concept** that must be taken into account from project design to the end of its lifespan, including maintenance and rehabilitation. Therefore, rather than creating a large number of new professional profiles, sustainable construction has an impact on old professional profiles in the sense that they will have to incorporate new skills and working methodologies.

Thus, there is a wide range of **professional profiles that will be on the rise**. The different sources consulted show that sustainable construction will soon demand professionals qualified in:

## Sustainability and energy efficiency of buildings



**Sustainable building site managers.** They are also referred to as construction site managers. This professional is directly responsible for the material execution of the construction project, carrying out the functions of transmitting technical information between construction managers and different foremen and operators who are responsible for the execution of the various construction works. They organise work teams and ensure that the corresponding technical conditions are met and that the plan is carried out. They must therefore know and effectively monitor sustainability requirements.



**Technicians in air conditioning, insulation and energy efficiency systems.** This professional profile represents an evolution of the technical professional in the maintenance of facilities. Therefore, they need to know the technical conditions of sustainability and operation of the facilities to ensure their preventive, corrective and renewal maintenance, especially with regard to applicable regulations.





**Installers of insulating and waterproofing materials.** This profile is an evolution of the technician in waterproofing systems in buildings and public works. Beyond repelling water, sustainable construction incorporates materials that insulate temperature and noise. The market has developed new materials, products and insulating systems that make construction sustainable and that need to be known when deciding on its layout and placement in construction.



**Environmental worksite management technician.** They are the architect or engineer (technical or superior) who ensures the correct environmental management of the construction processes and the incorporation of materials and products that make the site sustainable in a new work, in a restoration or in a wreck. They also ensure that the raw materials and other materials used on the site have the appropriate certifications, and are also responsible for the management and assessment of the fractions of waste produced.



**Technician on landscaped roofs and façades.** Professional in charge of implementing construction systems that make it possible to integrate vegetation into buildings. They usually act in urban areas with higher built-up density where the possibility of incorporating traditional landscapes is non-viable. Landscaped roofs are made up of a layered structure that must ensure the protection of the building, the development of vegetation and the maximisation of ecosystem services. They develop vertical gardening systems for buildings, either of climbing plants or hanging harbor bushes covering an important area of the façade, or landscape walls or live walls, in which a light structure covers the façade wall to support different types of herbaceous and bush plants.

## Digitisation of construction



**BIM experts.** They work both in the definition of a project (which corresponds to engineering and architecture professionals) and at the operational level of the work, which corresponds to the professionals who execute the management or coordination of the building or public work and who work with suppliers and building site managers.

## Modular or industrialised construction



**Modular construction projectist technician.** They specialise, within the process of creating the work (purchasing the plot, financing, drafting the technical project, obtaining funding, obtaining licences, constructing or building and defining interiorism) in providing solutions in modular construction for the construction phase -both in isolated homes and in multi-home buildings- and in new materials and isolation systems that make the building sustainable.



**Crane drivers.** Professional specialised in the basic handling and maintenance of tower cranes used to lift and transport the loads required in the execution of construction works. Modular construction, based on pre-made parts of concrete or other materials, brings more relevance to this professional since their activity becomes fundamental.



**Prefabricated block installation technician.** The main function of this professional is to place prefabricated blocks on their location (structural elements and closures) and to ensure proper sealing and cohesion with the rest of the structure built through the established fixation mechanisms.

## Building restoration



**Building restoration technician.** They are the professional who designs and implements sustainable building rehabilitation projects and their scope is in the recovery, reform and updating of the buildings constructed. As a professional, they specialise in the interpretation of environmental and sustainability requirements to apply to the rehabilitation of buildings and in the management, administration, organisation and coordination of works corresponding to the different interventions required by the building stock.

## Wood construction



**Woodworking and construction technician.** Wood construction is considered sustainable by definition. This professional is competent in construction systems (light wooden and rolled wooden fabric or CLT), raw materials (origin, certifications and qualities of wood), finished product, mechanisations, technical studies, installation, regulation and maintenance of wood constructions.

## Training staff



**Trainer in sustainable construction.** They perform the role of training other construction and building professionals in sustainability-related issues: energy efficiency, sustainable materials, applicable regulations and certifications, digitisation, construction techniques, waste management, among others.

It is true, however, that changes are also expected in these same professional profiles. As sustainable construction changes from a proposal to a reality in all constructions, the specific functions of some of these professional profiles will be taken on and integrated into professional practice for all jobs in the sector. In other words, **construction will become sustainable in its entirety** once its learning curve has been overcome.

**Figure 2.** Most in-demand and innovative occupations related to sustainable construction

	MOST IN-DEMAND PROFILES	MOST INNOVATIVE PROFILES
#1	Crane drivers	Prefabricated block installation technician
#2	Installers of insulating and waterproofing materials	Environmental worksite management technician
#3	Technicians in air conditioning, insulation and energy efficiency systems	Sustainable building site managers
#4	Trainer in sustainable construction	Modular construction projectist technician
#5	BIM experts	Technician on landscaped roofs and façades
#6	Building restoration technician	Woodworking and construction technician

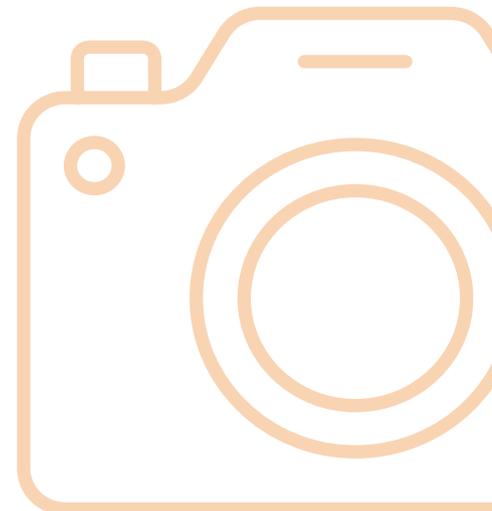
Source: Prepared by the authors.

## A focus on sustainable construction

**Sustainable construction** meets the needs of the present and the future. Given that the planet's resources are limited and that the population continues to increase, sustainable construction is a vital necessity that affects economic growth and responds to **social needs**, while **combating climate change** and **protecting the environment**.

Adopting sustainable construction techniques prepares construction companies and citizens for the future, as these are expected to be an increasingly present demand in any building project, and especially in public works. Thus, companies that already operate with a small impact and that produce low-impact products and buildings will have access to greater opportunities.

The learning curve will become easier and **sustainable building procedures will become universal practices** as more actors meet their requirements: companies that take sustainability measures will be more demanded and at the same time, **new generations** will feel more attracted to developing their careers in more sustainable companies.



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