

SUSTAINABLE BUILDINGS MARKET STUDY 2019

RAMBOLL

Bright ideas. Sustainable change.

CONTENT

This publication is divided into four themes:

1. THE BUSINESS CASE FOR SUSTAINABLE BUILDINGS

2. LIVEABILITY

3. CERTIFICATION SCHEMES

4. FUTURE TRENDS

In each section we explore the evidence and bring insight to the key findings from the study. We introduce a case study and recommendations for different stakeholders.

This market study is the sixth of its kind, formerly known as the Green Market Study. The 2017 study can be found here: https://issuu.com/ramboll/docs/ramboll_green_market_study_2017_web

Previous studies conducted in 2008, 2010 and 2012 were known as Pöyry Green Market Studies. Since 2014, the study has been conducted by Ramboll. In 2014 Ramboll became one of Finland's largest consulting companies through acquisition of a substantial part of Pöyry's building services including engineering, real estate consulting, project management and urban and regional planning operations.

Cover: Helsinki Library, inaugurated in 2018. Architect: Ala. Ramboll performed structural and technical design and project management. Photo: "Kuvio"

SUSTAINABLE BUILDINGS MAKE PEOPLE PROUD

In Europe, 90% of our daily lives are spent indoors. We live, learn and work in buildings, and the environments within and around our buildings have a strong influence on our productivity, health and overall well-being.

Today, buildings are responsible for more than 40 percent of global energy usage, and as much as one third of greenhouse gas emissions.

With an increasing number of governments legislating for a net-zero carbon future to limit global temperature rise, we must find a way to design, construct and operate buildings that improve their environmental sustainability, but also the internal environment for users

In addition, the construction sector has huge untapped potential for improving sustainability and efficiency across the entire value chain thanks to digitalisation, innovative technologies and new construction techniques. Consider for example, the emergence of Building Information Modelling (BIM), smart building technologies and new building materials – which have now reached maturity. Leveraging such innovations, companies can boost productivity, streamline project management and procedures, and improve environmental sustainability throughout the entire process.

At Ramboll, we want to be at the forefront of this development. Therefore, we conduct the bi-annual 'Sustainable Buildings Market Study' that explores drivers and trends related to sustainable development in the construction sector.

There are no quick-fix solutions for a more sustainable built environment. However, we hope that by contributing with market and domain insight, we can bridge the knowledge gap, puncture a few myths and provide actionable insights for investors, contractors and users of sustainable buildings.

Aside from technical developments that are driving improved sustainability and outcomes on the bottom line, we must bring into focus an important emerging driver for sustainable buildings; this being the growing population of individuals making a stand to battle climate change, by marching the streets and demanding systemic changes. It

would be reckless to underestimate this powerful movement and we fully anticipate an increasing interest from future generations in leading sustainable lifestyles, minimizing their personal carbon footprint and working for companies that share their values and operate sustainably.

Sustainable buildings tap into this trend – they will increasingly become an identity marker for companies striving to make a difference and for end users choosing to support them. This means there will be growing demand for sustainable buildings that support their sustainable values and lifestyle and make them feel proud.

At Ramboll we are proud to present the 2019-version of our 'Sustainable Buildings Market Study', previously known as the Green Market Study" – to emphasize that sustainability is not only about being green and environmentally-friendly.

For us, sustainability is also about respecting the intergenerational contract that is embedded in the Bruntland-definition – we must carefully consider the quality of the built environment that we pass on to future generations.

We hope that this edition helps inform the global conversation on sustainable buildings.



Rikke Bjerregaard Orry
Global Sustainability Director
Ramboll Buildings

**95% CONSIDER
SUSTAINABILITY
IMPORTANT FOR
SUCCESSFUL
BUSINESS
OPERATIONS.**

EXECUTIVE SUMMARY

The design and construction of buildings has a fundamental impact on people, communities and on our natural environment. Understanding how we can deliver buildings that enable people and businesses to flourish and grow, and simultaneously have a positive impact on our climate and environment is one of the key issues for our generation.

At Ramboll, we design more than 10 million square meters of buildings every year. We aim to be at the forefront of the sustainable building movement. Therefore, we conduct the bi-annual 'Sustainable Buildings Market Study' that explores drivers and trends related to sustainable development in the construction sector. The survey canvasses the views of nearly 400 Nordic and UK based stakeholders – architects, developers, contractors, real estate investors and contractors – and gives insight to how the construction sector perceives sustainable buildings, benefits and what is driving the demand of sustainable buildings.

Good news: Sustainability is becoming mainstream

First the good news, increasingly the respondents reported that their current and future projects could be considered sustainable. In 2017, 5% of the respondents stated that none of their current projects could be considered sustainable, whilst two years later the number was down to 0%. Looking ahead, 57% of respondents stated that they expected more than half of their future projects to be sustainable. Sustainability is becoming mainstream.

In our survey, Health and Well-being emerged as an important trend for sustainable buildings, underlining the liveability aspect of a building as an important factor. Life Cycle Thinking is still the most important trend, closely followed by Carbon Neutrality, and these are driven by a strong push from the EU and national policies aiming to limit emissions throughout the life cycle of a building.

Get help from certifications

In relation to health and well-being, indoor air quality, lighting and thermal comfort are rated by the respondents as the most important well-being and health-related factors. Interestingly, few countries have mandatory thresholds for such well-being factors. However, environmental certifications standards such as DGNB, LEED and BREEAM can help address issues such as air quality, by dictating requirements to building materials with low levels of chemical substances.

Less good news: Lack of clarity on the costs and benefits

When asked if sustainable buildings are a good investment, close to 50% of all respondents have little or no insight if sustainable buildings cost more to build, if they have reduced operational cost or if they trade at a premium. It is clear there is a lack of hard evidence to show whether sustainable buildings yield a positive return on investment. Addressing this knowledge gap will be vital for accelerating the uptake of sustainable buildings.

The definition of a sustainable building is constantly evolving: in the early days, the focus was on environmental sustainability, often in the form of energy efficiency. A more mature definition includes both environmental, social and financial aspects of a building - throughout the building's life cycle.

DRIVERS FOR SUSTAINABLE CHANGE



One of the most important drivers of sustainable buildings in a market economy is the financial benefits. If the business case is positive, the solutions will emerge and grow exponentially.

Investments in energy and water efficient solutions result in savings in operating costs during a building's operation. In addition, sustainability throughout the total life cycle of the building can be further addressed with carefully select-ed building materials and robust solutions that reduce risk and costs associated with cleaning, maintenance and recyclability.

Moreover, higher quality leads to higher property value, higher rent levels and lower vacancy rates in the long run. The challenge in the construction industry is to capture the evidence for these mechanisms and present them in a credible and consistent way.

Other drivers are regulatory incentives and/or restrictions that are imposed on the construction industry. These incentives can be designed as 'hard law' in the shape of minimum requirements, or 'soft law' in the shape of voluntary schemes in local building codes.

Increased awareness among stakeholders is pushing investors towards raised levels of ambitions. Many global companies now have sustainable office buildings as an integrated part of their sustainability strategies due to the brand value and image benefits - it is easier to attract and retain the right employees in a sustainable and high quality office building.

For the residential market, there is an emerging trend of building developments that foster social cohesion and support communities,

specifically focusing on shared values and/or shared facilities, health and well-being, mixed generations, senior citizens or flexible solutions for single parents.

The traditional family pattern is disintegrating and there is a growing recognition that home buyers and residents have different needs at different stages of their lives. It is no longer "one size fits all" and a simple choice between two or three bedrooms when marketing housing for buyers or tenants.

Many of these residents are selective, well-informed, value driven and they want to contribute to the sustainable change in their lifestyle and choice of housing.

These trends are supported by a report published by the World Green Building Council (World Green Building Trends 2018 SmartMarket Report). This report provides a comprehensive study of the global green building market and includes a survey of how multiple stakeholders view drivers for constructing sustainable buildings. Participants were asked to select the top three drivers from a list of 16 options.

The top two drivers in this report are: 'Client Demands' and 'Environmental Regulation' underlining the importance of the market and regulations in stimulating demand for sustainable buildings. In third place was the concept of 'Healthier Buildings' and tenant well-being as also highlighted in the Ramboll study.

SUSTAINABLE BUILDINGS: A GOOD RETURN ON INVESTMENT?

The construction and property industry have complex value chains that bring together the right expertise to deliver a building project. Teams are formed from across different organisations and disciplines that often find themselves collaborating for the first time on a specific project. Investors, developers, designers, consultants, contractors, manufacturers and end users all have their own agenda. These complex value chains, coupled with their differing experiences often results in a lack of clearly defined goals for sustainability that can be supported with agreed and reputable forms in which to measure the value and return of sustainable investment.

There is still a lack of hard evidence available to show whether sustainable buildings generate a positive return on investment. Establishing the link between investing in sustainable buildings and capturing the added value in the long run is extremely complex. Nevertheless, it is pivotal for decision-makers to have this insight because it is a prerequisite for making informed decisions.

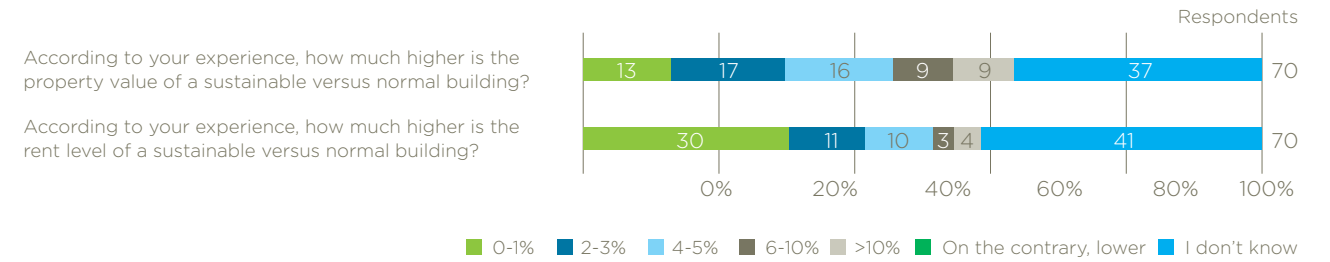
Sustainable building barriers
According to the survey, there is a general perception that sustainability measures increase the investment cost of a given project. Two thirds of respondents believe it's more expensive to build a sustainable building, whilst 15% indicate they don't know if costs are increased. Not surprisingly, higher costs (perceived or actual) are also the biggest barrier preventing sustainability measures being considered by organisations (64%), followed by lack of market demand (38%) and

lack of faith in the profitability of green buildings (36%).

Cost, quality and liveability drivers
However, there are several financial value drivers that justify making an initial extra investment in sustainability. The most obvious one is reduced operational costs due to increased energy and water efficiency. In terms of perceived added value, this is the most popular item associated with sustainable buildings in the survey (48%), followed by healthier and more comfortable spaces (38%) and higher quality (30%).

50% of the respondents have actual experience of achieving operational savings between 1 and 10%. And in Sweden, more than 20% of the respondents have experienced savings of more than 10% in operating costs, which is likely to be related to the mandatory follow-up on energy usage after two years of use in Sweden.

RESPONSES FROM PROPERTY OWNERS/INVESTORS REGARDING OPERATIONAL COSTS



Investors' perspective on the business case

Another financial value driver is the increased property value of a sustainable building. 30% of the property owners/investors report an increased property value of 0-3%, 25% report an increased property value of 4-10% and 9% report an increased property value of more than 10%.

Knowledge gaps

For all respondents in all countries, approximately 50% of the respondents have no knowledge of the operational savings, the rent level, the vacancy rates or the property value. This indicates a huge knowledge gap in terms of establishing the business case for sustainable buildings. These patterns indicate a need for further research and economic post-occupancy evaluation in order to uncover the actual operational costs, vacancy rates and property value of sustainable buildings versus non-sustainable buildings.

How large is the actual extra investment in the design and the construction stage? And how large is the actual return on investment?

Evidence-based studies

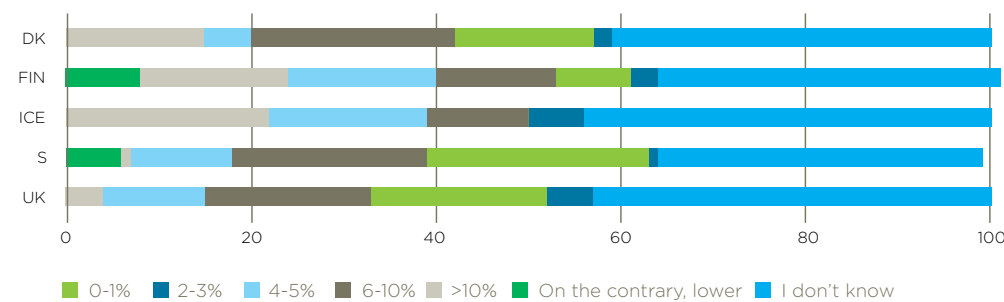
Several studies of the economic effects of a sustainable construction have been conducted, but we have yet to see an evidence-based study of sustainable buildings that clarifies the full business case in a convincing way.

- A recent study from Denmark 'Rethinking life cycle costs drivers for sustainable office buildings in Denmark' (Haugbølle and Raffnsøe, 2019) analyses data from 21 DGNB-certified office building projects from 2013-2017. The study includes actual construction costs and calculated costs for three main cost drivers: Maintenance and replacements, costs for utilities and cleaning costs over a period of 50 years. The study concludes that the relative

- distribution of supply costs versus cleaning costs seems to be 1:2, meaning that cleaning costs are approximately twice as high as supply costs in total. These buildings are probably very energy efficient, but the calculated energy consumption is a theoretical number which is likely to be higher if factors like service levels and user behaviour were added - or if the study were conducted with actual costs instead of calculated costs.
- A study conducted by M&G Real Estate on their own European property portfolio, published in November 2018 revealed that the certified share of their assets achieves a slightly higher income to investors.
- Studies of LEED-certified buildings in the US from 2000-2003 indicate an extra investment of up to 2%, but going towards zero in a downwards trend, and that the extra investment typically yields life cycle savings of over 10 times the initial investments.

OPERATIONAL COSTS OF SUSTAINABLE BUILDING

According to your experience, how much lower are the operational costs of a sustainable versus normal building?



MISSING FACTS ON COST-BENEFITS

37% of the property owners didn't know if sustainability features increase the property value of their building. 56% of the property owners have no knowledge of the impact on vacancy rates. 41% have no knowledge of the impact on rent level. 31% of them have no knowledge of the operating costs of sustainable versus non-sustainable buildings.

“The new building has saved us around 875,000 EUR in operating costs annually and being DGNB certified has been rewarding on many levels”

Henrik Mott Frandsen,
Head of Occupational Health & Safety,
Middelfart Municipality

MIDDELFART CITY HALL

Middelfart City Hall, the most sustainable public building in Denmark, is also the first building in the country to be DGNB Platinum and Diamond certified. The town hall has also been included in Sustania and Realdania's 'Climate100' publication, which recognises the 100 most sustainable buildings in Denmark.

A wide-range of measures have been implemented to ensure that the building is economically, environmentally and socially sustainable.

The Council previously operated from six separate locations, and by moving all functions to the new town hall, the council is aiming to realise significant maintenance and transport cost savings.

To minimise the building's environmental impact energy usage is minimised through a very energy-efficient

mechanical cooling system and the installation of 700m² of solar cells on the building's roof. The aluminium façade has a low environmental impact, requires low maintenance, and is very durable.

The interior design is focused on optimising indoor temperature, daylight and acoustics and thereby aims to improve the well-being and productivity of employees.

The timeless and attractive architectural design of the town hall is intended to future proof and maximise the longevity of the building, which has an expected life span of 150 years.

The city hall had a construction cost of 1,922 EUR per m². This is a relatively low cost for an office building and punctures the myth that the cost of a certified building is higher than a non-certified.

AT A GLANCE

Client: Middelfart Council

Location: Middelfart, Denmark

Architect: Henning Larsen

Project size: 21,000m² mixed use development

Sustainability credentials: DGNB Platinum and Diamond certified

ACTIONABLE INSIGHTS AND RECOMMENDATIONS

1 For property owners and investors: Investigate your portfolio in terms of building performance, ROI and systematic risks. Certified buildings are likely to carry lower risks, lower vacancy rates and higher rental income. The decision to certify the building should be taken as early as possible in the design process to develop an integrated design strategy, which provides a better result at a minimum or zero additional cost.

2 For building designers: Energy efficient solutions are key in reducing the operational costs. Use passive design measures as a basis for the design, complement with energy efficient technical installations and equipment. Only use on-site renewable energy sources if it is also viable from a societal perspective. Besides energy efficient solutions, consider the ease of cleaning when designing the buildings. Glass facades require regular cleaning on both sides, and if they are difficult to reach, the cleaning requires lifts or rappelling, which can add significant costs.

3 For end users: Sustainable buildings are likely to have higher rent levels, but if utility costs are lower, it might be a positive investment. Other value drivers such as brand and reputation, talent attraction, higher productivity and customer attraction should also be taken in to account.

4 All: By definition, life cycle costs cover construction, operation, maintenance and replacements, and end-of life costs. Operational costs should be split into costs for maintenance, costs for utilities (water, sewage and energy including electricity consumption) and costs for cleaning. Actual energy consumption is likely to exceed calculated energy consumption due to user behaviour and variations in service levels, and the fact that the amount of user equipment is likely to exceed expectations made in the design stage.

DETAILS OF REFERENCES

1 Kim Haugbølle, Lau M. Raffnsøe, (2019) "Rethinking life cycle cost drivers for sustainable office buildings in Denmark", Facilities , <https://doi.org/10.1108/F-01-2018-0003>

2 M&G Real estate, November 2018: Green buildings: what are the financial benefits for investors?

3 Geof Syphers, Mara Baum, Darren Bouton, and Wesley Sullens (2003), KEMA: Managing the Cost of Green Buildings.

ARE SUSTAINABLE BUILDINGS ALSO LIVEABLE BUILDINGS?

The building sector has reached a level of competence, where 'nearly zero-buildings' are achievable in most European countries. Ventilation systems are currently designed with very high efficiency and recovery rates. Building façades are designed with the highest possible thickness of insulation and windows are placed and designed to allow for daylight and passive heat gain to be exploited as much as possible. Additional energy optimising initiatives in buildings are often unfeasible from a financial perspective.

What makes a building a good place to live, learn and work?

Liveability describes the conditions required to enable people to flourish – and covers both physical as well as mental health. All these conditions must be included when a site is being developed to make it a success. It is important to create buildings that are both environmentally friendly and enables end users to thrive. A liveable building takes all aspects of creating a sustainable building into account.

Ramboll's 'Liveable Buildings' concept focuses on a building's physical, social and cultural conditions and for each dimension we have identified several indicators that can be addressed in the design process. The combined result of all indicators classifies how liveable a building is. The framework can be used in combination with third party certification of the building. By systematically discussing all indicators in a project, design teams are forced to consider not only environmental issues, as is commonly done today, but also social and cultural issues that are equally important from an end user's perspective.

The result is a clear description of issues to consider for the building design. The developer can evaluate the benefits of suggested solutions. Costs for the solutions can then be calculated, and responsibilities for implementation can be assigned. This creates transparency regarding building solutions and

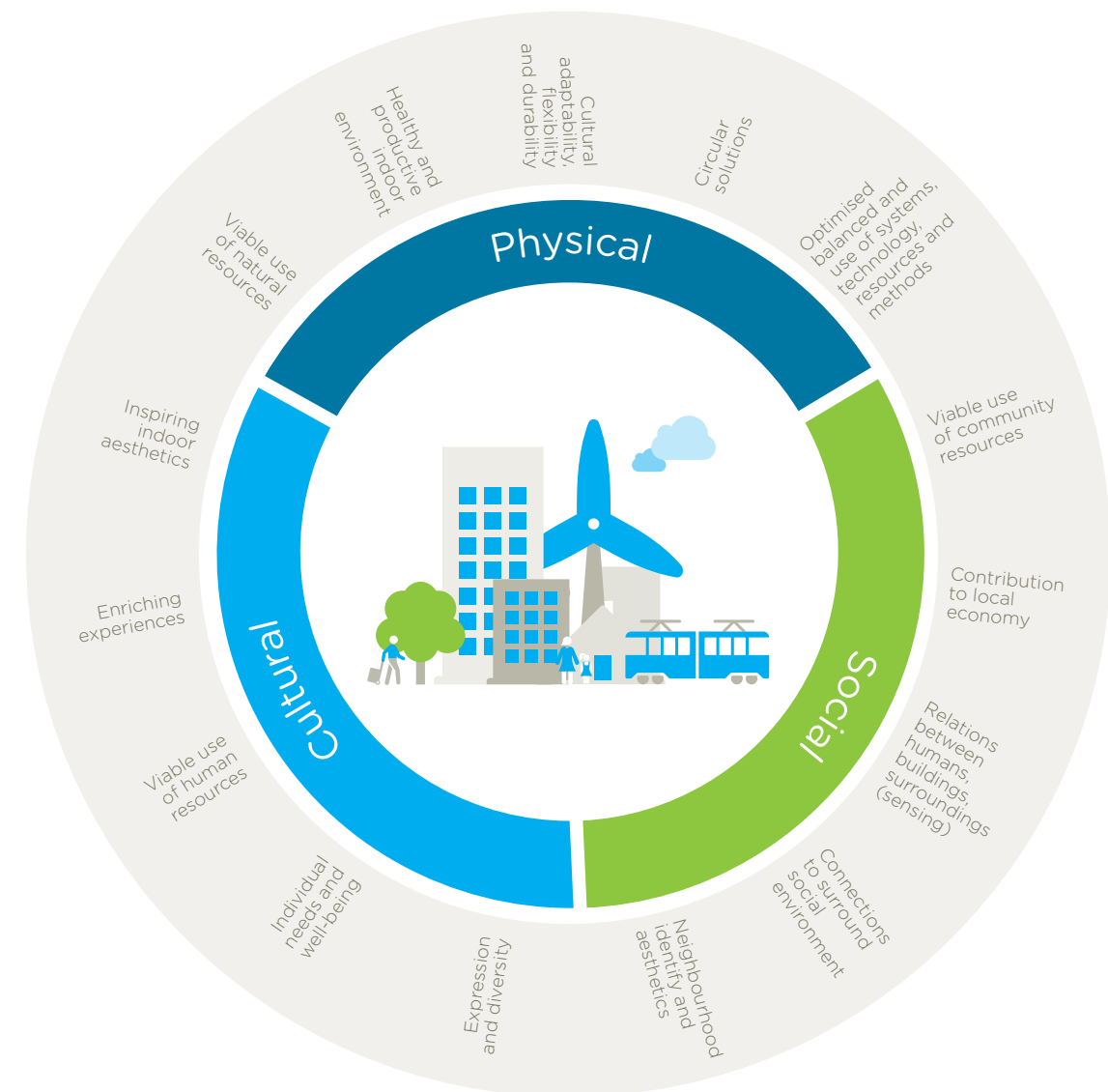
functions, which can again be easily communicated to stakeholders and investors.

Liveability is an emerging notion that embraces the well-being of people by looking at factors such as the design elements used and the surrounding facilities we interact with on a daily basis. Buildings are part of a person's daily routine and experience and need to cater for everyday needs.

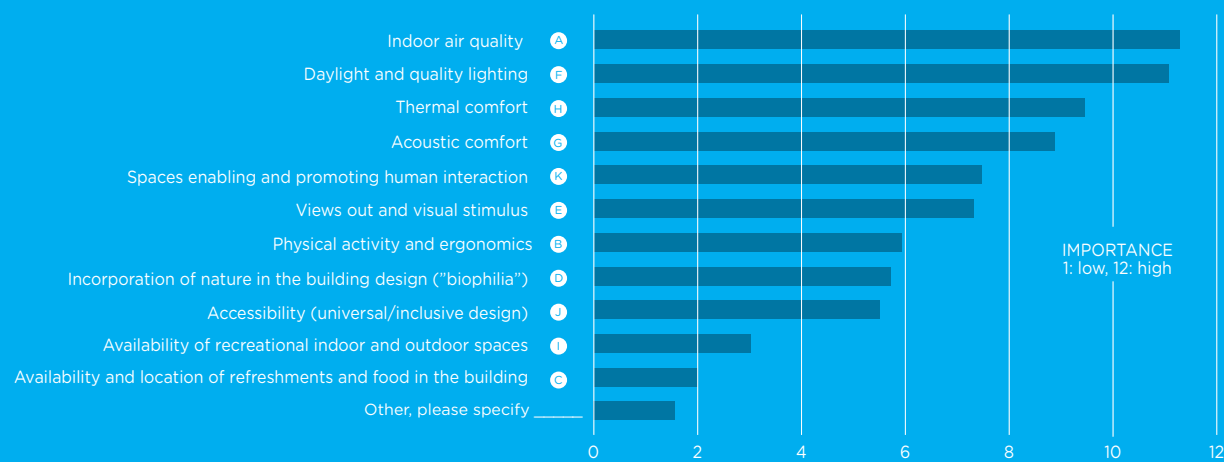
Studies show and support the necessity of focusing on the actual experience of living in buildings. Contributing factors include the determination of air volumes or the amount of daylight or physical space that is required by regulation. Sometimes, however, the engineered design underperforms and negatively affects the productivity or health of the occupants. Therefore understanding how a building is likely to perform in use is crucial to a successful design and requires the use of more data and analysis at the start of a project.

Factors contributing to liveability

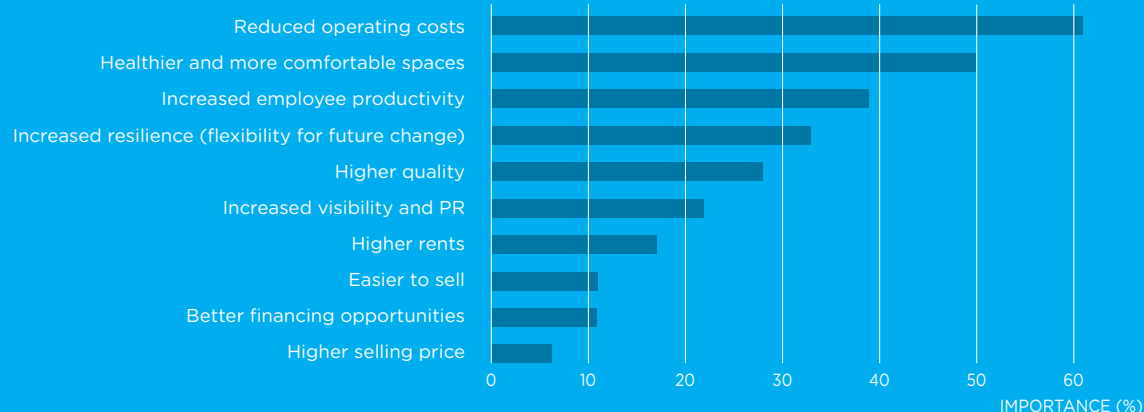
As shown in the figure below, respondents consider indoor air quality, daylight and quality lighting, and thermal comfort to be the top three most important well-being and health-related factors. This is an interesting result since few countries have mandatory thresholds for indoor air quality in their building codes. There is usually a great deal of effort put into optimising and documenting daylight conditions and thermal comfort in the design stages, and few resources are



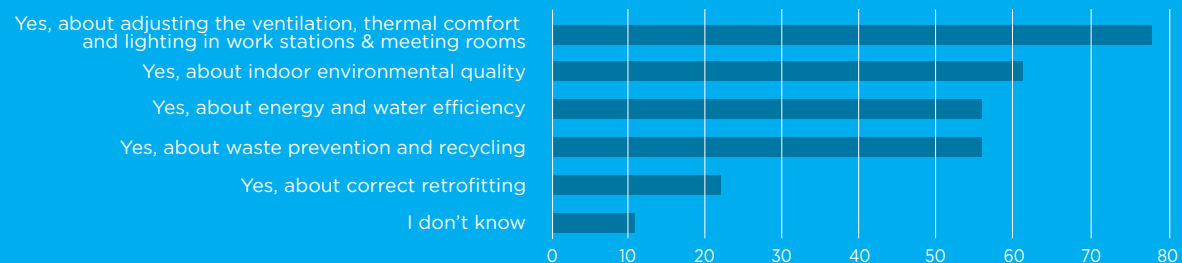
THE MOST IMPORTANT WELL-BEING & HEALTH RELATED FACTORS



MOST IMPORTANT ADDED VALUES CONNECTED TO SUSTAINABLE BUILDINGS



REQUESTED ASSISTANCE IN PERFORMING MORE SUSTAINABLE BUILDINGS



allocated to selecting low emission building materials and measuring volatile organic compounds (VOC's) and CO2-levels once the building is finalised.

In a sustainable building, there should be a strong focus and attention on ensuring a clean environment for the occupants, but also in relation to the importance of using "clean" building materials that can be used in several "building cycles". The movement towards using a material twice or more therefore depends on the content of unwanted dangerous substances and additional treatments to the core material.

Environmental certification standards such as DGNB, LEED and BREEAM address this by imposing requirements regarding the selection of building materials, which have documented low levels of unwanted chemical substances.

Evidence-based studies

A Danish study 'Indoor climate in day care institutions' pin-points the need for an increased focus on the indoor climate conditions, especially in relation to daycare centres and educational environments, as these buildings cater for vulnerable people; our children.

One of the study findings was that, in all 20 institutions, the level of unwanted chemicals was significantly above legal thresholds.

This applied to chemicals such as phthalates and flame retardants, which are banned in products for children (and for some of them in all consumer products).

When designing liveable buildings, one must underline the importance of involving disciplines as MEP and CTS engineers from the beginning. The study found that some institutions had no mechanical ventilation, which resulted in CO2-levels ranging up to 3000 ppm, which is also significantly above recommended levels. Even in institutions with mechanical ventilation systems with constant air flow, but without CO2-sensors, there were examples of up to 2000 ppm.

How do tenants relate to sustainable buildings?

What are the tenant's demands when choosing a new home or office? And, why does it matter for consultants? Tenants relate sustainable buildings to reduced operating costs, healthier and more comfortable spaces as well as increased employee productivity in office premises.

All three values somehow relate to the unforeseen or 'invisible' costs in a house or an office.

From a tenant's perspective there is a clear interest in realising the savings during the rental period. Commissioning and interior design are two areas, where it is possible to optimise and influence the end-users' experience and costs in the long term.

61% of those surveyed across all countries consider reduced operating costs to be the most important added value connected to sustainable buildings.

If buildings are designed in accordance with various sustainability standards (DGNB, LEED, BREEAM for example), the chance of reducing operating costs is expected to be high. This is due to criteria within these standards imposing very specific requirements to energy efficiency and a comprehensive commissioning process. They are therefore geared up to being economically sustainable in the long run.

Lower operating costs and rents

Operating costs depend on the solutions implemented when designing the building in the initial phases. The initial expense of cost-efficient equipment and MEP design may be higher, but cheaper during operation. Tenants are not interested in paying higher rents, even though a building is designed sustainably. The owner obviously has an interest in mitigating the vacancy level of a property as well as maintaining a competitive rent.

The variable, where both parties can benefit financially is therefore the

maintenance and service costs. It has been proven with cases such as Middelfart Townhall in Denmark, that sustainably designed buildings have much lower maintenance and service costs. Savings on maintenance and operation costs, depend on the optimal usage of the various equipment and technologies.

Healthy living environments

The survey reveals a strong interest in ensuring a healthy living environment, where the setting, indoor climate and materials together provide high comfort levels. 50% of the tenants surveyed across the countries associate sustainable buildings with healthy and more comfortable spaces.

78% of surveyed respondents requested more assistance and instructions on how to adjust the ventilation, thermal comfort and lighting in work stations and meeting rooms, with a view to ensuring sustainable use of the equipment. Any incorrect use of the equipment and technologies in a building can lead to higher operating costs and poor indoor climate - leading to lower work productivity, concentration difficulties or fatigue. Early involvement of commissioning staff can help them be prepared with the knowledge needed to provide assistance when the building is in use.

ACTIONABLE INSIGHTS AND RECOMMENDATIONS

1 For property owners and investors:

Investigate your portfolio in terms of indoor climate conditions and user perception of the liveability-parameters of the buildings. If current standards are not met, this is likely to cause discontent among end users. Furthermore, poor indoor climate can be an indicator for poorly balanced technical installations and unnecessary high energy consumption.

Recommendations for improvement:

- Remove or mitigate sources of unwanted chemicals and pollution and integrate eco-labelled products in your procurement process.
- Provide user manuals and training for both technical and non-technical users.
- Conduct regular building performance evaluation and service and maintenance activities on the technical installations. This will improve building performance, reduce energy consumption and prolong the life span of the components.

2 For building designers:

- Define internal loads and indoor climate requirements in collaboration with property owner and end users.
- Ensure 10-20% extra capacity in technical installations to allow flexibility for future changes.

3 For end users:

- Review user manuals and use the technical installations according to recommendations. Ensure that new staff or users are introduced to manuals and procedures.
- Avoid unnecessary polluting activities – limit bonfires and live candles to special occasions and ventilate manually several times a day. Avoid over-occupancy of rooms with people or technical equipment, such as flat screens which emit heat, CO₂ and unacceptable noise



PATIENT WELL-BEING IN FOCUS

The New Karolinska Solna (NKS), which opened in 2017, is one of the world's most ambitious hospitals. A key objective of the new hospital was to put Stockholm on the forefront of healthcare innovation by integrating healthcare, research and education, ensuring knowledge transfer between research and healthcare.

Everything has been designed with attention to make the most out of the setting and natural resources, such as the impact of daylight, views from the building and the design of spaces focused on patient well-being. The new building features low-energy designs, a ventilation system that uses less energy, intelligent processing of chemical waste and ensuring materials used in construction are resource-efficient.

The building is designed to consume half of the energy of a similar hospital and has received the environmental certification Miljöbyggnad Gold, while also being

certified according to Leadership in Energy and Environmental Design (LEED) Gold standards.

All patients are offered what is known as thematic care, meaning that a team of medical experts and specialists will work together to treat them in their rooms, rather than requiring them to be transferred between hospital departments for different therapies.

Aiming to be on the forefront of innovation and sustainability, the hospital is equipped with 29 automated guided vehicles (AGVs) that autonomously carry out about 1,600 transport jobs per day. Everything from picking up food, cleaning carts and laundry, freeing up more time for patient care. The project has been developed in a BIM environment from the outset, using a single data standard, set out clearly in the project's BIM execution plan, ensures that information is well-structured and enables a smooth transition from the construction to the operational phase.

AT A GLANCE

Client: Stockholm County Council

Location: Stockholm, Sweden

Architect: White Arkitekter AB

Project size: 320,000 m²

Sustainability credentials: Miljöbyggnad Gold, and certified according to Leadership in Energy and Environmental Design (LEED) Gold standards.

WHAT CERTIFICATION SYSTEMS ARE BEING RECOGNISED AND USED?

The demand for third-party certification is increasing in the construction industry, and at Ramboll we currently have more than 170 employees who are trained and licensed to certify buildings or urban developments in more than 20 different schemes globally. But what are the reasons for investors to certify their projects? And why so many different schemes and definitions of sustainability?

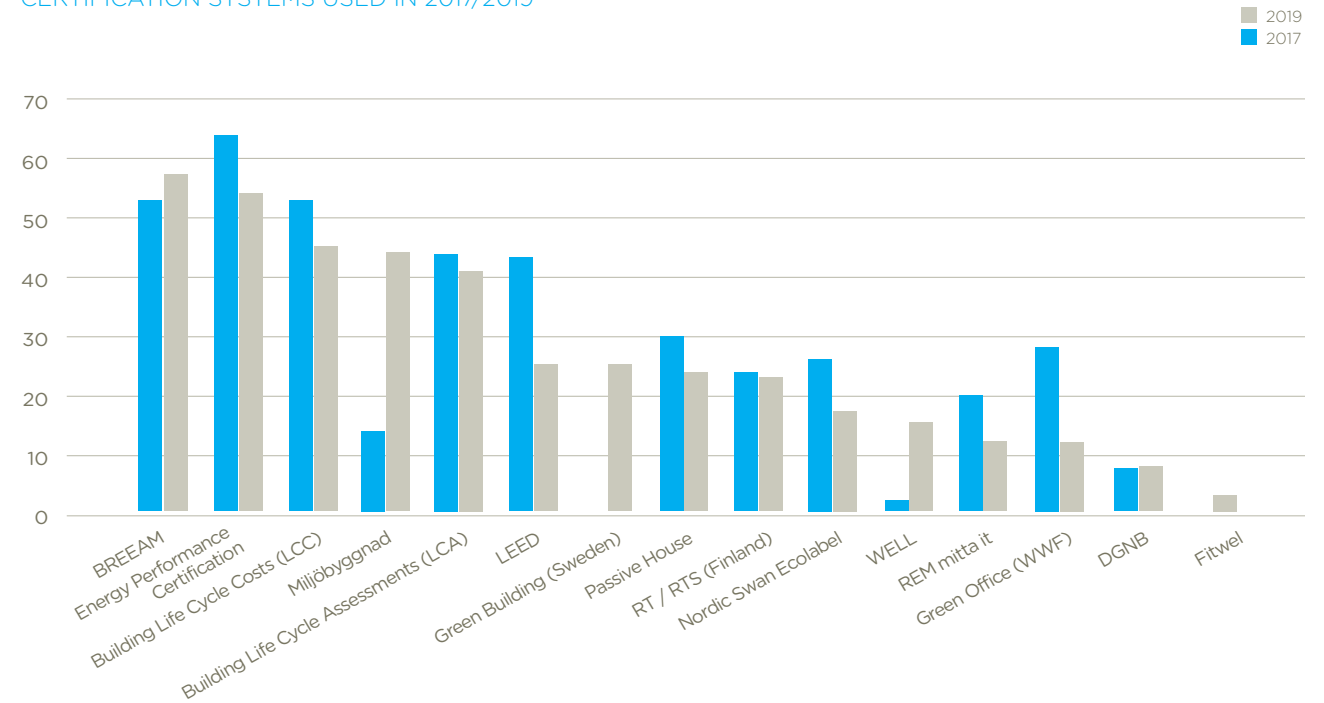
One of the most important reasons for certification is that it provides an undisputable identity and quality assurance by a globally recognised third-party. Furthermore, it gives the project team a clear and common objective, subject to contract agreement and a driver of many design decisions.

Most third-party certification schemes have performance criteria that set requirements that are more demanding than local building codes. This means that certified buildings must perform better

than buildings that just comply with codes and on a larger number of parameters; and this must be documented in order for the independent third party to issue the certificate. This means that certification ensures high quality documentation of process as well as quality and detailed solutions for building owner documentation, which is often incomplete or missing in non-certified projects.

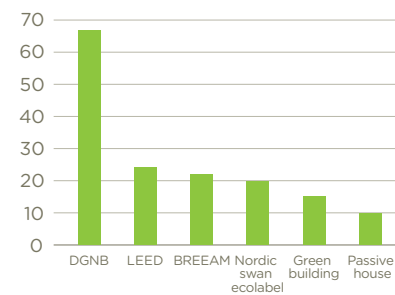
The main reason for the large variety of certification schemes is context sensitivity. The schemes

CERTIFICATION SYSTEMS USED IN 2017/2019

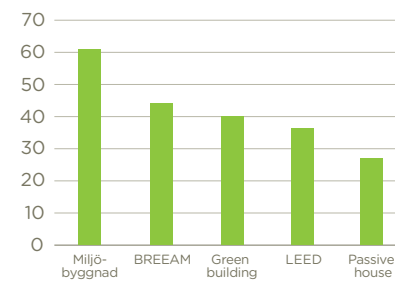


THE TOP FIVE CERTIFICATION SCHEMES PER COUNTRY

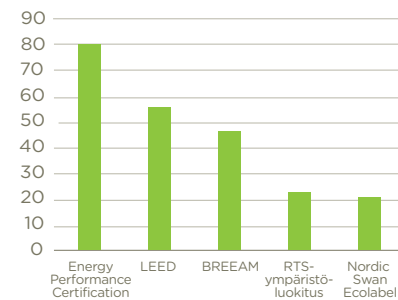
DENMARK



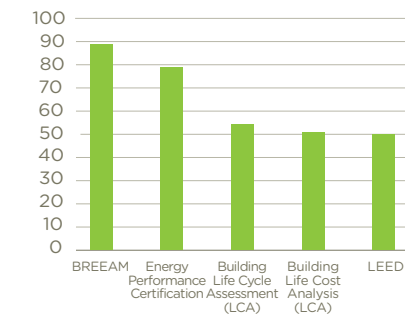
SWEDEN



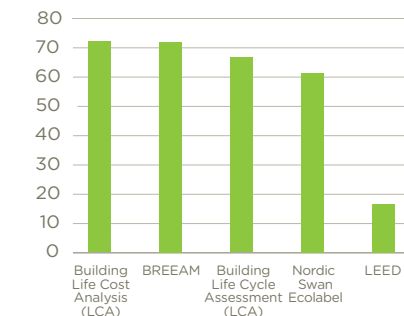
FINLAND



UK



ICELAND



have emerged in different countries and cultures, and each of them have their own focus areas, weightings and pros and cons. Some are simple, cost-efficient and with a relatively narrow scope. Some are more comprehensive and have a holistic approach. For each project, we advise the client or investor to consider which sustainability themes are important to them, what benefits they want to achieve and who they are communicating with in relation to marketing and operation of the building. A site analysis and a stakeholder analysis are often eye-opening in terms of uncovering expectations and finding the right level of ambition for the project.

Use of third-party certification schemes and recognised tools

Respondents were asked to indicate which third-party certification schemes and tools they know, have used or are going to use.

When looking exclusively at the 2019 “have used” responses and comparing them to 2017, several trends can be identified.

The total percentage of organisations using LEED as a certification scheme has decreased from 43% to 25%, and the percentage of organisations using Miljöbyggnad has increased significantly. The Fitwel and WELL certification schemes are gaining momentum, which is in line with the increasing focus on health and well-being as an important trend, as described in the previous section.

To certify or not to certify - what influences the decision?

Survey respondents were asked to indicate the three most important issues that influenced their decision to use environmental certification schemes. The top three responses in 2019 were ‘Client, tenant or

other stakeholder requirement’ (60%), ‘Enhancement of building performance’ (51%) and ‘Improved quality’ (44%). The option ‘Client, tenant or other stakeholder requirement’ was not in the 2017 survey but has quickly emerged to become the top influencing factor.

In terms of deciding to NOT use environmental certification system, respondents were also asked which issues most influenced their decision. The majority of the respondents found the certification too expensive/time consuming (60%) in 2019, compared to 73% in 2017. 47% the respondents stated that the documentation process was too extensive, and 34% stated that assessment criteria were not relevant for the particular project.

Sustainability management and disclosure

What you measure gets managed. 88% of all respondents state that sustainability indicators are being monitored in their organisation.

Sustainability indicators, such as energy and water consumption, amount of waste, greenhouse gases and tenant satisfaction are managed more strategically and in a more structured way than before. 31% of respondents say the key sustainability indicators are integrated in a sustainability strategy and there is an appointed person in charge of monitoring and managing the progress.

There are several frameworks for measuring and benchmarking the results against peers, such as GRESB Real Estate Assessment (REA), Carbon Disclosure Project (CDP) and GRI Standards.

Overall results from this survey show that:

- GRI Standards (7%) and GRESB REA (7%) remain the most used reporting frameworks for real estate companies.
- There remains a significant group of respondents that are not working with company-wide reporting for various reasons.
- The use of CDP has increased due to its popularity in the UK (6% compared to 3% in 2017)

Evidence-based studies

The publication “No more excuses” issued by DGNB (4) underlines that certified buildings do not necessarily imply higher constructions costs. By designing the core construction to be more flexible for the future, choosing the right materials, creating an adaptable MEP system etc, the examination shows that buildings with DGNB-certification have up to 7% higher property value and up to 12% higher rent.

The positive economic impact is also seen in the gross selling price of development land in urban districts, where there is an increase of more than €3,50/m2.

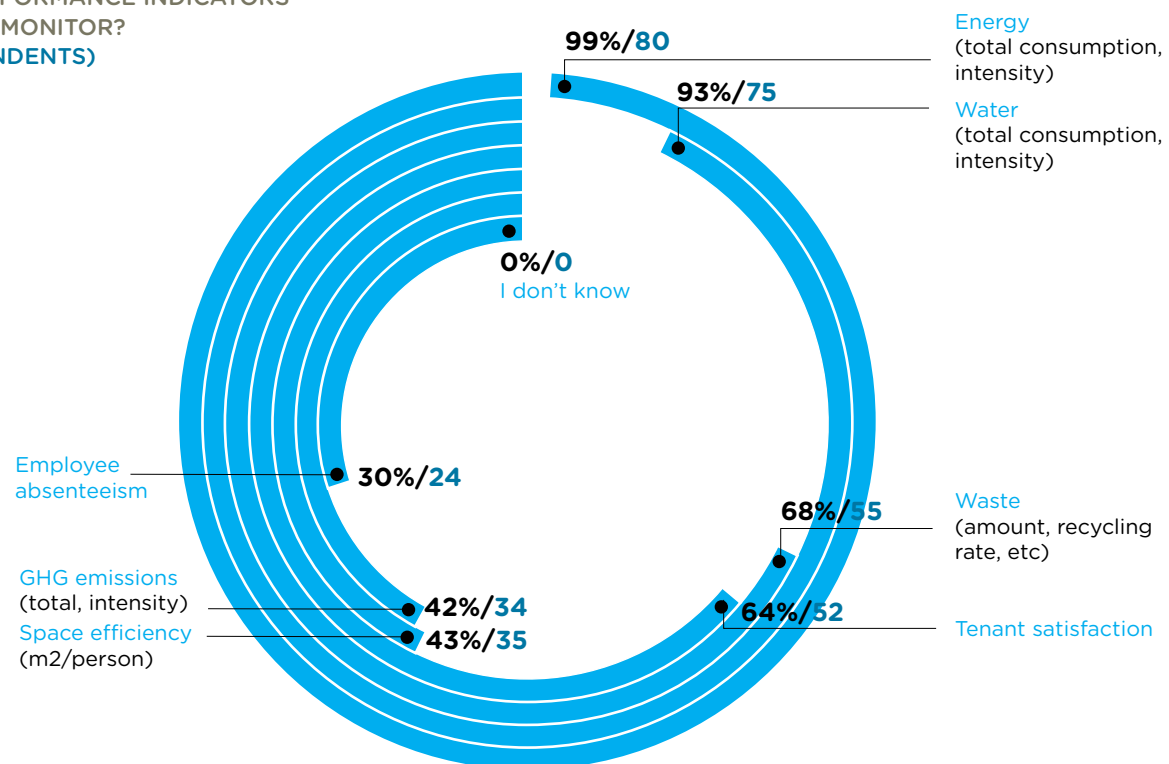
One of the main topics in this publication is well-being and health. The choice of the right materials from the beginning not only contribute to operational cost savings, but also to diminishing health related issues. 86% of the certified buildings meet high or very high standards for avoidance of substances that are known to be harmful or hazardous. 9 out of 10 DGNB Certified buildings achieve maximum ratings for interior air measurements in the pollutant categories TVOC and formaldehyde.

Client and user satisfaction leaves a positive mark, and the study states that 82% of certification applicants would certify buildings again.

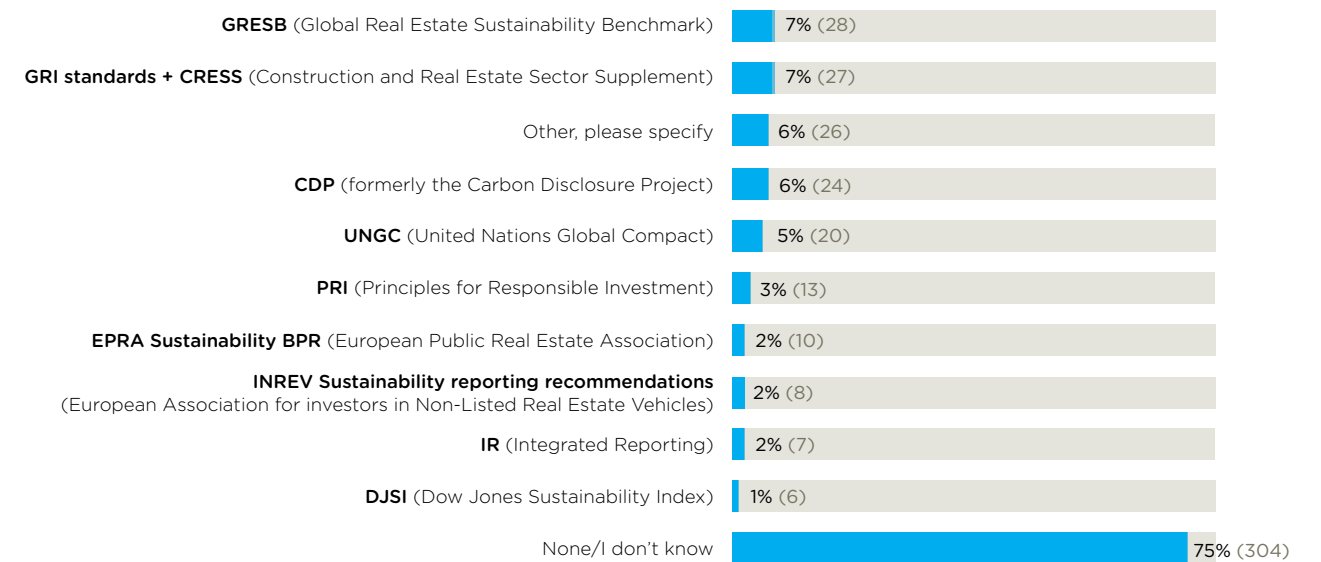
“Achieved certifications improve the leasability and interest of the property in the real estate market. When the certification requirements are taken into consideration in the early phase of new construction and renovation projects, the additional costs from the certification remain small compared to the achieved benefits. We have a target to certify at least half of our new office and major building renovation projects. Now 10% of our total portfolio, when measured in total market value, is LEED certified.”

Eero Kokkonen
Environmental Manager
Local Tapiola Real Estate Asset Management Ltd

WHICH OF THE FOLLOWING KEY PERFORMANCE INDICATORS DO YOU MONITOR? (RESPONDENTS)



WHICH SUSTAINABILITY REPORTING SCHEMES ARE CURRENTLY APPLIED IN YOUR ORGANISATION?



Number in brackets = respondents



THE “DEER” - DGNB GOLD CERTIFIED KINDERGARTEN

The kindergarten “Rådyret” (The Deer) was inaugurated in 2019 with DGNB Gold certification. To reduce the building’s carbon footprint, a timber construction was chosen, as well as a green roof. The client’s holistic decision-making process has created a state-of-the-art kindergarten in terms of e.g. indoor air quality, noise reduction, and choice of materials, a place where children and adults alike can thrive.

“Taking the decision to build sustainably and with DGNB certification has without a doubt been rewarding and has created a resilient and liveable building. Moreover, the process has pushed everyone involved to think holistically.”

Jakob Dahl, project manager
on “Rådyret” kindergarten project,
Rebild Municipality.

AT A GLANCE

Client: HP Byg / Rebild Municipality
Location: Støvring, Denmark
Architect: Rambøll
Project size: 900 m²
Sustainability credentials: DGNB Gold

ACTIONABLE INSIGHTS AND RECOMMENDATIONS

1 For property owners and investors:

- Investigate your construction site and local neighbourhood for constraints and environmental challenges. Analyse your stakeholders’ sustainability expectations and ambitions. Investigate the business case for investing in a certification – what is the realistic effect on property value, rent level, operational costs? Is there a positive ROI in the long run?
- One solution is to develop a simple, bespoke sustainability strategy focusing on energy efficiency, but without a certificate it will be difficult to communicate to stakeholders, and carries the risk that incomplete procedures and documentation will prevent implementation.
- Decide whether to pursue a certification or a bespoke sustainability strategy as early as possible in the design process, as early decisions have the biggest impact on a project’s sustainability profile, and the costs for changes increase over time.
- Ensure sustainable operation and continuous follow-up on energy management and social quality, consider adopting a certified sustainability programme or reporting scheme for existing buildings.
- A big challenge is collecting energy, water and waste data from tenants. The best way to maximise data coverage is to encourage tenants occupying the largest floor space to share their data, for example, by providing a simple online portal to submit usage figures.

2 For building designers:

- When working on a certified sustainable project:
- Define level of ambition for each criterion at an early stage and use the criteria proactively as a design driver and not as a retrospective checklist.
 - Sustainability is a team sport – take the opportunity to create innovative and implemented design with other members of the design team with different backgrounds.
 - Document your decisions and design solutions carefully – they are up for 3rd party review.

3 For end users:

- Review certification criteria and documentation to fully understand the design intentions and the qualities of the building.
- Communicate the certification on relevant channels and ensure that the building is used and maintained in line with the design intentions.
- Improved quality on a wider number of design parameters should be the focus when deciding to certify. Enhanced building performance is a derivative from the improved quality but is still connected with high uncertainty due to lack of documentation. We therefore encourage more evaluations on how certified buildings perform socially, economically and environmentally on a global scale.

WHAT ARE THE KEY FUTURE TRENDS IN THE CONSTRUCTION INDUSTRY?

The future trends in the construction and property industry are triggered by several incentives such as regulatory incentives or restrictions on a national or EU level, increased financial benefits of sustainable buildings and a rise in stakeholder requirements in

terms of environmental awareness and responsibility towards building users. The survey responses indicate an increase in the share of sustainable projects, both now and when looking five to ten years ahead.

The study shows a slight increase in the use of certification systems compared with the survey in 2017, with stakeholder demands being a key influential factor.

To reduce the environmental impact of the construction industry, we must reduce the amount of resources consumed. The circular economy is therefore setting the agenda in several countries, backed by EU and national initiatives.

Improving occupant health and well-being is one of the most important emerging trends in the construction industry, as well as wider use of technology such as BIM tools, on-site energy production and smart building technologies.

Sustainable construction activity: current and expected

Respondents were asked to estimate the share of their projects that can be considered sustainable – both now and within a five to ten year period in the future.

If we look at existing buildings and buildings currently under construction, there is a trend towards higher levels of sustainable building activity.

- In 2017, 5% of the respondents stated that none of their current projects could be considered sustainable.
- In 2019 none of the respondents chose that option.
- 30% of the respondents in the survey from 2017 reported that 50% or more of their projects under construction are current-

ly sustainable. This number has increased to 33% in 2019.

For buildings to be constructed five to ten years from now, the tendency is the same.

In 2017, 3% of respondents stated that none of their future projects could be considered sustainable.

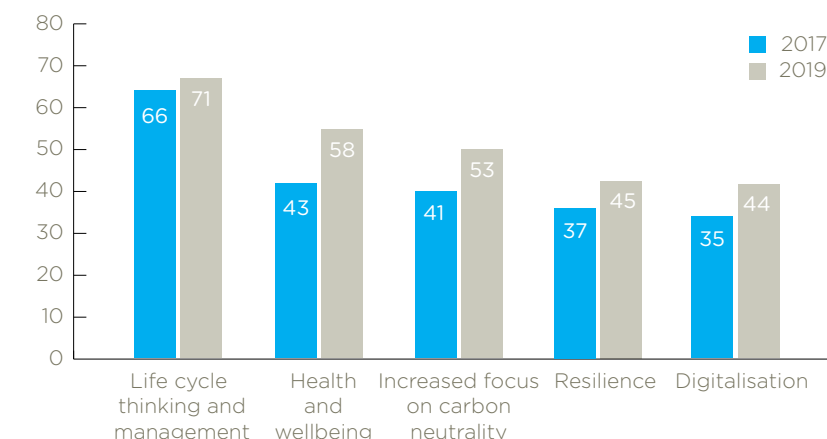
But in 2019, none of the respondents chose that option. In 2017, 51% of respondents reported that they expect 50% or more of their future projects to be sustainable. This number has increased to 57% in 2019.

Top trends driving future sustainable building activity

The respondents were asked to rank the five most important trends for the construction and real estate sector out of a list of 13 topics in total. Three new scenarios were added to the 2019 survey and they were all within the top five responses: 'Health and Well-being', 'Resilience Against Climate Change' and 'Digitalisation'. The emergence of 'Health and Well-being' in relation to building design is a global trend that is reflected in other questions in this study, and in other studies as well.

However, 'Life Cycle Thinking and Management' is still the biggest trend with 71%, and 'Carbon Neutrality' has increased from 35% in 2017 to 53% in 2019. EU and national policies are promoting the uptake of life cycle thinking and management, which is key to

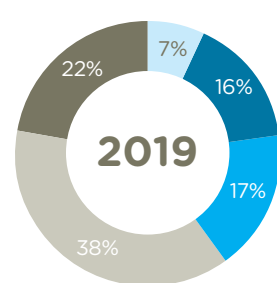
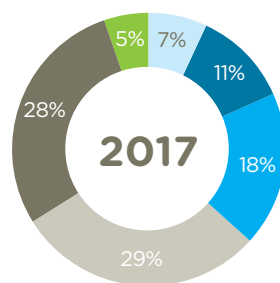
TOP 5 MOST IMPORTANT TRENDS



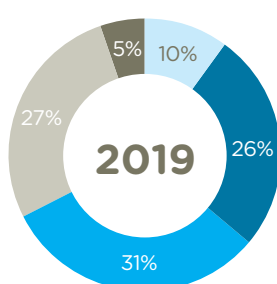
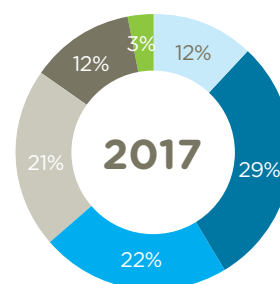
SHARE OF YOUR PROJECTS THAT CAN BE CONSIDERED SUSTAINABLE NOW - AND WITHIN 5-YEARS FROM NOW

EXISTING BUILDINGS AND BUILDINGS CURRENTLY UNDER CONSTRUCTION

Don't know
More than 80%
51-80%
21-50%
1-20%
None



BUILDINGS TO BE CONSTRUCTED WITHIN 5-10 YEARS FROM NOW



limiting CO2 emissions during the initial phases and throughout the entire process.

Health and well-being, an increased focus on carbon neutrality, multi-functioning and adaptability and lastly digitalisation are envisioned as the most relevant factors to explore and implement in the building sector. Digitalisation may actually be the starting point for many of these tools and technologies to evolve.

The traceability and transparency that digital models provide is valuable for the whole supply chain in the building process and also afterwards, when the building is in operation.

Technology trends

In terms of important technologies to consider, we can expect a wider use of Building Information Models (BIM) not only in the design phase, but also in the operational and end-of-life stages of a building. The objective of this technology is to consolidate different sustainability-enforcing means, such as LCA and LCC, into a single model and thereby making it possible to base decisions on more complete environmental and economical foundations.

Other important technologies to consider in the future are on-site renewables and/or de-centralised energy production. From the 2017 to 2019 surveys, "on-site renewable energy" has taken over the lead from "the wider use of BIM-models" – 49% of respondents now find that this is currently the most important technology.

Industrialisation of construction such as deliveries of larger assemblies to the site, is another upcoming megatrend. As concepts and strategies for circular economy appear on the market, the topic of construction waste prevention emerges in parallel. Optimising the quantities of materials and the development and use of demountable elements could have a greater impact than upcycling or recycling in the long term.

LIFE CYCLE
THINKING AND
MANAGEMENT

INCREASED
FOCUS ON
CARBON
NEUTRALITY

HEALTH AND
WELL-BEING

MULTI-
FUNCTIONING
AND
ADAPTABILITY

DIGITALISATION



THE WORLD'S MOST SUSTAINABLE DISTRIBUTION CENTER?

Lidl's new distribution centre in Finland is home to one of the world's largest transcritical CO₂ refrigeration plants. Here a holistic energy concept was designed for the site where the client set ambitions to go beyond the traditional rulebook, resulting in the delivery of one of the first building-level microgrid management systems and on-site electrical battery, with the micro grid system spanning heating, cooling, thermal and electrical. All energy flows are controlled by predictive cost

optimization. The approach involved installation of 1,600 solar panels on the roof, generating electricity for refrigeration and using excess condensate heat from refrigeration for district heating. The building will also be connected to demand-response services and the flexibility is supported by 2.6MW electrical battery. The approach did not pose any risks to the centre's operations and delivered a carbon-negative building through operating 100% from renewable energy.



ACTIONABLE INSIGHTS AND RECOMMENDATIONS

1

For property owners and investors:

- Make requests and engage early in the design phase, by reviewing various simulations or by using virtual reality to visualize and track pitfalls in the early stages.
- Strive for a solid BIM agreement that ensures visibility and traceability of the building components.
- Use digital tools to monitor and assess the choice of materials. The value chain behind the materials reveals the actual CO2 impact.
- Use digital tools to provide an initial idea of the expected visual, atmospheric, thermal and acoustic indoor climate.
- Digitalisation ensures that land owners can make the most out of their assets as it can help identify how to maximise the number of square meters on a given plot.
- New processes like off-site construction have many benefits. They can lead to a faster construction programme, improve onsite safety, raise quality levels as material manufacture is carried out offsite in a controlled environment, and improve sustainability through more efficient deployment of materials leading to less waste.

2

For building designers:

- Promote the idea of using other materials such as CLT in competitions or when consulting the client e.g. in the development of an RFP.
- Ensure the consistency of the digital project by engaging in the content of the BIM agreement.
- Involve consultants with expertise in LCC and LCA from early stage.
- Integrate data on lifecycle emissions and lifecycle costs with early stage models, providing the client more element-specific data to select from.

3

For end users:

- Participate in user/public meetings and ask to review simulations or models to have a chance of influencing changes in the building layout. Small changes that can be tracked may have an impact on health and well-being when the building is in use.
- Indoor climate is not static and varies from place to place dependent on the segment of end-users.
- Management of systems; Address the importance of being educated in handling the indoor climate.

DALSTON WORKS

Dalston Works is the largest cross laminated timber (CLT) project globally, using more timber than any other scheme in the world by volume. The 33m residential structure has approximately 50 percent less embodied carbon when compared to a traditional concrete frame. The timber also acts as carbon storage with over 2,600 tonnes of CO2 locked into the material. This effectively makes the building carbon negative for the first years of its usage.

As well as delivering a more sustainable building the CLT solution ensured the viability of the scheme. It enabled a lighter building and smaller foundations, a critical element of the development as it was constructed over London's underground network. Furthermore, it improved the client's return on investment as it enabled two additional storeys to be added.

Using pre-fabricated technologies improved design coordination and build quality, reduced material wastage and contributed to better fabric performance. This is evident from the excellent air-tightness results (2.37 m3/h.m2) and thermal performance brought about by an improvement in psi-values over Accredited Details. These factors help reduce GHG emissions resulting from energy in use and contributed to BREEAM Excellent and Code for Sustainable Homes Level 4 accreditation.

The CLT erection phase of the build took just 374 days to complete, the equivalent to a floor every week-and-a-half by a crew of five people. This, along with the 80% reduction in site deliveries (exactly 111 were recorded for the CLT compared to an estimated 700 for an equivalent concrete building) limited associated pollution and GHG emissions.

AT A GLANCE

Client: Regal Homes UK

Location: Hackney, London

Architect: Waugh Thistleton

Project size: 12,000 m2 mixed use development

Sustainability credentials: The world's largest CLT building, Dalston Works is BREEAM 'Excellent' and has Code for Sustainable Homes 'Level 4' accreditation. It won the 2017 Structural Timber Award - Winner of Winners, adding to its earlier success as Best Solid Wood Project and Best Private Housing Project.



OUR APPROACH

Ramboll's approach to sustainable building design is best described by our motto: 'No building is an island'.

At Ramboll we believe that:

- Buildings should be designed to be attractive to individual users. People should feel good in the buildings they live and work in.
- Buildings should stimulate people and encourage people to interact with each other.
- Buildings should adapt to the local environment and to their surroundings.
- The concept of planetary boundaries* presents the

framework for development of human society on our planet. Hence, a building should make a net positive contribution to our planet.

* Planetary boundaries present a so-called safe operating space for humanity. If these boundaries are crossed due to human actions, the functioning of earth's natural systems is threatened and the risk of irreversible and abrupt environmental change increases. (Rockström et al. (2009): A safe operating space for humanity. Nature, 461/24).

HOW THE STUDY WAS CONDUCTED

The data for the Sustainable Building Market Survey 2019 was collected through an online survey of real estate and construction (REC) industry professionals: property owners, investors, contractors and tenants as well as industry peers and service providers. The aim of the survey is to gather experiences and opinions relating to sustainable business operations, green building and construction. The survey is a self-assessment - all replies are based on the respondents' own experiences. The questionnaire consists of 37 questions (excluding background questions).

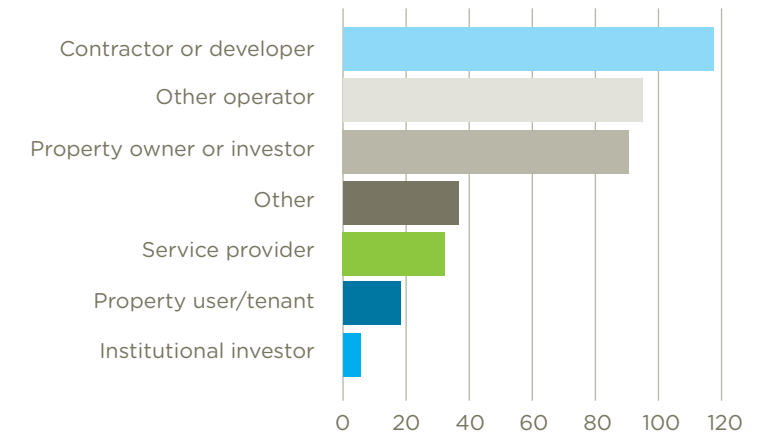
The survey was conducted in November-December 2018, using Ramboll's SurveyXact online survey tool. The questionnaire was sent as an e-mail link to REC industry operators in Finland, Sweden, Denmark, Iceland and the UK. It was also possible to participate in the survey through social media, as the survey was promoted on Ramboll's website, LinkedIn and Facebook pages.

Norway has not been part of the 2019 survey, but it is anticipated that they will be included again in 2021.

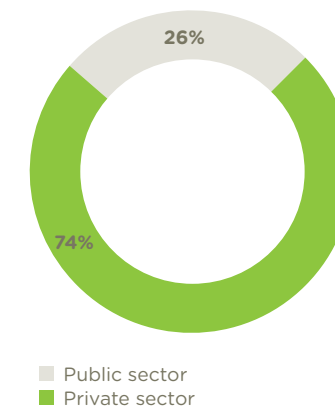
We would like to thank our collaboration partner in Iceland - Mannvit - for being part of this survey for the first time.

The survey received 405 responses. Figures on the adjacent page illustrate the distribution of the respondent groups.

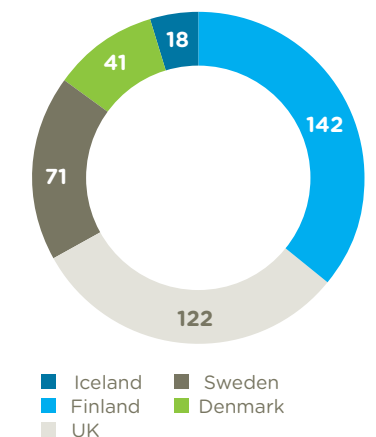
NUMBER OF RESPONDENTS IN DIFFERENT ROLES



SHARE OF RESPONDENTS BASED ON SECTOR



NUMBER OF RESPONSES FROM EACH COUNTRY



GLOSSARY

In this survey, a 'Green/Sustainable Building' refers to a building where sustainability issues are emphasised throughout the building life cycle.

THESE ISSUES INCLUDE

1. Environmental (such as energy, water and material efficiency, alternative transportation and site ecology enhancement)
2. Economic (such as life cycle costing)
3. Social aspects (such as safety, accessibility and health and well-being related issues like indoor environmental quality).

OTHER TERMS

AR (Augmented Reality) is a technology that places computer-generated overlays on the physical real-world environment. The reality is thus augmented or supplemented by virtual input. An example of augmented reality is Microsoft's HoloLens technology.

BIM (Building Information Model) is a computer-generated 3D model of building geometry which contains relevant data to support the entire construction process from design, procurement and construction activities, to actual delivery of the project. When used correctly, BIM allows efficient knowledge sharing and improved collaboration between stakeholders.

BREEAM (BRE Environmental Assessment Method) is an environmental assessment method and rating system operated by British BRE (Building Research Establishment) and used globally. www.breeam.com

DGNB is a sustainability assessment and certification system for buildings and urban districts. DGNB was developed in Germany and is applicable globally. www.dgnb-system.de/en

EPRA (European Public Real Estate Association) is a non-profit association whose mission is to promote, develop and represent the European public real estate sector. www.epra.com

GreenBuilding was an EU initiative in 2004-2014 to promote energy efficiency within the REC industry. In Sweden, the local Green Building Council SGBC has since continued to administrate and develop the certification system. www.sgbc.se/om-greenbuilding

Green Lease is a model of lease agreement which brings incentives to operations in accordance with sustainable development. The benefits are divided between the contracting parties. The idea is to generate a higher return on investment for the owner and efficient business premises for the occupant.

Green Office is an environmental management system for offices developed by World Wildlife Fund. wwf.fi/en/green-office

GRESB (Global Real Estate Sustainability Benchmark) is an investor-driven organization committed to assessing the Environmental, Social and Governance (ESG) performance of real estate assets and portfolios globally. www.gresb.com

GRI (Global Reporting Initiative) is an international independent organisation that has developed sustainability reporting standards for communicating the impact of business on climate change, human rights, corruption and others. www.globalreporting.org/Pages/default.aspx

LCA (Life Cycle Assessment) is a tool for evaluation and quantification of environmental impacts generated throughout a product's life cycle from raw material extraction, production and use to end-of-life

LCC (Life Cycle Costing) is, according to the International Organization for Standardization, a technique to predict and assess the cost performance of constructed assets. It is one form of analysis for determining whether a project meets the client's performance requirements.

LEED (Leadership in Energy and Environmental Design) is an environmental certification system developed and administrated by the United States Green Building Council (USGBC) and used globally. www.usgbc.org/leed

Miljöbyggnad is an environmental assessment and classification system for buildings, developed by Sweden Green Building Council. www.sgbc.se

Nordic Swan Ecolabel scheme is available for around 60 product groups from detergents to buildings and real estate. www.nordic-ecolabel.org

NZEB (Near Zero Energy Building) by definition have very high energy performance, and the low amount of energy required comes mostly from renewable sources. The EU Energy Performance of Buildings Directive requires all new buildings to be nearly zero-energy by the end of 2020. All new public buildings must be nearly zero-energy by 2018.

Demand response means change in normal consumption pattern of electricity by an end-use client in response to changes in the price (or other incentives) of electricity over time.

New ways of working reflect a shift in workplace management and operations allowing for more flexibility and hopes to attain better employee satisfaction and retention. Examples of applications of new ways of working include telecommuting, remote working and flexible working hours.

VR (Virtual Reality) is a computer-generated simulation of real-life environment. Virtual reality replaces the real world, while augmented reality supplements it.

WELL Building Standard is a certification tool that concentrates on human health and well-being aspects of buildings and spaces. It is developed by the International WELL Building Institute

WGBC World Green Building Council, a global network of Green Building Councils who are independent, non-profit organisations made up of businesses and organisations working in the building and construction industry.

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ABOUT RAMBOLL

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945 and employing more than 15,000 experts globally. With 300 offices in 35 countries, Ramboll combines local experience with a global knowledge base to achieve inspiring and exacting solutions that make a genuine difference to our clients, the end-users, and society at large. Ramboll works across the following markets: Buildings, Transport, Planning & Urban Design, Water, Environment & Health, Energy, and Management Consulting.

Within the buildings market, Ramboll brings together nearly 4000 multidisciplinary experts worldwide. As a top 10 buildings consultancy globally, we design around 10 million m2 of buildings each year. Our design philosophy is to always make room for the human experience and our comprehensive service covers all aspects of building engineering, design, architecture, and consultancy. We work on 10,000 projects annually and have an extensive track record in developing inspiring healthcare, pharmaceutical, commercial, retail, hotels, residential, education, arts & culture, sports, high-rise, and airport buildings.

www.ramboll.com/buildings

ABOUT MANNVIT

Mannvit is an international consultancy firm in the fields of engineering, technical services and innovation. The company offers services in the fields of engineering, geoscience, environmental studies, IT and Project Management. Mannvit has over a half century of experience across a wide variety of projects and industries.

www.mannvit.com/



Helsinki Library, inaugurated in 2018.
Architect: Ala. Ramboll performed structural and technical design and project management. User involvement enabled the planners to reprioritize, giving the library more space for events and public participation. Photo: Tuomas Uusheimo

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