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Adapting the RBC Sector to Climate Change
INTRODUCTION

This section highlights some of the changes that are either underway or needed in the construction sector in order to better incorporate adaptation challenges such as risk assessment, extended life cycle building process, regulatory framework and stakeholder engagement. It also presents concrete actions, and the main messages to be retained from this section are as follows:

Need to develop a risk management culture. In order to deal with the consequences of climate change, it is first necessary to ensure that each stakeholder has a good understanding of the risks. Strengthening risk assessment capacity is therefore essential.

Need to change the organisation of the building construction process: Integrating climate change adaptation into the challenges of building construction requires a systemic approach that goes beyond current practices that are often limited to short-term issues and contractual relationships.

• Develop an extended life cycle approach: The aim is to involve the entire value chain and integrate long-term issues. To this end, life-cycle planning and assessment of adaptation is determined both at the building level – including the products incorporated into a building – and at the level of assets and services. In practical terms, focusing on each phase of the extended life cycle is a first step towards establishing frameworks for action for the adaptation of buildings to climate change.

• Changes in procurement policies: Climate change risk should be attributed to the contracting party best able to manage the impacts.

Need for an enabling regulatory framework: Governments have a central responsibility to act and reduce current and future climate risks.

• The technical and urban planning regulatory framework for buildings must evolve to strengthen reporting requirements, broaden the concept of safety in buildings to include resilience and social dimensions (e.g. add rules for degraded operation and rapid repair of basic services), and develop performance-based standards.

• Integrating adaptation into codes and standards: This process is already underway, as can be seen with the new European (revision of the 2013 mandate for “Adaptation to climate change in infrastructure standards”) and international standards (ISO 14090 “Adaptation to climate change”) that are being put in place to address the adaptation and resilience of buildings and civil works.

Need for stakeholder engagement: Improved reporting on exposure to climate risks is a climate adaptation measure. Various tools and recommendations are available, often not specific to the RBC sector. In addition to reporting, certifications help assess adaptation measures.

• General reporting frameworks on climate and sustainable development: Public (TCFD, European action plan for sustainable financing, French law on energy transition) or private (GRI and CDP).

• Declaration frameworks specific to real estate. The GRESB assessment and reference framework includes a module on resilience that reports on climate risks as well as the state and management of resilience.

• Green building certification systems such as LEED, BREEAM, HQE, DGNB, are beginning to include requirements for the adaptation of buildings to climate change. There are also specific certifications focusing only on resilience, including natural risks related to climate change.
1. Who is concerned?

Climate adaptation is at the crossroad of sustainability, risk management, and finance affairs. In line with this, policymakers overseeing the three following areas must work together to adapt the RBC sector:

- **CO₂ emissions and energy reduction** are major targets of sustainability in the RBC sector. Designing and implementing both adaptation and mitigation measures simultaneously is beneficial, as they are, like many in the RBC sector, interdependent. The social and organisational dimension of the adaptation process should not be underestimated: involving stakeholders and following methods traditionally used in sustainability approaches offers multiple benefits.

- **Risk management** nowadays includes climate-related risks. Climate change exacerbates climate-related disasters and adds these challenges to other existing risks such as earthquakes, terrorism, cyber security, etc.

- **ESG (Environmental, Social, Governance) reporting** and monitoring increasingly include climate risks since the introduction of the TCFD (Task Force on Climate-related Financial Disclosures) Recommendations. But beyond reporting it is also necessary to implement actions to reduce the exposure and vulnerability of buildings and real-estate assets to climate risk. Choosing appropriate adaptation upgrade works or selecting well-rated assets are examples of measures having a positive impact in this field.

**Key Responsibilities for Integrating Climate Change Adaptation into the Building Process**

Organisations in the building value chain (manufacturers, contractors, owners), influencers (engineering firms, developers, brokers, finance, insurance, modelers), and regulators (state, local authorities) have a responsibility in the adaptation process.

- **Engineers and contractors**: to assess and design climate-proof buildings to decrease loss and reduce the cost of damage and recovery measures, based on the estimated frequency and intensity of the expected risks.

- **Developers**: to justify the market value of adaptation measures.

- **Brokers**: to provide information on climate-related risks.

- **Owners**: to build in safe locations and implement reasonable reinforcement measures to reduce the impacts of climate change.

- **Regulators**: to update building codes and planning rules while reinforcing code compliance, and supplement insurance in case of large-scale climate change events.

- **Government investors**: to offer grants and incentive programs.

- **Local authorities**: to implement and verify the compliance of urban planning.

- **Finance actors**: to preserve the security of loan assets, as mortgage, and finance the initial cost of adaptive investment.

- **Insurance actors**: to monitor risks and losses related to the current climate and cover risk at an affordable price (risk retention, reinsurance, catastrophe bonds, and others).

- **Modelers**: to evaluate the future climate-related risks with appropriate granularity and develop models that can make climate projections, with a particular focus on extreme events versus average climate predictions.

- **Certifiers**: to assess buildings and provide certification for them.

- **Manufacturers**: to certify and inform their customers about the “climate resistance” of their buildings or systems.

This list is a preliminary overview which will be looked at in greater detail in Part III of this report.
To deal with the consequences of climate change the first step is assessing the risk, or vulnerability. Risk studies are cross-sectional and require three-dimensional analysis based on the study of the nature of the hazard, the exposure, and the system sensitivity. The conclusion gives an understanding of the vulnerability and is supplemented by two other dimensions: the value of the property and the life cycle.

Hazards and exposure are location-dependent: climate hazards differ from region to region.

a) **Hazards** are climate change-related events to which the building will be exposed (floods, storms, heatwaves, etc.). Knowing the nature of the hazard is a prerequisite for assessing risk and evaluating vulnerability.

b) **Exposure** varies across world regions, countries, and land plots, since each geography will not be equally impacted by climate change. Frequency, or probability, and intensity of hazards vary according to IPCC scenario trajectories. Parameters such as elevation, impervious or permeable surfaces, distance to water courses also have an impact on local climates. Exposure therefore includes criteria that affect the resilience of the surroundings of the building.

c) **Vulnerability** of the buildings largely depends on the choices that are made during the construction or renovation stages (e.g. large glazed surface, presence of a basement, high-rise structure), and which increase or decrease the vulnerability of a building. The technical conditions that a building must satisfy vary according to the use of said building (e.g. as a hospital, offices, etc.).

An assessment of the value of the property may complement this three-dimensional risk analysis, since the inability to use a property or its bad technical condition can seriously decrease its value. The level of financial risk also increases according to the nature of the damage, and a building may in addition have cultural, heritage or strategic value (e.g. when it plays a role in maintaining public health or safety). In such cases the risk goes beyond simply the financial.

d) **Timescale** is another dimension to be included in the analysis.

- **In current assessments all risks are not equal, with chronic hazards evaluated less than acute hazards** (UNEP FI, 2019): “This is likely to be linked to the different temporal nature of these hazards: acute climate shocks are likely to have short-lived effects on a business, for example through temporary business interruption, while chronic changes in the climate lead to longer-term impacts and more fundamental changes in the nature of the business.”

- The methodology used to assess the risks depends on the timeframe. When assessing future risks, the use of historical data is insufficient, as hazards increase in intensity and frequency over time. Exposure to physical climate risks cannot be assessed using historical data alone. The methods used for risk assessment depend on the timeframe and the hazard in question, and the nature of the impacts. The following graph, produced by the European Bank for Reconstruction and Development, proposes an approach for assessing physical climate risks.
Methods have been developed to assess risk at both the physical (building) and decision-making levels. ULI for instance defines the following method to assess risks generating risk-curve for each event and asset.

**STEP 1**
Identify the types of relevant hazards.
The first step is identifying the hazards relevant both today and in the future for a given location.

**STEP 2**
Two or three scenarios are designated for each event.
The most extreme events have the lowest probability, and the mildest versions have a higher probability of occurring. Relying solely on probability and historical data may not be enough as climate change is fundamentally altering the probability of extreme event. The timescale is also important: long-term chronic conditions may be as bad as hazardous, short-term conditions.

**STEP 3**
Identify affected assets.
Assessing both direct (e.g. damages to property) and indirect (e.g. higher insurance rates, lost services) impacts.

**STEP 4**
Financial assessment.
The following figure ranks estimated damages according to probability and severity of events. It shows that overall, events with a very low probability and very high severity will tend to generate very high damages, while events with a high probability and low severity will tend to create lower damages.

**STEP 5**
Calculate annual risk exposure values
For each event type and each asset, create a risk curve, then calculate the annual risk exposure by estimating the area under the curve.

**STEP 6**
Calculate cumulative risk exposure values
Calculate the net presence value of all future annual-risk-exposure values to understand the total risk a city and the assets face.

Several assets, vulnerability curves or damage depth curves are used when defining a model: they describe the amount of damage expected as a function of the severity of the events.

The total risk, or cumulative risk exposure, for a given type of event is determined by calculating the net present value of the future annual risk exposure value.

Numerous methods exist to make risk assessments. The ISO 31000 standard “risk management” includes useful guidance for assessing and managing risks once they have been identified.

Its new 2018 version places more emphasis on the importance of governance (e.g. involvement of top management and integration into organisational decision-making processes).
Adaptation and the Buildings’ Life Cycle

Adaptation must be integrated in each of the building’s life cycle phase

Inception
- Assess climate risk
- Share targets and challenges of adaptation
- Develop tools to make adaptation-related decisions

Planning
- Integrate reuse
- Conceive with resilient landscaping and nature-based interventions
- List and evaluate adaptation measure

Construction
- Set up regular reporting on the delivery of adaptation targets
- Mitigate the impacts of construction activities on pre-existing adaptation features

Contracting
- Integrate an adaptation action plan
- Select solutions for a sustainable construction with the lead contractor
- Include uncertainty in O&M protocols

Operation & maintenance (O&M)
- Update occupants on climate-related risks
- Assess the impact of adaptation measures
- Review reporting and monitoring procedures and users’ guides

End-of-life
- Assess the impact of adaptation measures on the lifespan of the asset
3. Developing a Lifecycle Approach in the Building Fabric

Associating the whole value chain and integrating long-term issues is necessary. All actors of the value chain are concerned by adaptation issues. The stakes of each actor will be studied in the following part on the frameworks of action.

3.1 THE EXTENDED PROJECT LIFECYCLE

Integrating climate change adaptation in buildings requires a systemic approach that goes beyond current practices that are often limited to short-term issues and contractual relationships.

A project to construct, renovate or adapt a building is generally carried out for a limited period and according to a temporary organisation mode (project mode) in order to meet specific requirements. To maximise the benefits for stakeholders, the project needs to achieve an optimal combination of time, cost, and quality performance in terms of allocating and exploiting resources while integrating wide-ranging social and environmental life-cycle considerations. These considerations have historically tended to be limited to the project itself and to short-term issues and contractual relationships, without accountability for impacts and performance over the long-term.

However, the impact that a project has on society, the environment, and the economy as well as its performance with respect to climate change, extends well beyond a project’s execution. Consideration should be given to the extended life cycle of a project that includes not only the life cycle of the building itself, but also the life-cycles of the result of the project, namely the building as an asset and as a provider of services (see the figure above).

- The building’s life-cycle is mainly concerned today with delivery and management of the project, while the asset and service life-cycles include the long-term deliverables that the project realizes, including the increasingly important deconstruction or renovation phase of the asset life cycle that is required for circularity.
- A building’s extended life cycle therefore recognizes that the planning and life-cycle assessment of adaptation are determined at both the building-level, including the products incorporated into a building, and at the asset and service levels, namely the benefits and loads beyond the boundary of the building. In practice, the extended life-cycle excludes the pre-manufacture of products, while the various design phases are included in the planning phase. Testing and commissioning is included in the construction phase, and decommissioning and disposal (or phase-out) is included in the end-of-life phase.

Focusing on each of the extended life-cycle phases is a first step towards establishing action frameworks for the adaptation of buildings to climate change. This is because this approach helps identify the main issues and opportunities that stakeholders must coordinate on in order to provide seamless integration while balancing their own responsibilities with those of the construction process and that of the building.

- Without this focus, owing to the lack of direct benefits, established concepts, clear drivers and easily understood incentives, stakeholders tend not to be motivated to account for impacts, constraints, and opportunities that arise throughout a building’s lifetime.
A) EMBEDDING ADAPTATION
The two main approaches for embedding climate-change adaptation into activities in the course of a building's life-cycle are:
• implementing a stand-alone, parallel adaptation plan, management system or management process in which the various actors engage at different phases
• inclusion of adaptation into normal business-as-usual processes at each phase

The inclusion of adaptation measures on buildings should become the norm. The business-as-usual approach is preferred because adaptation should be part of a building suppliers' standard services and not presented as an additional charge that depends on a client's decision. Clients are also unlikely to consider climate change adaptation in isolation from the overall effort to design and construct a satisfactory building.

The more a client can see that adaptation services are a well-established part of the building suppliers' normal service and in-house practice, the greater the acceptance of adaptation measures will be. The skills and competence required for delivering adaptation services are seen as extensions of existing practices that are informed by new principles.

B) THE CHALLENGES OF EMBEDDING ADAPTATION
The traditional project delivery model for all types of construction is generally sequential, reflecting the input of the project owner, financiers, architects, consulting engineers, contractors and key suppliers at different phases.

Ideally, the knowledge of all stakeholders involved at all phases should be fully utilised, especially early on in the design and planning phases and at later stages, depending upon the adaptation strategy.

In practice, contractors often work jointly with other partners using the design-build delivery model where some phases, notably planning and construction, overlap (other delivery models such as having a construction manager carry the construction risk are also used, but are less common). Design-build project delivery is increasingly supported by procurement processes enabled by BIM (Building Information Modelling) that provide increased flexibility in project procurement by allowing direct reporting to the client, optimal design input at early stages, early contractor and supplier engagement, and negotiation during tendering.

Similar life-cycle phases are recognisable for most delivery models, and activities at each phase do not depend strongly on the delivery model for most types of buildings.

Focusing on each of the life-cycle phases is therefore valuable and worthwhile, and helps in meeting the main adaptation challenge of developing an effective overall strategy and action framework for the entire life-cycle of a building.

With regard to adaptation, both the strategy and the action framework require effective decision-making and management processes to address the organisational, legal, financial, and information challenges which are summarised in Table 1.
### Challenges & Barriers for Building Adaptation

<table>
<thead>
<tr>
<th>Organisational</th>
<th>Legal</th>
<th>Financial</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Fragmentation and a lack of collaboration in value and supply chains.</td>
<td>- Property ownership situation where property rights may be distributed between various parties.</td>
<td>- Secure financing prior to the construction or renovation of a building.</td>
<td>- The more widespread and generalised climate-change impacts develop over the long-term and concern aspects that are often not immediately and easily identified.</td>
</tr>
<tr>
<td>- Essentially linear, step-by-step, on-site production processes involving a large number and variety of resources and knowledge-intensive services.</td>
<td>- Tenure situation whereby a building’s occupiers may be the owner, leaseholders, or tenants.</td>
<td>- Availability of public funds such as grants and tax advantages which promote the adoption of adaptation measures.</td>
<td>- Ways to exploit adaptive capacity as the primary strategy for the most efficient use of resources over the extended life-cycle.</td>
</tr>
<tr>
<td>- Wide variety of actors, each with conflicting interests, goals, and values.</td>
<td>- Land use and zoning plans that determine the extent to which a building or a building’s use can change in order to adapt to climate change.</td>
<td>- Maximise short and long-term financial returns on investments and minimise risk.</td>
<td>- Building users are generally unknown during the conception phase, meaning that it can be adjusted quickly to the users’ needs.</td>
</tr>
<tr>
<td>- Tight couplings between actors in individual projects and loose couplings elsewhere in order to balance the sharing and protection of knowledge, such that coordination is often transacted inefficiently at two interdependent levels, through either personal relationships or permanent networks of partnerships.</td>
<td>- Secure construction permits and meet regulated building codes.</td>
<td>- Diverging incentives and benefits between owners and occupiers.</td>
<td>- Building adaptation needs to handle both slow onset (“chronic”) impacts and sudden impacts owing to extreme (“acute”) events.</td>
</tr>
<tr>
<td>- Processes, contractual agreements, liabilities, and complex interactions that link many connected but independent and heterogeneous actors.</td>
<td>- Cross-referenced building codes, standards, and regulations with a long-term perspective so that adaptation provisions agreed at the outset apply throughout the extended life-cycle of a building.</td>
<td>- Perceived high cost of project failure.</td>
<td>- Risk analysis for past, present, and future trends in terms of both average and extreme climate conditions, particularly with regard to extreme events.</td>
</tr>
<tr>
<td>- Actions ranging from incremental changes within current processes to those aimed at a fundamental transformation resulting from either single initiatives or a series of rapid incremental changes.</td>
<td>- Fixed schedules for regulatory and similar requirements.</td>
<td></td>
<td>- Variability and seasonality of relevant climatic variables.</td>
</tr>
<tr>
<td>- Adjustment of the level, complexity and expertise requirements of decision-making, implementation and management throughout the building’s lifespan.</td>
<td>- Complementarity of engineered approaches with nature-based and management approaches through the integration of hard and soft measures while recognising that the complexity of natural and social systems may imply less precision and difficulty in establish legally binding requirements.</td>
<td></td>
<td>- Identify climatic variables that are suitable for establishing performance standards.</td>
</tr>
<tr>
<td>- Consideration of extended life-cycle issues such as adaptive capacity, land-use policies, spatial planning, and the resilience and vulnerability of the system within which a building operates, even if the system is outside the direct control of those managing or occupying the building.</td>
<td></td>
<td></td>
<td>- Responses to be based on evidence-based decisions, with adjustment of risk assessment and management to the level of uncertainty and including both vulnerability and critical thresholds for chronic and acute impacts.</td>
</tr>
</tbody>
</table>

*Table 1: Effective decision making for building adaptation faces many challenges*
Developments such as digitisation and the implementation of circular economy principles, modular construction and new methods such as performance-based procurement, mixed-method and value network approaches, science-based targets, and the definition of ‘value’ in terms of more inclusive non-financial criteria help mitigate challenges faced by the RBC sector.

However, given the degree of transformation required and the urgent need to future-proof buildings, both demand-side and supply-side actors will face challenges in mitigating climate change. Their contingency plans to drive efficiency and value for owners and users will also similarly face challenges.

### 3.2 IMPLEMENTING ADAPTATION INTO A BUILDING’S LIFE-CYCLE PHASES

Providing a succinct appraisal of adaptation issues and responses for each phase of a building’s extended life-cycle is essential since the various adaptation issues can be crystallised at each phase into a limited and practical set of conclusions and outcomes that are carried forward to the next phase of a building’s extended life-cycle.

For instance, stakeholders need:
- At inception phase, to agree on overall objectives for a building. For adaptation, as discussed below, they will ideally share their understanding of the issues by conducting a risk assessment and then agree on priorities and an overall strategy.
- At planning phase, to include feasibility studies, design (concept, detailed, technical) and documents on adaptation targets in the project and final brief and to explore a range of solutions according climate and economic scenarios. There is no one perfect solution that outclasses the others, but instead a set of possible solutions depending on the uncertainties and the choice of scenario.
<table>
<thead>
<tr>
<th>Inception</th>
<th>Planning</th>
<th>Contracting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
<td><strong>Activity</strong></td>
<td><strong>Activity</strong></td>
</tr>
</tbody>
</table>
| • Sharing challenges and benefits of targets  
• Setting realistic parameters  
• Drafting a Strategic Brief | • Project team  
• Roles & responsibilities  
• Further dev. of strategic assessment  
• Brief (project, final), feasibility studies, design (concept, detailed, technical) | • Deployment of financial resources  
• Statutory & Planning  
• Warranty  
• Information for tendering  
• Tendering |

<table>
<thead>
<tr>
<th>Process</th>
<th><strong>Share Understanding</strong></th>
<th><strong>Project Brief</strong></th>
<th><strong>Adaptation Plan</strong></th>
</tr>
</thead>
</table>
| **Realistic Approach** | • Agreed targets for adaption  
• Liability with respect to taking reasonable account of CC  
• Duty of care: inform stakeholder about integration of CC in the process  
• Life-cycle approach (i.e Level(s))  
• Tools to help make adaptation-related decisions | • Include adaptation targets  
• Detailed climate resilience analysis  
• Reuse potential of the materials and systems  
• Choice of material climatic variables | • Include adaptive management  
• Allocative efficiency of hard and soft measures  
• Designs that allow reuse  
• Resilient landscaping and nature-based interventions |
| **Strategic Brief** | • Strategic risk assessment including limitations | **Final Project Brief** | **Design** |
| | | • Assessment of impacts  
• Recognition of chronic and acute impacts on building  
• Weather file validity  
• Verification of significant climate vulnerability and risk | • Test robustness of critical design components  
• Explore a range of solutions (best and worst scenario)  
• Description of seasonal control strategies and system  
• Requirements for systems, appliances, and fixtures |
| | | **Review & compliance** | **Review & compliance** |
| | | • of final specifications to agreed adaptation criteria | |
### 3.3. Changes in Procurement Policies

Climate risks are being increasingly integrated in procurement policies. This section on the building life-cycle can illustrate the importance of considering climate risks in the entire value chain.

Fievet (2013) stresses: “Four predicted changes to climate are likely to have the greatest implications for procurement decisions: rising sea level, higher temperatures, increased precipitation, and increased frequency of intense storms.”

The following actions can be taken to integrate climate change into the procurement process:

- Estimate the cost of installing, financing, maintaining, and replacing an added component because of climate change.
- **Reduce exposure to risk through contractual risk allocation and warranty negotiation with service providers.**
  - Evaluate alternative technologies and favour the one with the lowest life-cycle cost estimate
  - Favour no-regret options.

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**Table 2:** Table: synthesis of detailed checklist (see appendix) to integrate adaptation into the building process.

<table>
<thead>
<tr>
<th>Construction</th>
<th>Operation &amp; Maintenance</th>
<th>End-of-Life</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Site handover to the lead contractor</td>
<td>- Assistance to occupants and users</td>
<td>- Plan deconstruction and demolition</td>
</tr>
<tr>
<td>- Mobilization of resources</td>
<td>- Monitoring of O&amp;M</td>
<td>- Transport and treatment of Waste and demolition material</td>
</tr>
<tr>
<td>- Physical construction process</td>
<td>- Maintaining and improve maintainability</td>
<td>- Circularity</td>
</tr>
<tr>
<td>- Handover to the client</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Conformity with respect to adaptation targets</td>
<td>- Satisfaction surveys</td>
<td>- Assessment of adaptation measures on life span of the existing asset</td>
</tr>
<tr>
<td>- Regular reporting on delivery of adaptation targets</td>
<td>- Regular communication on assessment of climate-risks</td>
<td></td>
</tr>
<tr>
<td>- Monitoring and testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mitigation of construction activity impacts on preexisting nature based on site adaptation features</td>
<td>- Long-term monitoring the adaptation plan</td>
<td></td>
</tr>
<tr>
<td>Handover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Assessment at Handover</td>
<td>- Evidence based Impact assessment of adaptation measures</td>
<td></td>
</tr>
<tr>
<td>Review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Information and assessment of adaptability (as O&amp;M information)</td>
<td>- Opportunities for further adaptation measures</td>
<td></td>
</tr>
<tr>
<td>Occupants &amp; Users</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Satisfaction surveys</td>
<td>- Assessment of repair &amp; maintenance</td>
<td></td>
</tr>
<tr>
<td>Adaptation plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Long-term monitoring the adaptation plan</td>
<td>- Evidence based Impact assessment of adaptation measures</td>
<td></td>
</tr>
<tr>
<td>- Opportunities for further adaptation measures</td>
<td>- Assessment of repair &amp; maintenance</td>
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<tr>
<td>- Assessment of repair &amp; maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Follow-up procedures, guidelines</td>
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</table>
Scottish Sustainable Procurement Guidance on Climate Change

The sustainable procurement guidance on climate change adaptation provided by the Scottish Procurement and Commercial Directorate advises that “contracting authorities must consider carefully: the procurement stages at which adaptation is considered; the extent to which the contracting authority can prescribe adaptation measures; the extent to which the contracting authority can evaluate potentially diverse and even conflicting submissions from bidders” (Scottish Procurement and Commercial Directorate 2018). The guidance offers wording to be included in the contract notice:

- “a requirement of this contract is that the supply or products and services is as climate resilient as is practicable, reflecting known or anticipated climate change impacts that may affect their supply during the lifetime of this contract”, or.
- “The Contracting Authority has included obligations within the specification and contract conditions relating to adaptation to known or anticipated climate change, which are relevant to the products/services to be delivered.”
- In the specification development phase, the contractor may be expected “to provide a method statement setting out how it has assessed risks associated with climate change, what those potential risks are and how they will be managed in the delivery of the contract/project.”

Recommendations include:
- Treating excessive cost overruns associated with recovery from climate-induced extreme events as part of the history of non-performing contracts, and thereby penalising tenderers in future tenders.
- Mandating the use of climate projections to inform the design parameter.
- Realistically estimating potential emergency works on the basis of risk allocations.
- Providing asset owners with the maintenance history, as a means to identify trends in climate-change risks, so that increasingly accurate resilience considerations are addressed in future bids.
- Incentivising long-term climate change risk mitigation and adaptation by having longer contract periods.

For Bennett and Collin (2018), in performance-based contracts “the risk of climate change must be allocated to the contracting party best able to manage the impacts”. Five steps are proposed to manage the risks:

- Determine the criticality of the asset.
- Determine its vulnerability (including the exposure to hazards and the adaptation measures available).
- Determine the climate threat (future climate exposure).
- Determine the consequences in terms of costs.
- Identify adaptation measures.
4. Need for an Enabling Regulatory Framework

4.1 Adapting Buildings to Climate Change: Governments Have a Responsibility to Legislate

Climate change has significant impacts on the economic, social, financial, and cultural life of a community and on the safety of its citizens. As such, governments have the responsibility to act on the reduction of current and future climate risks.

Government Engagement on Adapting Buildings to Climate Change

There are multiple reasons for the intervention of governments in the buildings' adaptation process:

- The need to reduce the vulnerability of buildings is recognized at the international level. The Sendai Framework offers a common vision for catastrophe-related risk reduction and recognizes the need to reduce the vulnerability of buildings.
- Protecting people and properties is a key function of governments. More precisely, protecting the built environment against risks is crucial to the functioning of human groups and is at the basis of existing regulations on buildings. As climate change increasingly stresses the built environment and threatens human safety, adapting buildings should be a high priority for governments and one of their primary responsibilities.
- Climate change could have a significant social cost for governments: Investing in buildings' adaptation can be seen by governments as a way to prevent some societal problems (e.g. violence, delinquency), that will be exacerbated if living conditions deteriorate.
- The stakes are also financial for governments: the earlier they invest in adaptation the lower the costs will be in terms of social and societal problems and also crisis management.
- Climate change also calls into question the measures currently in place to protect cultural heritage sites that may be threatened by climate change and its impacts. Informal buildings represent another challenge, one that would allow governments to tackle poverty and better protect their vulnerable populations.

Adaptation measures are by nature location-specific and require the involvement of national and local governments. National governments define National Adaptation Plans which are then adapted at the local scale.

4.2 The Technical and Planning Regulatory Framework on Buildings Must Evolve

Integrating the current and future climate in the regulatory framework is a complex endeavour.

- The climate of reference is essential for establishing construction norms and zoning. However, often the current climate is used as reference even though it is not an adequate reflection of what the climate will be like in the future.
- Producing and sharing reliable information on the climate is required to improve risk management and adaptation, yet governments face challenges in producing such information.
- Risk management and sustainability efforts converge as climate change disrupts businesses and challenges green goals.
- Integrating adaptation policies in mitigation and development policies is crucial to ensure that these policies do not contradict each other.

At the inter-ministerial level, the main ongoing changes are the following:

- Requirements on reporting for private actors regarding their extra-financial performance. Authorities often use these requirements to measure how the private sector is contributing toward climate change adaptation, as well as its awareness of the inherent risks involved.
• The current approach to safety in buildings needs to be broadened to include resilience and the social aspect of the issue, both of which at present are rarely considered. The current approach focuses on increasing a building’s sturdiness, while its security is based on the ultimate limit state (ULs). An approach to safety incorporating resilience and social dimensions could involve for example the functioning of a building in “degraded mode” or the quick repair of basic services.

• The future-proofing of buildings is hampered by the absence of codes, regulations and standards. Certain countries and cities have recently decided to use performance-based standards that do not require climate criteria to be defined. Such standards make revision easier, since the base set of climatic data can be modified depending on future climate change without affecting the parent code. New initiatives looking at cities and infrastructure standards have been established to develop performance-based infrastructure standards.

The EU Taxonomy for Sustainable Activities

The EU Taxonomy is a tool for understanding whether an economic activity is environmentally sustainable or not. It sets performance thresholds for economic activities that make a substantial contribution to an environmental objective, avoiding significant harm to others (e.g. climate change mitigation and adaptation, pollution, waste and circular economy, water, biodiversity) and complying with minimum social safeguards. The taxonomy presents screening criteria on eight economic activities, including construction and real estate activities.

The Taxonomy is included in the European Commission’s Action Plan on Financing Sustainable Growth. In 2018 the Technical Expert Group on Sustainable Finance was established to help develop the technical details of the Taxonomy and make recommendations on climate disclosure, low carbon, benchmarks and an EU Green Bond Standard.

4.3 INTEGRATING ADAPTATION INTO CODES AND STANDARDS

Governments have identified important standards to guarantee the resilience of buildings to climate change and are currently seeking to identify which standards need to be adapted to better take into account the current and future impacts of climate change in investment decisions.

New European and international standards are currently being put in place to help deal with adaptation and resilience for buildings and civil engineering works: standardisation supports regulation and stakeholders in their approach to climate change.

• The RBC sector is one of the three priority sectors involved in the review process of the Eurocodes, according to the 2013 mandate “adaptation to climate change in standards for infrastructures”. The revision concerns the thermal performance of buildings and building components (EN ISO 15927-4), ventilation for buildings (EN 16798), Sustainability of Construction Works, calculation methods for buildings (EN 15978 series) and for civil engineering works (EN 17472). As Eurocodes are being used by non-UE countries, the impact of this reviewing process will be significant (more information here).
Due to regulations and voluntary initiatives, organisations are increasingly communicating their exposure to climate and ESG (Environmental, Social and Governance) risks (UNEP FI 2019). Improving reporting on climate risk exposure is a climate adaptation measure. However, forward-looking disclosure is barely required, as regulation focuses mostly on current and short-term exposure. Different tools and recommendations are available, often not specific to the RBC sector.

5.1 General Reporting Frameworks Addressing Climate Change and Sustainable Development

Banks and financial institutions play a major role in real estate markets, providing loans and services to home buyers and asset investors. Finance is also exposed to climate risks, because linked to the real-estate industries, for instance to keep property value as collateral of a mortgage.

Frameworks led by public authorities include:
- At the global level, the TCFD (Task Force on Climate-related Financial Disclosures) proposed, in June 2017, recommendations on the disclosure of clear, comparable and coherent information on the risks and opportunities of climate change.

Copernicus Climate Change Services, in cooperation with NEN and BMGI, is developing a methodology to upgrade standards for the adaptation of infrastructures to climate change.

The Task Force aims at improving transparency for investors on the climate risks they are exposed to.
- At the regional level, improving transparency on climate vulnerability is one of the objectives of the European action plan for sustainable finance.
- At the national level, for example in France, The French Article 173 of the Energy Transition Law of 2015 requires investors to report on how ESG and climate are integrated in their investment strategy. This includes measures implemented to adapt to climate change.

• ISO 14090, Adaptation to climate change — Principles, requirements and guidelines, is the first in a range of ISO standards in this area. It was released in June 2019.
The objective of the Task Force on Climate-related Financial Disclosures (TCFD) is to develop voluntary, consistent climate-related financial risk disclosures to be used by companies in order to provide information to all their stakeholders. It considers the physical and transition risks associated with climate change and what constitutes effective financial disclosures across industries.

The work and recommendations of the Task Force help firms understand what financial markets want from disclosure in order to measure and respond to climate change risks and encourage firms to align their disclosures with investors’ needs. Adaptation to climate change can be anchored in the four climate-related disclosures pillars.

The 2019 status report of the TCFD reveals that the materials and buildings industry has high levels of disclosure on strategy (impact on organisation) and metrics and targets (climate-related metrics and climate-related targets).

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Frameworks led by the private sector include the GRI (Global Reporting Initiative) and CDP (Carbon Disclosure Project). Companies are also encouraged to integrate reporting on ESG stakes into financial disclosures (including climate-risks adaptation strategies) and follow standards such as the “Sustainability Accounting Standards Board” and the “UN Principles for Responsible Investment.”

The GRI Sustainability Reporting Standards (GRI Standards) are the first and most widely adopted global standards for sustainability reporting. 93% of the world’s largest 250 corporations now report on their sustainability performance using these standards.

CDP is a not-for-profit charity that runs a global disclosure system for investors, companies, cities, states, and regions to measure and manage their environmental impacts (e.g. climate change, water security and deforestation).

5.2 REPORTING FRAMEWORKS SPECIFIC TO REAL ESTATE

The Global Real Estate Sustainability Benchmark (GRESB) assessments, covering real estate, infrastructure funds, and infrastructure assets, assess and benchmark ESG performance for real assets. For the past three years, GRESB has offered a Resilience Module, designed to improve reporting and benchmarking for climate risk and resilience by property and infrastructure companies. In 2021, the Resilience Module will be integrated into its core assessments, making climate risk and resilience reporting mandatory for its participants.

GRESB assesses and benchmarks the Environmental, Social and Governance (ESG) performance of real assets, providing standardised and validated data to the capital markets. The 2019 real estate benchmark covers more than 1,000 property companies, real estate investment trusts (REITs), funds, and developers.

GRESB has an optional Resilience Module addressing the vulnerability of business operations and of assets to social and environmental shocks and stressors. This Resilience Module addresses the two fundamental dimensions of climate risk and resilience identified by TCFD: transition and physical risks. After 2020, resilience indicators will migrate into the core Real Estate and Infrastructure Assessments.

According to GRESB, in 2019 “participants reported having systematic risk management processes for all three issues with 92% reporting on physical risk management, 84% reporting on transition risk management, and 72% reporting on social risk management. Practices within these broad categories varied widely, and only a small minority of companies reported comprehensive programs.” Results from the 2019 GRESB Resilience Module support several practical recommendations for real asset investors, for example not assuming that all companies are effectively managing climate risk and promoting resilience, asking for more information, having well-defined climate governance relevant risk assessment processes, coordinated business strategies, and aligned targets and operational measurement.
5.3 VOLUNTARY CERTIFICATION SCHEMES FOR BUILDINGS

Green Certification Schemes are starting to include requirements on the adaptation of buildings to climate change.

- **LEED** has released a Climate Resilience Screening Tool to provide a framework to prioritise opportunities for resilience rewarded in LEED credits (more information available [here](#)).
- For the **BREEAM** certification, a number of issues within the Refurbishment and Fit-Out scheme contains assessment criteria to support the mitigation of the impacts of extreme weather events arising from climate change (more information available [here](#)).
- **HQE** includes the identification of climate risk in the site analysis (more information available [here](#)).

Some specific resilience certifications exist, such as:

- **Fortified** in USA (from Insurance Institute for Business and Home Safety, [IBHS](#)) for reinforcing natural hazard requirements
- **RELi** (from [GBCI](#)) which has a 360 degree approach of risk management (including natural hazard)

![Figure 18: Example of climate resilience criteria in green Certification schemes](image-url)

Although green building ratings and standards historically have prioritised climate change mitigation activities over adaptation, many of these ratings and standards can also be used to adapt buildings to climate change by considering specific issues, such as using LEED to reduce negative health outcomes following exposure to climatic events.
6. Adaptation of Non-Engineered Buildings

Non-engineered buildings need a specific approach.

It is estimated that non-engineered construction (either "traditional" construction based on local materials or construction that misuses industrial materials) count for more than half of the buildings in most of the cities of the developing world. These buildings account for most of the collapses and fatalities during natural disasters. Lack of integrity of a building’s structural elements, improper detailing of a building’s structural elements and low quality of construction materials are typical problems found in many of these structures due to misconceptions and a lack of guidelines and skilled technicians.

6.1 Locally-driven

Beyond the building-specific specifications the need to strengthen, develop, and incorporate local knowledge and capacity within the community is of equal importance. It is often assumed that markets in developing countries lack access to appropriate materials for construction, and that this is why buildings fail when facing hazards. However, often this is not the main reason for the vulnerability of the built environment in these countries.

The vulnerability of the built environment in developing countries is frequently due to failure in knowledgeable monitoring and inspecting the construction phase; the misuse or misapplication of tools, materials, and techniques; or even a lack of sufficient time given to a process (e.g. allowing concrete to fully cure before proceeding with construction). Coupling international support (e.g. knowledge, materials, technologies) with local resources, knowledge, and skills builds capacity, lowers vulnerability, improves resilience, and maximises benefit for donor investments.

As underlined by IIED, global climate finance needs to develop the institutional channels through which to encourage and support hundreds of locally driven upgrading initiatives, within which resilience enhancement is embedded. This means that global funds for adaptation will have to establish how to work with local governments, and also with grassroots organisations and federations formed by the inhabitants of informal settlements.

6.2 Guidance for Developing Countries

In many parts of developing countries, the most suitable approach for governments is to work with the inhabitants of informal settlements and their community organisations in improving housing quality and providing needed infrastructure and services. Owner-driven construction or upgrading can offer an alternative to a more formal method of governing building design and construction, such as through building codes and formal permitting processes.

Integrating adaptive and resilient approaches in owner-driven construction or slum upgrading projects could help to unlock greater capacity and action among at-risk populations, leading to an overall reduction in vulnerability. UNEP issued a “Guidance note on adaptation and the built environment” that presents a range of approaches and technologies tailored to a developing country context and a built environment that is largely self-constructed.

Identifying design ideas and potential technical approaches to reduce vulnerability according to local context is a crucial first step for any building and construction project. To address adaptation and resilience in owner-driven construction or slum upgrading initiatives, the UNEP guidance note encourages government officers, adaptation specialists, and development practitioners to consider the following points prior to undertaking a new project.
SUGGESTED LIST OF KEY QUESTIONS

According to UNEP’s “Guidance note on adaptation and the built environment,” governments and project developers in developing countries should aim to identify the adaptation needs of their buildings and construction project and corresponding solutions.

1) **What are the current local climatic conditions and the expected future conditions triggered by global climate change?** Knowing how a building’s design or use addresses the current and expected future climate conditions is of high importance.
   a) Is the area in a hot and humid, hot and arid, temperate, or other type of climate zone?
   b) What are the daily temperatures and expected future change (cooling-degree days)?
   c) What are the current and expected changes in precipitation (increased or decreased rainfall, water shortages, flooding, etc.)?
   d) Are there impacts expected from sea-level rise (flooding, storm surge, and availability of fresh water)?

2) **What are the climate change-related risks (both current and future) at the project site?**
   a) Is there a better site for the project? One that has fewer expected hazards?
   b) If the site cannot be moved or the hazard avoided, what is the magnitude of the hazard (e.g. top wind-speeds, flood line, etc.)? Knowing this will be critical in selecting a more appropriate building design approach.

3) **Is the building location optimised?**
   a) Is the site and building designed to minimise flood or other climate risks (e.g. heat wave, sea-level rise etc.)?
   b) Has the site taken full advantage of available nature-based solutions for solar gain, shading, and natural ventilation or drainage?

4) **Do the key building design elements (such as walls, roofs, internal layout of spaces) adequately respond to current and expected future needs (e.g. warming, precipitation, etc.) and expected hazards, such as high-winds?**
   a) Is the roof optimized for shading? Reducing heat-gain? Resisting or mitigating damage from strong winds? (Reminder: this can include the shape and materials used but also construction methods).
   b) Are the walls adequately designed for minimising unwanted heat loss or gain? Resisting or mitigating wind and water damage?
   c) Is the layout (placement of rooms) optimised for natural ventilation and managing the heat or cold? What about for safety (e.g. bedrooms above flood elevation)?

5) **Are the most appropriate materials and methods selected?**
   a) Is there sufficient local capacity for the installation and maintenance of the materials and/or construction practices, or is more knowledge and training needed?
   b) Does the building utilise materials or methods that can mitigate or reduce risk (e.g. wet-dry construction)? Does it utilise a design for reconstruction? Does it employ frangible or triage design approaches?
   c) Are the materials sustainably and locally sourced? Are the chosen materials most appropriate for the local climate (e.g. thermal performance, strength, recyclability)?