**Level 1 Basic Activity:**

**Introduction to Strategic Foresight for Sustainable Engineering**

# **Key concept 1: Strategic Foresight**

**Strategic foresight** is a structured approach used to explore and prepare for multiple plausible futures. Rather than predicting a single outcome, foresight helps individuals, organizations, and societies anticipate change, identify emerging opportunities and risks, and make better decisions today based on long-term thinking.

In the context of engineering and sustainability, strategic foresight equips students and professionals with the mindset and tools to navigate complexity, uncertainty, and rapid change — particularly in response to global challenges such as climate change, resource scarcity, technological disruption, and shifting political landscapes.

Strategic foresight is:

* Future-oriented (10–50+ years)
* Exploratory (examines what could happen, not what will happen)
* Scenario-based (uses multiple futures to explore consequences of change)
* Participatory (encourages collaboration across disciplines and stakeholders)
* Strategic (connects insights from foresight to present-day decisions)

Common Tools Used in Strategic Foresight include:

* STEEP (Social, Technological, Economic, Environmental, Political)
* Three Horizons Framework
* Scenario Matrix

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# **Key concept 2: STEEP Framework**

**STEEP** is used to scan for external drivers of change across five dimensions/impacting factors.

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| **Dimensions/Factors** | **Examples** |
| S – Social | Changing lifestyles, urbanization, education |
| T – Technological | Clean energy tech, AI |
| E – Economic | Carbon pricing, raw material scarcity |
| E – Environmental | Biodiversity loss, climate change impacts |
| P – Political | Green regulations, international treaties |

**Example: STEEP application on sustainable materials in construction**

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| **Dimensions/Factors** | **Driver of Change** |
| Social | Growing public demand for green buildings and climate-resilient infrastructure |
| Technological | Advancements in bio-based materials (e.g., mycelium composites), 3D printing, and smart sensors |
| Economic | Rising cost of raw materials and economic incentives for green certifications (e.g. ESG) |
| Environmental | Urgency to reduce embodied carbon, address waste from demolition, and preserve ecosystems |
| Political | New building regulations requiring lifecycle carbon assessments and circularity standards |

# **Key concept 3: Three Horizons Framework**

The **Three Horizons Framework** helps visualize how systems change over time — from the status quo to a sustainable future.

* Horizon 1: The current dominant system — business-as-usual
* Horizon 2: The transition — conflict, innovation, emerging practices
* Horizon 3: The future — the long-term vision of a more sustainable world

**Example: Three Horizons Framework application on sustainable materials in construction**

The Three Horizons model helps visualize how the transition to sustainable, low-carbon, and circular materials in construction might unfold over time:

*Horizon 1 – Business-as-Usual "How things are now"*

Engineering mindset: "Build fast, build cheap, meet minimum standards"

* Use of carbon-intensive materials (e.g. concrete, virgin steel)
* Designs focused on cost and short-term performance
* Wasteful linear processes: extract → build → demolish
* Sustainability considered a compliance issue, not a design priority

*Horizon 2 – Transition and Innovation "The messy middle"*

Engineering mindset: "Try new solutions — but balance risk, cost, and performance"

* Introduction of low-carbon alternatives (e.g. recycled aggregates, geopolymer concrete)
* Greater use of Life Cycle Assessment (LCA) and material passports
* Pilot projects using modular and disassemblable construction methods
* Policy shifts and certifications incentivize greener material choices

*Horizon 3 – Sustainable Future* ***"****The long-term goal"*

Engineering mindset: "Designing for climate, circularity, and future generations"

* Mainstream use of circular, bio-based, and regenerative materials
* Buildings designed as material banks – ready for reuse or transformation
* Full integration of LCA, digital design tools, and circular economics
* Construction becomes net-positive — reducing emissions, regenerating ecosystems