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The WFEO Approach: Strengthening Engineering and STI Partnerships for Sustainable Development

Special Task Force for Engineering Capacity building for Africa Program, WFEO

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Engineering: A Cornerstone of Human Progress and Sustainability

"We have great tests before us.We need to come together for common solutions and governance tools, so that technology serves human rights and the common good. The good news is that we have the scientific know-how and the technology we need to design and build a better future. **Engineers are critical. We need Engineering.**"

---Ms Audrey Azoulay
Director-General of UNESCO

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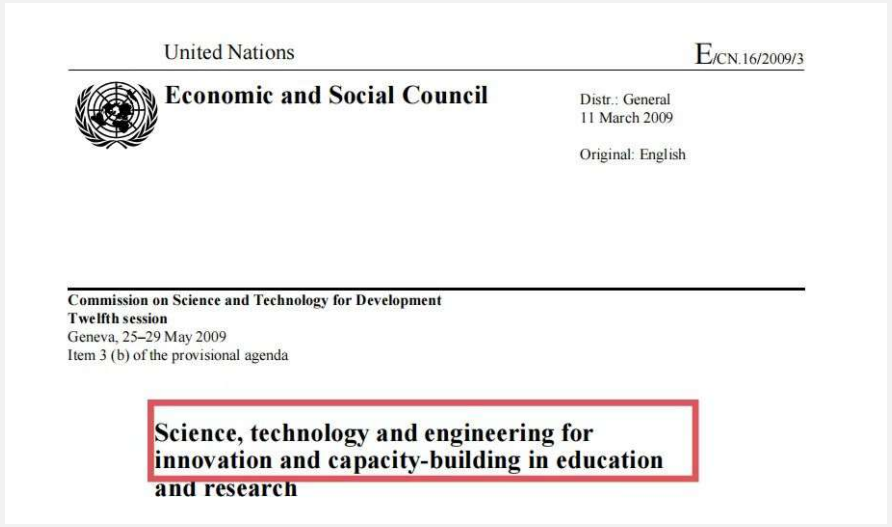
STI - Engineering Partnership:

Catalysts for Development as Advocated in UN Frameworks



United Nations E/CN.16/2009/3

Economic and Social Council

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Item 3 (b) of the provisional agenda

Science, technology and engineering for innovation and capacity-building in education and research

- Engineering is the field or discipline, practice, profession and art that relates to the development, acquisition and application of technical, scientific and mathematical knowledge about the understanding, design, development, invention, innovation and use of materials, machines, structures, systems and processes for specific purposes. *---UNESCO Engineering report*
- By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes. *---UN 2030 Agenda*
- Scale up investment in science, technology, engineering and mathematics education (§119) *---Addis Ababa Action Agenda*

Navigating Challenges and Opportunities: The Essential Role of STI-Engineering Partnerships in Today's Landscape

- The lingering impacts of the COVID-19 pandemic, escalating conflicts, geopolitical tensions and growing climate chaos have **severely hindered SDG progress**. Currently, only 17 per cent of the SDG targets are currently on track, with nearly half showing minimal or moderate progress, and over one-third stalled or regressing.

- "Looking to the future, one of the most seismic shifts that will shape the 21st century is digital transformation." "The digital revolution and Artificial Intelligence are changing our world and our lives. They can turbocharge sustainable development and could be a game-changer for the Sustainable Development Goals."

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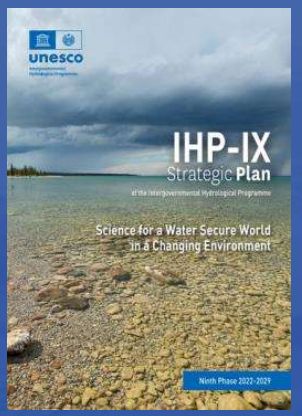
STI-Engineering Partnerships Case I: **AI and Big Data for Water Security**

Figure 1 | The role of multidisciplinary engineering in tackling SDG 6 and relevant targets

Throughout history, engineers from various disciplines have approached these complex water issues through multidisciplinary strategies, applying scientific knowledge to develop innovative solutions.



1. Scientific Research and innovation

2. Water education in the Fourth Industrial Revolution

3. Bridging the data-knowledge gap

4. Integrated water management under conditions of global change

5. Water governance based on science for mitigation, adaptation, and resilience

----*The IHP-IX Priority Areas*

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STI-Engineering Partnerships Case II:
AI and Engineering for Enhancing the Road Tunnels Resilience

Direct Transport Targets of the Sustainable Development Goals	
SDG 3. Ensure healthy lives and promote well-being for all at all ages	**3.6** By 2020, halve the number of global deaths and injuries from road traffic accidents (*Road safety)*
SDG 7. Ensure access to affordable, reliable, sustainable and modern energy for all	**7.3** By 2030, double the global rate of improvement in energy efficiency (*Energy efficiency)*
SDG 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	**9.1** Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all (*Sustainable infrastructure)*
SDG 11. Make cities and human settlements inclusive, safe, resilient and sustainable	**11.2** By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons (*Urban access)*
SDG 12. Ensure sustainable consumption and production patterns	**12.c** Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities (*Fuel subsidies)*

Indirect Transport Targets of the Sustainable Development Goals	
SDG 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	**2.3** By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment *(Agricultural productivity)*
SDG 3. Ensure healthy lives and promote well-being for all at all ages	**3.9** By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination *(Air pollution)*
SDG 6. Ensure availability and sustainable management of water and sanitation for all	**6.1** By 2030, achieve universal and equitable access to safe and affordable drinking water for all *(Access to safe drinking water)*
SDG 11. Make cities and human settlements inclusive, safe, resilient and sustainable	**11.6** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management (*Sustainable cities)*
SDG 12. Ensure sustainable consumption and production patterns	**12.3** By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses *(Food loss and waste)*
SDG 13. Take urgent action to combat climate change and its impacts	**13.1** Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries *(Climate change adaptation)*
	13.2 Integrate climate change measures into national policies, strategies, and planning *(Climate change mitigation)*

Sustainable transportation can achieves better integration of the economy while respecting the environment. improving social equity, health, resilience of cities, urban-rural linkages and productivity of rural areas.

---2012 United Nations Conference on Sustainable Development (Rio +20)

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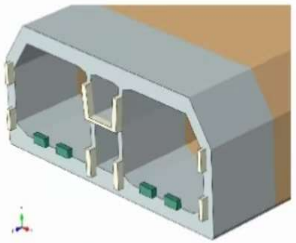
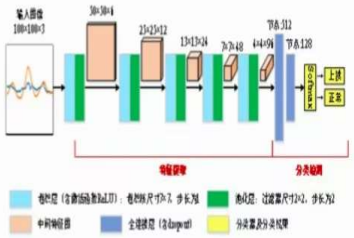
STI-Engineering Partnerships Case II:
AI and Engineering for Enhancing the Road Tunnels Resilience in China

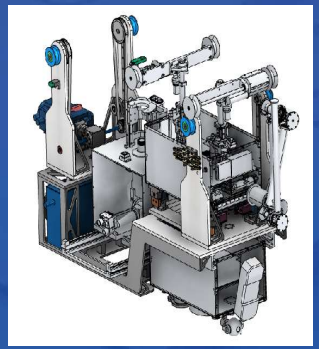
Real-time Structural Condition Monitoring

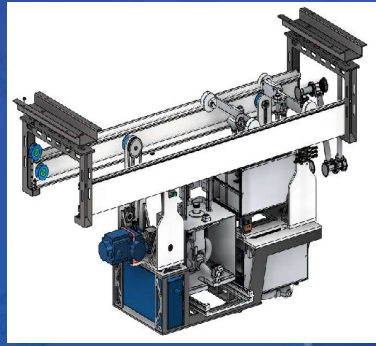


Comprehensive Accumulation of Structural Service Knowledge



Deep Mining of Intelligent Algorithms





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STI-Engineering Partnerships Case III: **AI Empowering the Steel Industry**

Total Digitization: Comprehensive Process Coverage

17 Major Processes: Encompassing the entire production cycle

All Elements Included: Over 35,000 pieces of equipment and more than 240,000 data points

All Positions Targeted: Supporting over 400 digital roles

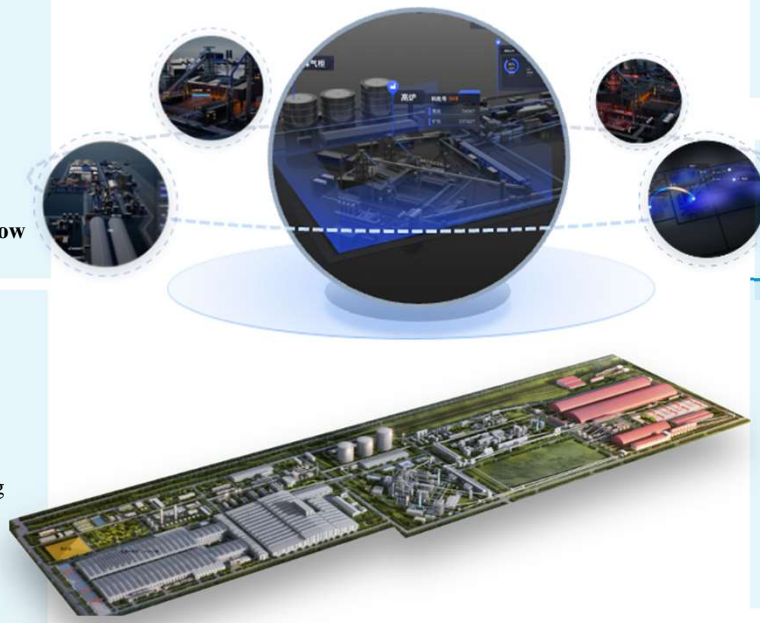
End-to-End Process Control: Managing the entire business **workflow**

New Infrastructure

1 Cloud: Over 230 virtual servers, establishing a cloud computing storage center

6 Networks: A communications network exceeding 100 km, creating an information superhighway

1 Intelligent Control Center: Spanning over 1,800 m², providing a physical space for collaborative control.



Labor Productivity

Annual Steel Production per Capita: Exceeding 1,800 tons

Material Production per Capita: 2,000 tons.

Cost Competitiveness

Average Cost per Ton of Steel: Reduced by 160 yuan compared to domestic advanced levels.

Environmental Sustainability:

Reduced Comprehensive Fuel Ratio in Blast Furnaces: Lowered by 18 kg per ton

Cost of Power Medium per Ton of Steel: Decreased by 20%

Annual CO2 Emissions Reduction: Exceeding 800,000 tons

Shandong Yongfeng Lingang: The World's First Fully Integrated Intelligent Factory Built on an Industrial Internet Platform

By integrating "Platform + Applications" and "Centralized Control," pioneering a new model of lean and intelligent manufacturing in the industry

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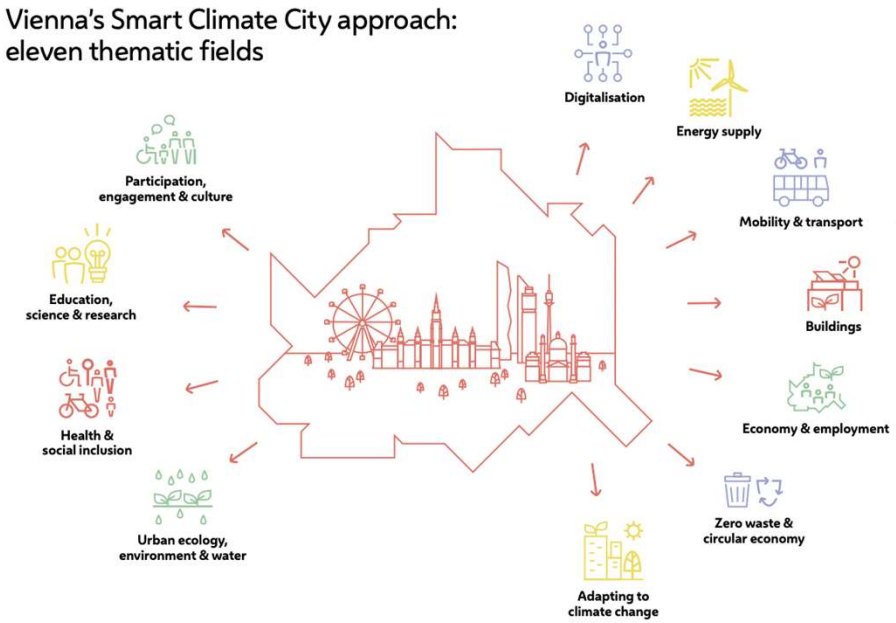
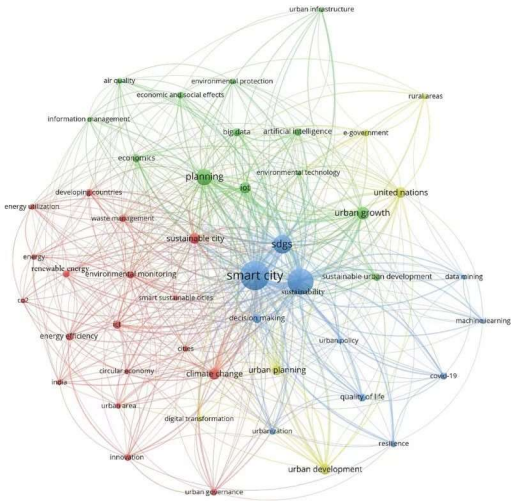
STI-Engineering Partnerships Case IV: **AI and Smart Cites**





The Smart City Vienna mission:

"High quality of life for everyone in Vienna through social and technical innovation in all areas, while maximising conservation of resources."

The Sag's Wien app supports the implementation of the Smart City Wien Framework Strategy in several different ways, with digitalisation of municipal services and increasing opportunities for public involvement and participation both being key components of Smart City Wien.

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Insights from Case Studies:
Integrating Economic, Social, and Environmental Factors in STI-Engineering Partnerships

Engineering is experiencing a moment of profound transformation and is facing immense challenges. As a discipline, it is expanding rapidly beyond the creation of artefact-based solutions to **permeate economic, ecological and social systems**.

---*UNESCO Engineering for Sustainable Development Report*

Science, technology and innovation can lead to economic growth by increasing productivity, reducing costs and increasing efficiency, it also helps to address and alleviate societal challenges, while finding effective ways to tackle environmental challenges. In other words, it feeds into the three components of sustainability: **economic, environmental and social**. ---*Guidebook for the preparation of STI for SDGs Roadmaps*

Concrete environmental, economical and social considerations in implementing the SDGs establish strong foundations for the STI-engineering partnership

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Engineering-STI for Sustainable Development

WORLD FEDERATION OF ENGINEERING ORGANIZATIONS (WFEO)