



World Federation of Engineering Organizations  
Fédération Mondiale des Organisations d'Ingénieurs

# **ENGINEERING: Playing the Role of Leveraging Science and Technology to Innovation for Sustainable Development Goals**

**GONG Ke**

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

October 8, 2024



# World Federation of Engineering Organizations (WFEO) is the world largest Engineering Family



Algeria  
Angola  
Argentina  
Australia  
Bahrain  
Bangladesh  
Belize  
Bolivia  
Brazil  
Bulgaria  
Cameroon  
Canada  
Chile  
China  
Chinese Taipei  
Colombia  
Costa Rica  
Croatia  
Cuba  
Cyprus  
Czech Republic

Ecuador  
Egypt  
Ethiopia  
Fiji  
France  
Germany  
Ghana  
Greece  
Honduras  
Hong Kong, China  
Hungary  
India  
Iraq  
Italy  
Ivory Coast  
Japan  
Jordan  
Kenya  
Korea  
Kuwait

Lebanon  
Libya  
Macedonia  
(FYROM)  
Madagascar  
Malawi  
Malaysia  
Malta  
Mauritius  
Mexico  
Moldavia  
Mongolia  
Montenegro  
Morocco  
Nepal  
New Zealand  
Nigeria  
Pakistan  
Palestine  
Peru  
Poland

Portugal  
Puerto Rico  
Qatar  
Romania  
Russia  
Rwanda  
Saudi  
Arabia  
Senegal  
Serbia  
Sierra Leone  
Singapore  
Slovakia  
Slovenia  
South Africa  
Spain  
Sri Lanka  
Sudan  
Switzerland  
Syria  
Tanzania

The Philippines  
Tunisia  
Turkey  
Uganda  
Ukraine  
United Arab  
Emirates  
United  
Kingdom  
United States  
Uruguay  
Yemen  
Zambia  
Zimbabwe



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

Throughout history, engineers from various disciplines have approached 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



13 CLIMATE ACTION



Water Distribution Pipes

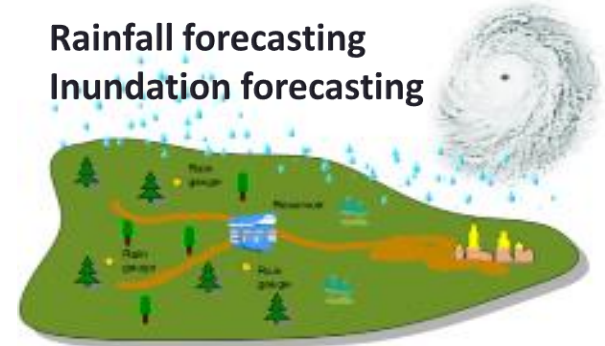


Stormwater Management

Sewer Pipes

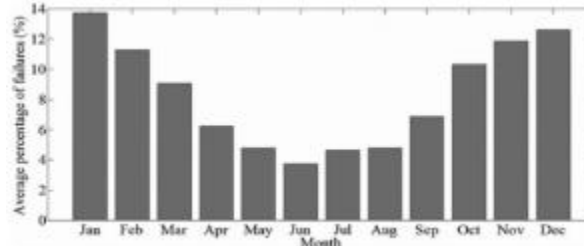


Rainfall forecasting  
 Inundation forecasting

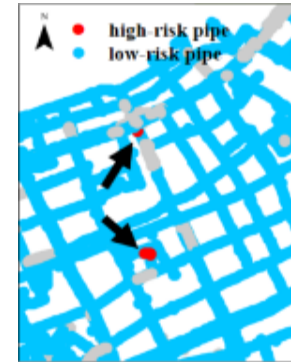


Both climate change induced cold wave and heat wave may increase the pipe failure substantially.

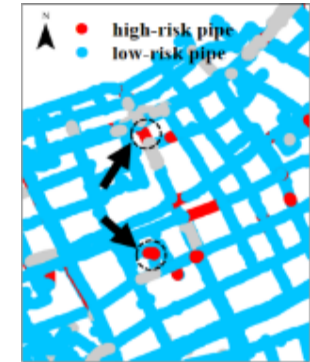
Average percentage of pipe failures per month (Kakoudakis, et al. 2019).



- AI technology could increase the accuracy of rainfall forecasting as well as inundation forecasting and provide longer lead-time for warning.
- AI facilitated forecasting could help in better management of infrastructure and reduce the cost of disaster.



Actual leakage distribution map



Predicted leakage distribution map

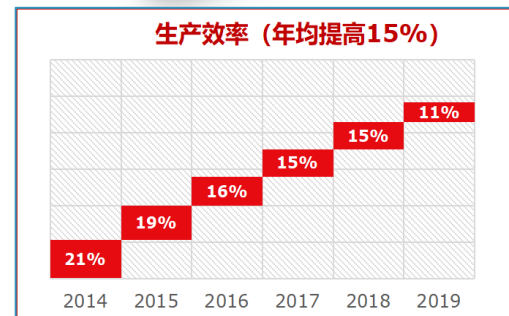
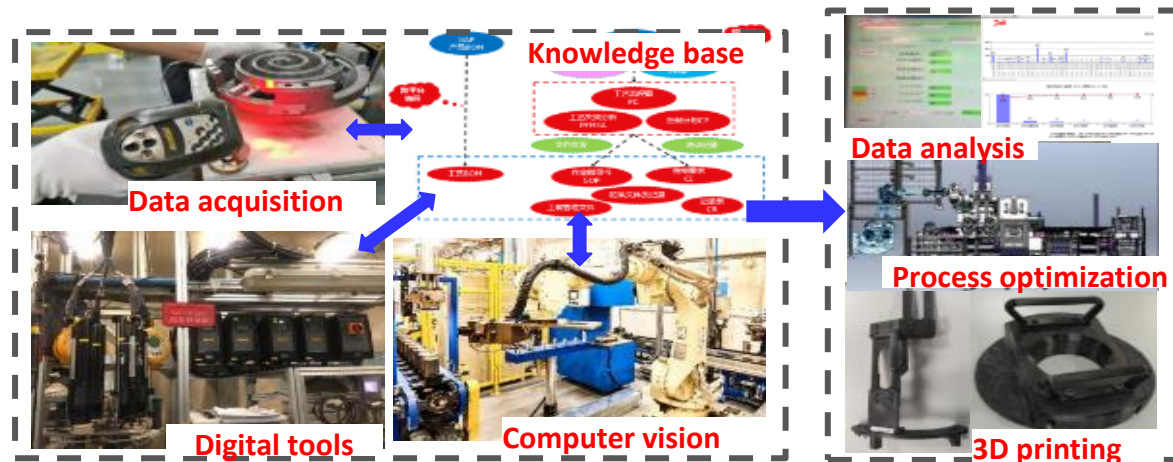
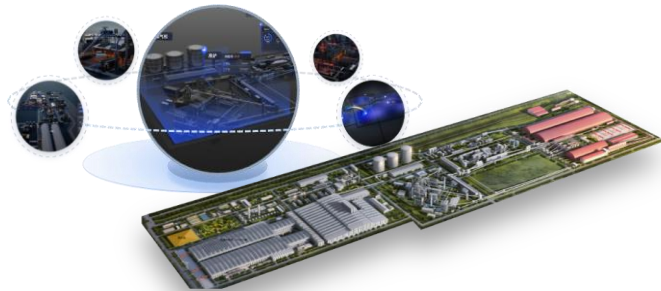


**9 INDUSTRY, INNOVATION AND INFRASTRUCTURE**



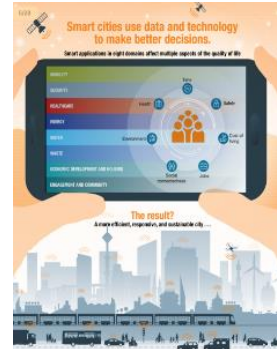
**Total Digitization Managing the entire workflow:**

The World's First Fully Integrated smart factory built on an Industrial Internet, with over 35,000 digital equipment and more than 240,000 data points, supporting over 400 digital roles, reduced 20% Cost of Power Medium per Ton of Steel, enhanced annual labour productivity reaching 1800+ tons per capita, and reduced 800,000 tons CO2 emission per year.





# Smart City



From top 4<sup>th</sup> to 57<sup>th</sup> by city brain

With help of **Big data and AI**, the implementation of **Smart City** can cut down on **traffic congestion and accidents**, increase **nature-based solutions** to adapt for **climate change**, address **pollution and other health and safety risks**.

## 11 SUSTAINABLE CITIES AND COMMUNITIES



**30-300**  
lives saved each  
year in a city of  
5 million

**30-40%**  
fewer crime  
incidents

**8-15%**  
lower disease  
burden

**15-30**  
minutes shaved  
off the daily  
commute

**25-80**  
liters of water  
saved per person  
per day

**20-35%**  
faster emergency  
response times



## 2021 Report Card for America's Infrastructure

AVIATION ↑ D+ PORTS ↑ B-



AMERICAN SOCIETY OF CIVIL ENGINEERS

**2025 REPORT CARD FOR AMERICA'S INFRASTRUCTURE**

- Analyzing the performance of 18 infrastructure categories
- Letter grades evaluating national conditions
- Comprehensive perspective from top infrastructure experts
- Identifying solutions to raise the grade
- Highlighting opportunities to increase resilience

**COMING MARCH 2025**  
[www.infrastructurereportcard.org](http://www.infrastructurereportcard.org)

PARKS AND RECREATION ↑ D+

America's Cumulative Infrastructure Grade

**C-**

A	EXCEPTIONAL
B	GOOD
C	MEDIOCRE
D	POOR
F	FAILING

## PURPOSE and GOALS

### Sustainability & Resilience

- Identifies deficiencies across infrastructure categories
- Promotes building standards and practices for stronger facilities

### Tools

- Informs other ASCE resources across engineering profession

### Advocacy & Policy Priorities

- Educates stakeholders on status of the nation's infrastructure




International Standard  
 ISO 4931-1:2024  
 Buildings and civil engineering works — Principles, framework and guidance for resilience design — Part 1: Adaptation to climate change  
 Edition 1  
 2024-09

**Adaptive to climate change**

ISO 4931-1:2024  
 Buildings and civil engineering works — Principles, framework and guidance for resilience design  
 Part 1: Adaptation to climate change

SUSTAINABLE DEVELOPMENT GOALS  
 3 9 11 13

Published (Edition 1, 2024)

## ASCE 73-23: Standard Practice for Sustainable Infrastructure

- Chapter 1 – General
- Chapter 2 – Sustainability Leadership
- Chapter 3 – Quality of Life
- Chapter 4 – Resource Allocation
- Chapter 5 – Natural World
- Chapter 6 – Greenhouse Gas Emissions
- Chapter 7 – Resilience
- Chapter 8 – Life Cycle Cost Analysis

“The Standard addresses development and implementation sustainable infrastructure solutions through the entire infrastructure life cycle”



ISO/TC59/SC20  
 Resilience of buildings and civil engineering works  
 Standardization in addressing resilience in design of built environment to reduce risks induced by hazards, whether natural or man-made, and changing environment.

**Climate change**  
 ISO 4931-1:2024

**Earthquake**  
 ISO DTR 18961

**Public health emergency**  
 ISO TR 5202:2023

SUSTAINABLE DEVELOPMENT GOALS  
 3 9 11 13

- Become resilient and adaptive
- Achieve climate neutrality
- Integrate climate action in governance and management





United Nations  
Educational, Scientific and  
Cultural Organization



**WORLD  
ENGINEERING  
DAY**

**Engineering** is about using  
**Science** and **Technology** to  
**Innovation** for solving  
problems facing humankind  
under specific **Social**,  
**Economical** and **Environmental**  
conditions.



**António Guterres** @antonioguterres · Mar 5

As a trained engineer, I am passionate about the potential of engineering to help solve the most pressing challenges facing our world.

But to truly maximize that potential, we must ensure women & girls have equal opportunities & representation in this field. #WorldEngineeringDay

On the 1<sup>st</sup> “UNESCO World Engineering Day for Sustainable Development” in 2021, the UN Secretary General António Guterres tweeted “**I am passionate about the potential of engineering to help solve the most pressing challenges facing our world**”.

For enhancing STI for SDGs, more attention should be paid to engineering development and engineering capacity building.



World Federation of Engineering Organizations  
Fédération Mondiale des Organisations d'Ingénieurs

# Thanks for your kind attention

*WFEO looks forward to working with all of you  
to promote sustainable development.*

