



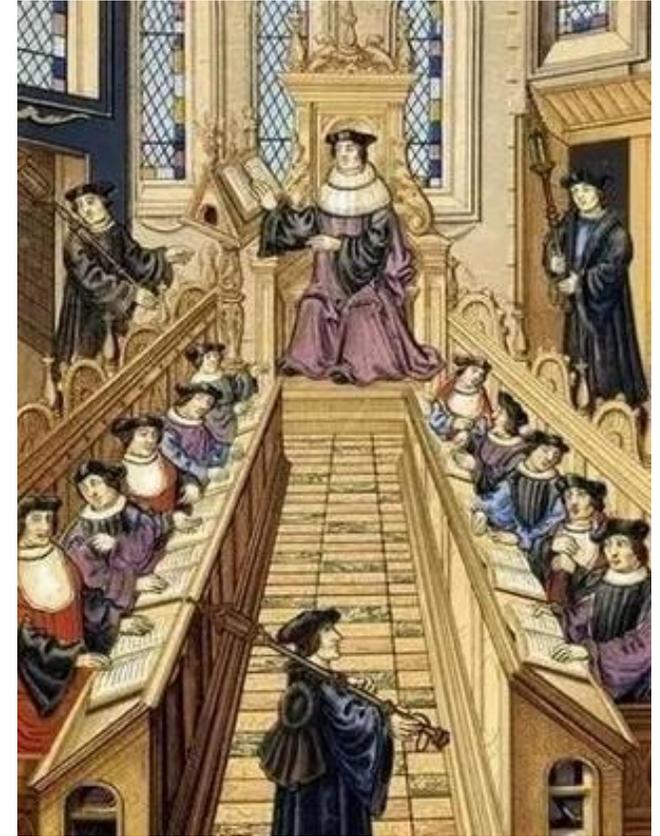
2019
LISBON CES
CIVIL ENGINEERING SUMMIT
24 - 28 SEPTEMBER 2019, LISBOA, PORTUGAL

Transition of Engineering Education
towards Industry 4.0 and Sustainability

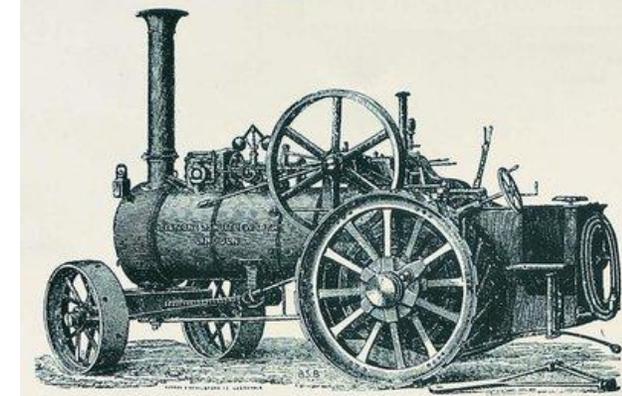
GONG Ke

ENGINEERING EDUCATION AND INDUSTRIALIZATION

- The modern engineering education is developing with industrialization. Every industrial revolution reforms engineering education, and the reformed engineering education, in turn, promotes the deepening of industrial revolution.
- Before industrial revolution, the goal of university education was to train priests, doctors, lawyers, gentlemen and state administrators, setting up philosophy, theology, law, medicine and other majors, the application of technical knowledge was excluded from university teaching, more than half of the graduates into the church.



- The 1st industrial revolution had also transformed the whole education system, science, mathematics and business subjects had become important to meet the requirements of the industrial society and modern engineering education was born.



- The 2nd industrial revolution opened the “Industry 2.0” era, with the continuous development of industry, a group of technical universities has emerged into university arena, highlighting the engineering, machinery, mining, electrical circuits and other courses, aimed at the training of senior technical personnel for industry and commerce.

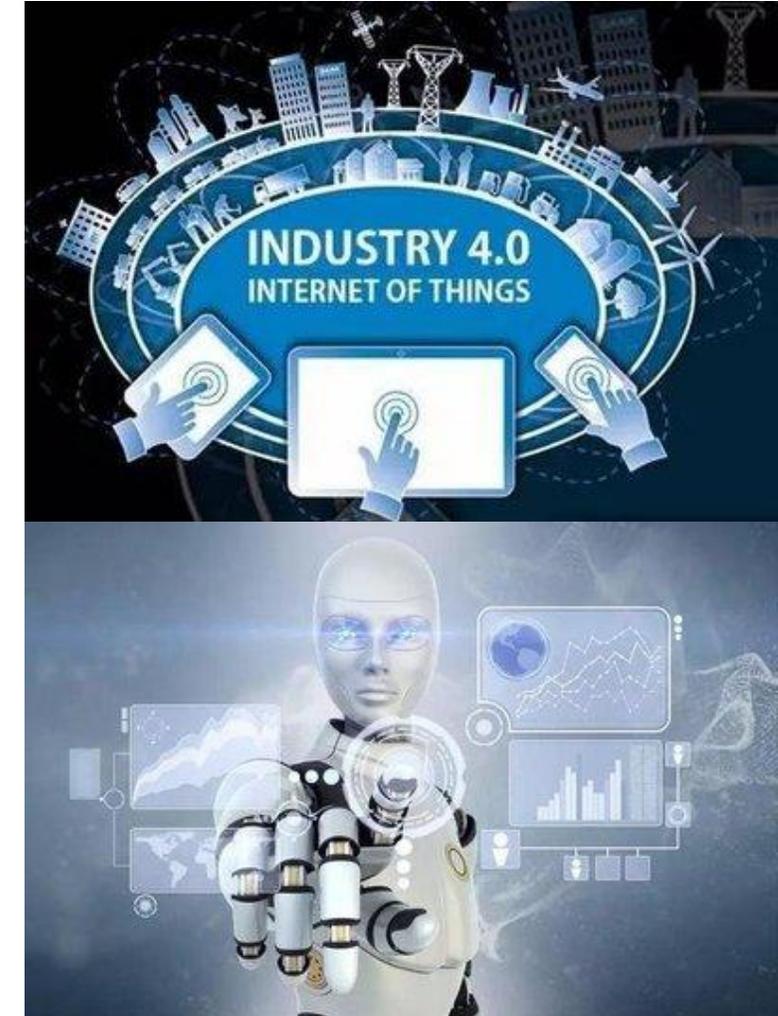


- The 3rd industrial revolution takes the ICT as the main content, "digitalization" and "informatization" are its distinctive features, the level of production automation is further improved, and the way of social development has entered the era of knowledge economy.

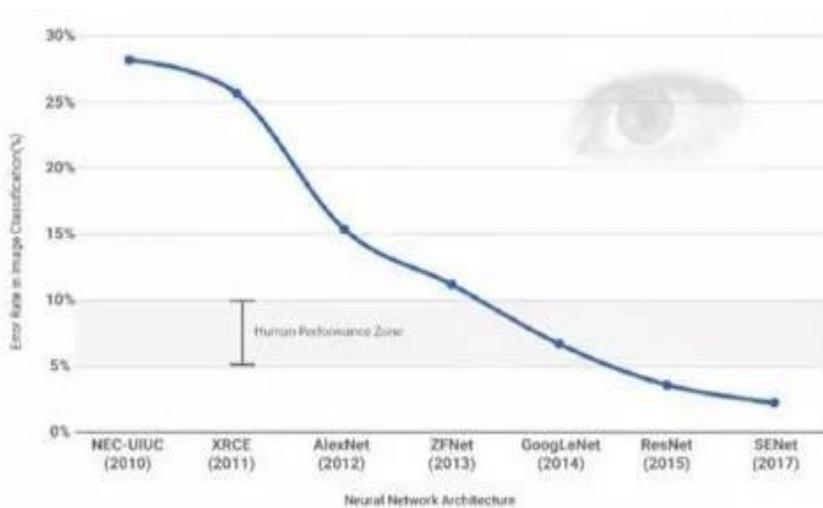


In the "Industry 3.0" era, the American universities, led by Harvard University, launched a general education campaign, because highly specialized education can no longer meet the needs of economic development.

- The 4th Industrial Revolution, with the help of the "physical systems" that the first industrial revolution and the second industrial revolution have created, and the "information systems" that gradually matured with the third industrial revolution, formed the "Internet of Things", the information physics system. The "Industry 4.0" puts forward new requirements for talents with more complex and comprehensive, highlighting the requirements of innovation, practicality and solid basic knowledge.



- Artificial Intelligence is enabling technology to the 4th industrial revolution and plays important role in Industry 4.0. With help of powerful deep learning algorithm and cooperated with big data and internet, AI has made breakthrough in this decade.



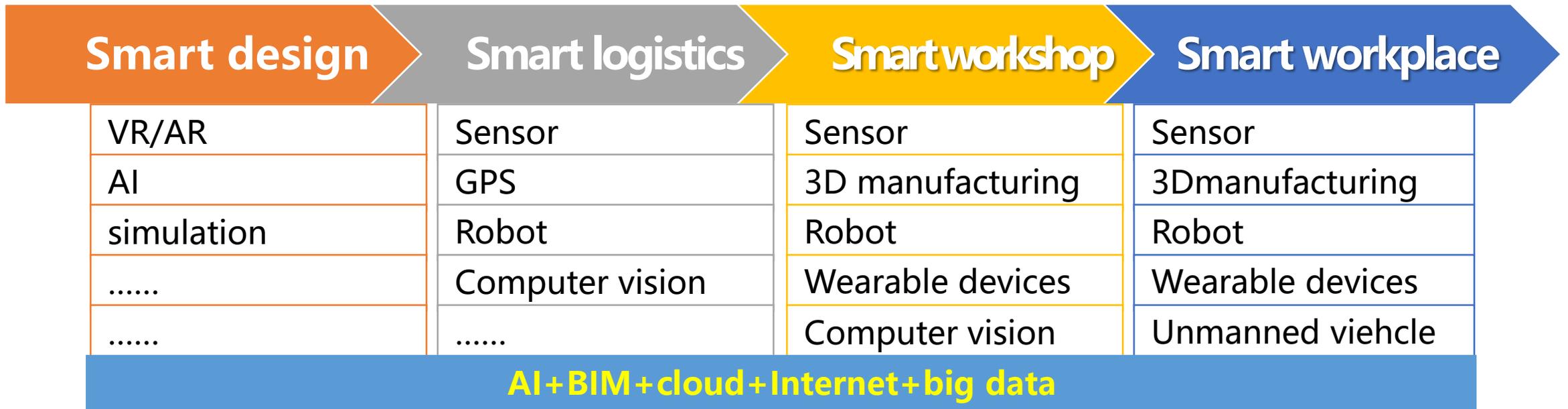
AI image recognition outperforms human



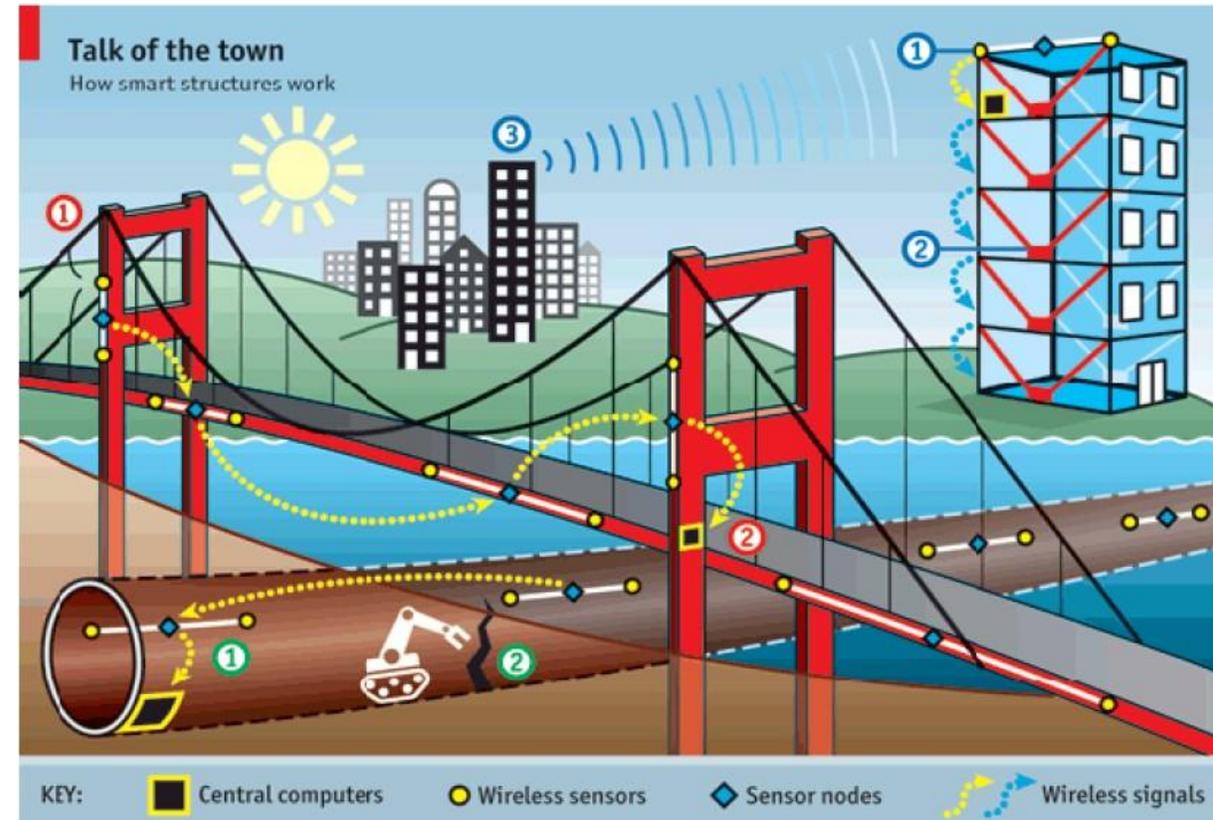
With a score of 511, AI performs better than human average of 416 in Japan National examination



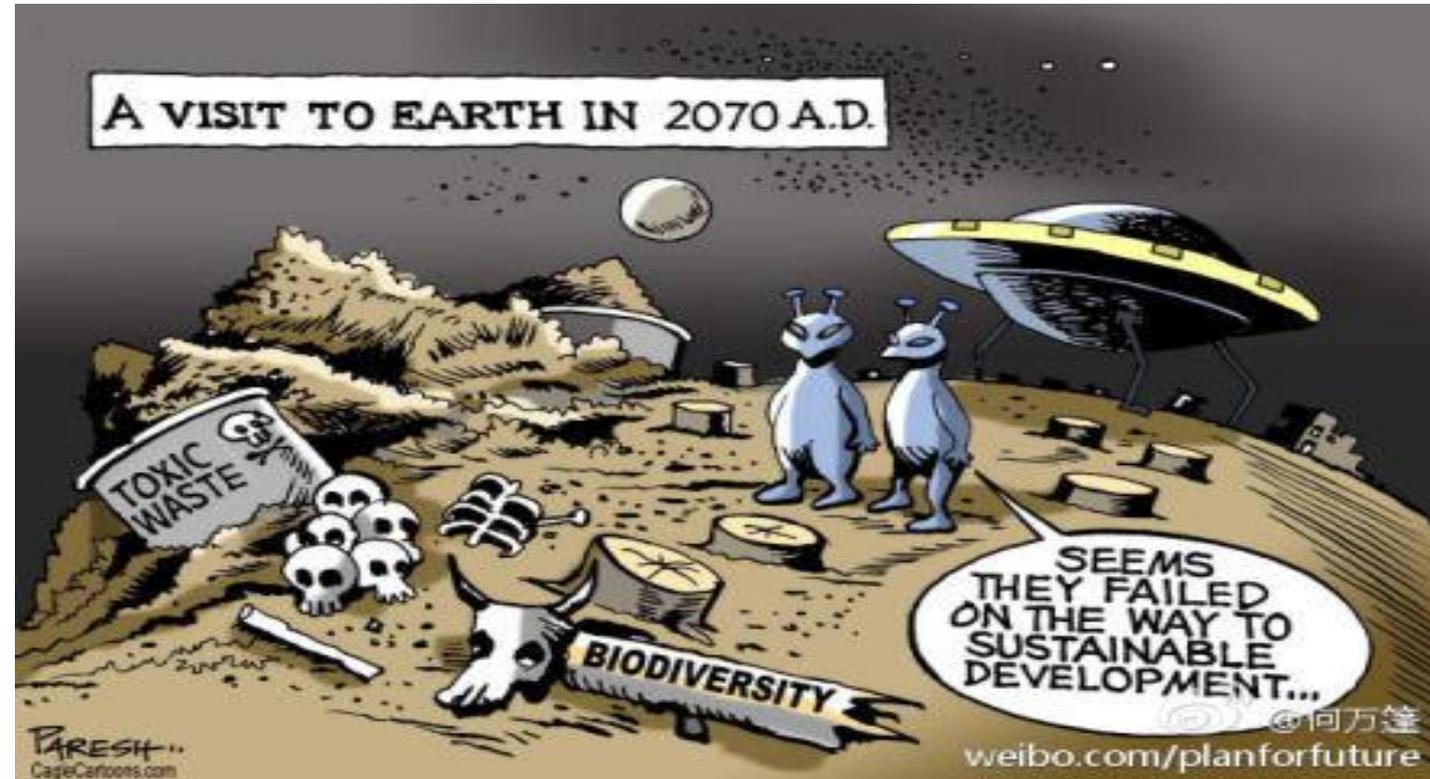
- Unlike some years ago AI was a branch of computer science, today's AI is penetrating into every engineering profession include civil engineering.



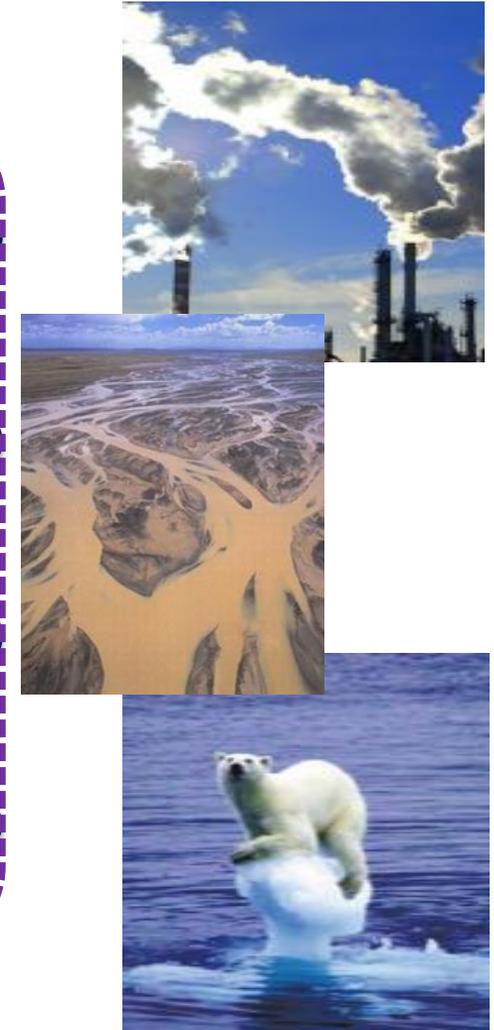
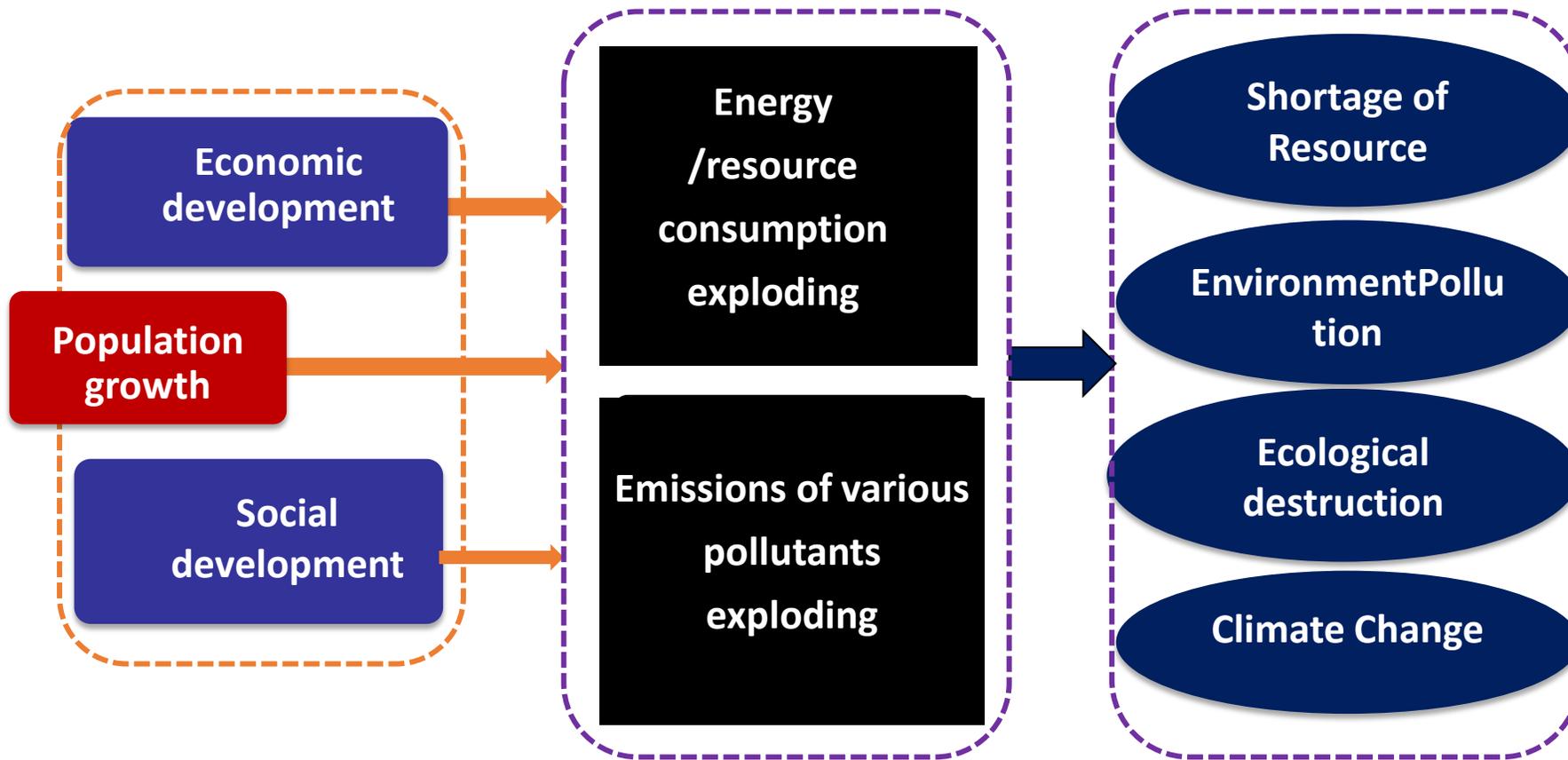
- The 4th industrial revolution with AI, robotics, VR/AR, IoT, Big Data, clean energy and biotechnology etc. as technological breakthroughs. Traditional geotechnical engineering is facing the transformation and development opportunities brought about by the 4th industrial revolution, carrying out multidisciplinary cross-cooperation and innovation, promoting the intelligent construction, service and maintenance of geotechnical engineering, is an important aspect of the quality of geotechnical engineering in the new era.



- Parallel to the 4th industrial revolution, sustainable development is a main demand of humanity and its environment. If we could not put the human development into a sustainable track, any technological development does not make sense.



The current development mode



We can be the **first** generation to succeed in ending poverty; just as we may be the **last** to have a chance of saving the planet.



The world will be a better place in 2030 if we succeed in our objectives.

GLOBAL AGENDA, COMMON GOALS



ENGINEERING IS THE KEY FOR ACHIEVING SDGS

“.....we strive to achieve the 17 Sustainable Development Goals – the world’s blueprint for building a future of peace and prosperity for all on a healthy planet. **Every one of the Goals requires solutions rooted in science, technology and engineering.**”



- How to adapt to the era of industry 4.0 and to be transformed for sustainability, is the dual challenges to engineering education. In line with the UN 2030 agenda of Sustainable Development, the engineering educators should make efforts to transit the current engineering education toward industry 4.0 and sustainability.
- Nowadays, a movement of New Engineering Education is happening in China. A national project - Research and Practice of New Engineering Education - is carried out to explore the new model and good practices of engineering education meeting the dual challenge in every engineering discipline.

1. EMBEDDING SUSTAINABLE DEVELOPMENT AS CORE VALUE OF ENGINEERING

- As required of SDG4, *By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development.*
- Every engineer should understand by education how his/her engineering profession linked with sustainably development issues, such as water, energy, resilient infrastructure, climate change, bio-diversity, as well as equity, inclusiveness, justice and partnership.
- Engineering education should provide relevant knowledge and training to help students to practice sustainability.



2. STRENGTHENING ICT SKILLS OF EVERY ENGINEER

- ICT especially the technology of big data, internet/IoT and AI are the enabling force of the 4th industrial revolution and becoming ever important for all engineering professions.
- Engineers need to be capable to master these emerging technology to improve the quality, efficiency, resiliency and eco-friendship of his/her engineering projects.
- Engineering education should provide sufficient ICT knowledge to student in every engineering discipline.



3. ENHANCING ENGINEERING ETHICS EDUCATION

- Every engineer should understand his/her responsibility to the sustainable development of humanity and the planet, should understand the ethical issues related to his/her professional works, such as integrity, security, privacy, inclusiveness and fairness, so that he/she could **responsible conduct with engineering works**.
- Engineering education should enhance the engineering ethics education, especially with AI, big data, bio- and medical engineering, new materials, etc.





Proposed Principles for Responsible Conduct with Big Data and AI in Engineering

- 1. Good for Humanity and Its Environment**
- 2. Fairness, Inclusiveness and Public Awareness**
- 3. Privacy and Data Integrity**
- 4. Transparency**
- 5. Accountability**
- 6. Peace, Safety and Security**
- 7. Collaboration**



wfeo-ceit@wfeo.org
<http://t.cn/EK7Vvud>

4. EXTENDING THE INTER-X COLLABORATION CAPABILITY

- Sustainable development is **an inter-disciplinary, inter- organization and inter-national** matter in nature, so that an engineer should not only master the knowledge and skills of his/her own profession, but also to be able to cooperate with multi-disciplinary and multi-national teams. Engineering education should reflect this requirements into its curriculum by giving a broader knowledge base and interdisciplinary team training.
- For example, future civil engineer should have fundamental knowledge of material and energy sciences as well as social sciences, master proper skills of ICT, especially IoT, big Data, AI.





WFEO / FMOI

Thanks for your kind attention

***WFEO is keen on working with
all of you together to promote the transition
of engineering education towards the
industry 4.0 and sustainability by establishing
global standards***