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Consulting Engineers South Africa

The Voice of Consulting Engineering

Sustainability is Engineering Business

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Contribution of Engineering to Human Betterment

Over 100 years ago life was a constant struggle against:

- **Disease;**
- **Pollution;**
- **Deforestation;**
- **Treacherous *and unsafe* working conditions; and**
- **Enormous cultural divides unreachable with current communications technologies.**

By the end of the 20th century the situation had turned around and the world had become a healthier, safer, and more productive place to live in, primarily because of engineering achievements.

Some of these achievements are related to infrastructure development and provision and they include:

20th Century Engineering Achievements
Electrification

Generation and the vast distribution network powers the developed world and every pursuit and enterprise in modern society

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20th Century Engineering Achievements
Safe Water

- **The availability of safe water in developed countries changed the way people lived and died during the past century**
- **In the early 1900s waterborne diseases like typhoid fever and cholera killed tens of thousand of people annually**
- **By the 1940s water treatment and distribution systems had almost totally eliminated these diseases in developed nations**
- **The distribution systems also brought water to vast tract of land that would otherwise have been uninhabitable**

20th Century Engineering Achievements
Freeways / Road Infrastructure

Connects regions, allowing goods distribution and personal access

20th Century Engineering Achievements Others

- **Nuclear Technologies**
  - A new source of electric power was gained from splitting an atom
- **High Performance Materials**
  - ✓ Development of higher quality, lighter, stronger and more adaptable such as:
  - ✓ Steel alloys
  - ✓ Synthetic fibres
  - ✓ Polymers
  - ✓ Composites and ceramics
- **In 2000 the National Academy of Engineering (USA) published a list of the top 20 engineering achievements they considered to have had the greatest impact on quality of life on the 20th century.**

20th Century Engineering Achievements
Top 20 engineering achievements

1. Electrification	11. Highways / Road Infrastructure
2. Automobile	12. Space Exploration
3. Airplane	13. Internet
4. Safe and Abundant Water	14. Imaging Technologies
5. Electronics	15. Household Appliances
6. Radio and Television	16. Health Technologies
7. Agricultural Mechanization	17. Petroleum and Gas Technologies
8. Computers	18. Laser and Fiber Optics
9. Telephone	19. Nuclear Technologies
10. Air Conditioning and Refrigeration	20. High Performance Materials

20th Century Engineering Achievements Challenges

While bringing benefits to the human population and improving their quality of life, engineering activity has also had adverse and / or unintended consequences associated with:

- **Increased population**
- **Urbanisation**
- **Severe climate risk**
- **Depleting natural resources & damaged ecosystem**

Challenge 1 - Increased Population

As a result of these engineering achievements, the quality of life improved with the resultant:

- **Increased life expectancy; and**
- **Increased world population**

This population growth created far-reaching consumption of and unprecedented demands for energy, food, land, water, transportation, materials, waste disposal, earth moving, health care, environmental clean-up, telecommunication and infrastructure.

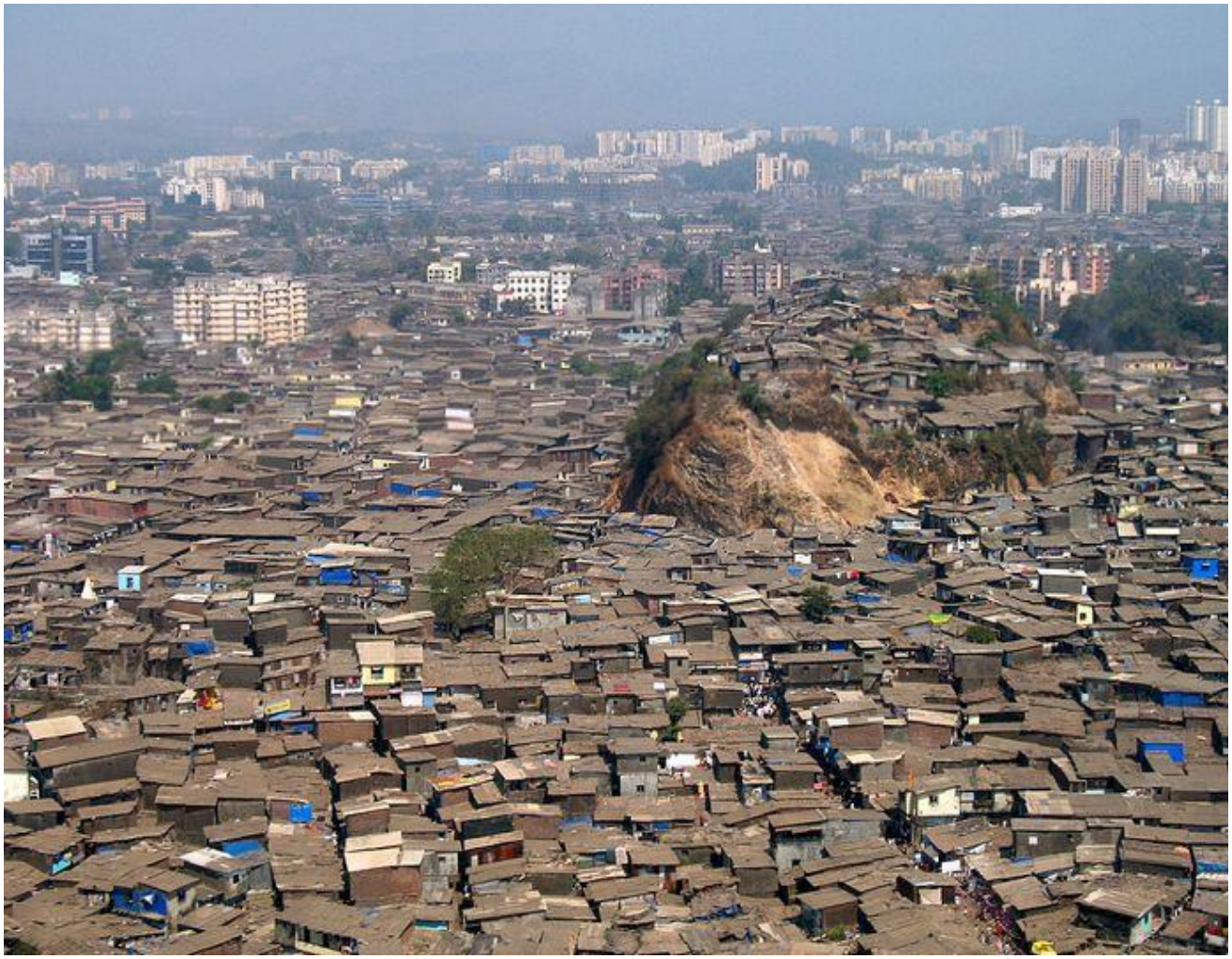
Challenge 2 – Urbanisation

Owing to urbanisation most of the world population resides in urban areas, in and around cities. It is estimated that:

- **Over half of the world population lives in cities covering 2% of the earth's land area.**
- **The 2011 Census Statistics confirmed that the percentage of SA population living in urban areas is 68% and likely to increase to over 70% by 2030.**
- **Many of the urban population:**
  - ✓ **Is poor and live in poverty,**
  - ✓ **Is unemployed. The current unemployment rate in SA is estimated at 25.6% & more than 50% of which is youth,**
  - **Is without decent shelter, and**
  - **Has no access to basic services.**

Service delivery protests – a regular occurrence in our cities

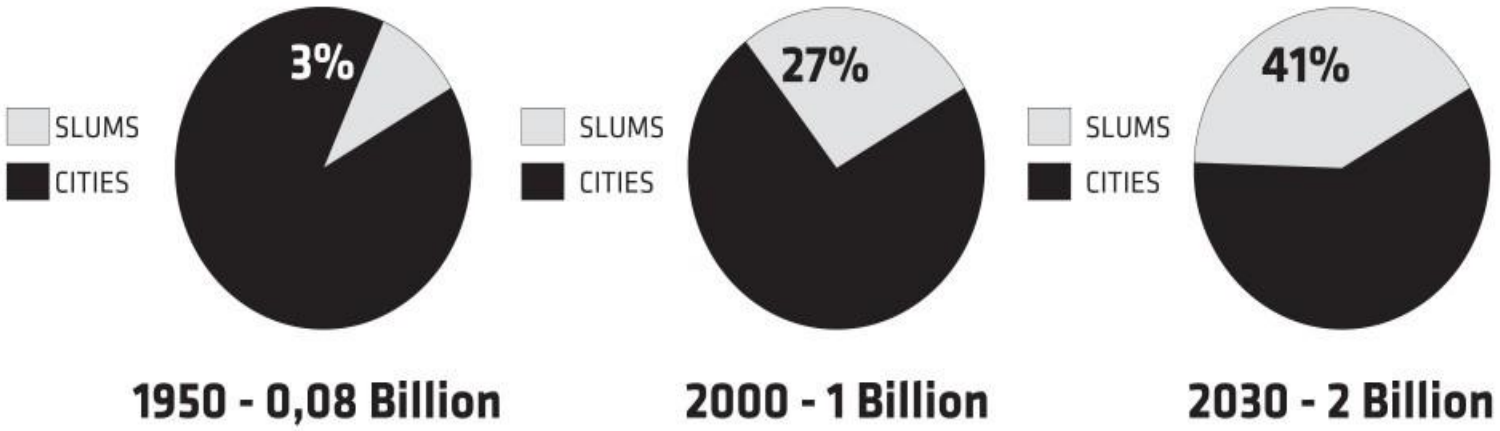
Living conditions of the poorest of the poor in urban areas – outside the city



Deteriorating living conditions in the city

Threatening slums growth

Proportion of the population living in slums on the total urban population



Challenge 2 – Urbanisation (cont.)

Urban areas present a different challenge and therefore deserve special attention which must take into account that:

- **SA cities are financially squeezed and are unable to meet the increasing demands such as housing and transport. Alternative funding solutions might include:**
  - ✓ **Raising special taxes from residents and / or**
  - ✓ **Higher allocations from the fiscus fund**
- **Spatial layout are inefficient**
- **Many SA cities:**
  - ✓ **have high infrastructure backlog**
  - ✓ **Lack requisite engineering and technical skills**
  - ✓ **Poor financial management**
  - ✓ **Corporate governance**
  - ✓ **Have inequitable infrastructure provision**

Challenge 3 – Severe climate risk

- Climate risk is considered the greatest challenge ever facing mankind.
- It is estimated that the urban population:
  - ✓ Use 75% of all energy generated in the world, and
  - ✓ Emit 80% of all carbon dioxide – the main cause of global warming.
- This further stresses the importance of giving cities special attention

Challenge 4 – Depleting Natural Resources & Damaging Ecosystem

Along with bringing benefits to the human population and improving their quality of life, engineering activity has also had adverse consequences on natural resources and ecosystem such as:

- **Degraded land and soil**
- **Declining biodiversity**
- **Depleting natural resources**
- **Polluted air and water**
- **Disasters and accidents**

This is the context within which engineering is carried out in the 21st century

- Increased population and severe inequity
- Urbanisation with associated slums / informal settlements
- Severe climate risk
- Depleting natural resources & damaged ecosystem

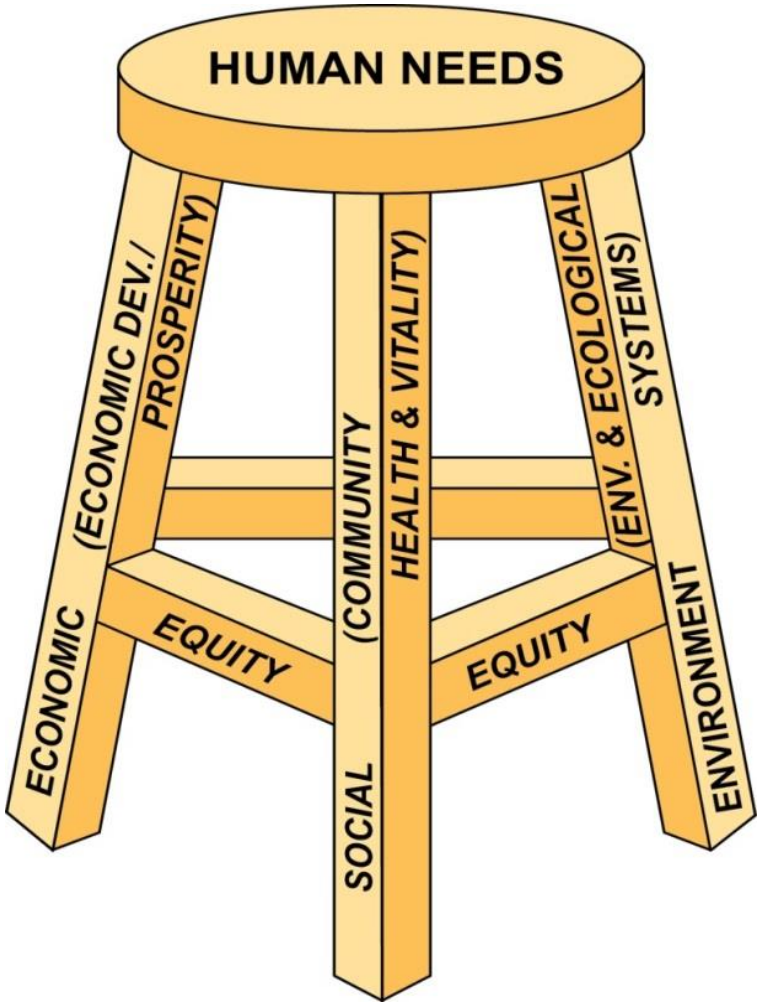
Is there hope?

- The question now arises whether it is possible to satisfy the **socio-economic needs** of the population that is growing **exponentially** while preserving the carrying capacity of the earth's ecosystems and biological and cultural diversity.

- A related question is what should be done now and in the near future to ensure that the **basic needs** of water, sanitation, nutrition, health, safety and meaningful work are fulfilled for **ALL** humans (**especially in cities**) - **Millennium Development Goals**.

- Sustainability and sustainable development is our hope

The solution – sustainability



Defining Sustainability

The American Society of Civil Engineers (ASCE) defines *sustainability* as:

"A set of economic, environmental and social conditions in which ALL of society has the capacity and opportunity to maintain and improve its quality of life indefinitely, without degrading the quantity, quality or the availability of natural resources and ecosystems"

Sustainability therefore:

- **Is not focussed on the environment but is a process by which individuals or organisations seek to integrate and produce balance among competing objectives in economic, environmental and social factors for the survival and well-being of mankind.**
- **It affects all people, rich and poor alike, developed and developing countries alike.**

Defining Sustainable Development

The American Society of Civil Engineers (ASCE) defines Sustainable development as:

"The process of converting natural resources into products and services that are more profitable, productive, and useful, while maintaining or enhancing the quantity, quality, availability and productivity of the remaining natural resource base and the ecological systems on which they depend"

Why is sustainability necessary?

- Engineers have leadership role in sustainable development, and their responsibility to provide effective and innovative solutions in addressing the challenges of sustainability.
- The ECSA Code of Ethics (clause 3(4)) compels registered persons (engineers and engineering technologists) to at all times:
  - ✓ have due regard for, and in their work avoid, adverse impact on the environment; and
  - ✓ adhere to generally accepted principles of sustainable development.
- The mooted multi billion rand government spend on infrastructure provide a platform for the engineering profession to fulfil this leadership role and contribute in changing the engineering landscape of the 21st century.

Why is sustainability necessary (cont.)?

- Natural resources are depleted at an alarmingly rapid rate. This will impact:
  - ✓ on the available capacity of resources,
  - ✓ the way people use and depend on natural resources and ultimately, and
  - ✓ the cost of either using or developing infrastructure dependent on these resources
- ***Improved risk management:***
  - ✓ Understanding sustainability issues will lead to a better understanding of project risk.
  - ✓ Planning effectively for sustainability allows for risks to be identified and addressed at an early stage.
- Shareholders and clients expect companies to responsibly manage the triple bottom line.
- Sustainability can drive innovation and entry into new market segments and sustainable practices can impact on overhead costs as it implies a more responsible resource use pattern.

Why is sustainability necessary (cont.)?

- According to Lee Scott, Wal-Mart CEO "Sustainability is the single biggest business opportunity of the 21st century...it will be the next main source of competitive advantage." (Trialogue Publications, July 2009).
- The construction value chain provides an opportunity for sustainable development principles to be applied from:
  - ✓ the extraction and beneficiation of raw materials,
  - ✓ through the planning, design and construction of buildings and infrastructure,
  - ✓ until their final deconstruction and management of the resultant waste.
- A number of skills and knowledge sets within the engineering sector already align to sustainability principles. The case should now be made to expand on these skills by ensuring a holistic approach to all projects.
- Embedding sustainability initiatives could greatly enhance a company's reputation and foster trust.

Sustainability Initiatives

FIDIC Initiatives:

- **Project Sustainability Management Guidelines (PSM I) – Published in 2004 to provide the consulting engineering industry with an approach in developing project specific indicators**
- **Policy statement on climate change – Issued in March 2012**
- **Report on sustainable infrastructure with a focus on decision making (including a overview of existing sustainability tools for infrastructure) – Published on September 2012**
- **Sustainability Pack comprising:**
  - ✓ **Rethink Cities – a white paper on societal challenges**
  - ✓ **PSL@2013 – a tool to support owners and their partners with collaborative work on sustainability**
  - ✓ **PSM II – guidelines for consulting engineers implementing major sustainability issues in projects**

Sustainability Initiatives

CESA run initiatives:

- **CESA Policy Framework on Sustainable Development (2010)**
- **Guideline Document for CESA Sustainability and CESA Sustainability Reporting Process (Nov 2013)**
- **CESA runs a course through the SCE**

Other local initiatives:

- **Green Building Council …**
- **Green Roads SA ….**
- **Green Infrastructure ….**
- **ECSA/CESA/universities collaboration ….**
- **Green Economy Accord**

What does this mean for you and me?

- The 21st century engineer must be able to apply scientific analysis and holistic synthesis to develop sustainable solutions that take into cognisance **and integrate social, environmental, cultural and economic systems.** This calls for a change in engineering culture and mind-set which require:
  - ✓ a major paradigm shift from control of to participation with nature;
  - ✓ an awareness of ecosystems, ecosystems services, and the preservation and restoration of natural capital; and
  - ✓ a new mind-set of the mutual enhancement of nature and humans that embraces the **principle of sustainable development, renewable resources management, appropriate technology, natural capitalism, and system thinking**
- Sustainable development will be impossible without the full input by the engineering profession.

You have the whole world in your hands

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