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Foresight: Using the Future for Strategic Decision-Making in Research and Practice

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Predictability of Total Solar Eclipses in Beijing

High

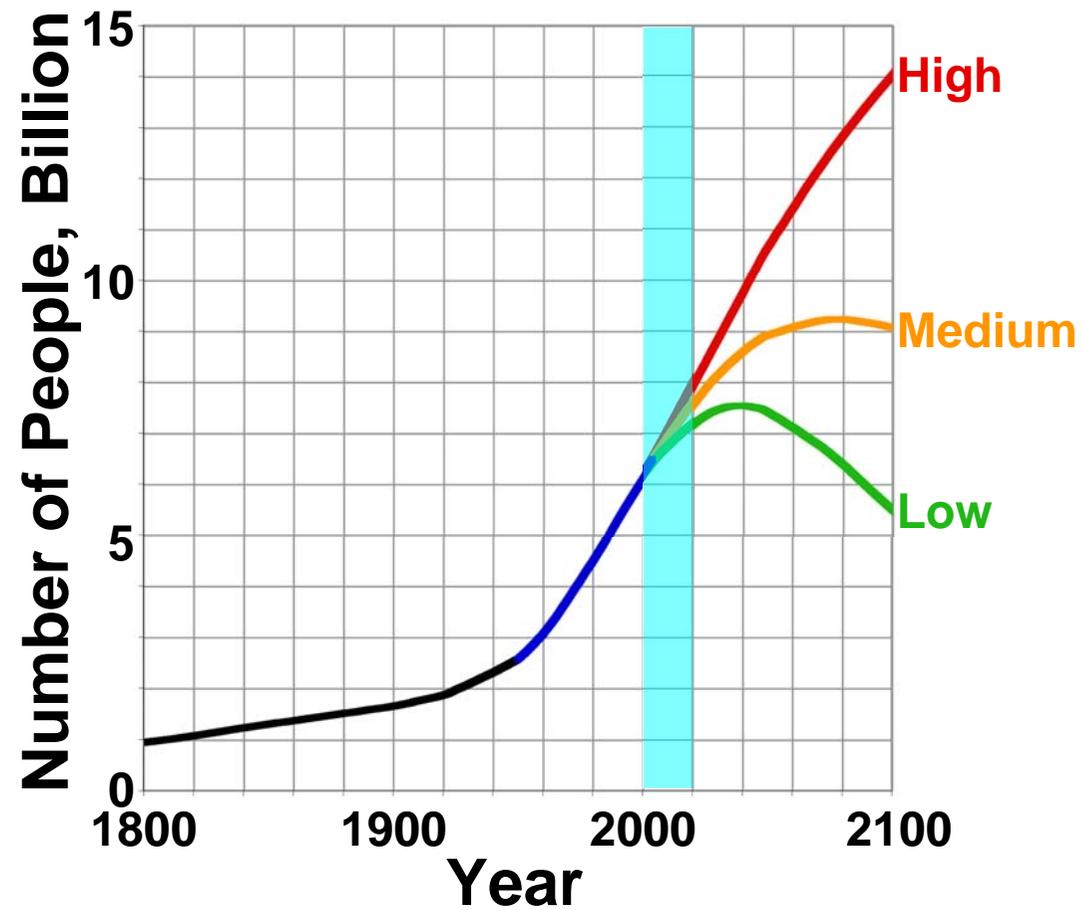


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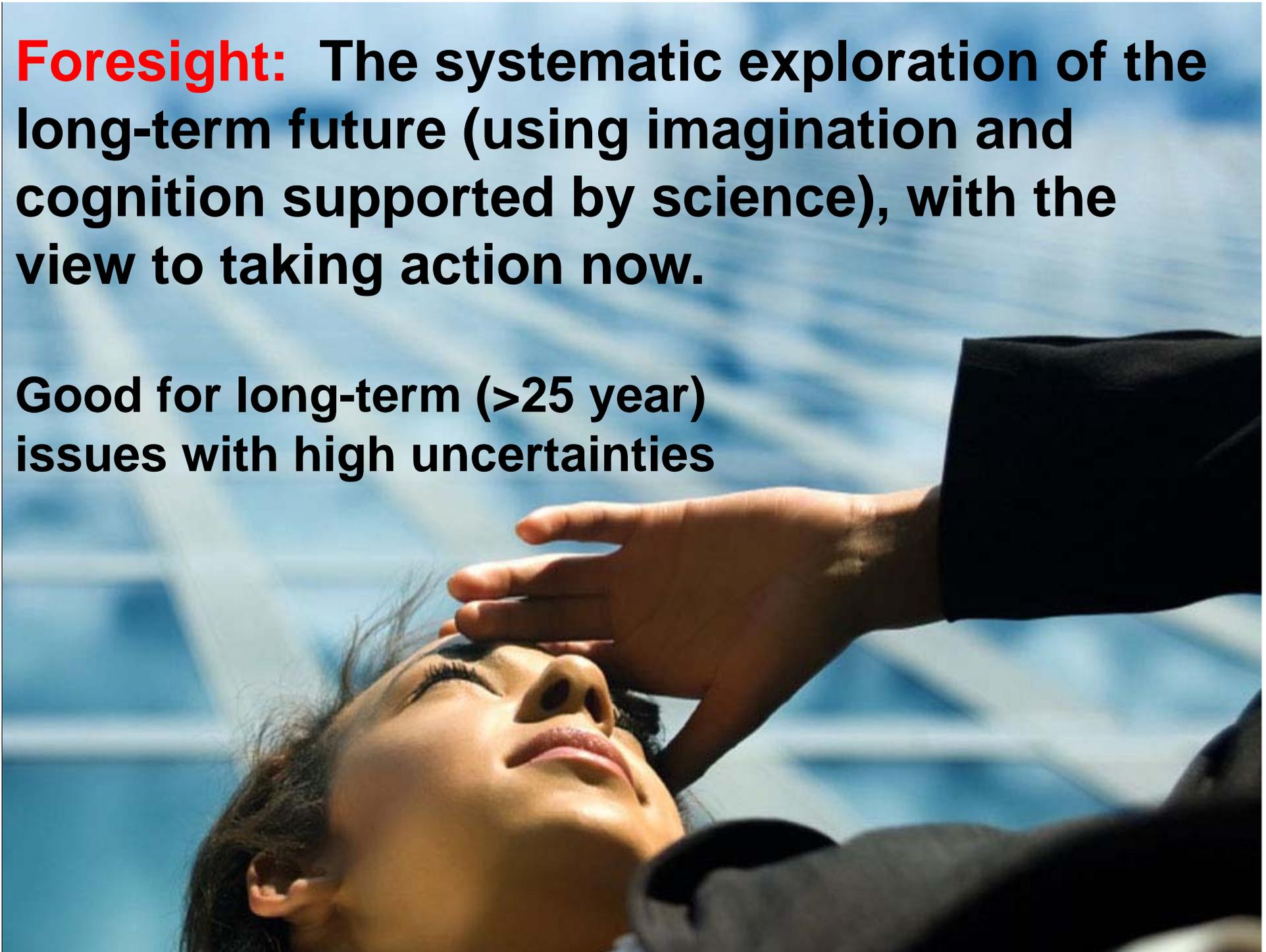
Predictability of World Population

Low



Foresight: The systematic exploration of the long-term future (using imagination and cognition supported by science), with the view to taking action now.

Good for long-term (>25 year) issues with high uncertainties

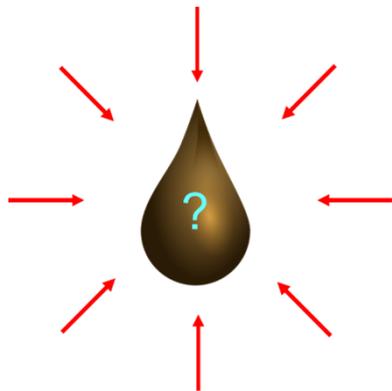


Scenario Creation Foresight Method: Principal Phases

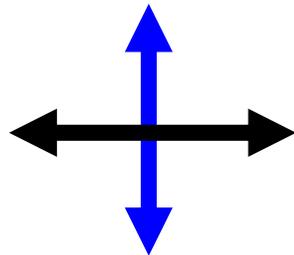
1. Define the 'focal question' and relevant timeframe **>20 years**

2. Review current knowledge, including relevant past events

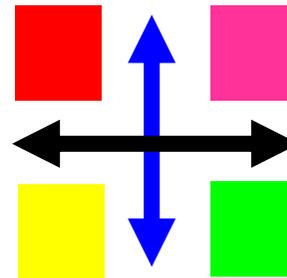
3. Identify
Forces &
Factors



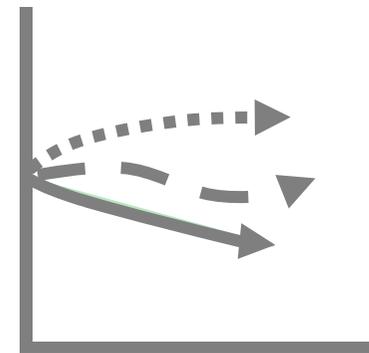
4. Identify
Critical
Uncertainties



5. Develop
Scenarios and
Characteristics



6. Determine
Strategies



Example #1: Oil and Gas

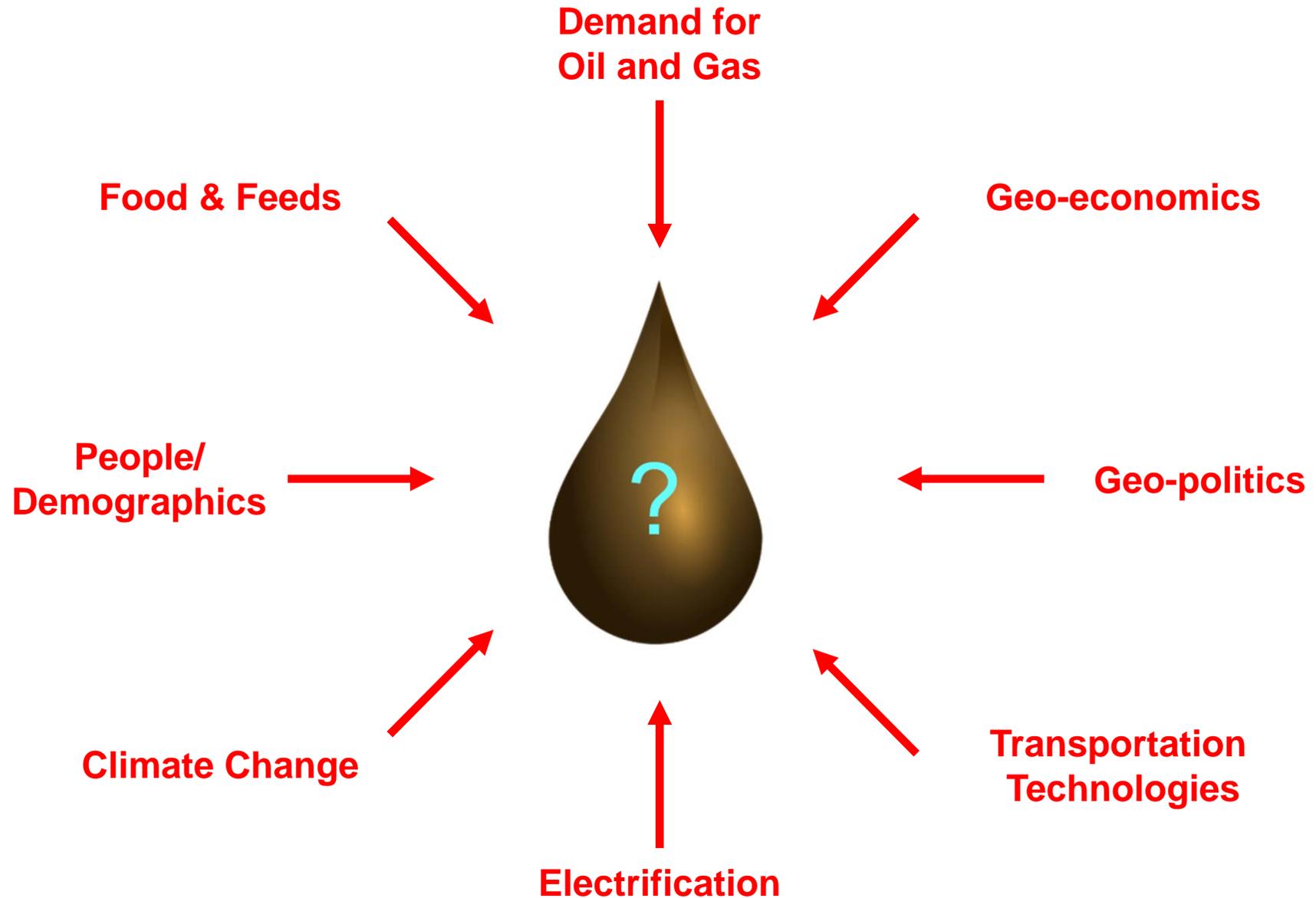


Focal Question

What is required to ensure that oil and gas are put to sustainable use in the long-term?



Forces & Factors

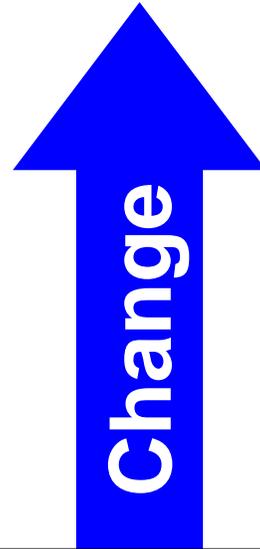


Critical Uncertainties



Critical Uncertainties

Rapid



Change

Dys-
functional



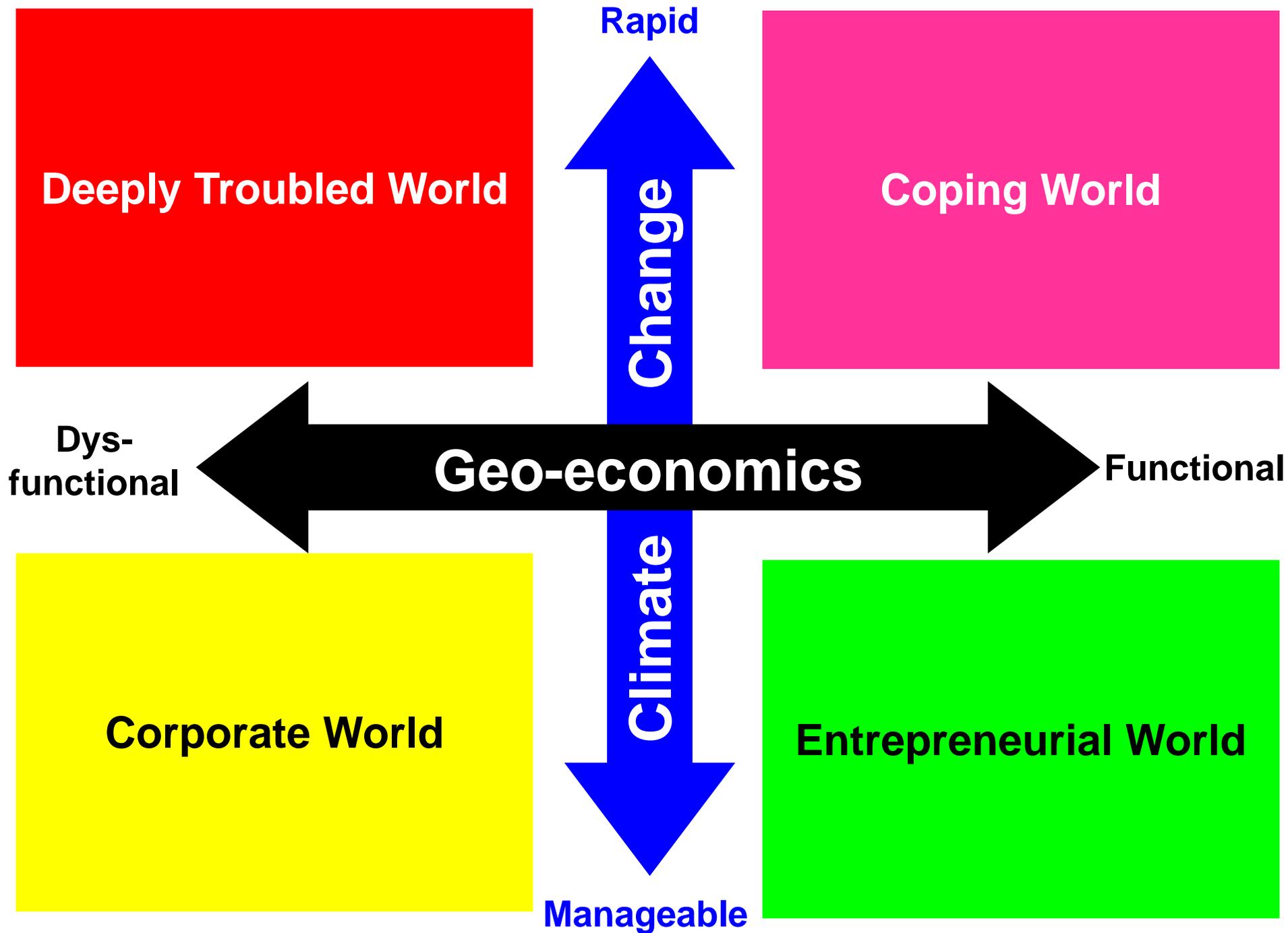
Geo-economics

Functional



Climate

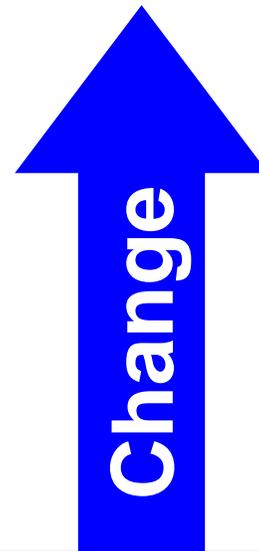
Manageable



Deeply Troubled World

- Governments and industry are weakened by fiscal constraints imposed by geo-economic failures
- Oil & gas development stalls as climate change worsens
- Oil & gas use, investments and research decline

Rapid



Coping World

- Climate change is a major economic and political driver
- Investments focus on climate change mitigation and adaptation
- Migration occurs to cooler northern latitudes
- Technical and research investments grow

Dys-
functional

Geo-economics

Functional

Corporate World

- Large, multinational corporations become most powerful
- Focus is on monetary returns and efficiencies
- Research and education are the purview of large corporations

Climate

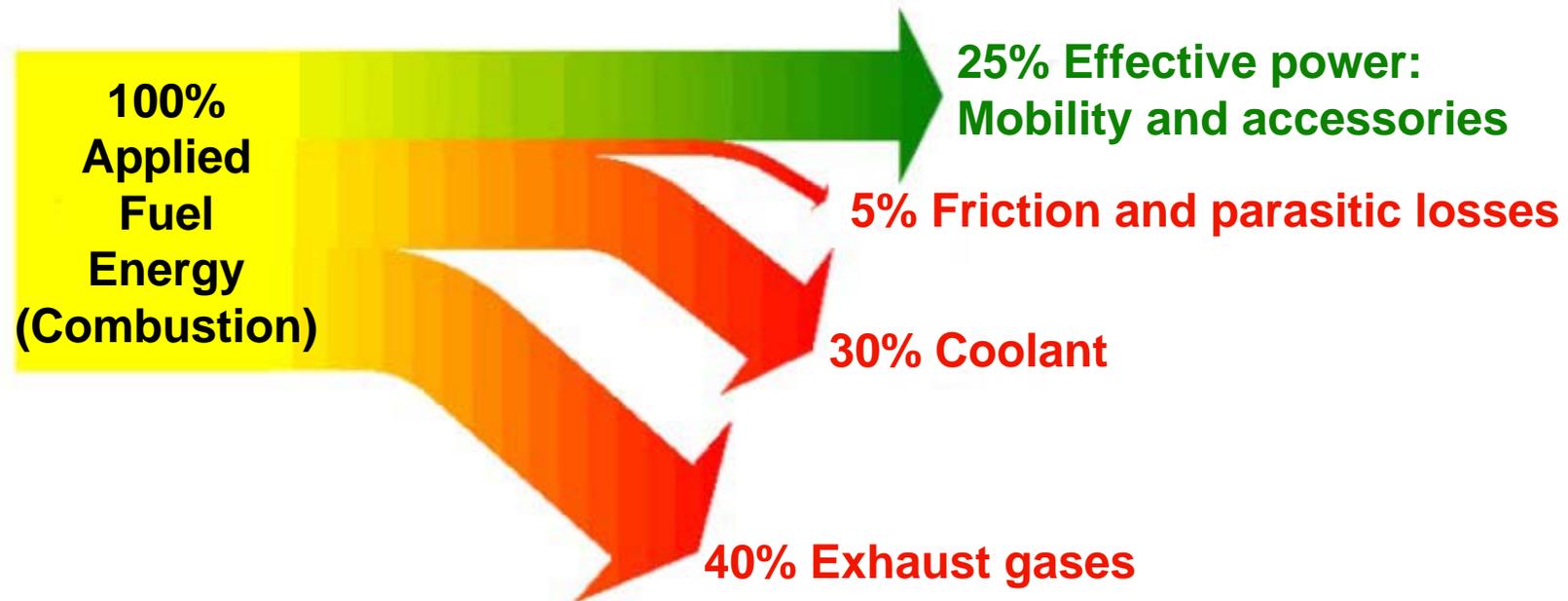


Manageable

Entrepreneurial World

- Oil & gas R&D and innovation are strong
- Oil & gas demand and prices are stable
- Oil & gas are primarily used as a source of materials
- Electricity is the dominant form of energy

Strategies for Oil & Gas: Strengthen research and innovation



**Typical energy split in gasoline internal
combustion engines**

Strategies for Oil & Gas: Diversify into materials



Carbon fibres



**Biodegradable
plastics**

Strategies for Oil & Gas: Focus on electricity



Solar cells



Redox flow cells

Strategies for Oil & Gas: Rethink unit operations



Electric steam generator

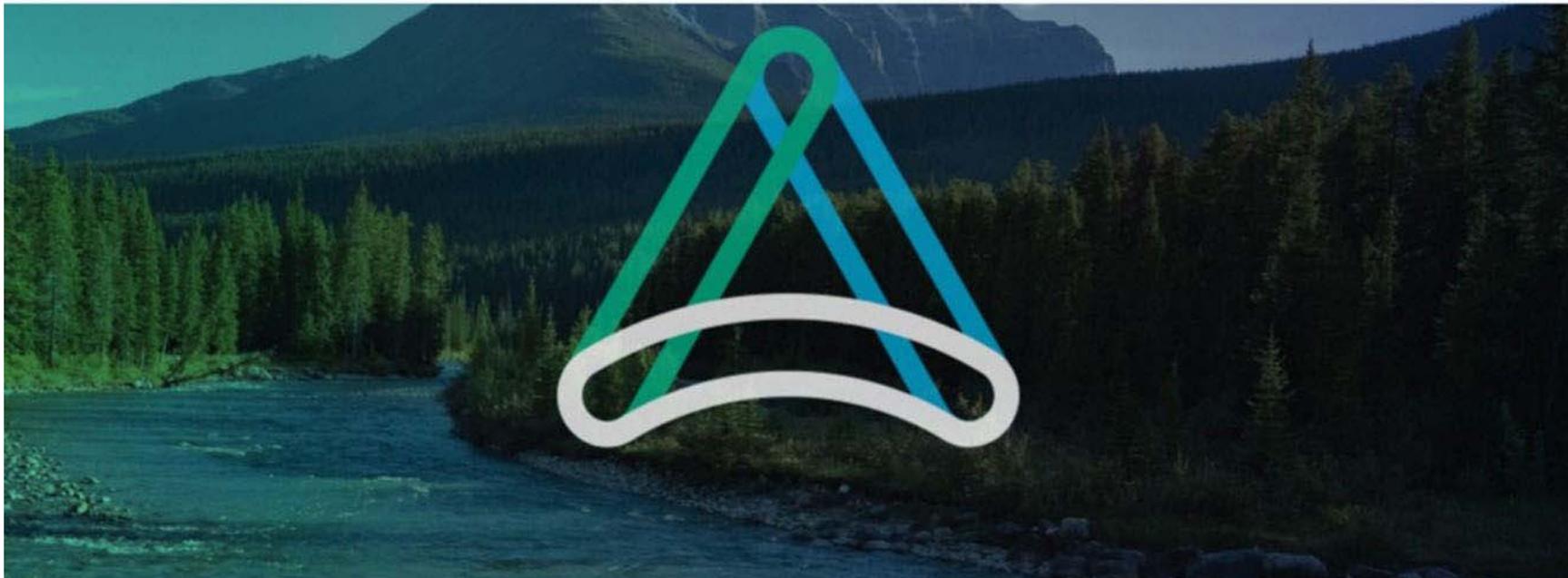


High-temperature electrolytic cells



Plasma reactor

Strategies for Oil & Gas: Create new funding programs



**Key Insights for Alternative Oil Sands Uses
in Tandem with \$2M Research Call
(April 2018)**

Example #2: Digital Learning

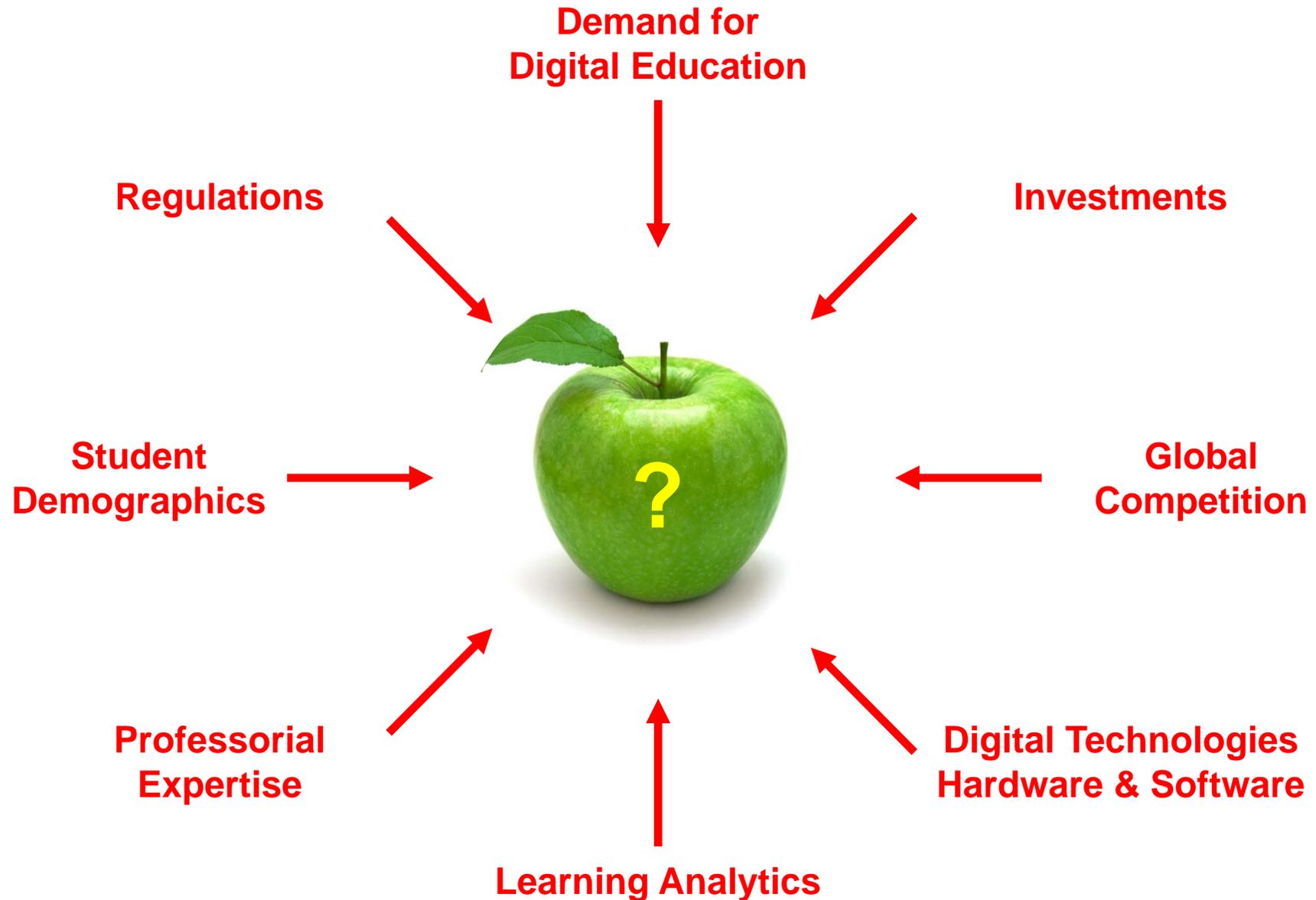


Focal Question

What is required of digital learning to benefit engineering practice and society by 2040?



Digital Learning: Forces & Factors



Ignorant World

- Minimal digital education
- High inequities in digital education infrastructure
- Students & professors lacking strong digital learning expertise
- Regulations largely absent and incoherent
- Digital learning is poor business

Debili-
tating

Competition

Insular World

- Fragmented digital education
- Digital education infrastructure varies by country / region
- Students & professors possess strong digital learning expertise
- Divisive, protective regulations
- Digital learning is good business in some countries / regions

Low

Investments

High

Donor-driven World

- Philanthropy shapes most digital learning education
- Students & professors with very variable digital learning expertise
- Regulations transplanted from donor entities
- Digital learning is marginal business

Global

Constructive

Learning World

- Globally coherent digital education
- Strong digital education infrastructure
- Students & professors possess strong digital learning expertise
- Supportive regulations
- Digital learning is good business

Strategies for Digital Learning: Increase reliability and reduce cost



Strategies for Digital Learning: Increase understanding of learners



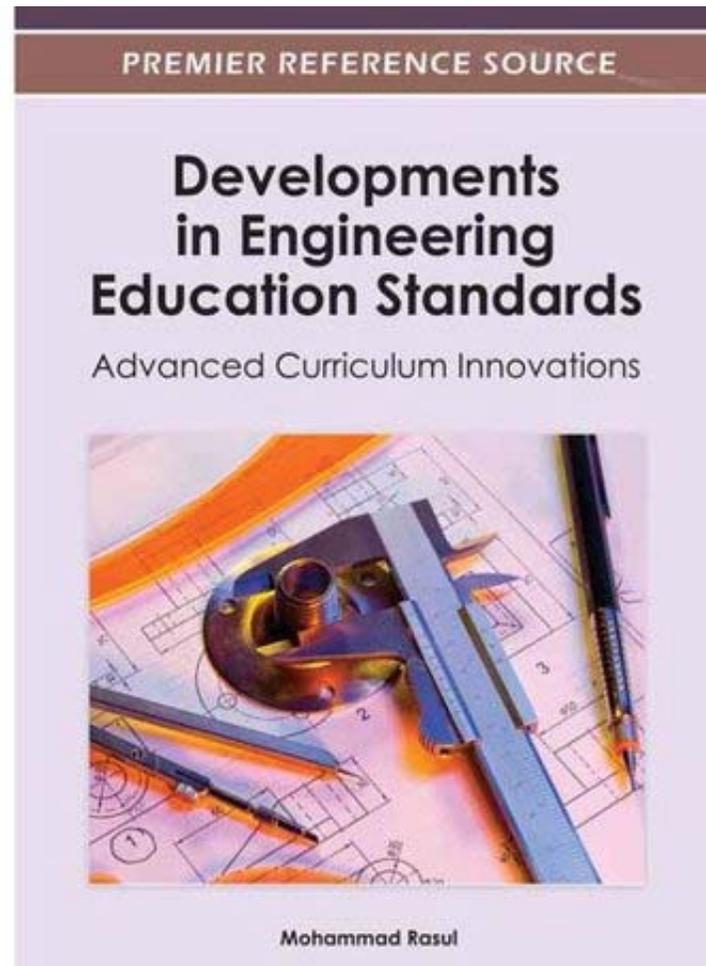
Strategies for Digital Learning: Create experiential materials



Strategies for Digital Learning: Extend professorial expertise



Strategies for Digital Learning: Create digital learning standards



Conclusions and Implications

- 1. Foresight (the exploration of the distant future) provides a useful basis for strategic plans and actions**
- 2. The oil and gas industry will increasingly become a materials industry, with electricity being the key energy source**
- 3. Digital learning has great promise if experiential learning materials can be created**
- 4. Foresight work is well-suited for international collaboration and action**

Acknowledgement

Some images in this presentation were taken from publicly available websites, with their use being gratefully acknowledged and restricted to this presentation

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