Building Engineering Capacity and Capability for the Evolving Technological Era

Developed and Presented by

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Lao Tzu

“When I let go of what I am, I become what I might be.”

Introduction: Understanding the Flow

1. The role of Engineering in Socio-Economic Transformation
2. Technological Development and Trends impacting human work
3. Building Engineering Capacity and Capability
4. Transforming Engineering Capacity into Products and Services with Impact
5. Balance in Society, Unity, Partnerships and Integration

Capacity Building

- Human Capacity Building
- Infrastructure Capacity Building

Engineering Capacity Building

- There is a strong relationship between a critical mass of educated and skilled engineering and science graduates and economic and social development
- Engineering provides solutions to several of the UN Sustainable Development Goals

Engineering Capacity Building

Investigate and Create Solutions
“Keeping us busy”

- State of Educational Institutions
- Industry University Integration
- Regulatory Institutions for Learning
- Critical Mass and Throughput
- Gap between Higher and Primary Education
- Gap between Higher Education and Industry
- Surplus / Shortage in Specialisation areas
- The need for mobility agreements

The Constraints / Issues

- No. of Graduates in Engineering
  - Several Countries have a low number of Graduates
  - Sub-Saharan Africa (1 Engineer to 6000 persons vs countries that have 1 Engineer to 200 – 800 persons)
  - Some Countries have Surplus / and deficiencies in certain area of Specialisation
- Recognition of Professional Standards and Educational Standards - Inconsistent Quality Standards of Graduates Around the World
- And hence the Lack of Acceptance for Mobility
- Lack of Regulatory Intuitional Capacity to Regulate the Engineering Profession

“

“Nature does not hurry, yet everything is accomplished” – **Lao Tzu**

Let us not hurry only to solve our current context, but create the foundations for systematic evolution to solve both the current and prepare the foundations for the future.

Policy

- Every Nation or Country plans for what it believes is in the best interest of its developmental context, and its national positioning in the world, for national economic growth
  - Mainly based on the positioning of its human capital and natural resources
- Is this the best way to plan for Human Capacity
  - Eg. Smaller Countries Vs Larger Countries (population) – Can we afford to build human capacity in all areas of specialization
  - Solution is to development capacity utilising the network of specialization capacity building model, combined with the centres of excellence model
  - The need for partnerships
- Human Capacity Building has to be linked to the strategy and plans of a nation and policy makers. Is there a world strategy accepted and supported by all nations – The UN Sustainable Development Goals?

The Changing Context (Technology Revolution)

- Timing
  - Do we really know what we need now?
    - Where do we get this information from?
    - How do we get to ask the right questions to attain this?
  - Do we know what we need in the future?
- Building Human Capacity takes time and we need to pace what we need to address in the short, medium, and long term

Changing Context

- Technology Explosion
- Interconnected World
- New Reality
- New Opportunities
- Required Competencies
- How do we prepare for this

Effects of the 4th Industrial Revolution

It will and has already started to affect:

- Business
- Societies
- Governments
- Professions (including Engineering)

NEW TECH DESTROYS JOBS

Whilst changing the nature of work and employment

Lost in my lifetime:

Typists
Dockers
Milkman
Blacksmith
Secretaries
Drawing office
Xerox operator
Elevator operator
Computer operator
Telephone operator
Comptometer operator
Financial report writers
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Lost in your lifetime:

Testers
Tasters
Analysts
Advisors
Educators
Reporters
Strategists
Call centres
Report writers
Personal bankers
Personal assistants
Answering services
Investment bankers
Warehouse People
Personal Assistant
Tech support
Stock Trader
Receptionist
Forecasters
Train driver
Researcher
Journalist
Drivers
Pilots
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TECH CREATES/ENHANCES JOBS

Whilst changing the nature of life, work & employment

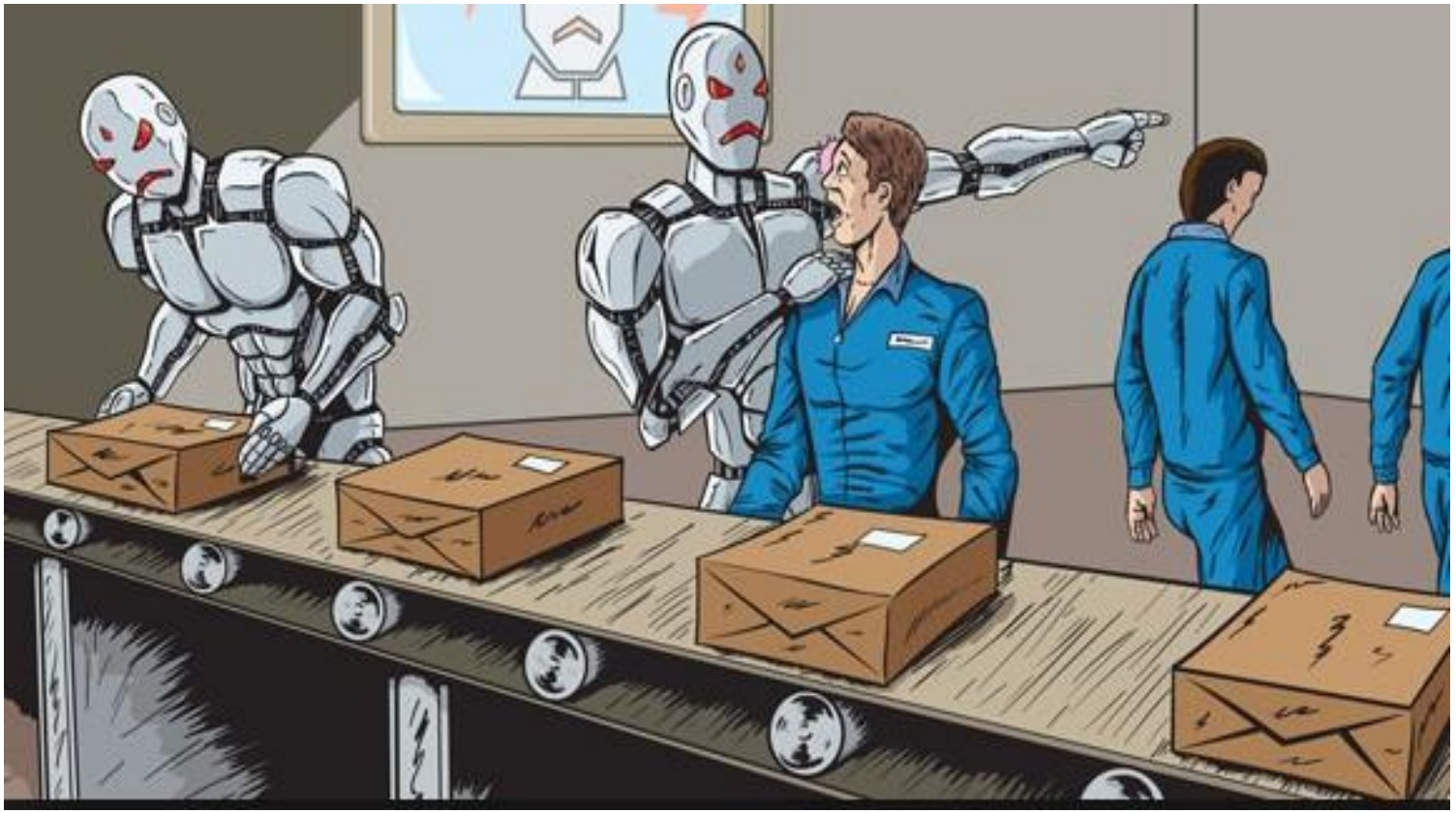
Jobs to come:

Material Programmer
Recycling Designers
Interface Designers
Machine Mediators
Wisdom Archivists
Genome Designer
Material Designer
Wisdom Monitors
Trouble Shooters
Nano-Engineers
Bio-Engineers
3/4D Designer
Risk Profilers
Cyborg Engineer
Protein Designer
Crime Predictor
Digital Historian
Information Caretaker
Truth Engine Mediator
Component Repurposer
Genome-Protein Activators

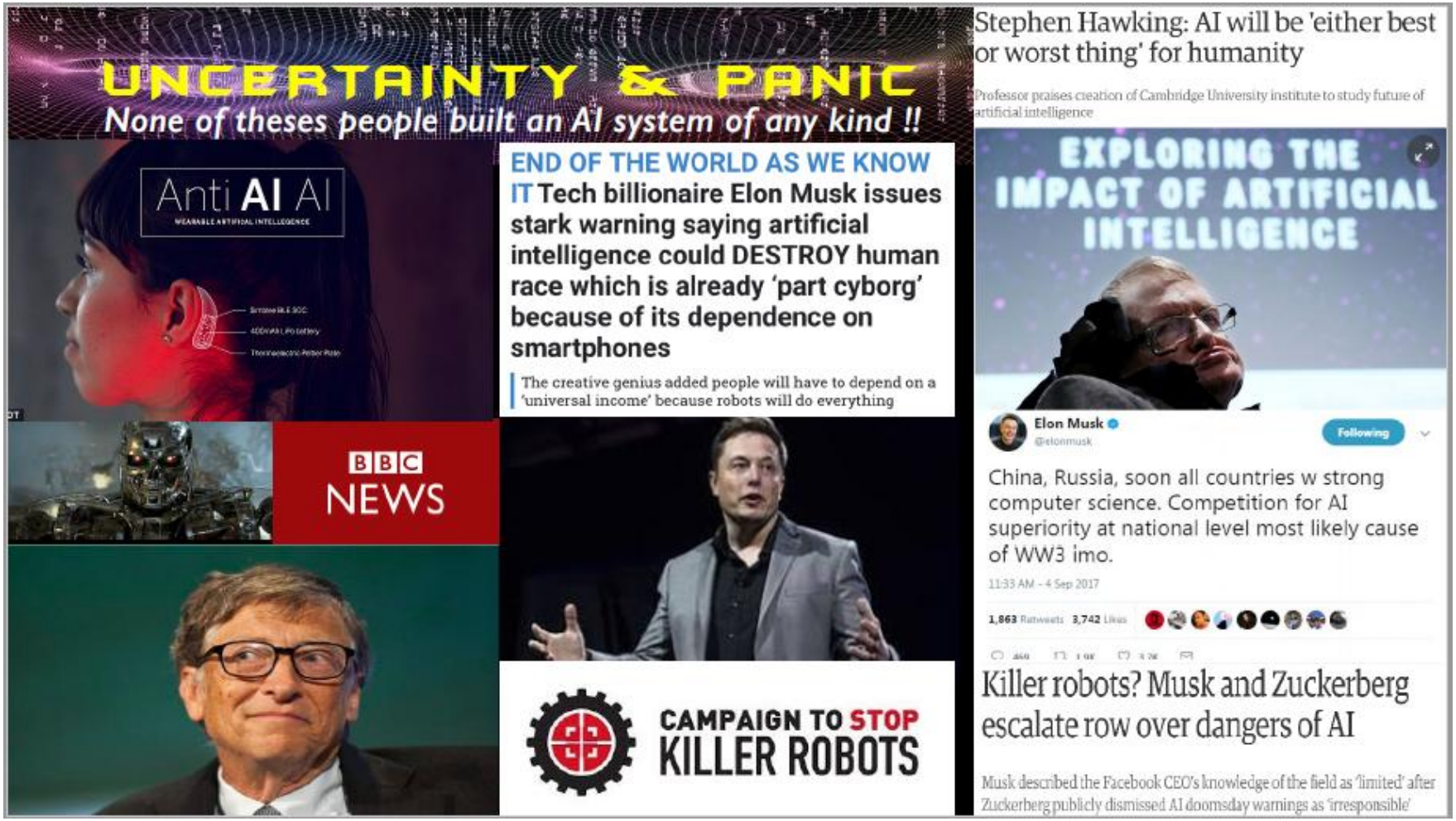
Jobs to Be enhanced:

Fabricator
Geneticist
Generalist
Proteomist
Multi-designer
Problem solver
Longevity advisor
Big Data Analyst
Cellular programmer
Material programmer
Complexity analysts
Security Experts
Entrepreneurs
Technologists
Consultants
Architects
Detectives
Designers
Engineers
Modellers
Scientists
Medics

Finding a new place for Humans:



Doom or Opportunity



Capacity Building Disrupters

- Human Positioning with Technology
  - What we do? – New Skills
  - How we do things? New competencies
- What competencies do we develop?
- How we develop these competencies?
- How do we prepare for this development?

Capacity Building: Pipelining

- Education pipelining requires planning, as Engineering capability takes time to develop

- Looking beyond the current competencies

Emerging Skills/Competence Areas

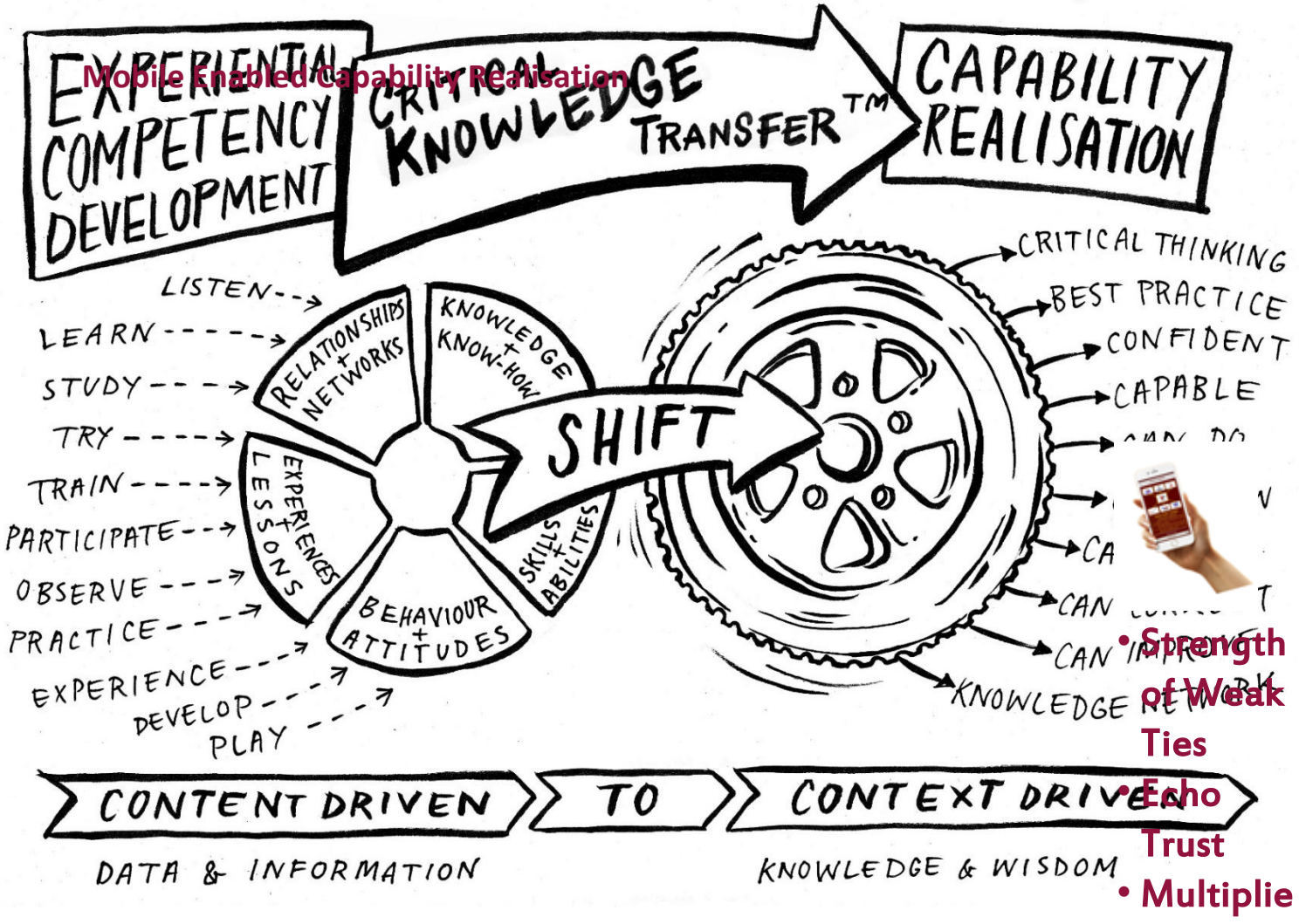
- Design / Engineering Thinking (across professions)
- Interpretation / Reflection
- Problem Identification Solution Creation
- Systems Thinking
- Intercultural Competence
- Creativity, Innovation, Design and Entrepreneurship
- Ethics and Responsibility
- Resourcing, and Aligned Networking

Understanding Complexity and Value, Leverage Diversity

Education of the Present/Future

- Accessible, Flexible, Innovative, Focused
- Broad base, modular focused delivery
- From programmes to competencies

Mobile Enabled Capability Realisation



- Strength of Weak Ties
- Echo
- Trust
- Multiplier Effect

Socio-Economic Development : The Role of Academia

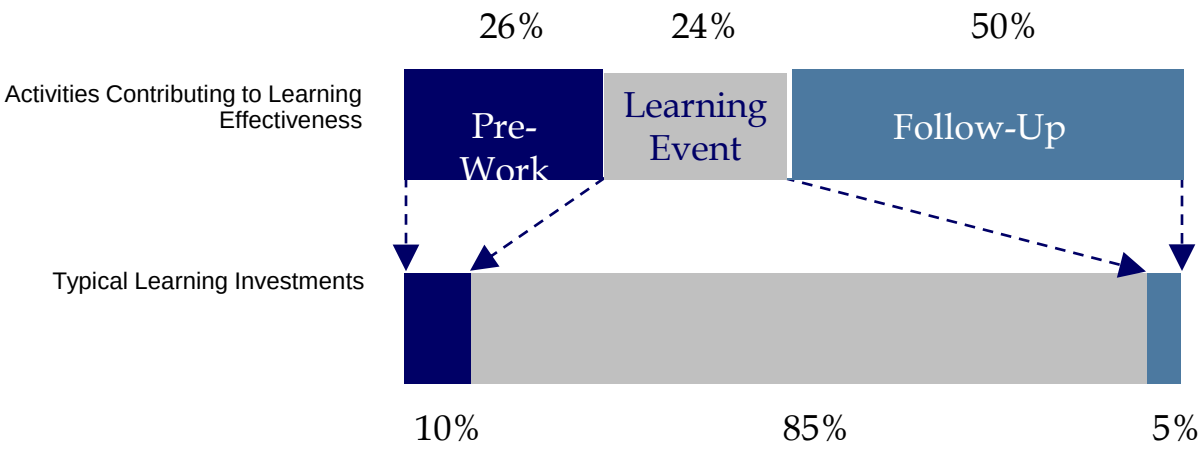
Prepare People for Job Employment

Vs

People for Job Creation with Value

Competencies to increase Employability

The Demonstration of Value



[1] Dr. Brent Peterson, CEO of Apollo Consulting Group

Improving on Learning Effectiveness and Costs through Technology

- Simulators (improves pre- and post learning)
- Mobile Laboratories

Successful Programmes (Content to Context) – Context on Demand

- Professional Development Programme (Structured with Flexibility)
- Mentorship
- Coaching
- Peer Support
- Aligned Assessments
- Support Systems
- Experience on Demand (Context): Mobile Technologies
- Experiential Wisdom

New Technologies create new Learning Opportunities and Threats

- Lower Cost to the student, the institution and the economy
- Ability to Scale
- Increase use of mobile laboratories and simulators

Engineering Practitioners requiring contextual and skills across Disciplines

1. Eg. MBA
2. Financial
3. Management / Leadership
4. Project Management
5. Systems Thinking

Other Professions requiring Engineering Context and Skills

1. Engineering Capability for the Engineering Profession
2. Engineering Capability beyond the Engineering Profession
3. Engineering Capability for the Society

The Engineering Profession needs to play a role

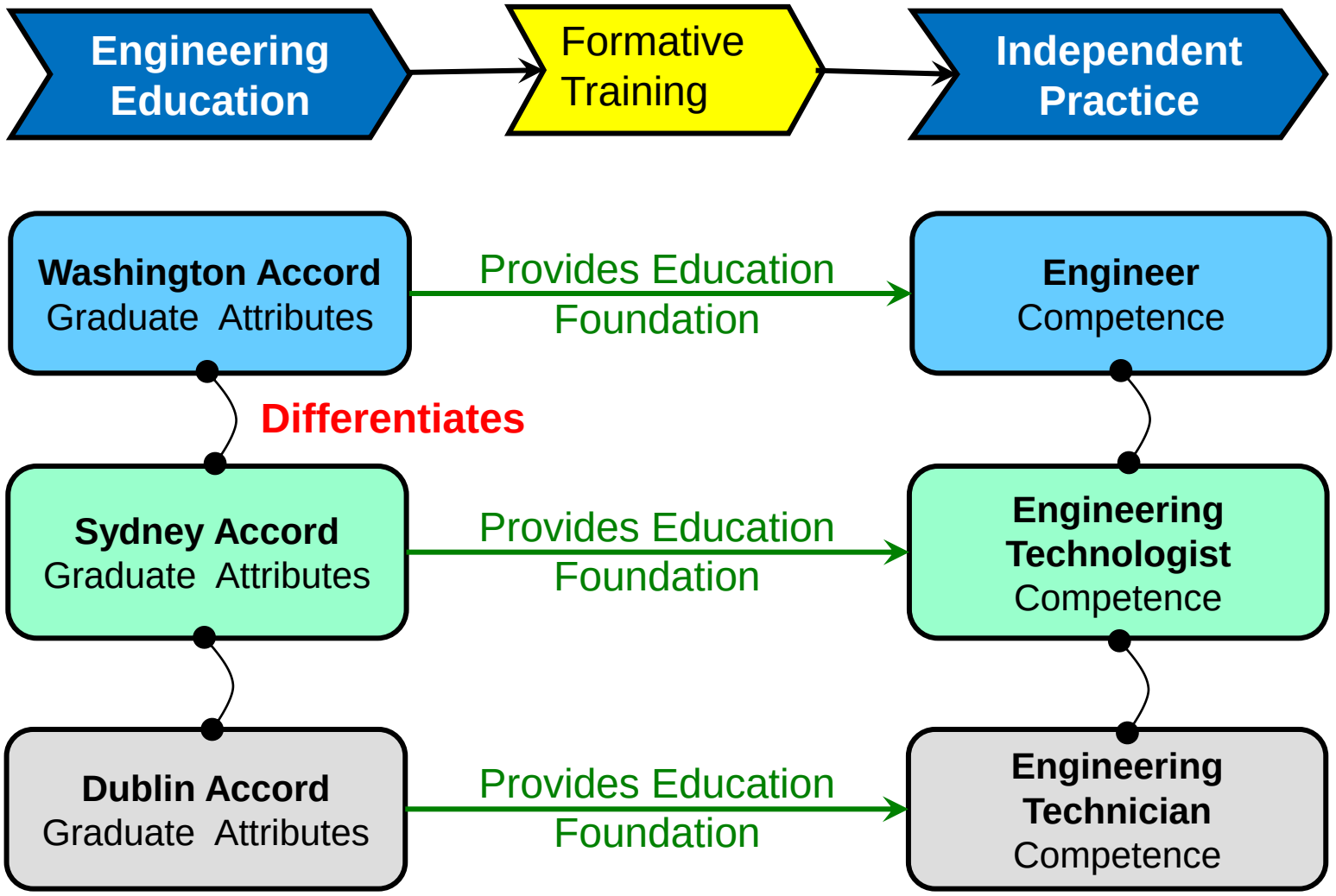
Three (3) Educational Accords

Washington Accord	Sydney Accord	Dublin Accord
• Engineers	• Engineering Technologists	• Engineering Technicians

Four (4) Competence Recognition/Mobility Agreements

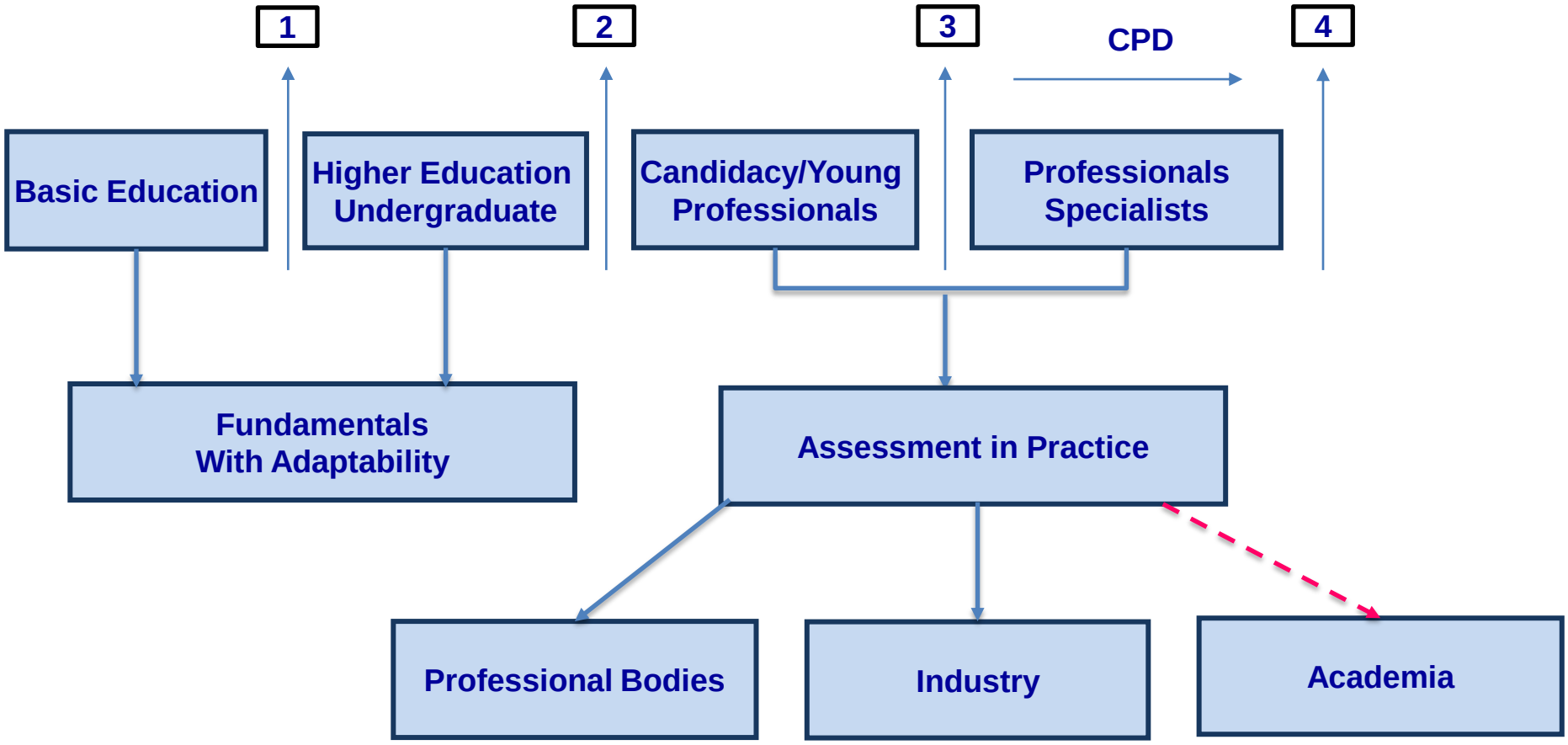
International Professional Engineers Agreement	Asia Pacific Economic Cooperation	International Engineering Technologists Agreement	Agreement for International Technicians Agreement
• Professional Engineers	• Professional Engineers • Regional Agreement	• International Engineering Technologists	• International Engineering Technicians

Graduates Attributes and Professional Competencies



Available at: www.ieagreements.org

Engineering Capacity Building Pipeline Defining Outcomes



Technology Evolution challenges the Engineering Roles and Current Definitions

Technology Tools: AI, Robotics, and Communication

1. Engineers
2. Technologists
3. Technicians
4. Artisans

And increasingly used across professions

WFEO Committees on Capacity Building

- Compendium, Capacity Building Guidebook
- Africa Catalyst, Capacity Development Programme for Africa
- UNESCO Engineering Week, Engineering Profession interfaces with Policy Makers
- Africa Engineering Report
- Participation on Youth Development / Gender Equality
- International Engineering Committee (Inaugural Meeting in London brings together Educational and Regulatory Leading Organisations (IEA, IFEES, GEDC, WFEO Education, ICEE)
  - Review Global Standards for Engineering Education pedagogy and graduate outcomes, Building Educational Capacity
  - Review Global Professional Attributes and Outcomes: aligned to Industry / Society
  - Mobility

Transforming the Capacity Building Landscape

- Alignment to Policy, and Influence of Policy
- Focus on new competencies eg intercultural competence
- Reviewing Global Engineering Professional Attributes and Outcomes
- Reviewing Global Standards on Pedagogy to improve learning effectiveness and develop competencies (simulators, mobile laboratories)
- Recognition and Mobility Agreements
- Introducing Collective Capacity Building Approaches: Networks of Specialisation
- Diverse strategies for short, medium and long term capacity building

African Proverb

If you want to go fast, go alone

If you want to go far, go together

Sources

Various Sources have been used, and available on request

Additional information: Contact

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