



# Exploring Engineering Graduate Opportunities and TVET Pathways

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EAC and ETAC Council member



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MATRADE Hall,  
MATRADE Exhibition & Convention Centre



# Outline of Presentation



**What Is Engineering And What Do Engineers Do.**



**Opportunities in Engineering**

**Engineering Vs Engineering TVET**

**Recognition and Mobility**



# ENGINEER

was derived from the Latin word  
“INGENIEUR”

# INGENIEUR

was derived from “Ingeniare”  
and “Ingenium”



# Introduction

## What is an Engineer?

***Engineering is the field or discipline, practice, profession and art that relates to the development, acquisition and application of technical, scientific and mathematical knowledge about the understanding, design, development, invention, innovation and use of materials, machines, structures, systems and processes for specific purposes.***

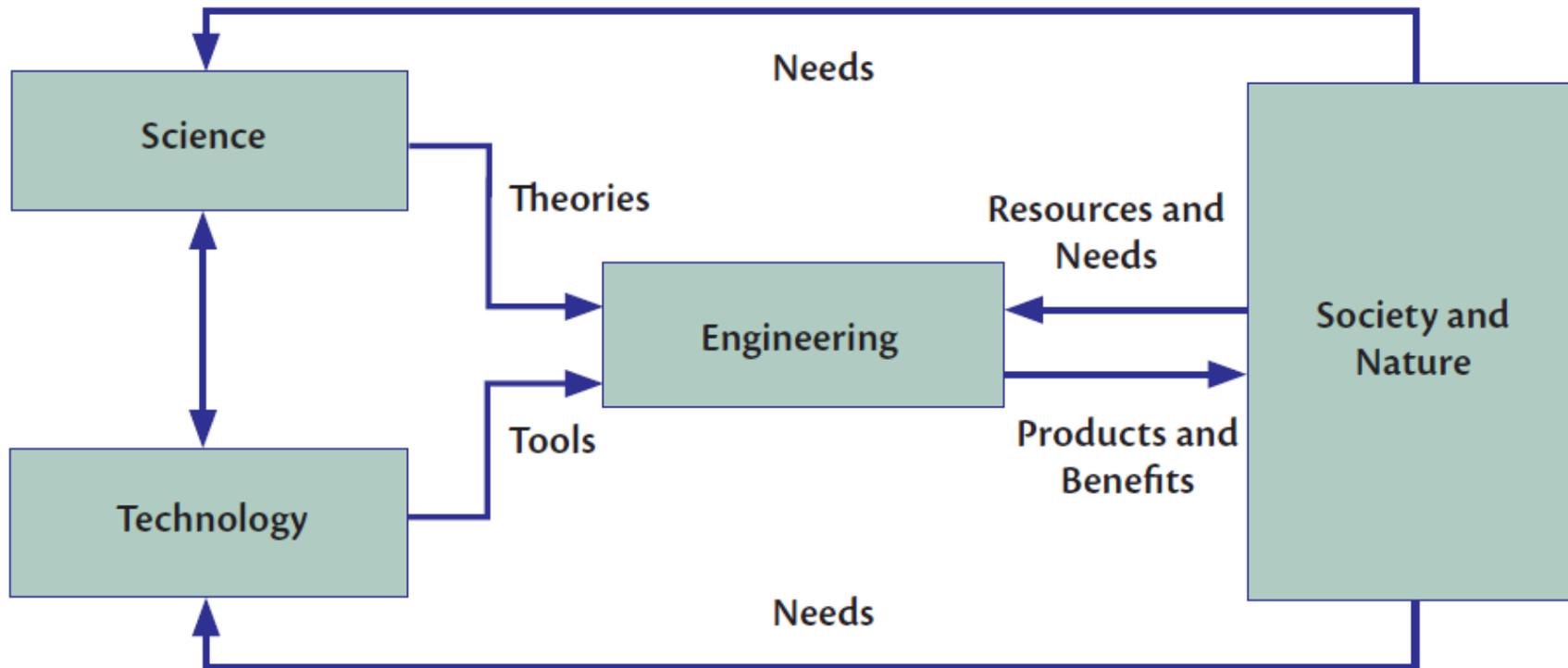
(UNESCO 2010)

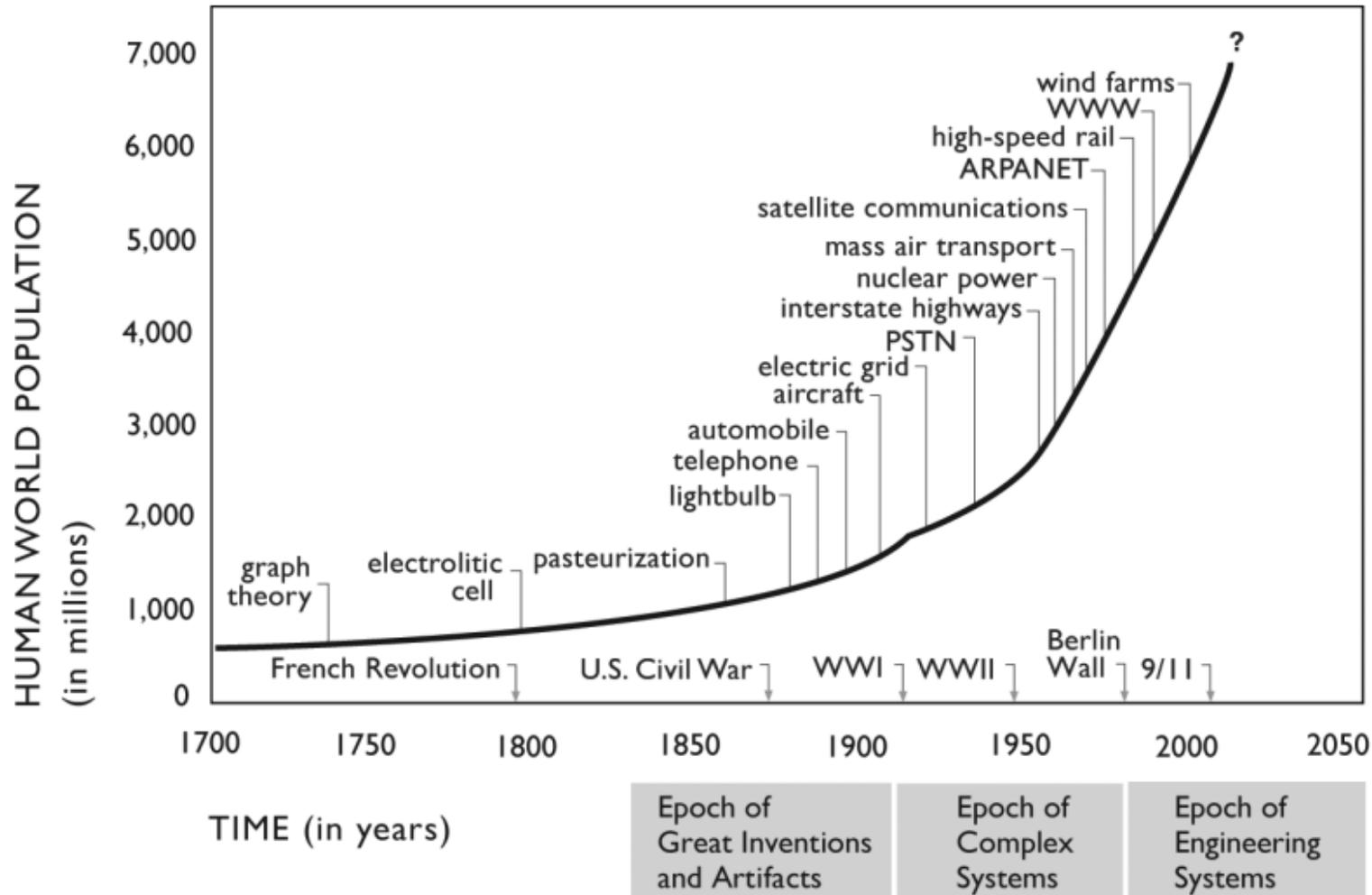
“Ingenium”

“technikos”



# What do engineers do?





World 's population had grown to 2.52 billion, and inventions were “growing” along with the population “

Engineering Systems: Meeting Human Needs in a Complex Technological World  
Book by Christopher L. Magee

**Figure 1.1**

Human population growth and important technological and political milestones (1700–2050).

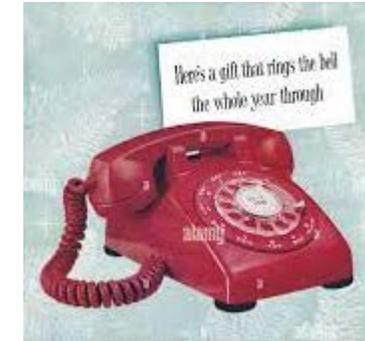
# What is the Future for the Engineering Career?

The Future is very bright.

We are moving from  
invention to Systems

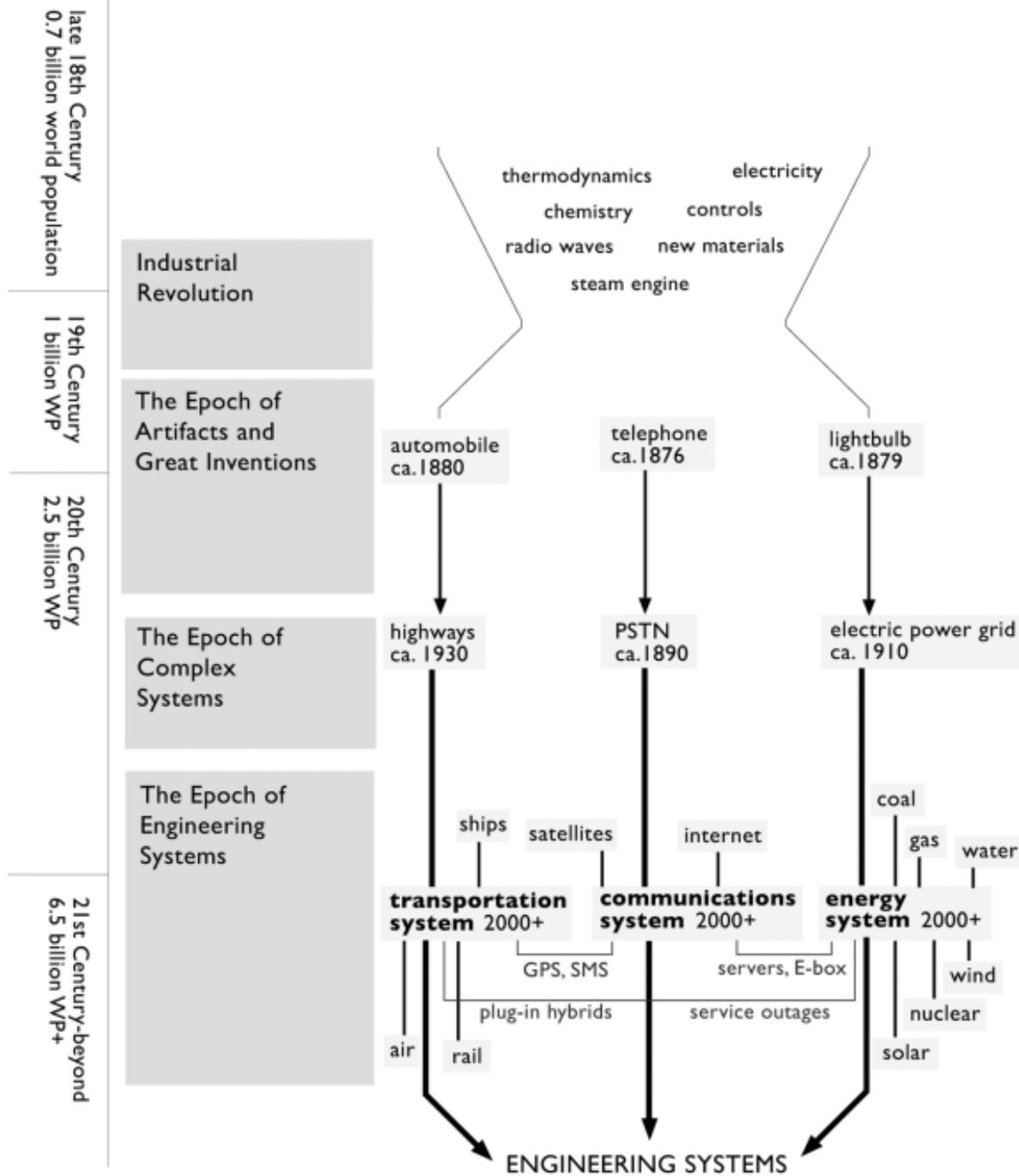


Engineers can be proud of the inventions that have made life much easier for humans



**>>>>> inventions now is part of systems.**



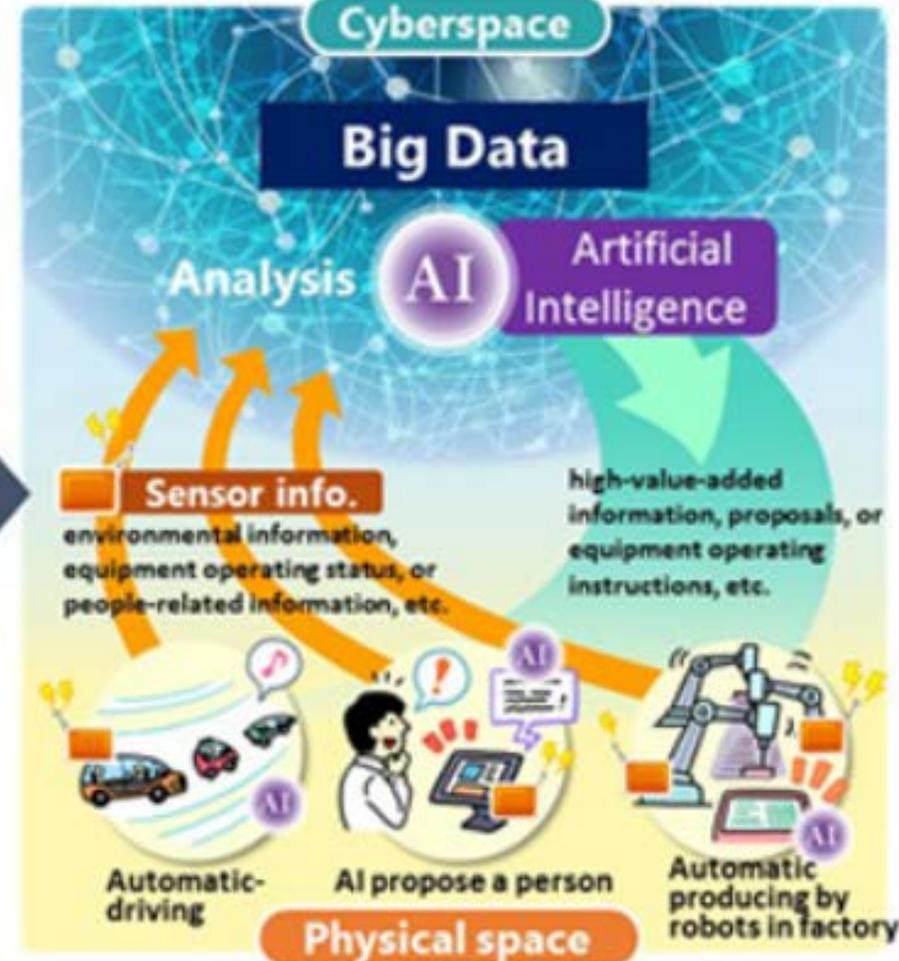
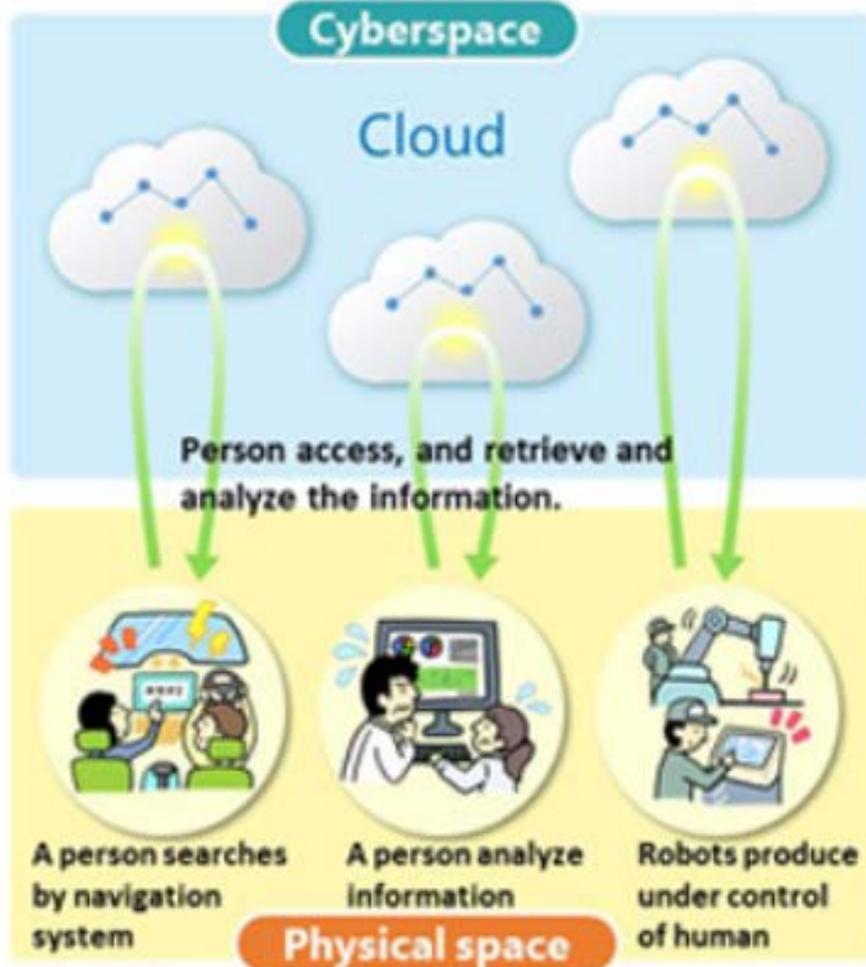


Engineering Systems: Meeting Human Needs in a Complex Technological World  
 Book by Christopher L. Magee



## Current information society (4.0)

## Society 5.0



[source: CAO,Japan]

**As inventions integrates/changes into systems >>>> more and more engineers are required.**

>>> How engineers work have changed



Graduate Engineer

Professional Engineer

Engineering Technologist

Inspector of Works (Engineering Technician)

>>> How they are educated have also changed



Washington Accord

Sydney Accord

Dublin Accord

Engineers' responsibilities increases not only technical competency but they now must put in a lot of thoughts into their design for sustainability to protect resources for future generation.



**SDGs**



# SUSTAINABLE DEVELOPMENT GOALS



Engineers need to contribute our creativity, knowhow and technology to achieve the SDGs for a better life and better future.



# Examples of Innovation Contributing Towards Achieving The SDGs





Mechatronics  
Engineering.



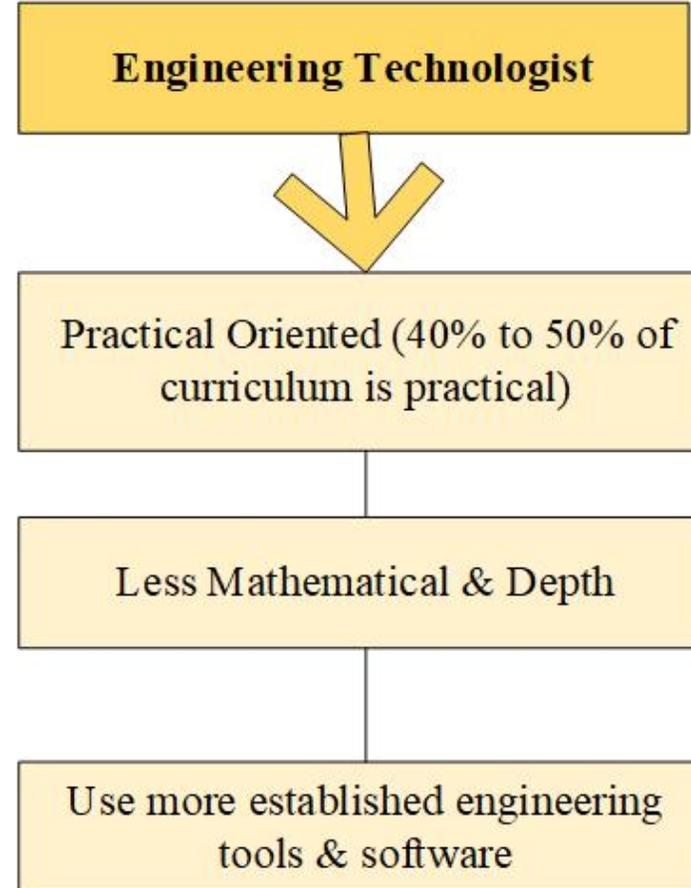
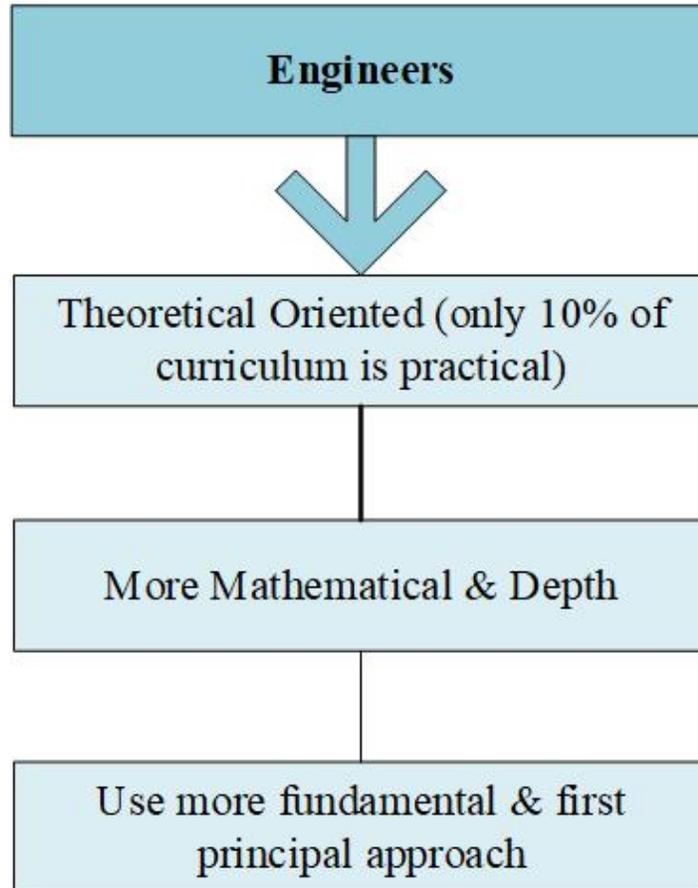
Biomedical  
engineers

New types of engineers and technologist in Malaysia continue its role as the nation builders not only physically but also as knowledge base engineers.

**Engineering education became more essential and the need to produce quality engineers/Technologist/Technicians requires**



**Accreditation of engineering programmes**



**Difference in educational requirements for Engineers.**





**Professionals- Eg. Engineers, Architects etc** are usually **regulated** and must adhere to **ethics standards, technical standards, and practices** as regulated by their regulators



**Board of Engineers Malaysia (BEM)**



**Engineers, Technologist, IOW**



**Board of Architects Malaysia**



**Architects**

**Singapore:- Professional Engineers Board (PEB)- Singapore**

**professional engineers board singapore**

**Thailand :- Council of Engineers Thailand COET**



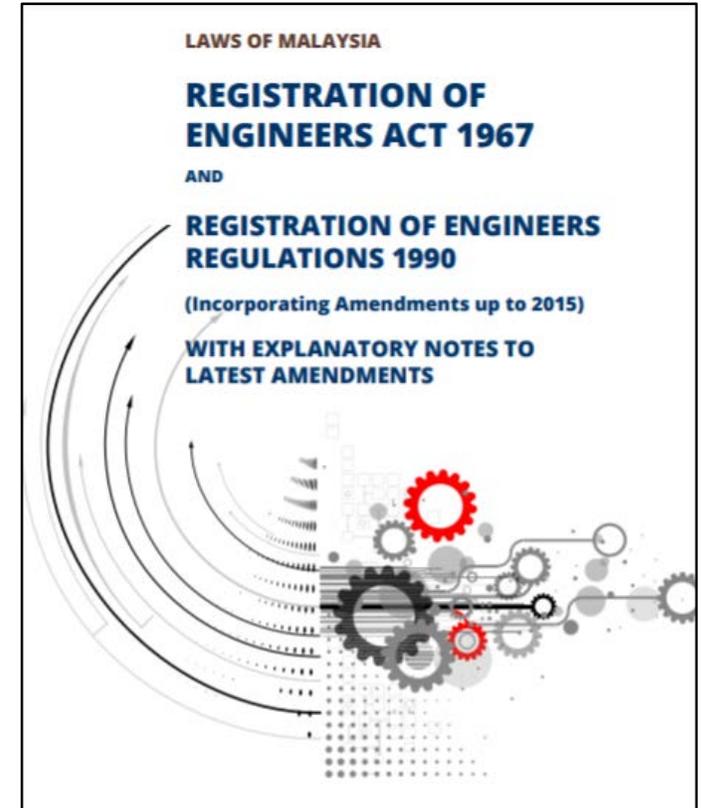
# Why do we need the Registration of Engineers Act ?

The purpose of the Act is :

**To protect the public by legislative control so that the practice of engineering, which has a bearing on public safety, health and welfare, can only be carried out by licensed Professional Engineers, Engineering Technologist and Engineering Technicians (IOW)**

**The Board of Engineers Malaysia (BEM)** is a statutory body constituted under the Registration of Engineers Act 1967. Its primary role is to regulate the practice of engineering under the Act.

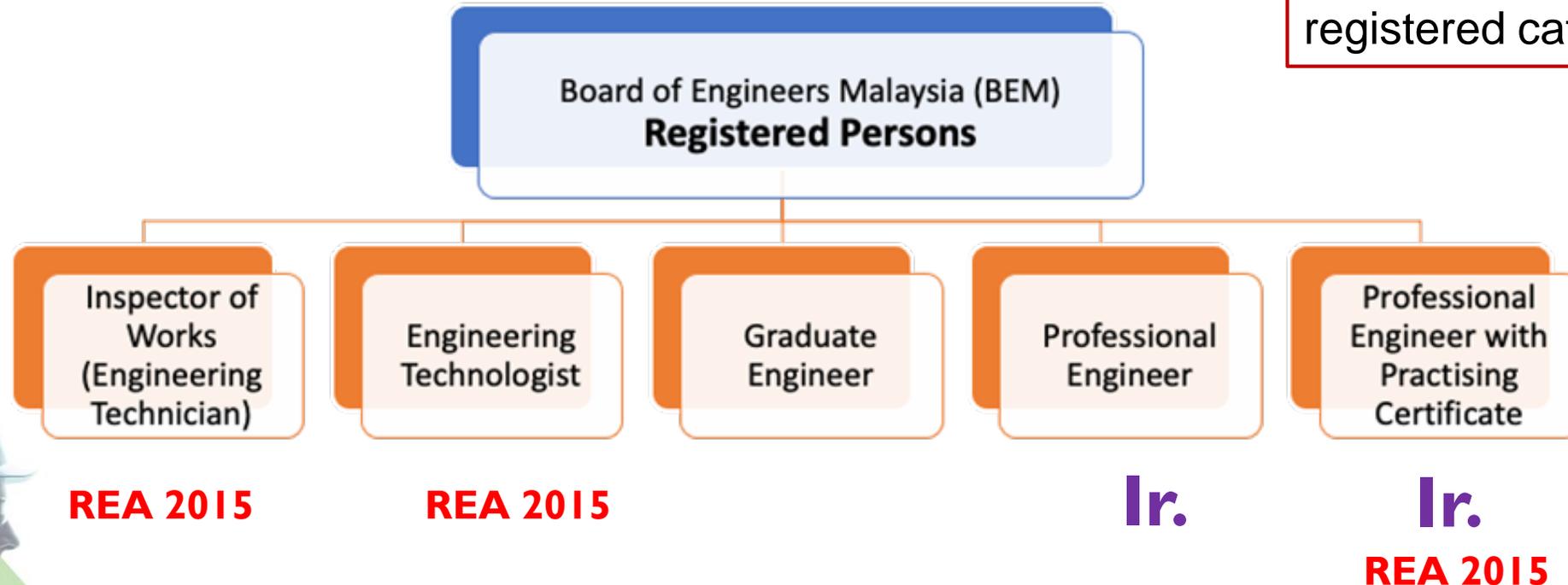
**Regulator**





Board of Engineers Malaysia (BEM) the regulatory body for Engineering practices in Malaysia. It was set-up by the Malaysian government under the Registration of Engineers Act, 1967 (REA) to administer and to enforce the REA and its provisions to protect public interest.

BEM Registered person is thus recognized in Malaysia and the level of competency and professional recognition depends on the individuals registered categories.



# Why the need for amendments ?

The amended REA will be known as “Registration of Engineers Act 1967 (Revised 2015)”, whilst the accompanying Regulations will be known as “Registration of Engineers Regulations 1990 (Revised 2015)”. The Regulations are meant to supplement the Act in the day-to-day affairs, operations and functions of the Board of Engineers (Board).

These latest amendments are a direct result of Government policies on trade for services. As Malaysia developed towards a service industry the issue of “liberalisation” of the services came to the forefront in the Free Trade Agreements (FTA) which the country signed. These latest amendments directly address liberalisation issues in order for the country to meet its international obligations.



**Mobility**

## 6.0 New Categories of Registered Persons

Section 10 of the REA was amended to include new sections namely Sections 10C, 10D and 10E to provide for the registration of Engineering Technologist, Professional Engineer with a Practising Certificate and Inspector of Works as shown in Figure 1.



**So that the new categories of registered persons can be regulated and recognised to enable mobility due to recognition by International bodies.**



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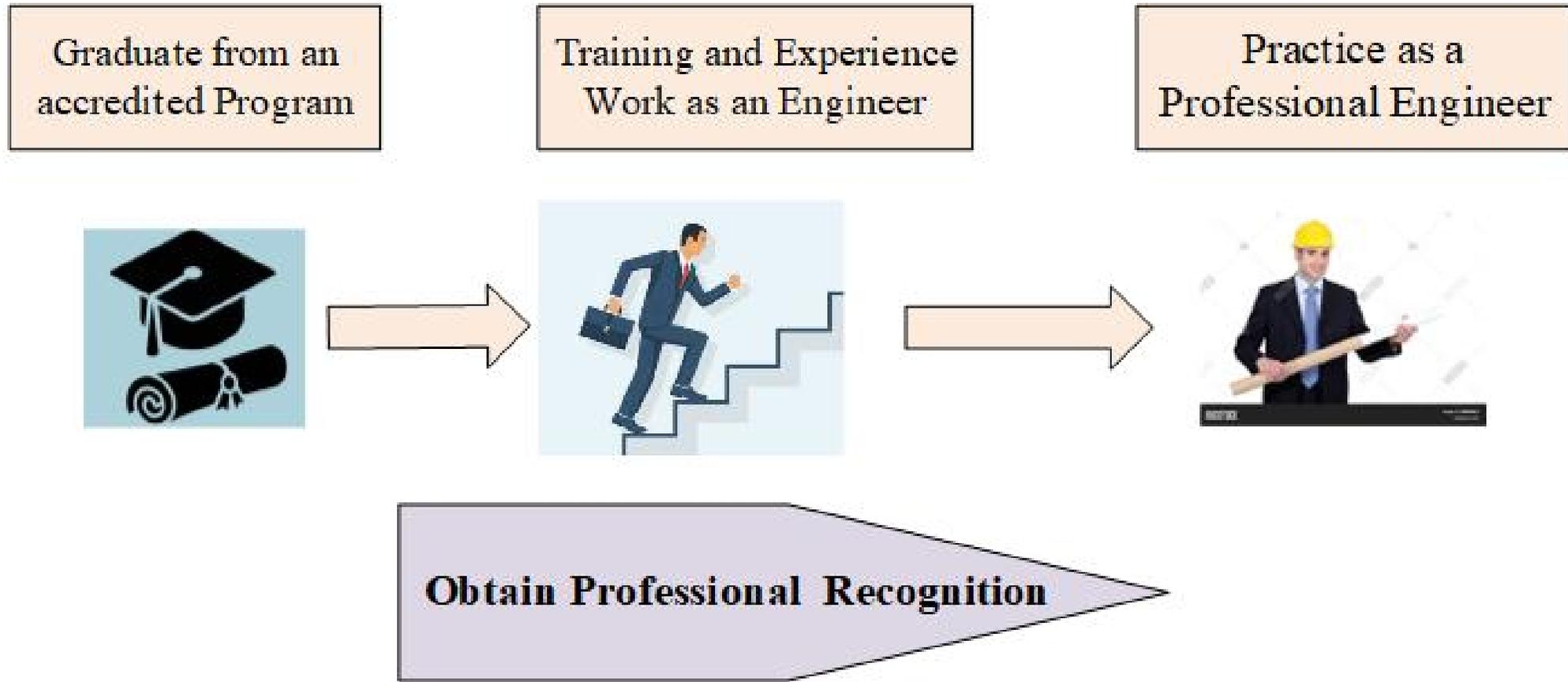


**Engineering Vs Engineering TVET**

**Recognition and Mobility**



# The Education and Training of a Professional Engineer



# Examples of other Technologist occupation:



**Food Technologists**



**Medical Laboratory Technologist**



Agricultural Technologist Near Branches ...



Agricultural Technologists ...

**Agricultural Technologists**



**Radiologic Technologists**

# What is Engineering (services)

Engineering works is defined in the REA Act as all works which include any publicly or privately owned public utilities, buildings, machines, equipment, processes, works or projects that requires the application of engineering principles and data.

Engineering is involved in the optimum conversion of natural resources for the benefit of mankind through design, building and maintenance of machines and structures.

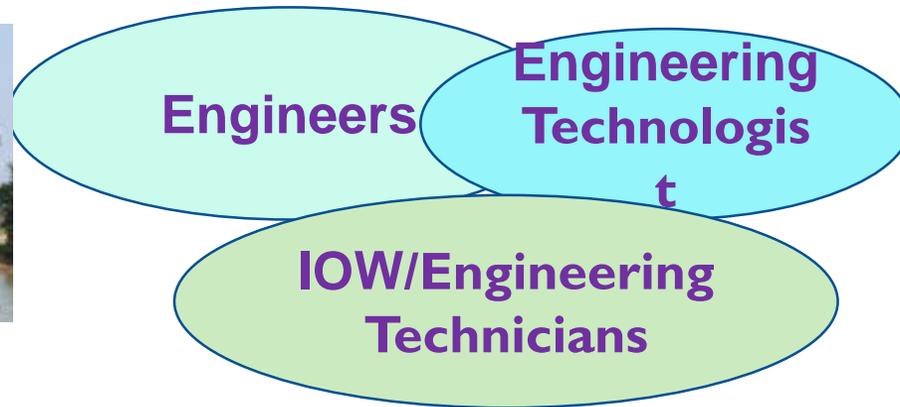
**The scope of engineering services or engineering works** encompass the entire product life cycle that includes research, complex analysis, complex design, development, product design, testing & evaluation, manufacturing, operations, service & maintenance and distribution & sales



# ENGINEERING AND THE ENGINEERING TEAM

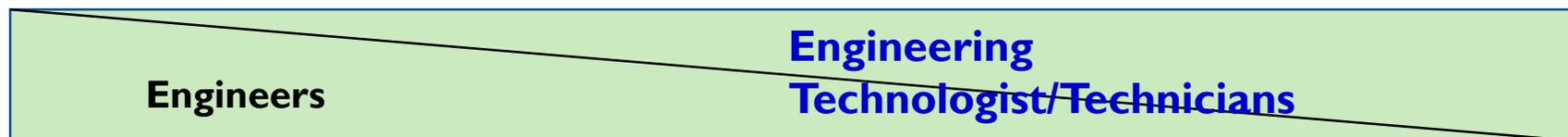
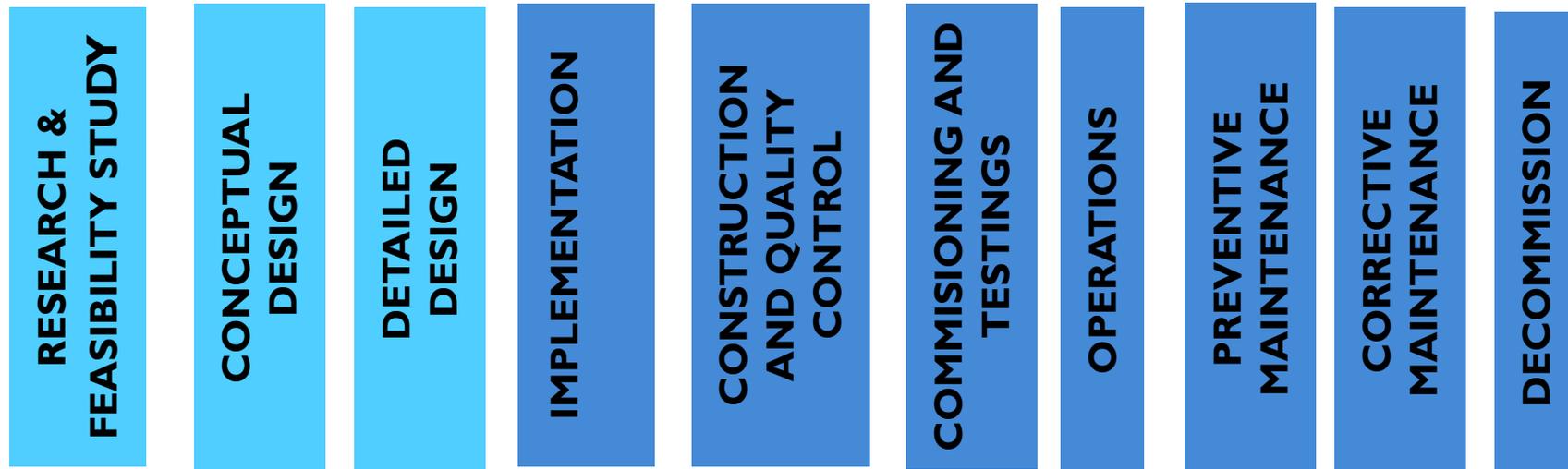
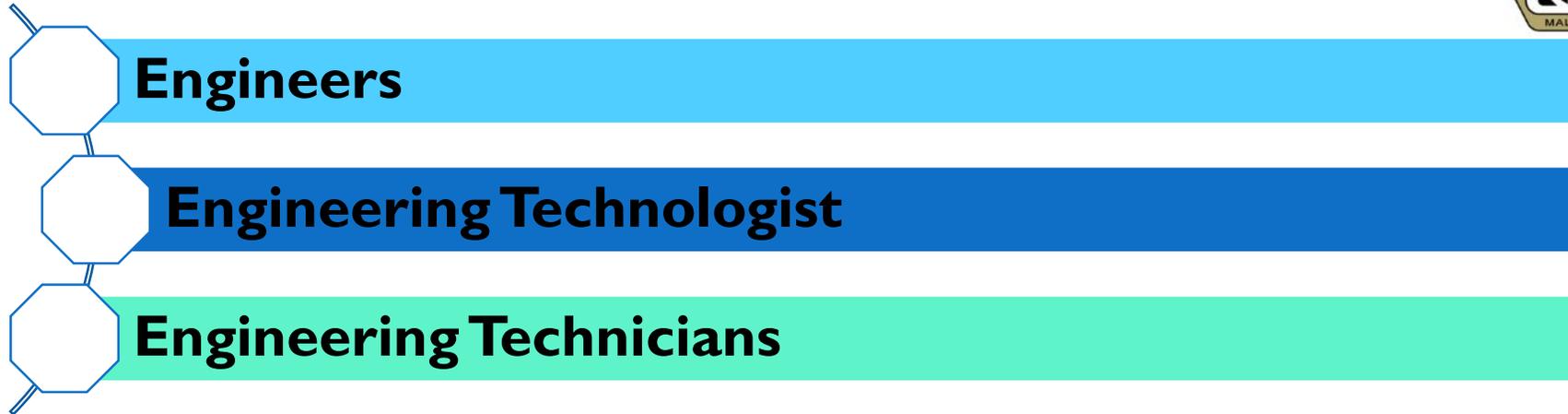


**Definition in the REA Act:** Engineering works include any publicly or privately owned public utilities, buildings, machines, equipment, processes, works or projects that requires the application of engineering principles and data.



**Engineering team performs engineering services or works and in many cases there are overlapping of functions.**





## ENGINEERING TECHNICIAN IN SERVICE INDUSTRY

- Engineering technicians (IOW) shall assist engineer in supervision of engineering work that requires application of engineering principles and data, help solve technical problems in many ways.



**EQUIPMENT**

**CONDUCT EXPERIMENTS (R&D)**



**Non Destructive Testing Services**

**QUALITY CONTROL**

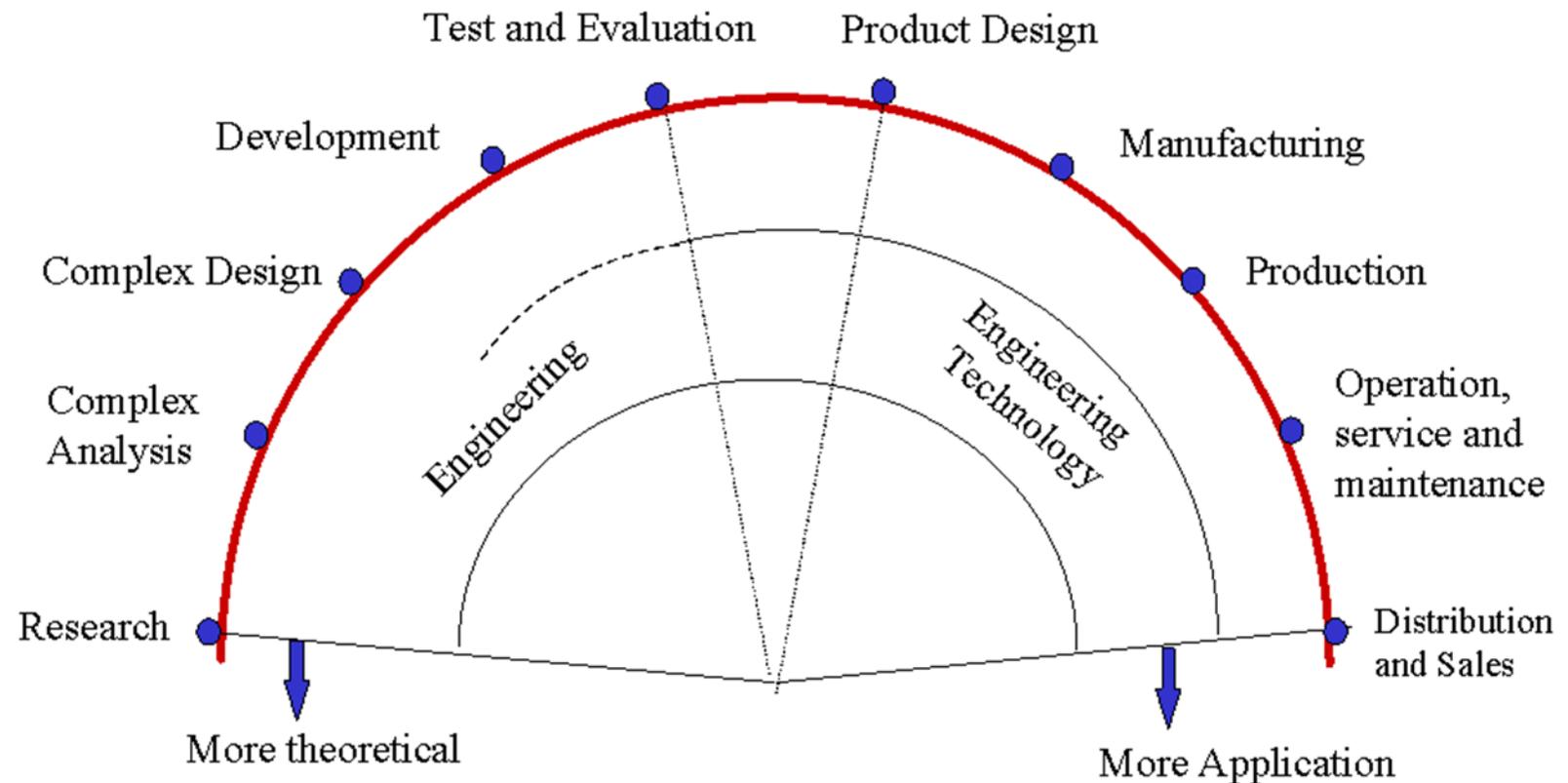
- Check product
- Do testing
- Collecting data

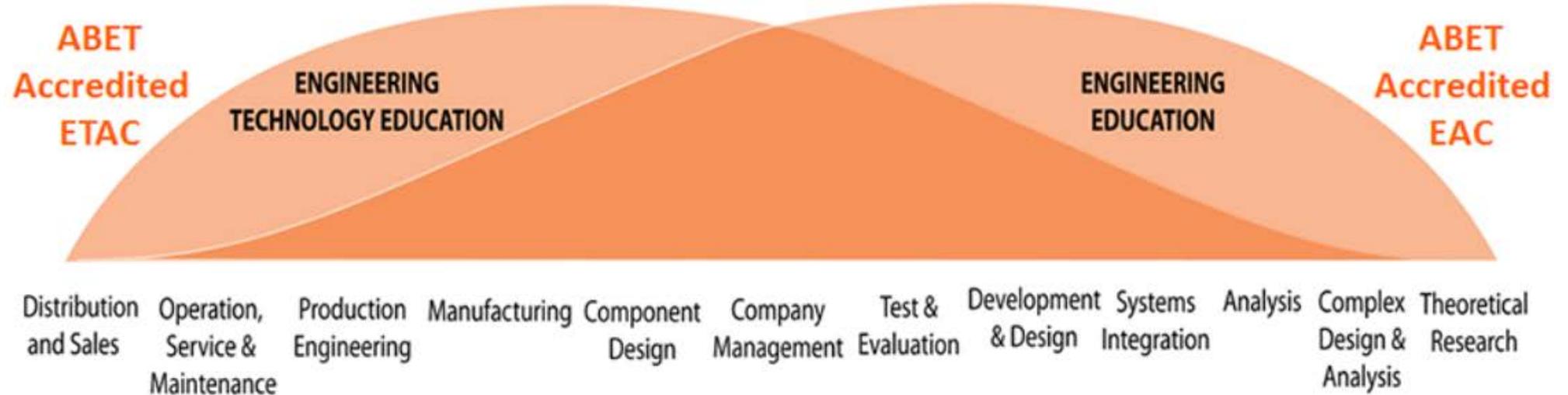
**COLLECT DATA & CALCULATE RESULT**



# ENGINEERING TECHNOLOGY vs ENGINEERING

## Spectrum of Technical Job Functions





(Chart above from the American Society for Mechanical Engineers.)

Jobs obtained by graduates of both engineering and engineering technology programs are often similar (American Society for Engineering Education).

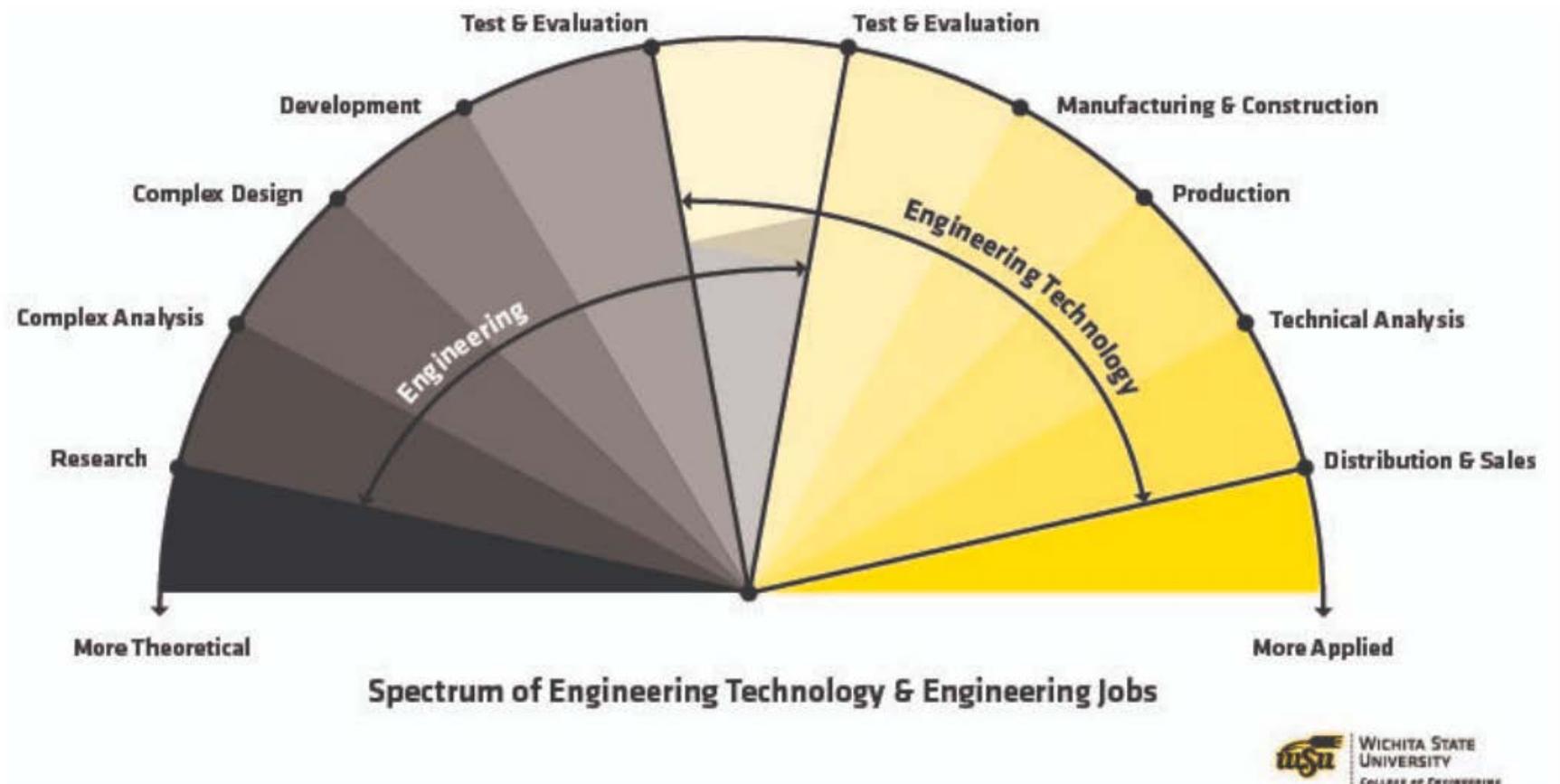


# ENGINEERING AND THE ENGINEERING TEAM



Where are the technicians????

Almost everywhere.



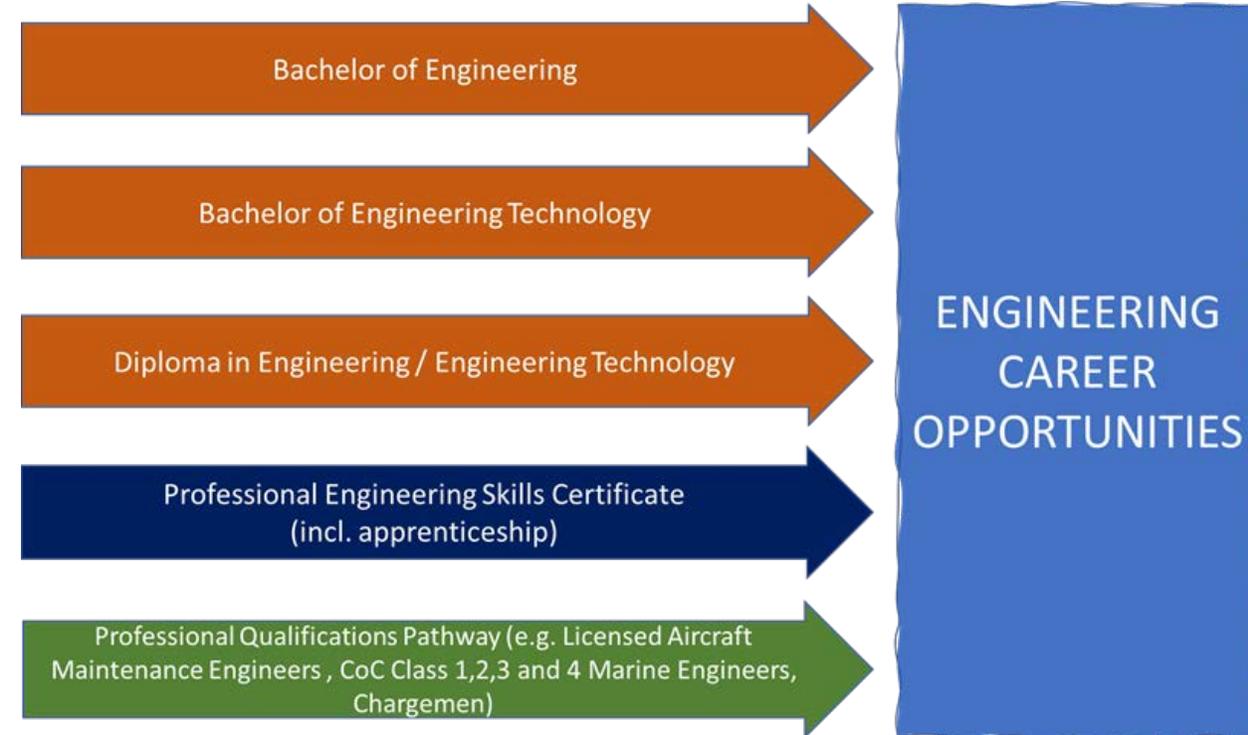
# CAREERS IN ENGINEERING



## Routes to careers in Engineering

There are several routes available via an academic programme at Diploma or Degree level in Engineering or Engineering Technology. **These academic programmes are accredited by BEM. For the latest list of accredited programmes visit [www.etac.org.my](http://www.etac.org.my).**

There are also routes via professional skills qualifications issued by other bodies such as the Energy Commission (eg. Chargeman) and the Construction and Industry Development Board (CIDB).





## Definition : **TVET** >> **Technical and Vocational Education Training**

**TVET as defined by UNESCO : an education that** involves “in addition to general education, the study of technologies and related sciences as well as the acquisition of practical skills, attitudes, understanding, and knowledge relating to occupations in various sectors of economics and social life”.

**Engineering Technologist and Engineering Technician** are graduates from **Engineering Technologist & Engineering Technician Education programmes.**



# ENGINEERING TECHNOLOGIST

Engineering technologist are graduates with a Bachelor's Degree in Engineering Technology (Level 6 MQF)

Engineering technologist education and training are application oriented, focusing among others on applied design, product development, manufacturing, product assurance, operation and maintenance based on current engineering practice standards.

Engineering technologists are also known as applied engineers or practical engineers and perform engineering works by applying engineering and scientific knowledge combined with technical skills.

## Engineering Technologist

- Implement **engineering works** by applying engineering & scientific knowledge combined with technical skills **to support engineering activities.**



# ENGINEERING TECHNICIAN

Engineering technicians are graduates that have acquired an Engineering or Engineering Technology Diploma qualification. Engineering technician education and training are highly application oriented and focusing on practical skills.

**Engineering technicians are employed to work as part of the engineering team together with engineering technologist and engineers.**

Engineering technicians assist engineers and engineering technologist to implement engineering works by applying engineering knowledge combined with practical skills. Engineering technicians support the whole spectrum of engineering activities such as design, development, testing, manufacturing, operation service and maintenance.



## Engineering Technician

- Implement **engineering technology works** by applying engineering knowledge combined with technical skills **to support engineering technology activities.**



# ENGINEERING TECHNICIAN



**Example:** In the job scope of testing for example, engineering technicians assist the engineers and engineering technologist in collecting data, designing and performing tests, assembling equipment and recording test data.

## Engineering Technician

- Implement **engineering technology works** by applying engineering knowledge combined with technical skills to support engineering technology activities.



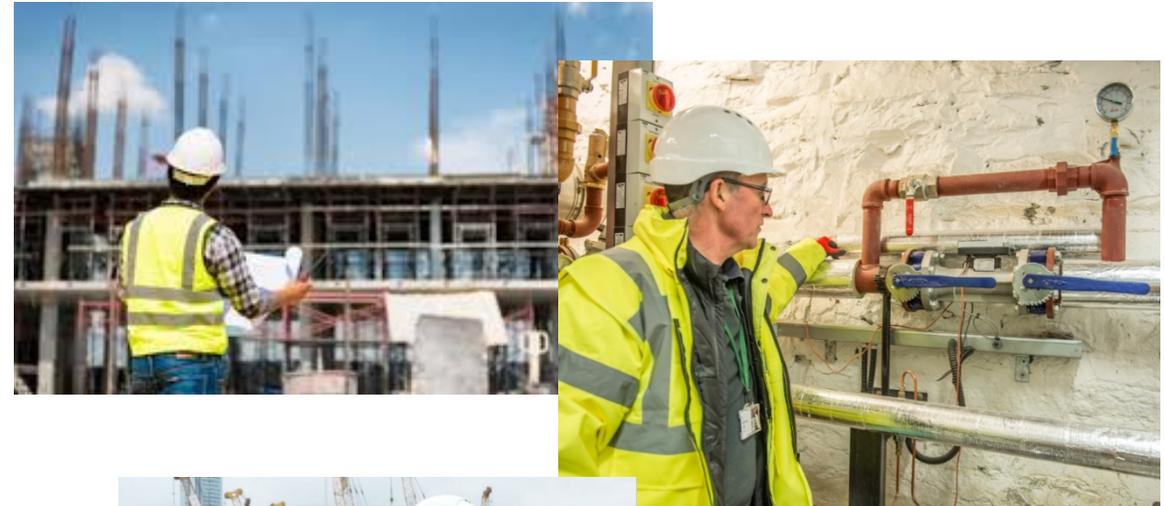
# Inspector of Works (IOW)



**Inspector of Works (IOW)** who is registered with the Board usually takes up employment which requires him to assist the Professional Engineer in the supervision of engineering works”.

The registration of IOW mainly under the three (3) main engineering disciplines i.e. **Civil, Electrical and Mechanical** or any other disciplines deemed appropriate.

**IOWs carry out supervision of engineering works on site assisting the Professional Engineers (PEPC /ECPs)**



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**Recognition and Mobility**





# Recognition and Mobility



## What does Mobility mean?

- ✓ Mobility – n. the movement of individuals or groups from place to place, job to job, or one social or economic level to another
- ✓ Talent mobility—moving people to where the work is
- ✓ Manpower mobility —extent to which the workers are able or willing to move between different jobs, occupations, and geographical areas
- ✓ **Mobility of Engineers** —extent to which the Engineers are able to move between jobs and geographical areas with proper engineering credentials and mutual recognitions among countries.



# Recognition and Mobility



Engineers, Engineering Technologist and Engineering Technicians must increase competency and competitiveness to gear toward Mobility and Engineering Services in a Liberalised and Globalised ASEAN market



## INTERNATIONAL ENGINEERING ALLIANCE

- Malaysia are signatories to the **Washington, Sydney and Dublin Accords** which falls under the umbrella of the International Engineering Alliance.
- **The Washington, Sydney and Dublin Accords were initiated to establish an international benchmarking for engineering technology qualifications at Bachelor and Diploma levels respectively and has developed statements of graduate attributes and professional competency profiles.**
- **A key benefit for holders of BEM accredited qualifications is that the programmes are recognized by other members of the international accords as ‘substantially equivalent’.**



## INTERNATIONAL ENGINEERING ALLIANCE (IEA)



### Educational Accords

- Washington Accord
- Sydney Accord
- Dublin Accord



### Competence Agreements

- APEC Engineer
- International Professional Engineer
- **International Engineering Technologist**
- **International Engineering Technician**

# Professional Recognition by Professional Bodies

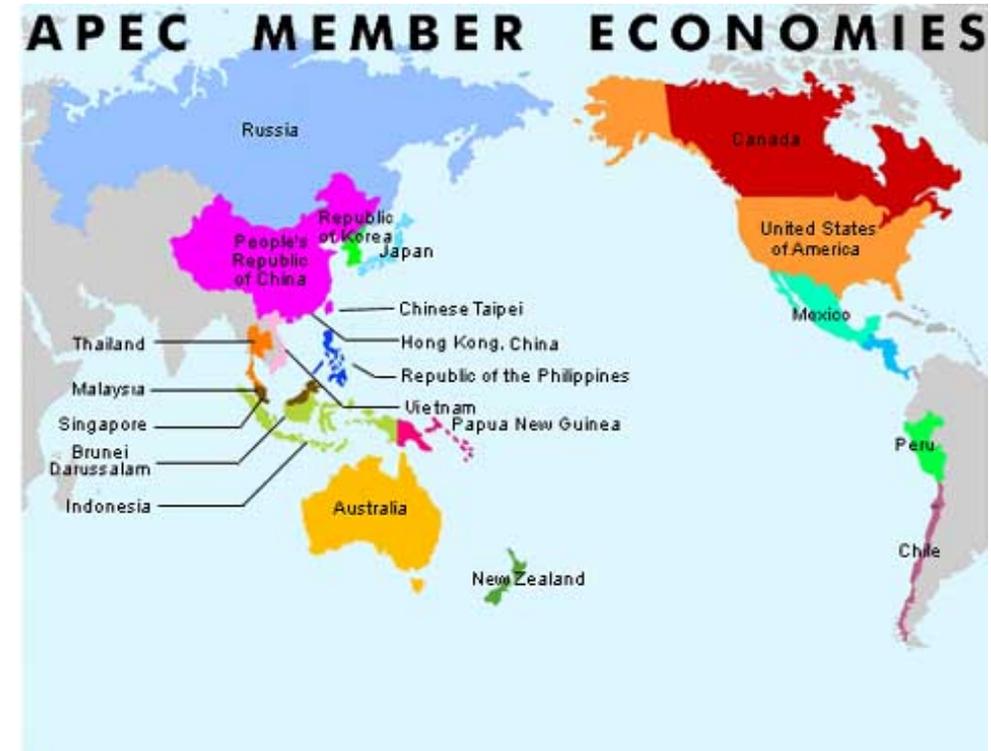


## APEC/ IPEA International Registrars

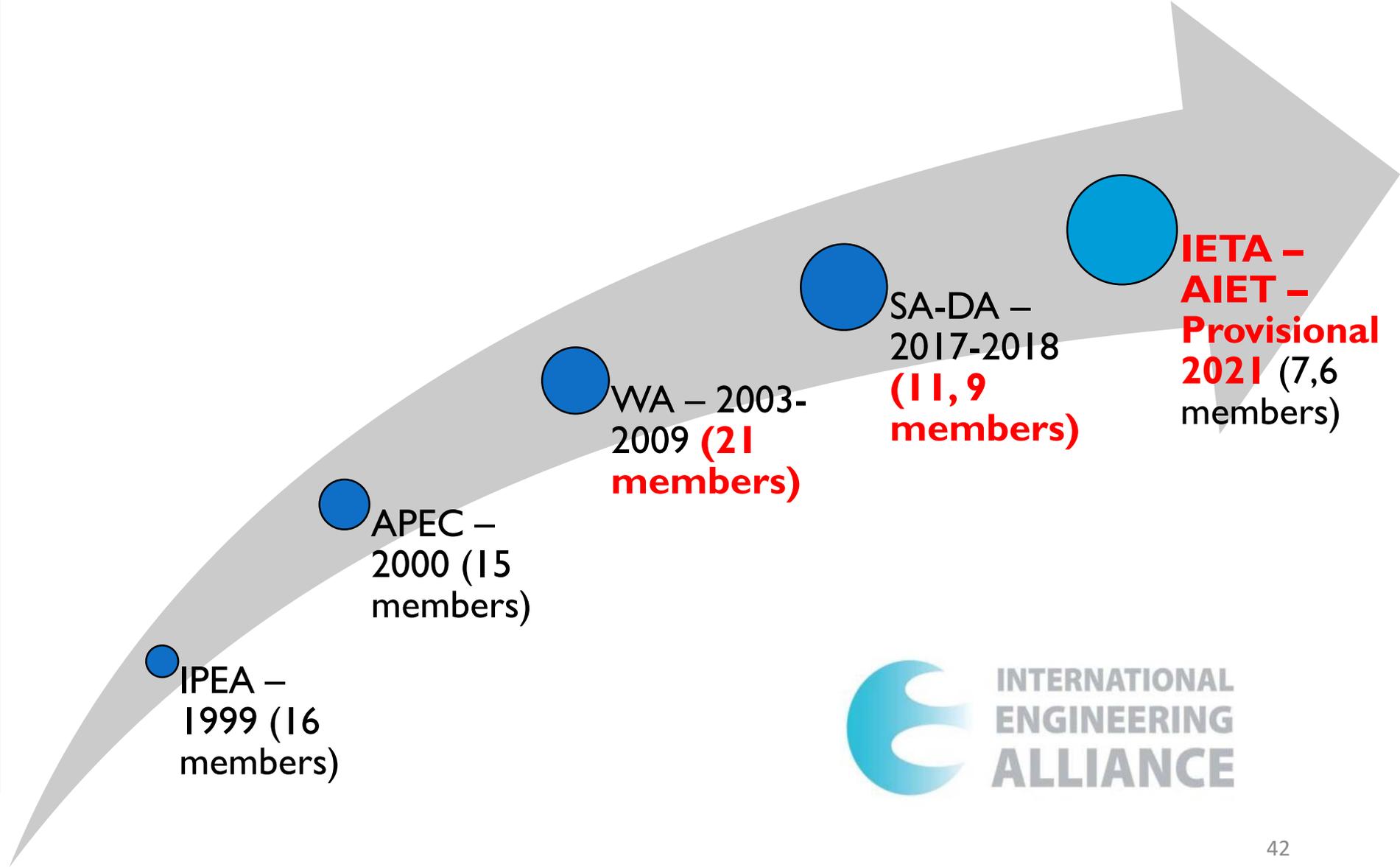
An **APEC Engineer (APEC Eng.)** : a person who is recognized as a Professional Engineer within an APEC Economy, and has satisfied an authorized body in that economy, and operating in accordance with the criteria and procedures approved by the APEC Engineer Coordinating Committee.

An **International Professional Engineer (IntPE(MY))** is one whose experience is accepted as being eligible for independent practice in another economy within which the full member countries/economies have standing

## Asia-Pacific Economic Co-operation (APEC)



International agreements **GOVERN** the recognition of engineering educational qualifications and professional competence, thus establishing and enforcing **internationally bench-marked standards.**



# Introduction to Professional Recognition In ASEAN

The ASEAN Economic Community (AEC)



# Professional Recognition in ASEAN



- I. Professional Recognition due to :**ASEAN Mutual Recognition Arrangement (MRA) on Engineering Services.**  
(Secretariat in Malaysia is the Board of Engineers Malaysia)



## Regulators

- i. **ASEAN Chartered Professional Engineer (ACPE).**

- 2) Professional Recognition by **ASEAN Federation of Engineering Organisation (AFEEO).**  
(Secretariat in Malaysia is the Institution of Engineers Malaysia)



- i. **ASEAN Engineer (ASEAN Eng.)**
- ii. **ASEAN Engineering Technologist (ASEAN Eng.Tech)**
- iii. **ASEAN Technician (ASEAN Tech)**
- iv. **Associate ASEAN Engineer (A.ASEAN Eng.)**
- v. **Associate ASEAN Engineering Technologist (A.ASEAN Eng.Tech)**
- vi. **ASEAN Technician (A.ASEAN Tech)**

## Engineering Institutions and Associations



# Recognition and Mobility



## What is AFEO?

The ASEAN Federation of Engineering Organisations (AFEO) is a non-governmental body.

Its members are the engineering institutions and organisations of ASEAN countries with the following main objectives:

- To promote goodwill and mutual understanding
- To establish and develop a ASEAN baseline standard for the engineering profession with the objective of facilitating the mobility of the engineers within the ASEAN countries.

**ASEAN  
Federation  
of  
Engineering  
organisation**



## The Role of AFEO & AER

- ✓ FACILITATE THE **MOBILITY OF Engineers, Engineering Technologists and Engineering Technicians** within the ASEAN Countries
- ✓ Similar to the **EUROPEAN ENGINEER REGISTER (EURO Eng)**

Both are **STAKEHOLDERS' INITIATIVES** to recognise **“COMPETENCY”** and **“BRANDING”** of the engineering personnel



**ASEAN  
ENGINEER**

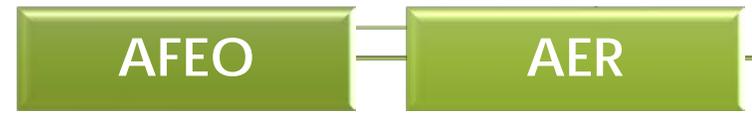
**ASEAN  
ENGINEERING  
TECHNOLOGIST**

**ASEAN  
ENGINEERING  
TECHNICIAN**



# Recognition and Mobility

## PROFESSIONAL INSTITUTION / SOCIETIES (AFEO'S AER) In Malaysia- The Institution of Engineers Malaysia (IEM)



- ASEAN Engineer (ASEAN Eng.)
- ASEAN Engineering Technologist (ASEAN Eng. Tech.)
- ASEAN Technician (ASEAN Tech.)
- Associate ASEAN Engineer (A. ASEAN Eng.)
- Associate ASEAN Engineering Technologist (A. ASEAN Eng. Tech.)
- Associate ASEAN Technician (A. ASEAN Tech.)





# Members of AFEO



## AFEO MEMBER ORGANISATION



**The Institution of Engineers Malaysia (IEM)**



**Board of Engineers Cambodia**



**Persatuan Insinyur Indonesia (PII)**



**Lao Union of Science and Engineering Association (LUCEA)**



**Pertubuhan Ukur Jurutera & Arkitek (PUJA)**



**Federation of Myanmar Engineering Society (Fed.MES)**



**The Philippine Technological Council (PTC)**



**The Institution of Engineers Singapore (IES)**



**The Engineering Institute of Thailand (EIT)**



**Vietnam Union of Science and Technology Associations (VUSTA)**



# ASEAN Professional Recognition



## PURPOSE & OBJECTIVE AFEO & AER

- **MOBILITY OF ENGINEERS AND ENGINEERING**



- **FACILITATE THE MOBILITY OF ENGINEERS AND ENGINEERING ( INCLUDING ENGINEERING TECHNOLOGIST AND TECHNICIAN ) WITHIN ASEAN COUNTRIES**

- **PROMOTE THE FORMULATION AND IMPLEMENTATION OF POLICIES**



- **TO PROMOTE THE FORMULATION AND IMPLEMENTATION OF POLICIES, PLANS AND PROJECTS FOR THE DEVELOPMENT OF THE COUNTRY OF THE MEMBER ORGANISATION OR THE ENTIRE ASEAN REGION THAT IS RELEVANT TO THE NEEDS AND ECONOMIC CAPABILITIES OF EACH COUNTRY;**

- **TO IDENTIFY OUR COMMON PURPOSE AND GOALS**



- **TO IDENTIFY OUR COMMON PURPOSE AND GOALS TO BUILD EFFECTIVE SOCIAL AND WORKING RELATIONSHIPS**

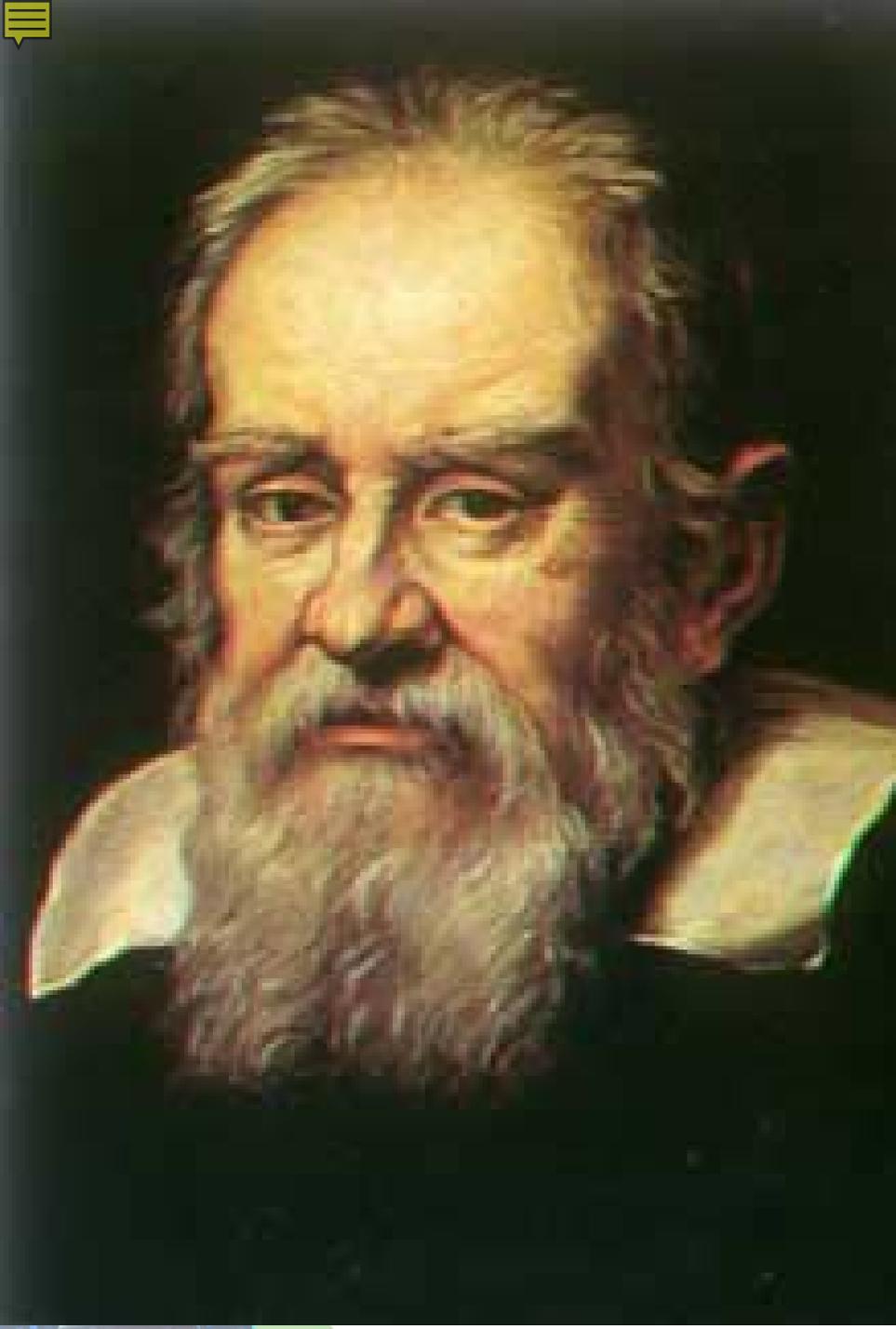
## Example of Technologist and Technicians in TLDM

**TUGASAN KUMPULAN  
KEJURUTERAAN DI KAPAL  
TLDM**



**VIDEO to be  
played.**

**Thank you for the video TLDM**



"Scientists study the world as it is,  
Engineers create the world that never has been"

...Theodore Von Karman



# Q & A





# THANK YOU



*“Committed To Engineering Excellence”*

**BOARD OF ENGINEERS MALAYSIA**

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