

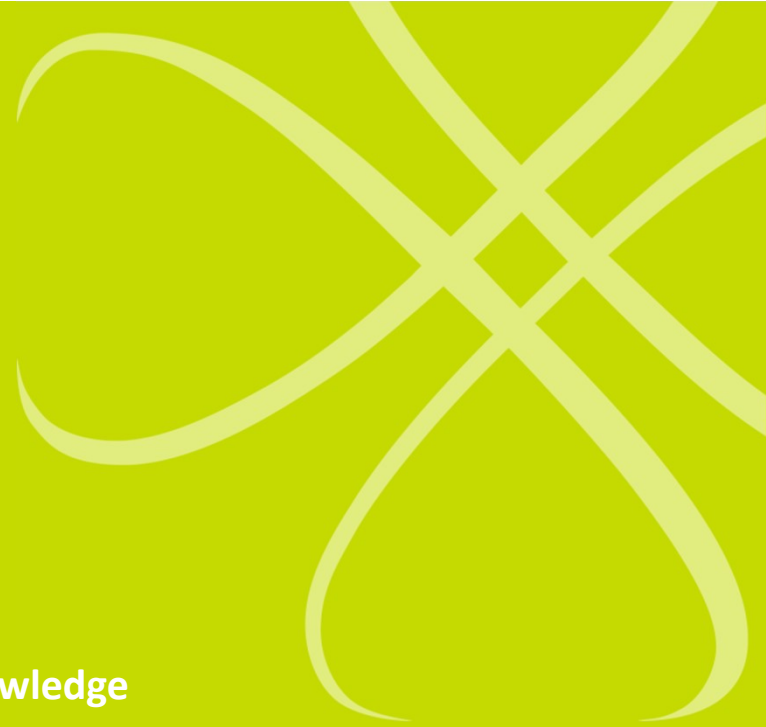
The Role of Chemical Engineers in the Palm Oil Industry



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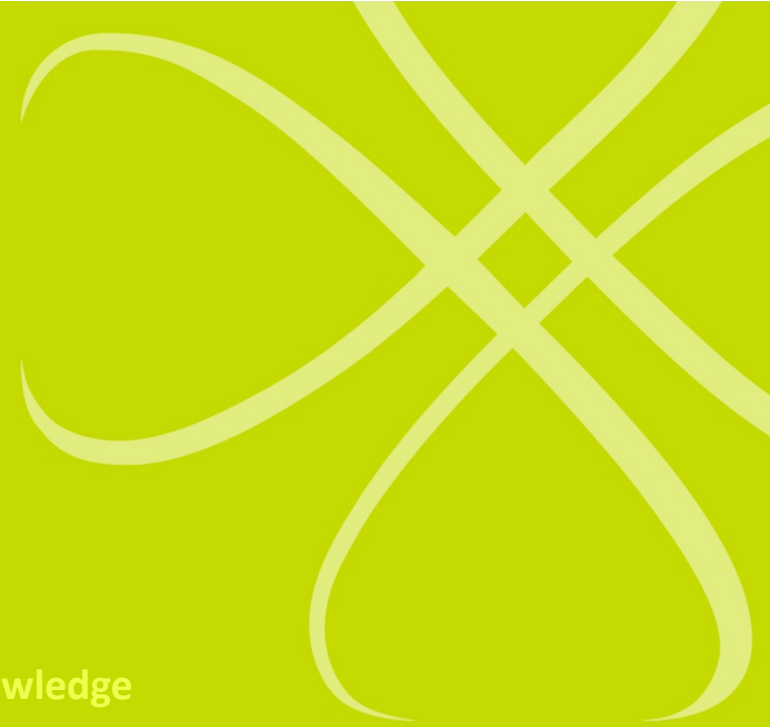
Session outline

- 1 Palm oil processing industry
- 2 Integration and application of chemical engineering knowledge
- 3 Challenges lying ahead



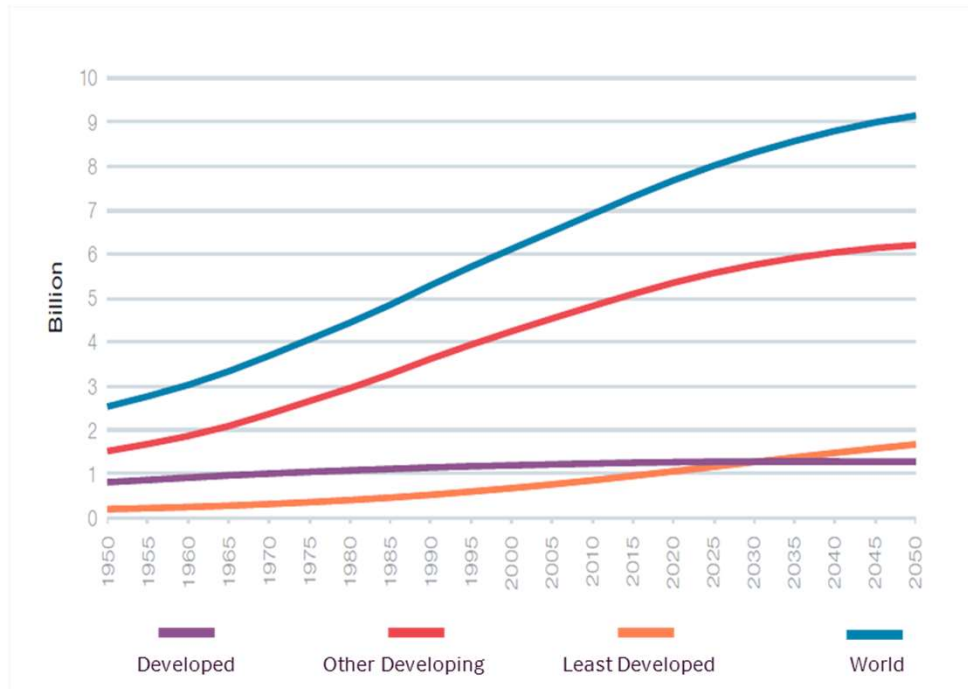
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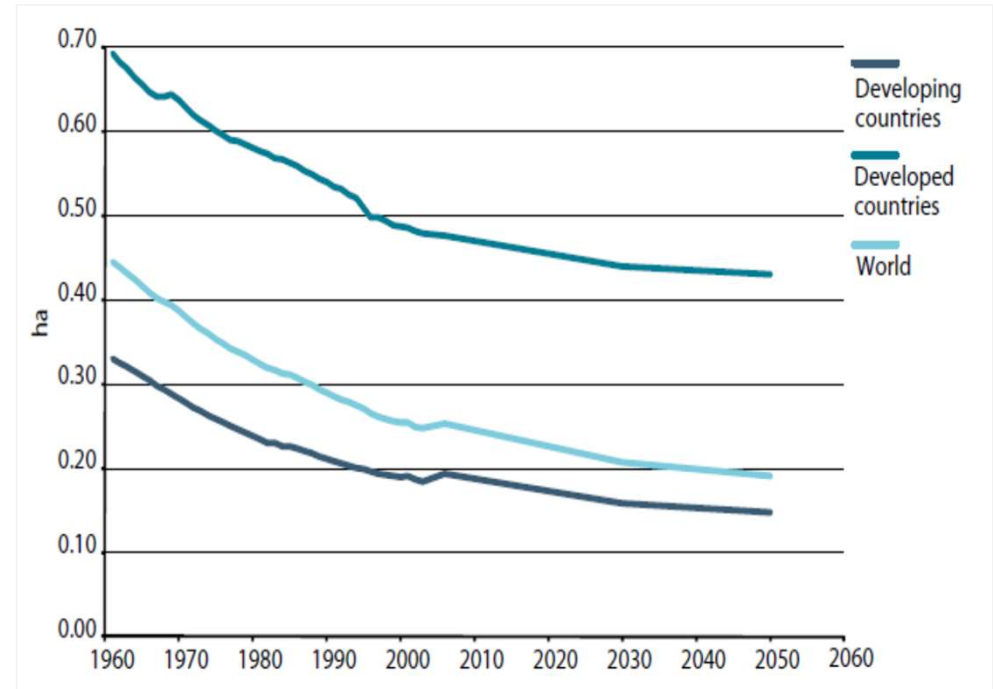


World population is estimated to reach 9 billion by 2050, but the arable land per person is shrinking

World population will reach 9.1 billion by 2050, with significant growth in developing countries



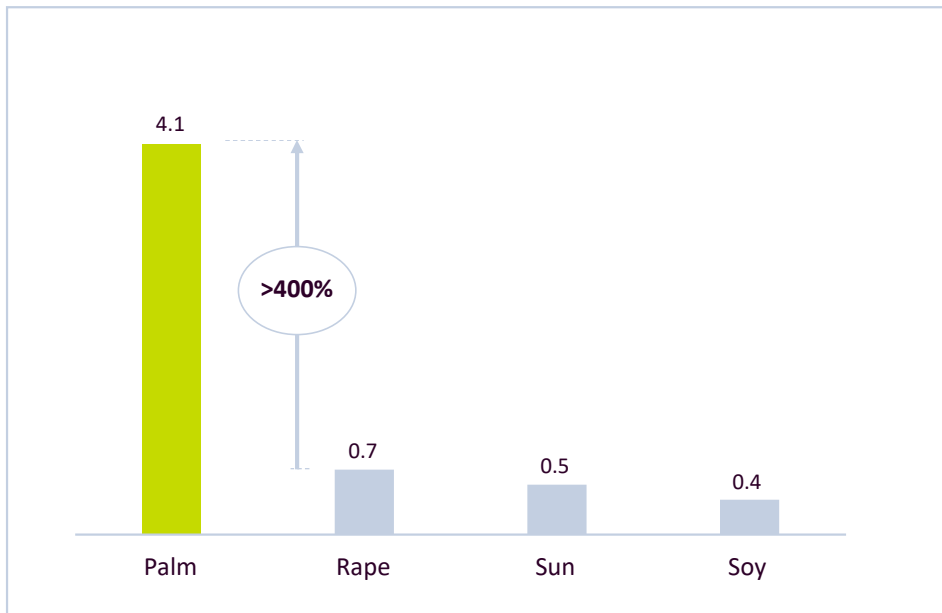
Arable land per capita with a projected decline from 0.38 ha in 1970 to 0.18 ha per person by 2050



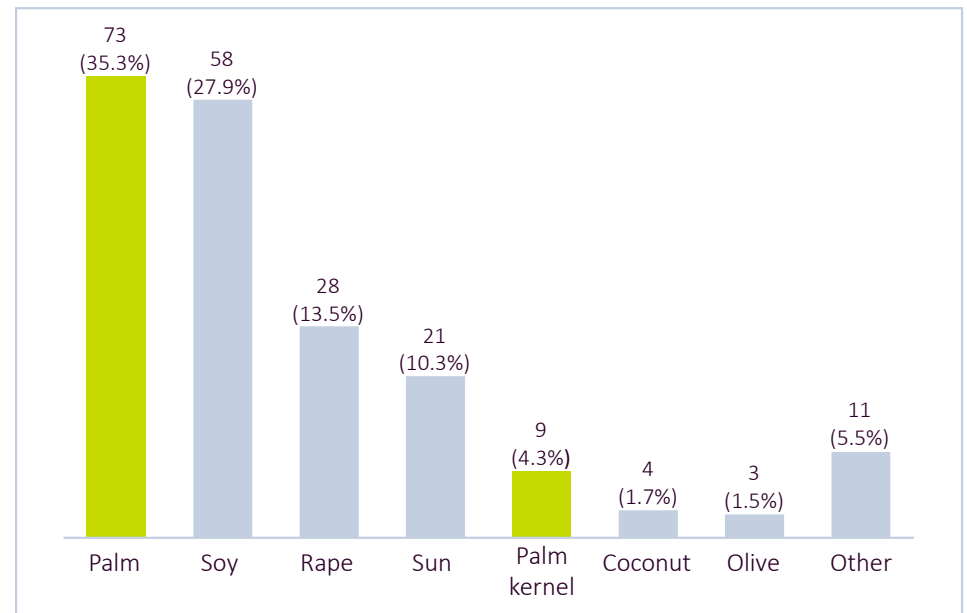
Palm by far is the most efficient oil crop

Palm oil accounts for one-third of the world vegetable oils

Palm outmatches all other oil crops when it comes to efficiency per used land (metric tonnes per ha)



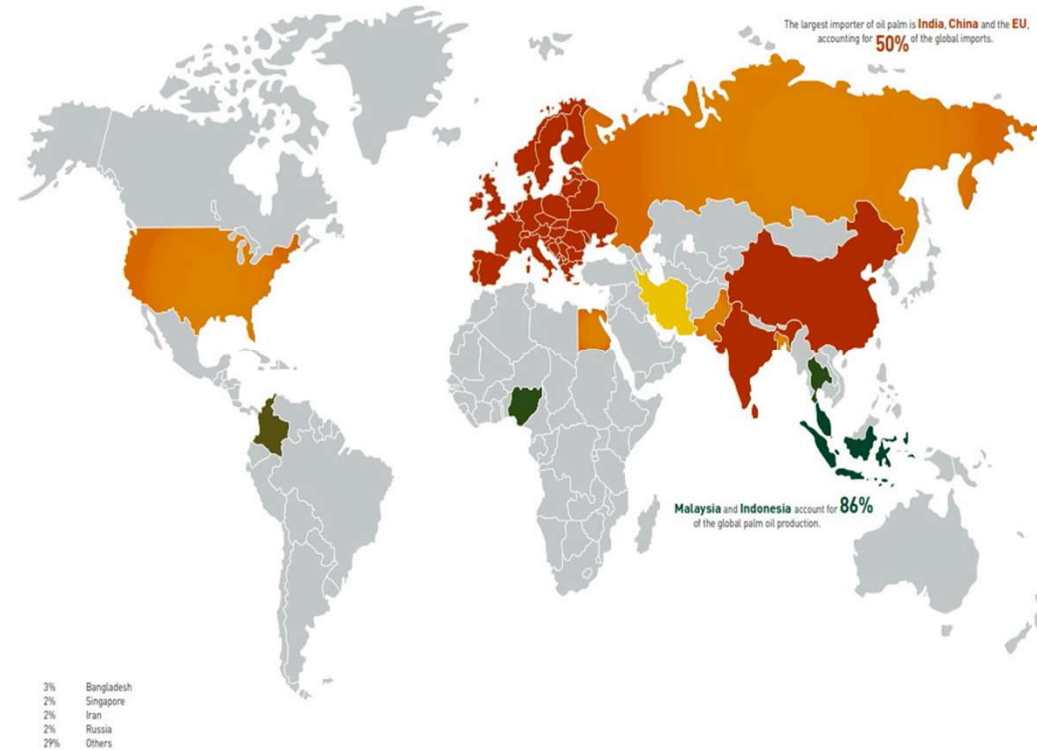
Global production of palm oil and palm kernel oil comprises of one-third of the global vegetable oil production in '19/20 (million metric tonnes)



Indonesia & Malaysia are responsible for producing about 86% of the world's palm oil.

India, China and EU are the largest importers of palm

PRODUCERS AND IMPORTERS OF OIL PALM



Palm oil in Malaysia at a glance

2

ND largest producer and exporter of palm oil worldwide

10

% of world's oils & fats production

5.8

MILLION HECTARES of land (17.5% of our land mass)

10

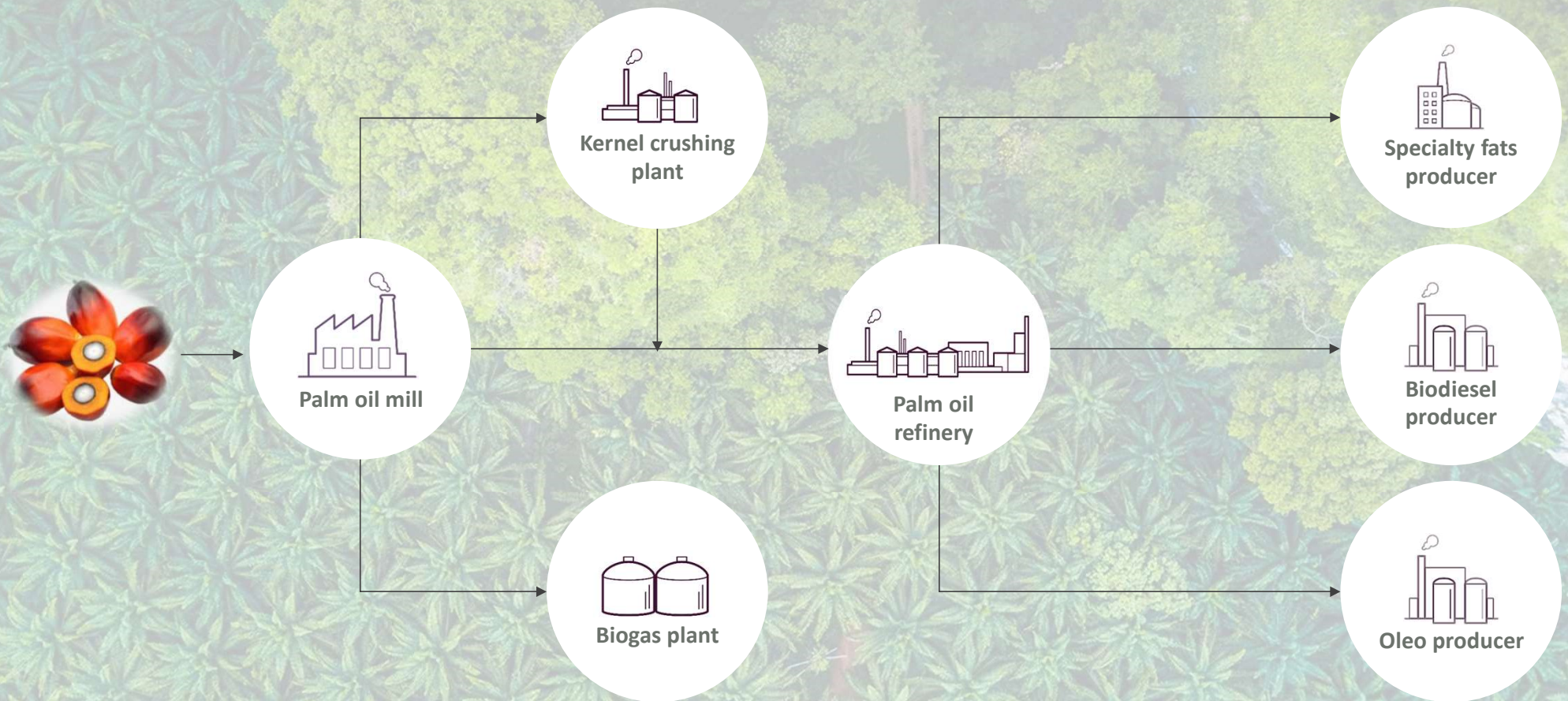
TOP largest export earner for Malaysia in the last decade

600,000

PEOPLE employed directly

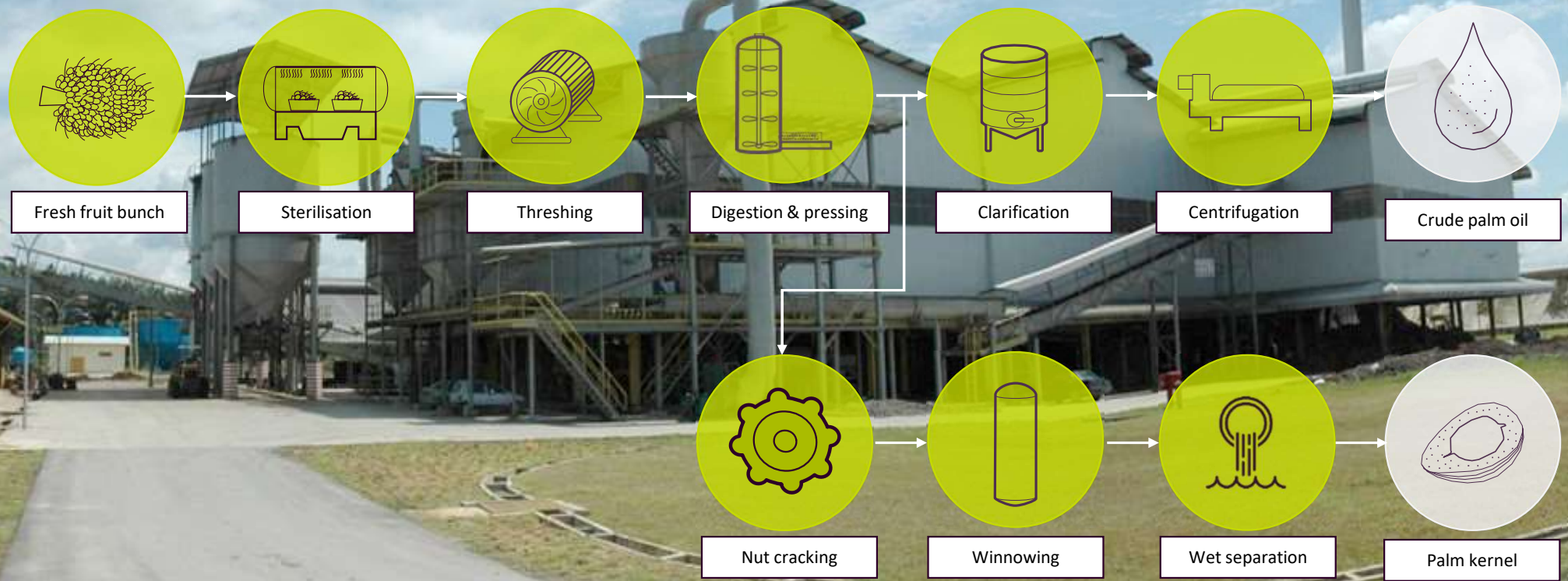
Palm oil processing value chain

In some ways it is not different from oil & gas industry. There is an upstream, midstream and downstream



Palm oil milling

Palm oil mill produces crude palm oil and kernels as primary products and biomass as secondary product



Refining is done by either physical refining or chemical refining



Fat Modification Technology

Enzyme
Inter-
esterification

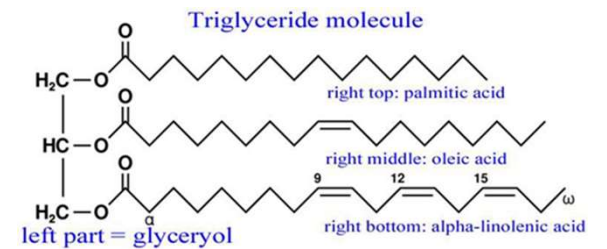
Chemical
Inter-
esterification

Hydrogenation

Solvent
Fractionation

Dry
Fractionation

Interesterification Fatty Acids move from one triglycerides position to another, and is used to obtain steeper melting curves



Enzymatic Interesterification (EIE)

Technology enabling customization of structural lipids with position-specific enzymes



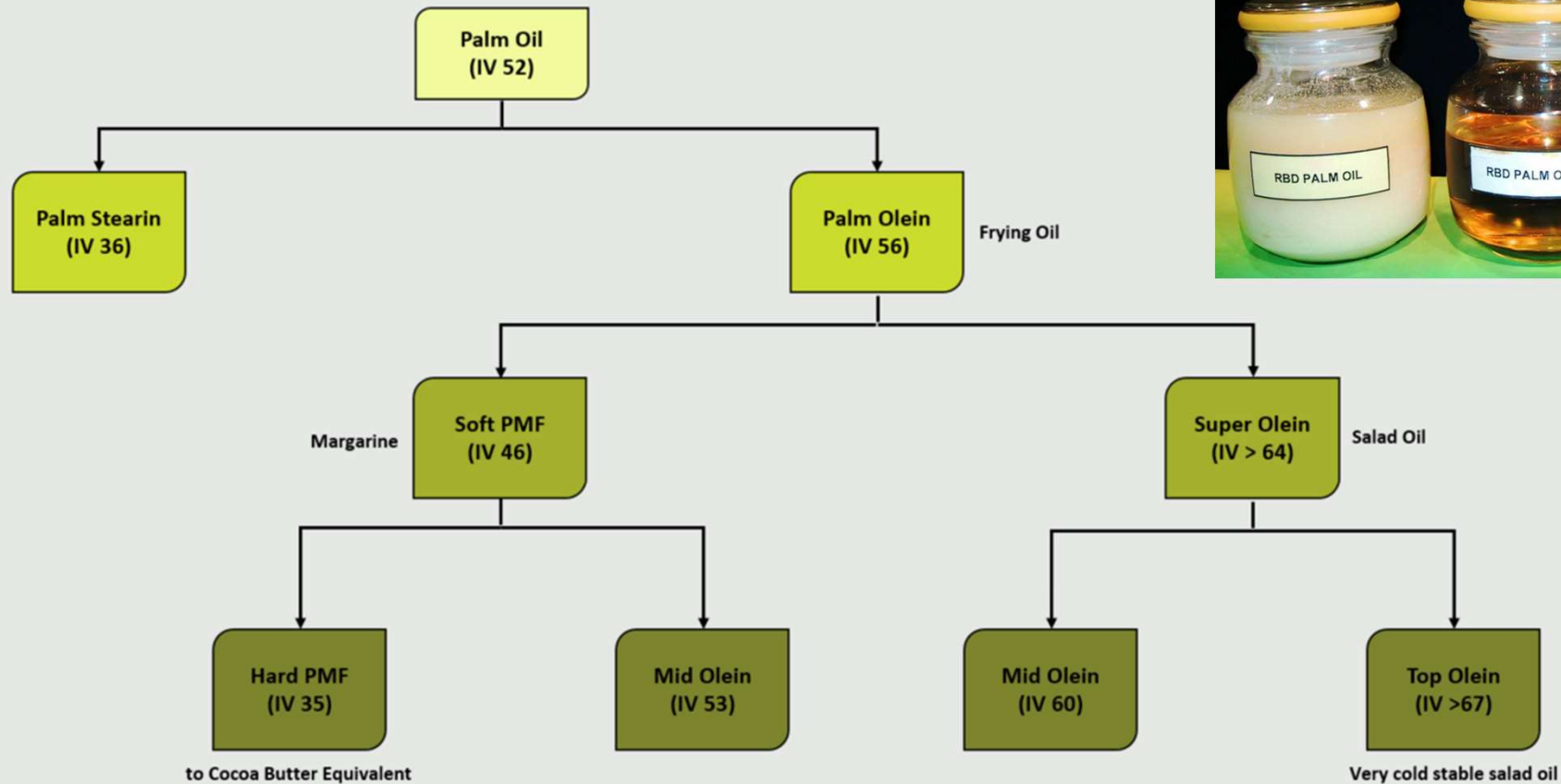
Cocoa butter
equivalents (CBE)



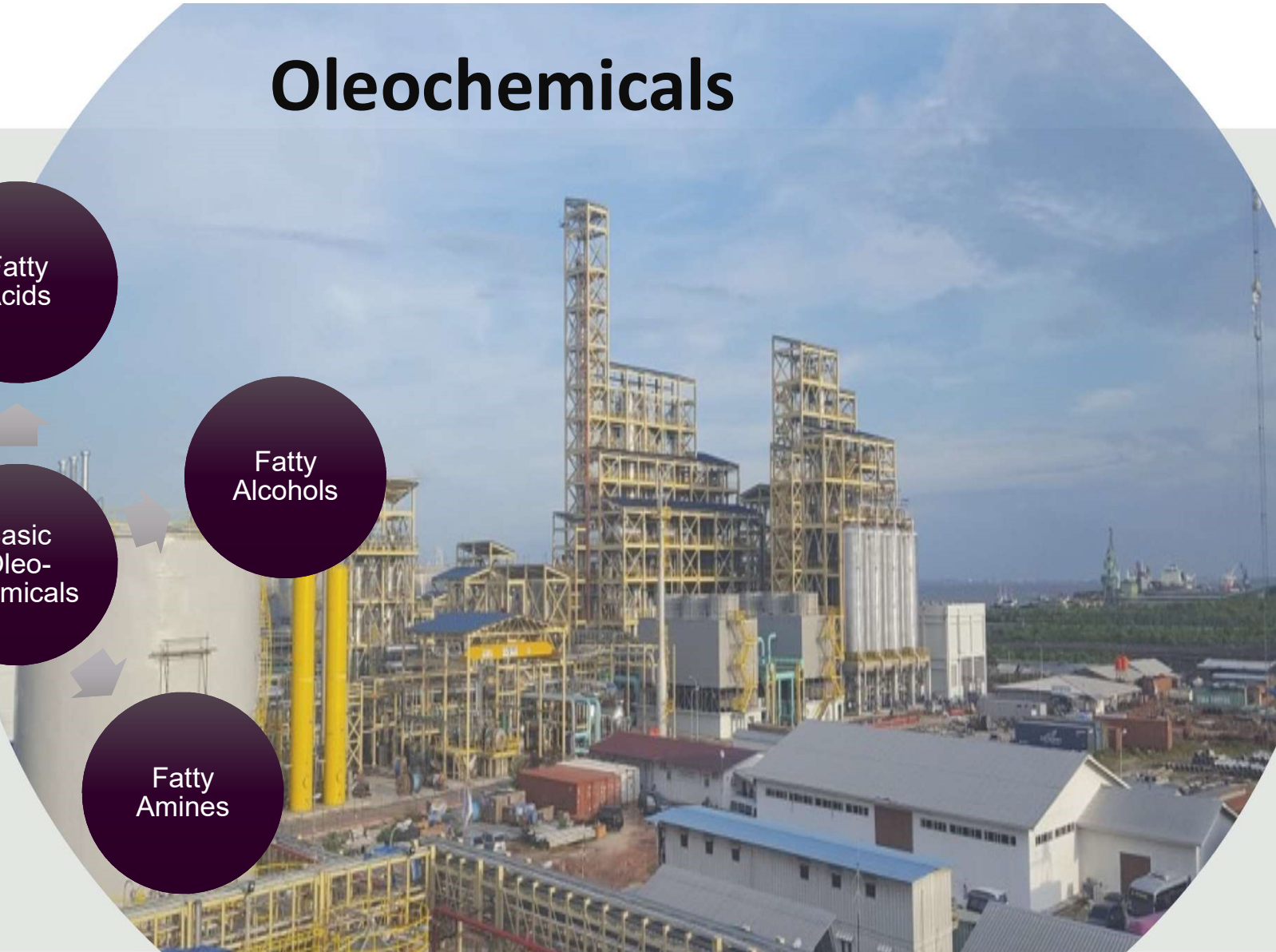
Human milk fat
equivalents (OPO)

Dry Fractionation of Palm Oil

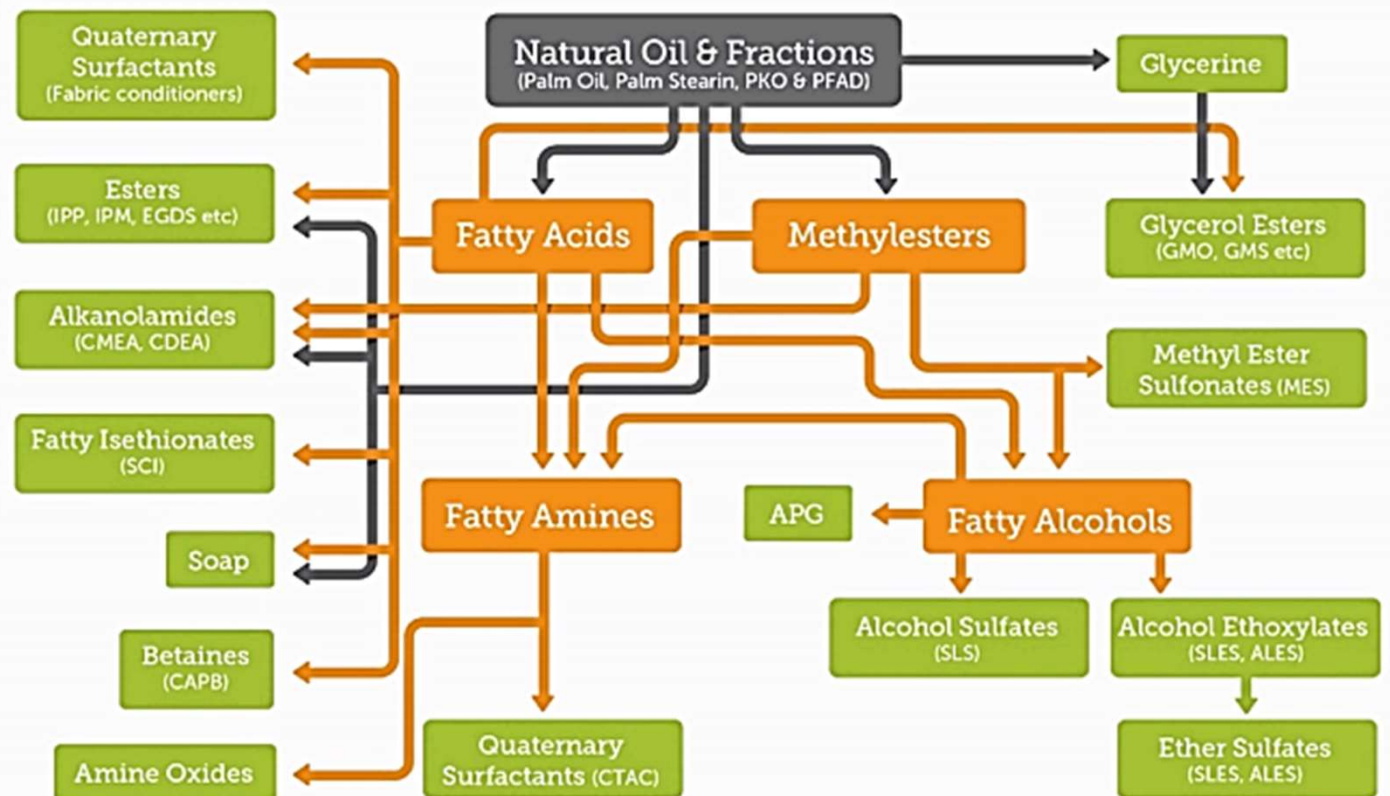
Typical fractionation by thermo-mechanical means



Oleochemicals



Pathways within oleochemicals



Source: https://www.efeca.com/wp-content/uploads/2019/12/Briefing-note-Oleochemicals_Efeca_09.08.18.pdf

Biodiesel processing





Cooking and frying oils



Potato chip



Body wash



Lubricating oil



Chocolates



Spreads



Lipstick



Candle



Margarine



Bakery product



Tocotrienol



Ice cream



Soap bar



Biodiesel

It's not unrealistic to claim more than half the products on sale in supermarkets are made with palm oil

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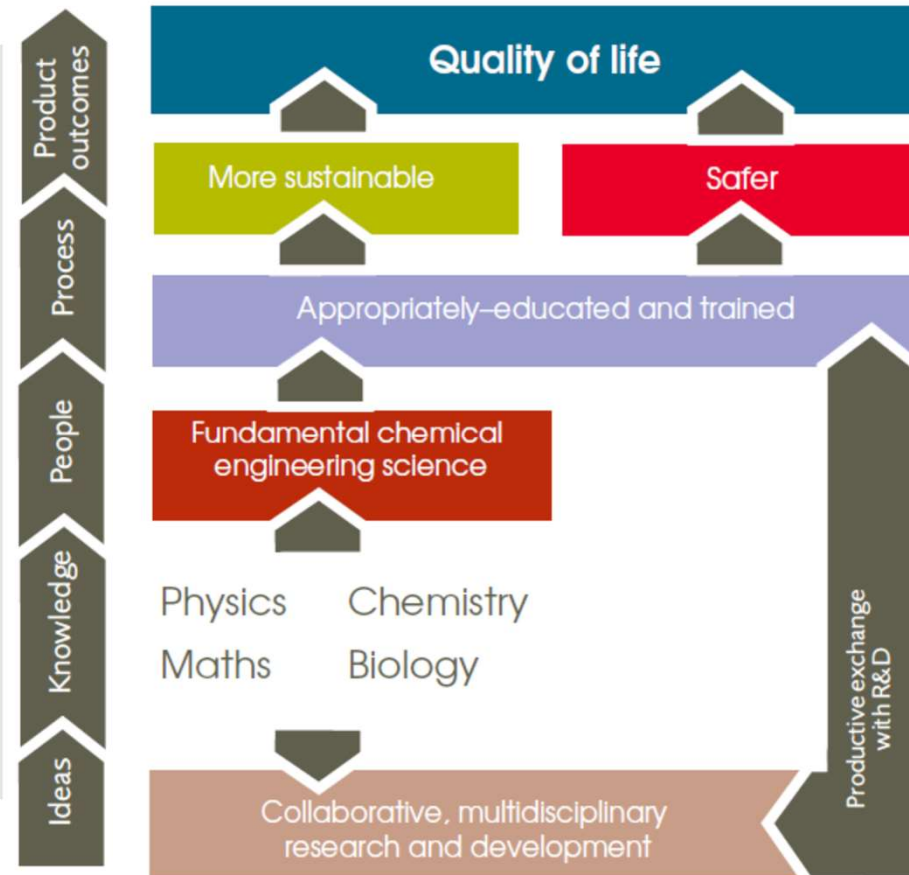
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Our role as chemical engineers is to improve the quality of life

We get **idea and knowledge** from people together in biology, chemical, maths and physics, and put it **together** as chemical engineering science.

We **collaborate and exchange ideas** with multidisciplinary teams in research and development.

When you are properly trained and educated, you can make the **process more sustainable and safer**.



Where chemical engineering knowledge applies in palm oil industry

Process technologies



Distillation, crystallization,
filtration, separation

Safety and loss prevention



Management of change,
HAZOP

Sustainability & environmental



Optimizing resources usage,
convert waste to wealth

Thermodynamics



Increasing splitting degree
in hydrolyzer

Mathematical modelling



Catalysed reaction, spray
crystallization

System analysis



Trouble shooting, control
of processes

Underlying chemistry



Hydrolysis, esterification,
transesterification

Economic evaluation



Plant debottlenecking,
cost optimization

Where you can find chemical engineers...



What does the palm oil processing industry expect from chemical engineers nowadays?

Able to apply
knowledge and
understanding to
practical situations

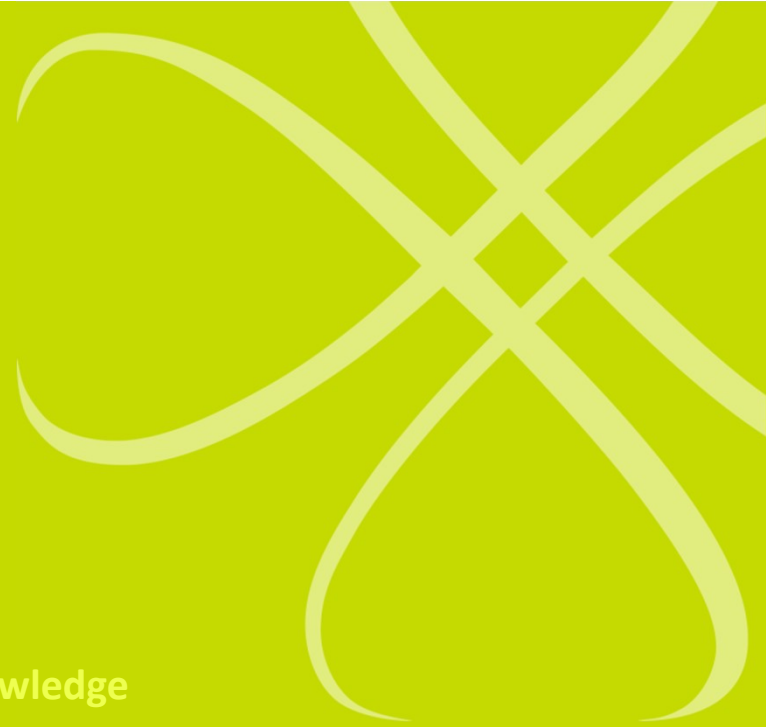
Able to manage
interpersonal
relationship,
demonstrate
leadership and
exhibit
communication skills

Commit to high
standards of
professional and
ethical conduct.

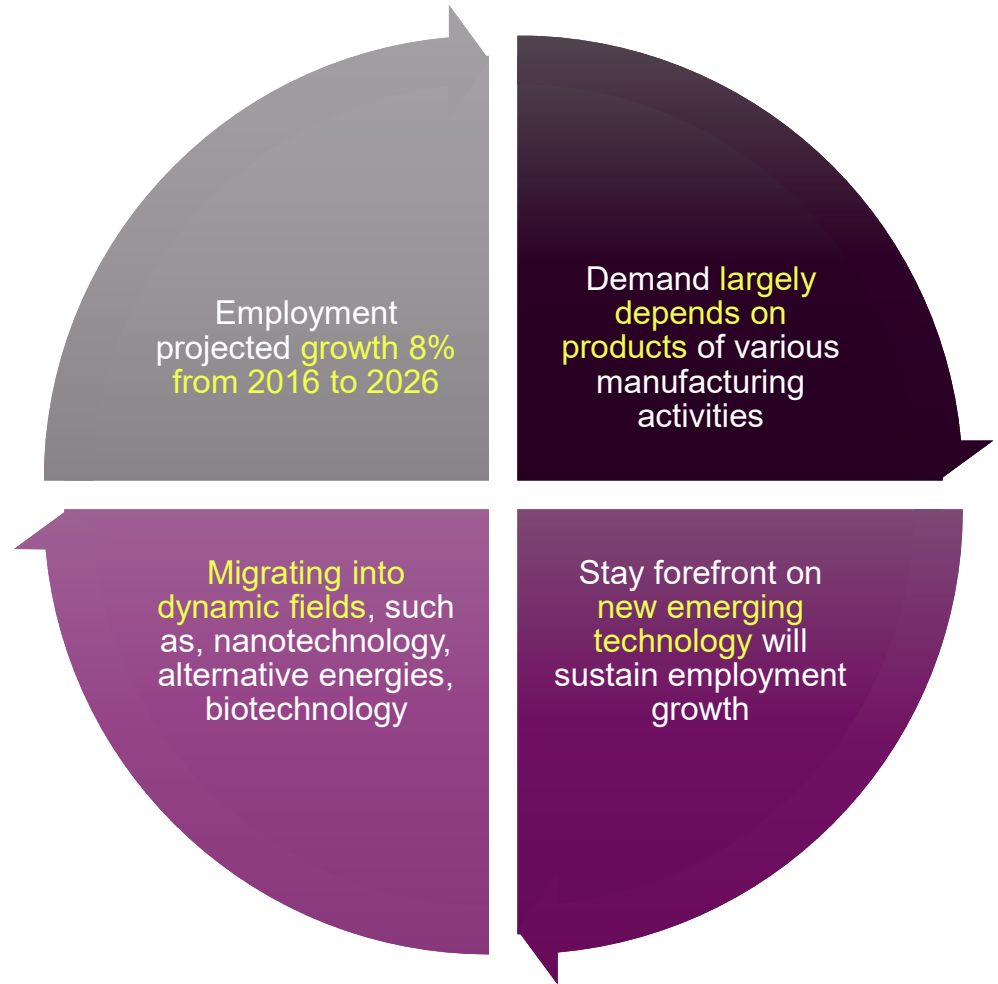
Commit to
continuing
professional
development, related
to professional
knowledge and
competence

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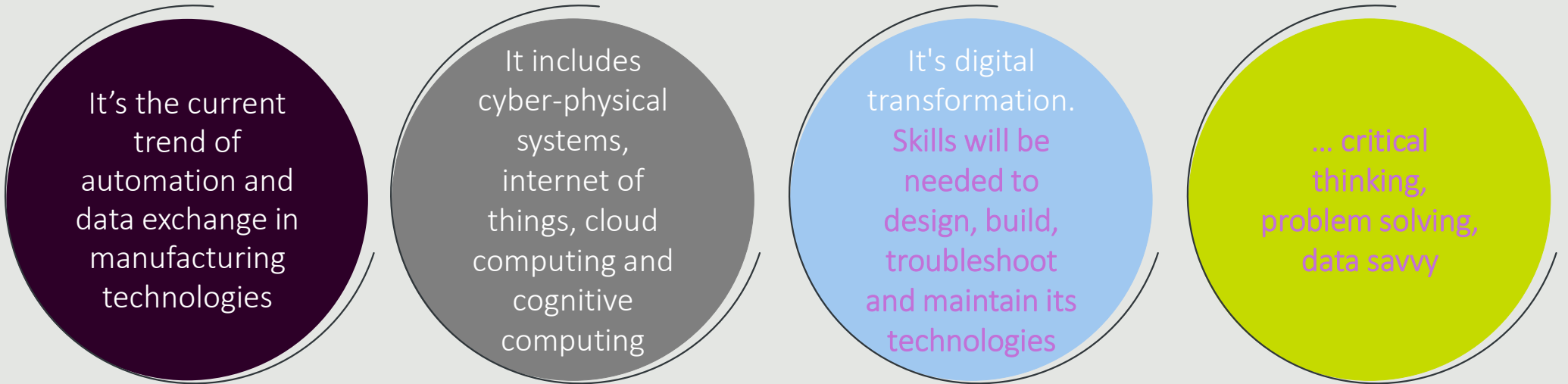


Employment outlook for Chemical Engineers



Source(s): [Chemical Engineers - Future Job Demand \(careerplanner.com\)](http://careerplanner.com)

What does the future of Industry 4.0 mean for students like you?



It's the current trend of automation and data exchange in manufacturing technologies

It includes cyber-physical systems, internet of things, cloud computing and cognitive computing

It's digital transformation.
Skills will be needed to design, build, troubleshoot and maintain its technologies

... critical thinking, problem solving, data savvy

Six qualities that will help you develop and excel in your job

**Analytical
Skills**

Creativity

Ingenuity

**Inter-
personal
skills**

**Math
Skills**

**Problem
Solving
Skills**



Thank you