

Economic Dimension – What is Economics?

- Economics is the study of the **production and distribution of goods and services**, it is the study of human efforts to satisfy unlimited wants with limited resources
- It studies **how agents allocate scarce resources** amongst alternatives to meet **unlimited** human **wants**



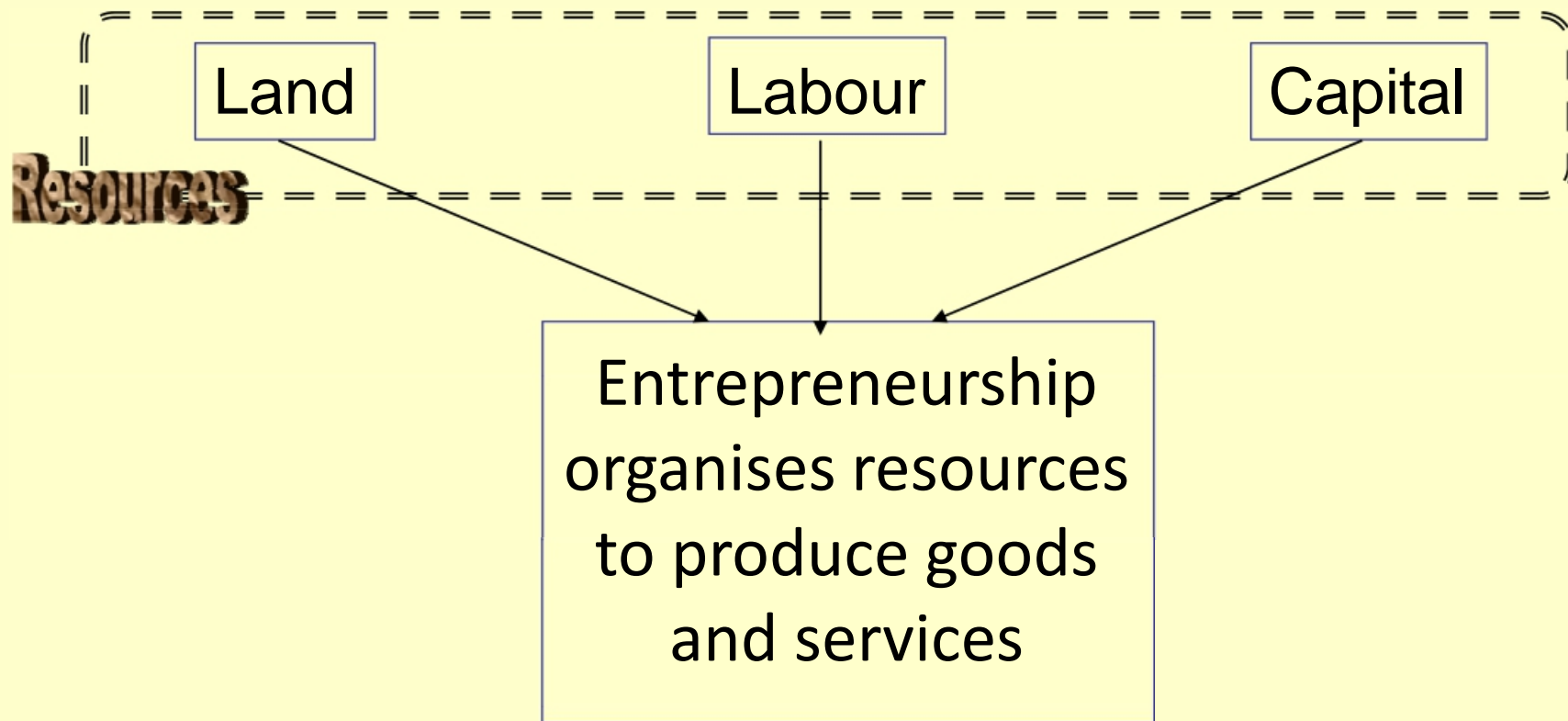
Allocation of resources

- Process occurs at many **levels**
 - Consumers
 - Firms
 - Government
 - Market System
- **Allocation** decisions impact natural environment
 - Want decisions to be based upon incentives that reflect **“true” value to society**
 - Unfortunately decision makers do not consider “true” value in choices
 - Need for policy intervention to overcome such market failure



Scarce resources and production

Resources are the basic categories of inputs organised by entrepreneurship (a special type of labour) to produce goods and services. Economists divide resources into the three categories of land, labour and capital.



Reference: A. Layton, R. Robinson and I.B. Tucker, 'Economics for today', Thomson 2002

The Hong Kong Polytechnic University

Contemporary Economics

- Macroeconomics – Aggregated analysis ←
 - John Maynard Keynes in 1936 and 1940
 - Choices of government
 - Monetary Policy - Federal Reserve
 - Fiscal Policy – Taxes and Spending
 - Macroeconomic targets
 - Income Levels
 - Inflation
 - Employment

aggregated indicators such as GDP, unemployment rates, national income, price indices, and the interrelations among the different sectors of the economy to better understand how the whole economy functions



Contemporary Economics

- Microeconomics – Disaggregated analysis ← studies the behavior of individuals and firms in making decisions and the interactions among these individuals and firms in narrowly-defined markets.
 - Adam Smith's Wealth of Nations in 1776
 - Choices of consumers (households) and producers (firms)
 - Two types of Markets
 - Factor Markets – Consumers sell inputs used in production to firms ← the labor markets, the capital market, the market for raw materials, and the market for management or entrepreneurial resources
 - Product Markets – Firms sell final output to consumers ← the goods and services that people and businesses sell and buy
 - Three types of analysis
 - Partial Equilibrium – Focus on single factor or good
 - Multi-Market – Interrelationships amongst key fundamental markets
 - General Equilibrium – Economy as a whole



Macro vs micro-economics

Microeconomics

- Examining **individual** trees rather than the wood
- Studies decision making by **single** individual, household, firm or industry
- Focus on **behaviour** of small economic units
- E.g. egg industry, will suppliers decide to supply more less or the same amount of eggs to the market in response to price changes? Will individual consumers decide to buy more, less or the same amount of eggs at new price?

Macroeconomics

- Surveys the wood
- Studies decision-making for the economy as a **whole**
- Examines **economy-wide variables**, e.g. inflation, unemployment, money supply, flows of exports/imports and international financial capital
- Macroeconomic decision makings considers 'big picture' policies as the effect of balancing the federal **budget** on **unemployment**, the effect of changing the money supply on prices and the effect of strong economic growth on the value of the **currency**.

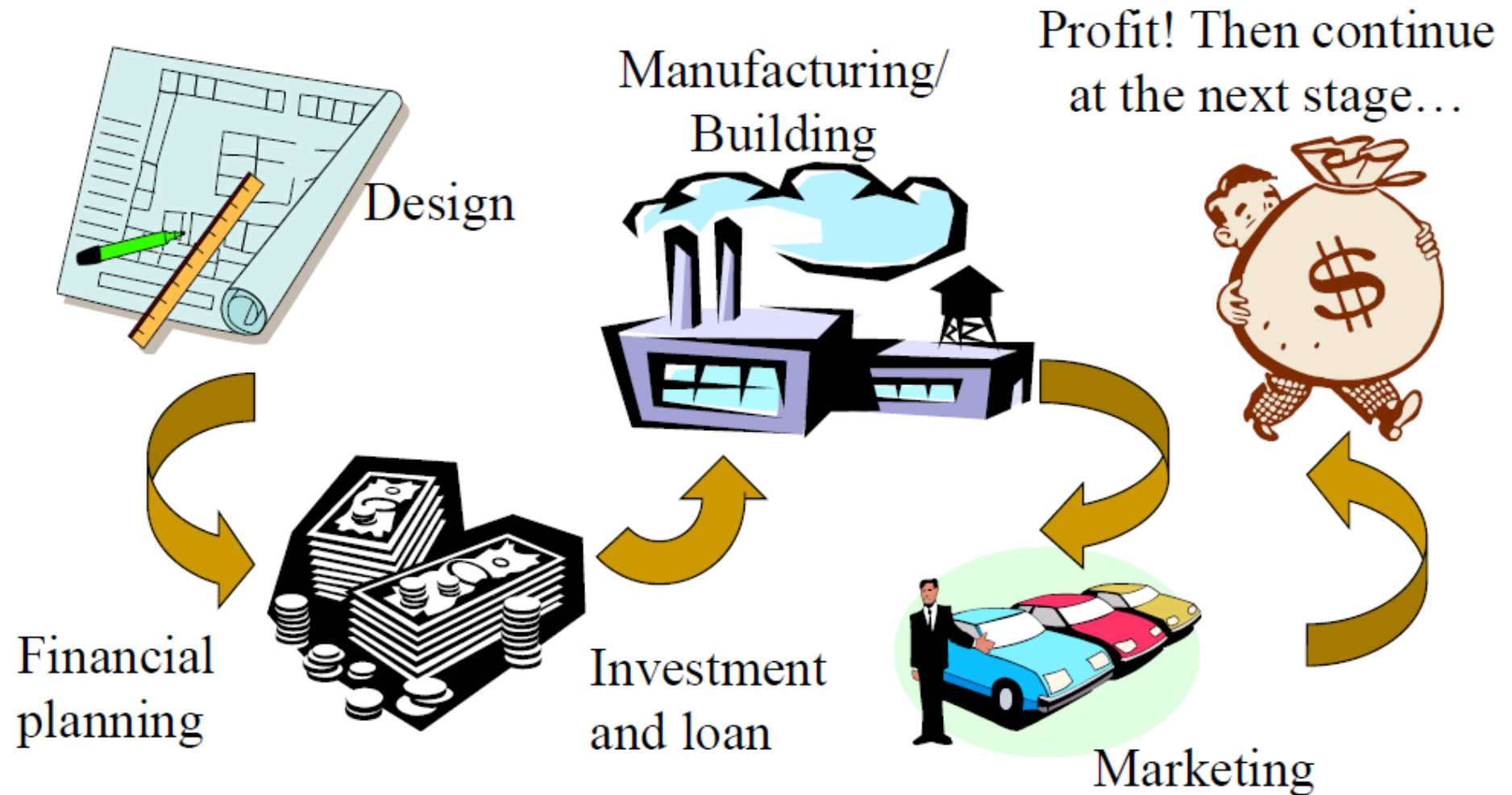


Why Does an Engineer Need To Understand Economics

□ The tools of engineering economy presented in this subject will help bridge the gap between **engineering** and **business** that otherwise will prevent the engineer from being successful .

Engineering Economic Decisions

Needed in the following (connected) areas:



Managing Resources

- ❑ Must also need economic considerations:
 - Economic feasibility. The solutions provided must not exceed **monetary budget limits**.
 - Economic efficiency. The most economical of the many technical solutions to a problem should be chosen.
- ❑ Engineers are burdened with satisfying both engineering requirements and economic requirements. These two requirements are not trivial.
- ❑ Provided that all of the solutions designed by the engineers are technically feasible, the tools of engineering economy allow the engineer to implement solutions that are **technically and economically efficient**.

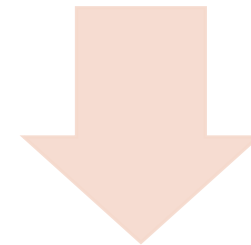
Linking Economics with Engineering

- ❑ In this subject, we generally assume that technical solutions are readily available or have already been designed. That is because those solutions are **discipline specific**.
- ❑ To be able to devise a plan on spending money and **justify reasoning** (e.g. Being able to calculate operating and maintenance costs is important in determine what type of materials should be used and why.)
- ❑ Any engineering project can be defined according to **cash inflows and outflows**. Outflows include all expenses (costs), while inflows include all saving or revenues derived from implementing a solution.
- ❑ The engineer **must evaluate the economic aspects of a project, not just its technical merit**

Engineering Economy

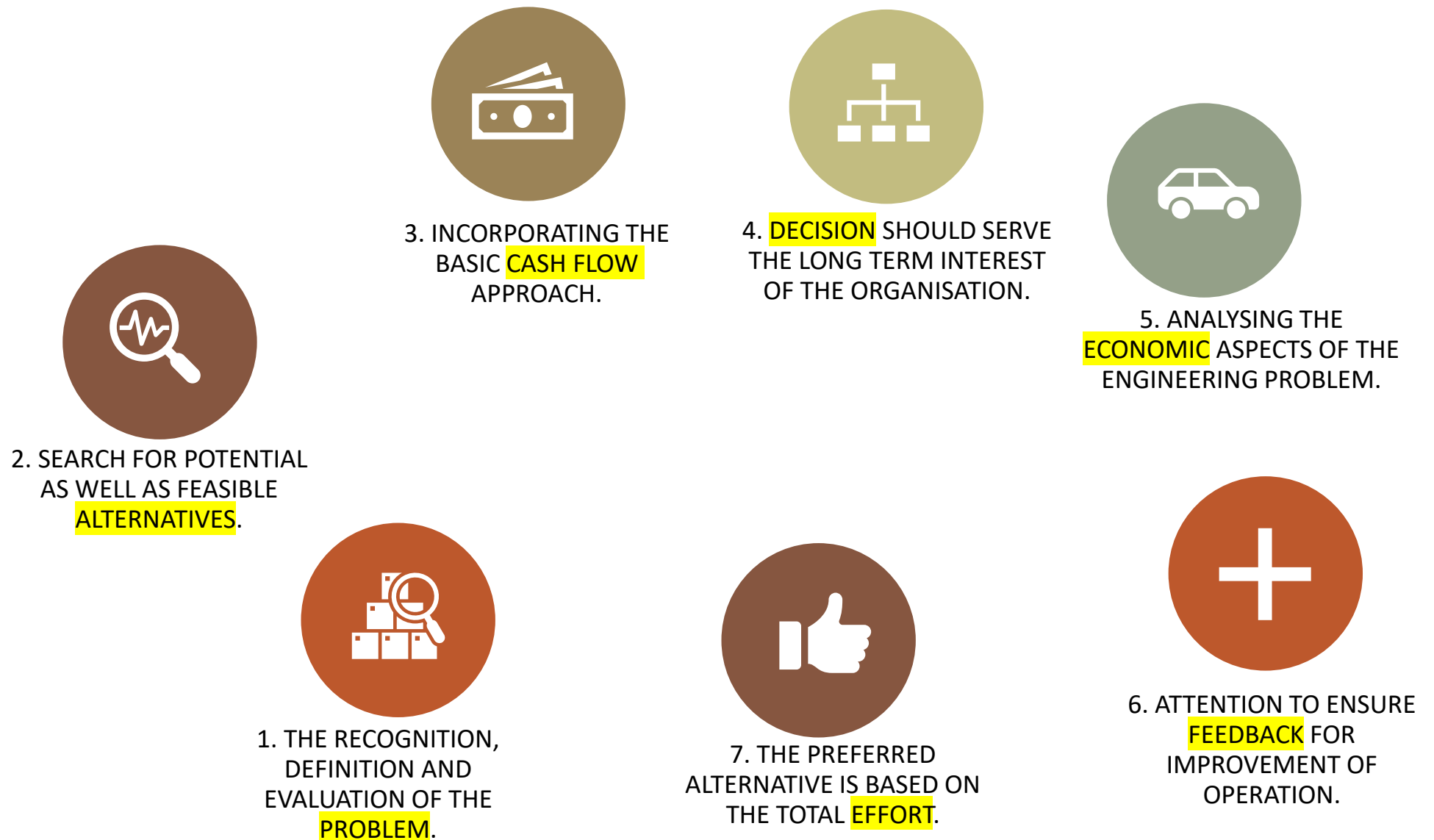
Engineering economics is closely aligned with conventional **micro-economics**. It is devoted to problem solving and decision making at the operational level.

- Engineering economics defines how the financial or economic aspects of a project are to be evaluated.
 - When **multiple projects** are available to solve a problem, the economic consequences of each of the **choices** can be evaluated and the **best alternative** selected for implementation.



Engineering Economics refers to those aspects of economics and its tools of analysis most relevant to the Engineer's **decision-making** process. (e.g. material selection, manufacturing method...)

This decision making includes a 7 step-procedure



Engineering Economic Decisions

Profit Enhancing Example:

New product development



- iPhone 14
- iPhone 12 Pro and iPhone 12 Pro Max deliver an advanced 5G experience on a global scale, engineered with a seamless integration of world-class hardware and world-class software. 5G on iPhone boasts improved speeds for faster downloads and uploads, higher quality video streaming, more responsive gaming, real-time interactivity in apps, FaceTime in high definition, and much more.
- Customers will also be able to enjoy a secure, fast connection, reducing the need to connect to public Wi-Fi hotspots.

Engineering Economic Decisions

Profit Enhancing Example:

Improved customer service



- Towngas: The total solutions include comprehensive customer services that serve her customers around the clock. In addition to a 24-hour service hotline and same day services for installation and maintenance, the customer service centres offer a friendly face and one-stop services as well as showcasing our total gas lifestyle concept.
- The Towngas Cooking Centre promotes the benefits of flame cooking, serving as a platform for cookery lovers, while [Towngas Avenue](#), which provides a blend of gourmet dining hand-in-hand with comprehensive customer services, has received widespread praise from customers.

Engineering Economic Decisions

Cost Control Example:

Improving efficiency
Streamlining operations

Self-service Check-in



- Time is on your side with our self-service facilities at the airport or at in-town station locations. Designed to speed you through check-in and bag drop, our self-service network will give you extra time to slow down and enjoy your journey. If you're new to the automated experience, our airport staff will be on hand to assist you.
- Check in and get your boarding pass from the kiosk, then proceed to the bag drop counter. If you have already completed online check-in, simply proceed directly to the bag drop counter.

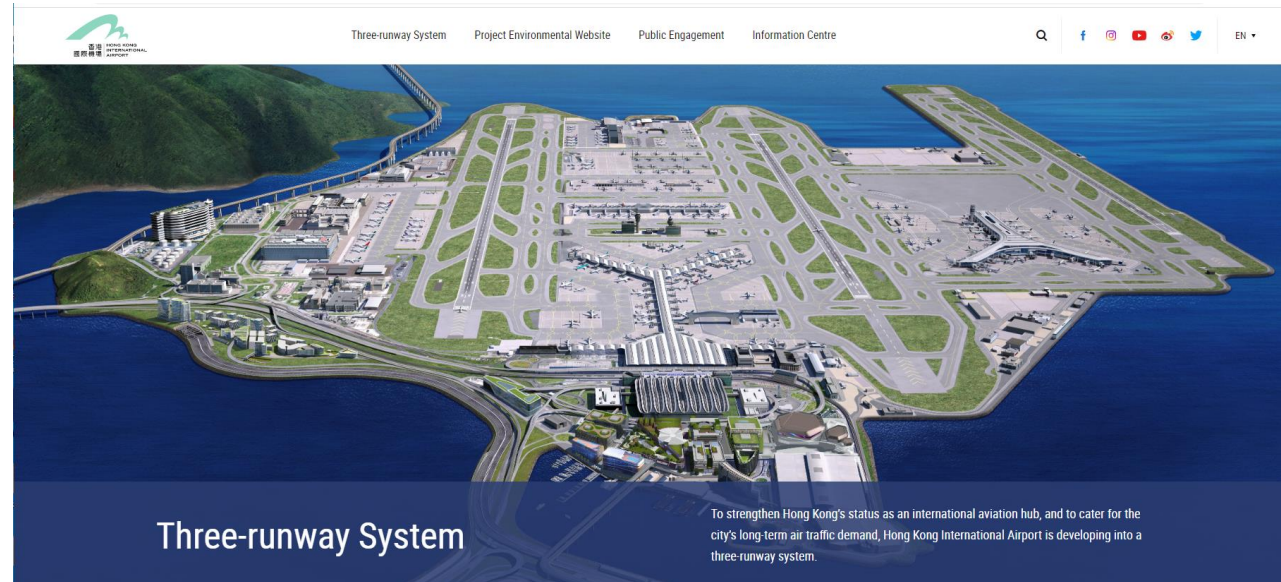
Engineering Economic Decisions

Public Improvement Example:

Increased public satisfaction

Improved infrastructure

Three-runway system (3RS)



- The estimated construction cost is HK\$141.5 billion at money-of-the-day prices. The overall financial arrangements for the 3RS are based on the “joint contribution and user-pay” principle. Funding is provided through three sources: retaining operating surplus of the Airport Authority Hong Kong (AAHK), levying an [airport construction fee \(ACF\)](#) on passengers departing from HKIA, and borrowing funds from the market through bank loans and bonds.

Engineering Economic Decisions

Public Improvement Example:

Increased public safety

Gas safety



- On 11 April 2006, leakage was found on a medium pressure ductile iron (MP DI) pipe underneath Jordan Valley North Road in Ngau Tau Kok.
- A Towngas explosion subsequently occurred inside Wai King Building, which is about 25 metres away from the point of leakage.
- The gas explosion incident has caused two fatalities and nine injuries, and damage of varying degrees to the property and utilities of Wai King Building.

Engineering Economic Decisions

Public Improvement Example:

Increased public safety

Accelerated Replacement of Towngas Pipelines

- Ductile Iron (DI) pipes are still in service for gas distribution network in various parts of the world such as the USA, European Union, Singapore and Japan.
- These pipes, with protective coatings, meet international safety standards and should last for 50 years under normal circumstances. Since the 1990s, HKCG has gradually phased out laying of DI pipes and introduced new polyethylene (PE) pipes (聚乙烯喉管) for underground distribution network to enhance gas safety. The PE pipes are free from ferrous corrosion problem, and possess enhanced quality of pipe joint and better resistance to ground subsidence.



Investment Decisions on Engineering Projects

Invest

- Releases funds to start a project

Do not invest

- Eliminates the project from further consideration

Wait (Delay)

- Time to gather information about the future can aid in decision-making

Predicting the Future

- Estimating a Required investment
- Forecasting a product demand
- Estimating a selling price
- Estimating a manufacturing cost
- Estimating a product life



⇒ Risk of wrong estimations

Investment Decisions on Engineering Projects

Capital budgeting, is the proper usage and utilization of capital to achieve project objectives.

The actual acquisition of that capital has many different routes. Factors such as risk of capital loss, along with possible or expected returns must also be considered when capital budgeting is underway.

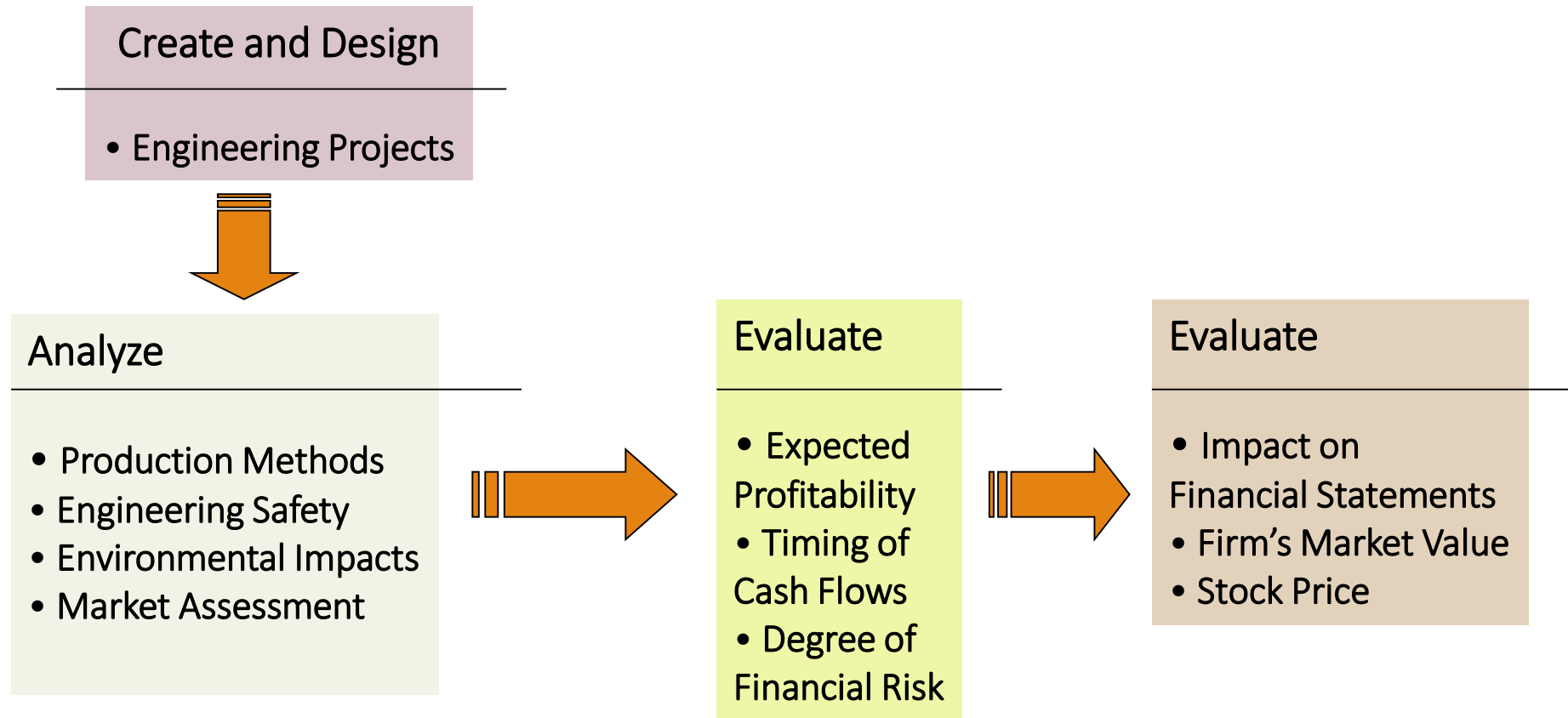
Example:

If a company has \$20,000 to invest in a number of *high, moderate, and low risk projects*, the decision would depend upon how much risk the company is willing to take on, and *if the returns offered by each category offset this perceived risk*.

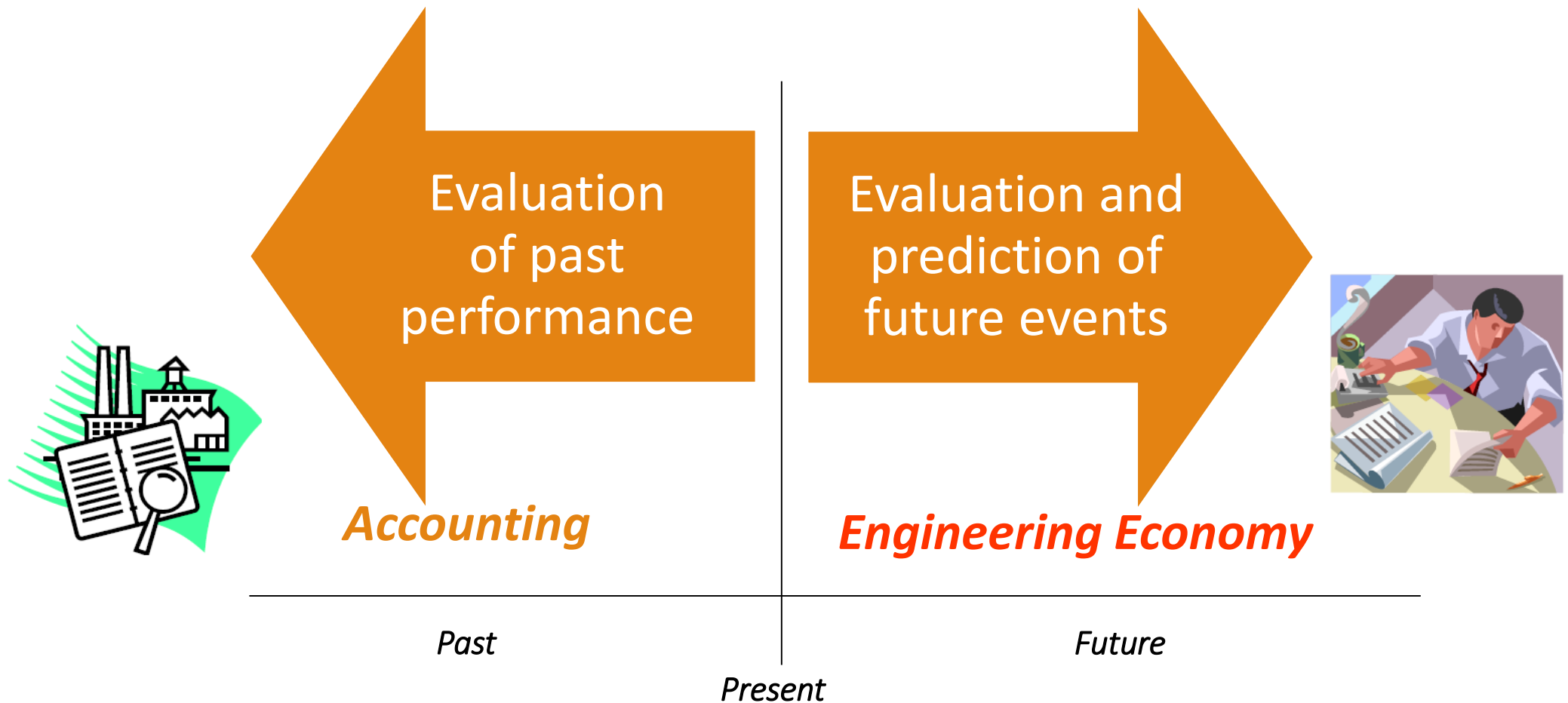
If the high risk offered only 20% return, while the moderate offered 19% return, engineers and managers would most likely choose the moderate risk project, as its return is far more favorable for its category. The high risk project failed to offer proper returns to warrant its risk status.

A more difficult decision may be between a moderate risk offering 15% while a low risk offering 11% return. The decision here would be much more subject to factors such as company policy, extra available capital, and possible investors.

Role of Engineers in Business



Accounting Vs. Engineering Economy



Example of macro economy

CEPA

- The Mainland and Hong Kong **Closer Economic Partnership Arrangement** (CEPA) is the first **free trade agreement** ever concluded by the Mainland of China and Hong Kong. The main text of CEPA was signed on 29 June 2003.
- CEPA opens up huge markets for Hong Kong goods and services, greatly enhancing the already close economic cooperation and integration between the Mainland and Hong Kong.



CEPA

- For Hong Kong, CEPA provides a window of opportunity for Hong Kong businesses to gain **greater access to the Mainland market**. CEPA also benefits the Mainland as Hong Kong serves as a perfect "springboard" for **Mainland enterprises to reach out** to the global market and accelerating the Mainland's full integration with the world economy. Foreign investors are also welcome to establish businesses in Hong Kong to leverage on the CEPA benefits and join hands in tapping the vast opportunities of the Mainland market.



CEPA Implementation

CEPA covers 3 broad areas:

- Trade in goods - All goods of Hong Kong origin importing into the Mainland enjoy **tariff free** treatment, upon applications by local manufacturers and upon the CEPA rules of origin (ROOs) being agreed and met.
- Trade in services - Hong Kong service suppliers enjoy preferential treatment in entering into the Mainland market in various service areas. Professional bodies of Hong Kong and the regulatory authorities in the Mainland have also signed a number of agreements or arrangements on mutual recognition of professional qualification.
- Trade and investment facilitation - Both sides agreed to enhance **co-operation** in various trade and investment environment facilitation areas to improve the overall business environment.



CEPA Update

Hong Kong Service Supplier

- On the whole, the new measures can help enhance HKSS' competitiveness in the Mainland.
 - Such measures will not only help enterprises overcome the current financial crisis,
 - but will also promote the long-term economic development of both sides.
- Details on CEPA including the newly agreed liberalisation and co-operation measures will be uploaded to the Trade and Industry Department's CEPA website: www.tid.gov.hk/english/cepa/index.html



Example of macro economy

Greater Bay Area

China's ambitious plan to develop its own 'Greater Bay Area'

<https://www.youtube.com/watch?v=D3rFwEfYUOw>

China's Greater Bay Area: How it differs from the other three

<https://www.youtube.com/watch?v=7jLE-eFmUYw>

Is the Greater Bay Area China's future?

<https://www.youtube.com/watch?v=iu9wTcMDpj8>

Self-reading: Keys to success in the Greater Bay Area