Duurzaam ondernemen door

een focus op

Life Cycle Costing (LCC)

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Presentator

- 20 jaar Fluor ervaring
- MBu Project Consultancy
- Leraar Cost Engineering (DACE/HAN)
  - Kwaliteitsmanagement
  - Value Management
  - Life Cycle Costing
  - Risicomanagement

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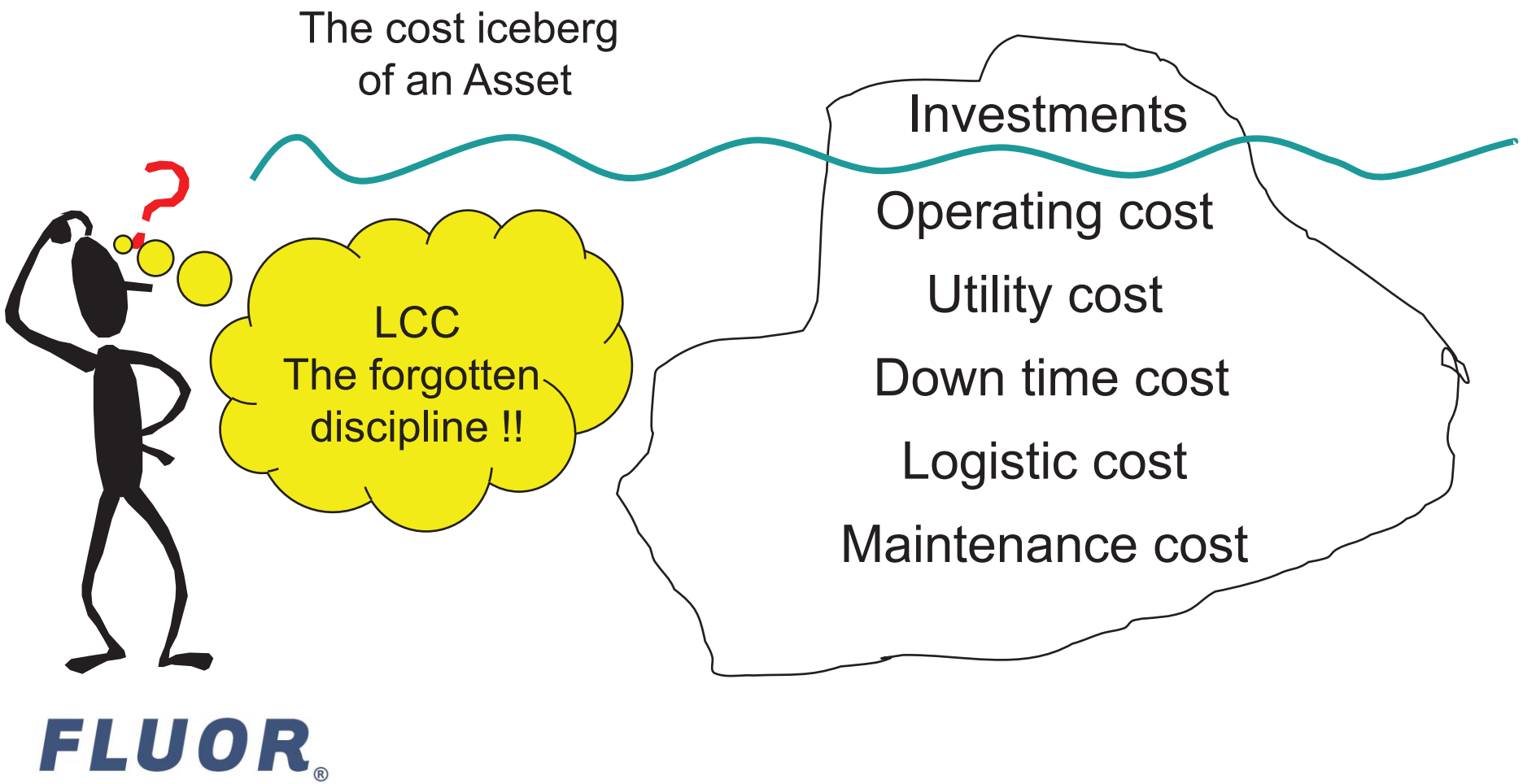
Presentation

1. What is Life Cycle Costing?
2. Examples
3. Conclusions
4. Discussion:

Is goedkoop altijd duurkoop?

Life Cycle Costing (LCC)



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What is Life Cycle Costing?

Major elements of Life Cycle Costing:

- Life Cycle Cost (LCC)
- Asset performance → Compliance to:
  - Functional requirements
  - Performance requirements (R**A**MS)
  - Life time requirements

$$\text{Asset Value} = \frac{\text{Required Asset Performance}}{\text{Lowest LCC}}$$

over a defined life time

Life Cycle Costing is a method to maximize Asset Value

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What is Life Cycle Costing?

Life Cycle Costing:

To evaluate and/or **optimize Life Cycle Cost (LCC)** while **satisfying specific Performance, Reliability, Availability, Maintainability & Safety (RAMS)** and other **requirements** over a **defined** (operational) **period**.

The aim is to provide **input to decision making** in all phases of a project life cycle. especially in the development phases

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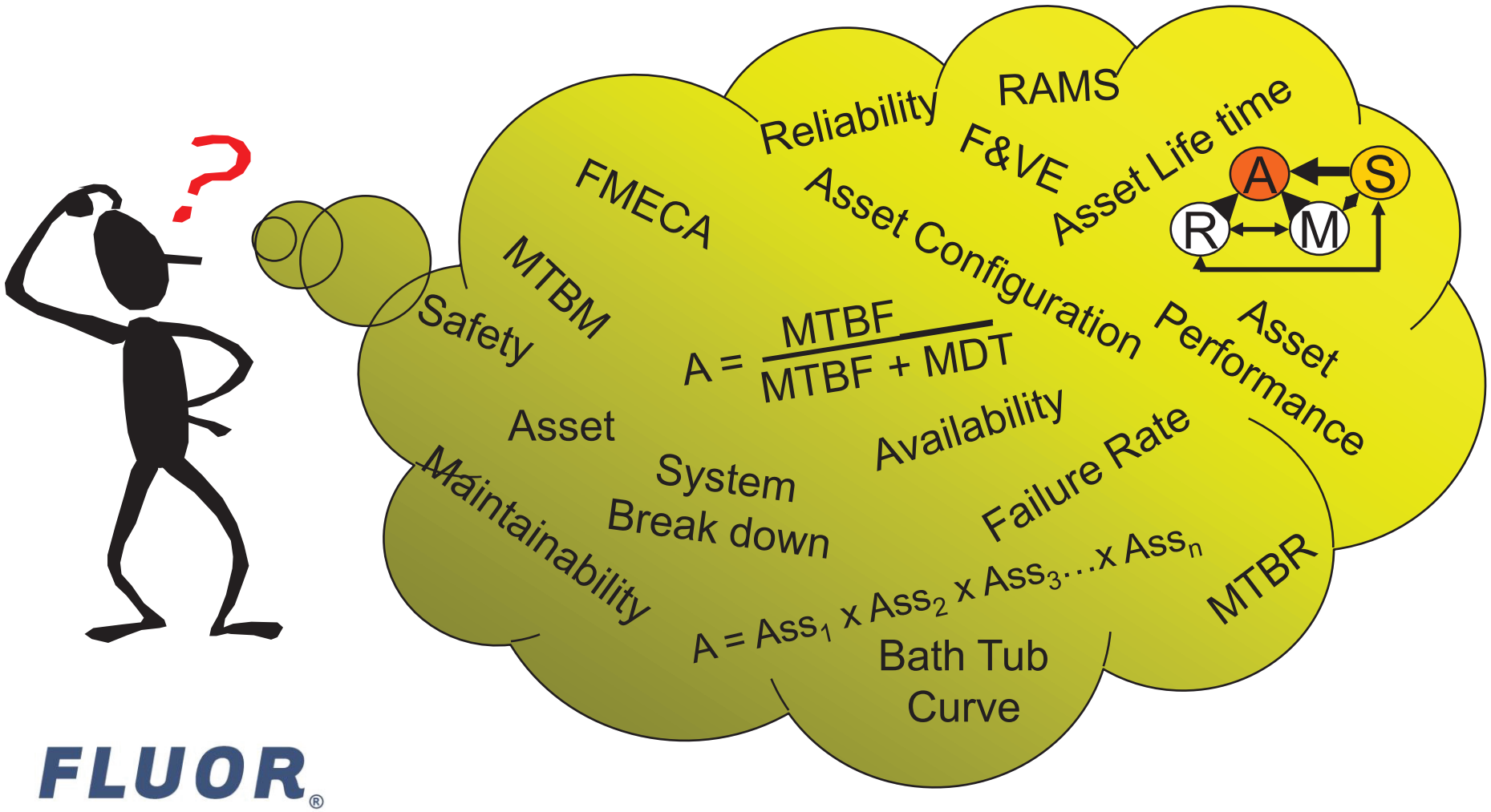
Asset Performance
Definitions and Formulas



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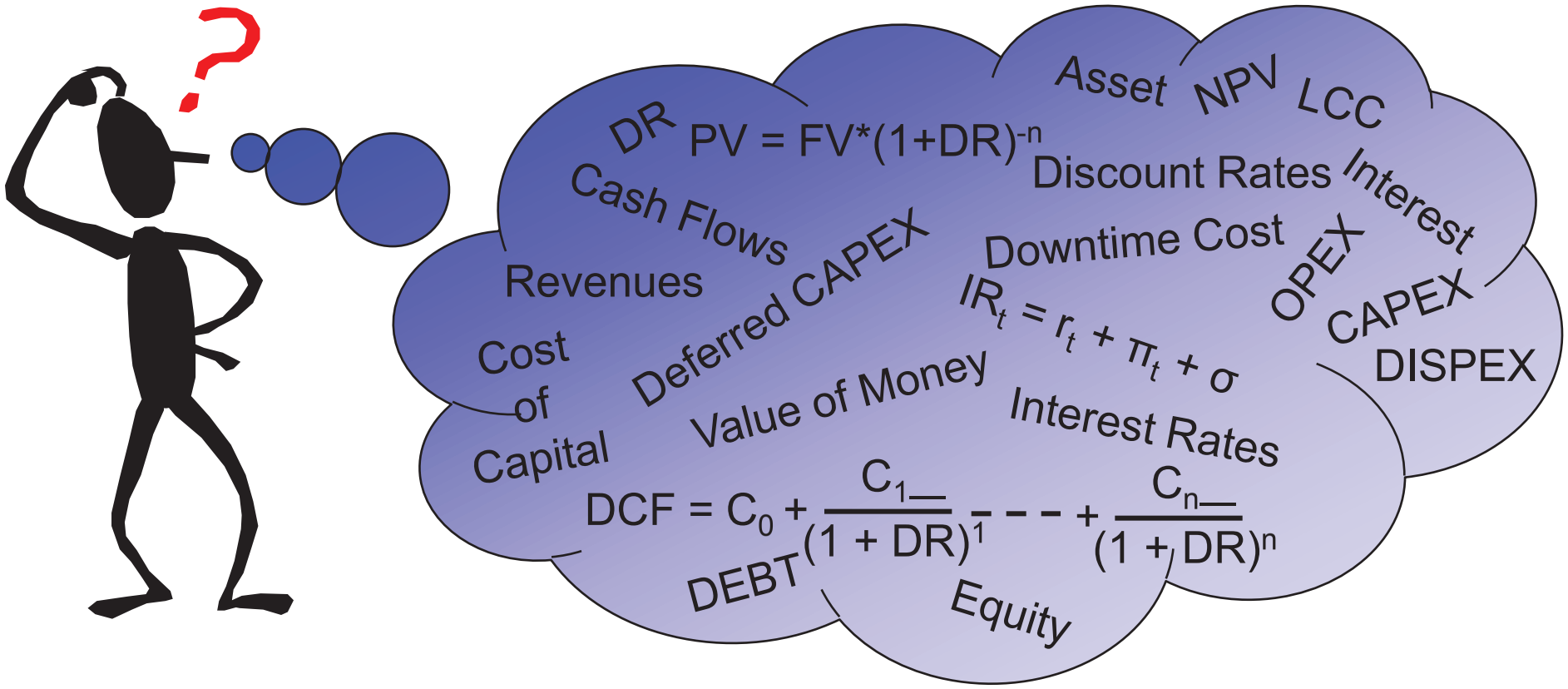
Financial Definitions and Formulas



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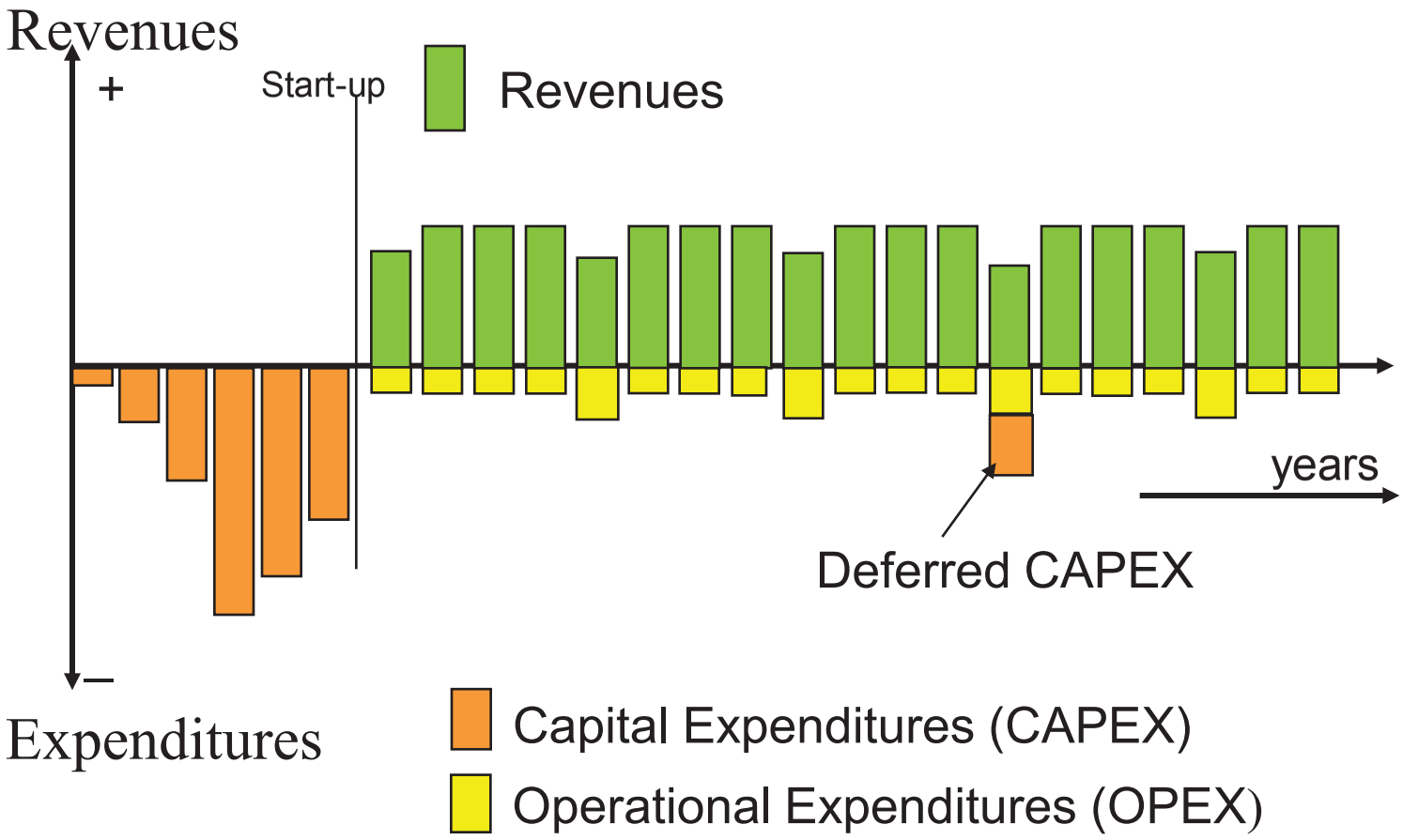
Typical Cash Flow model



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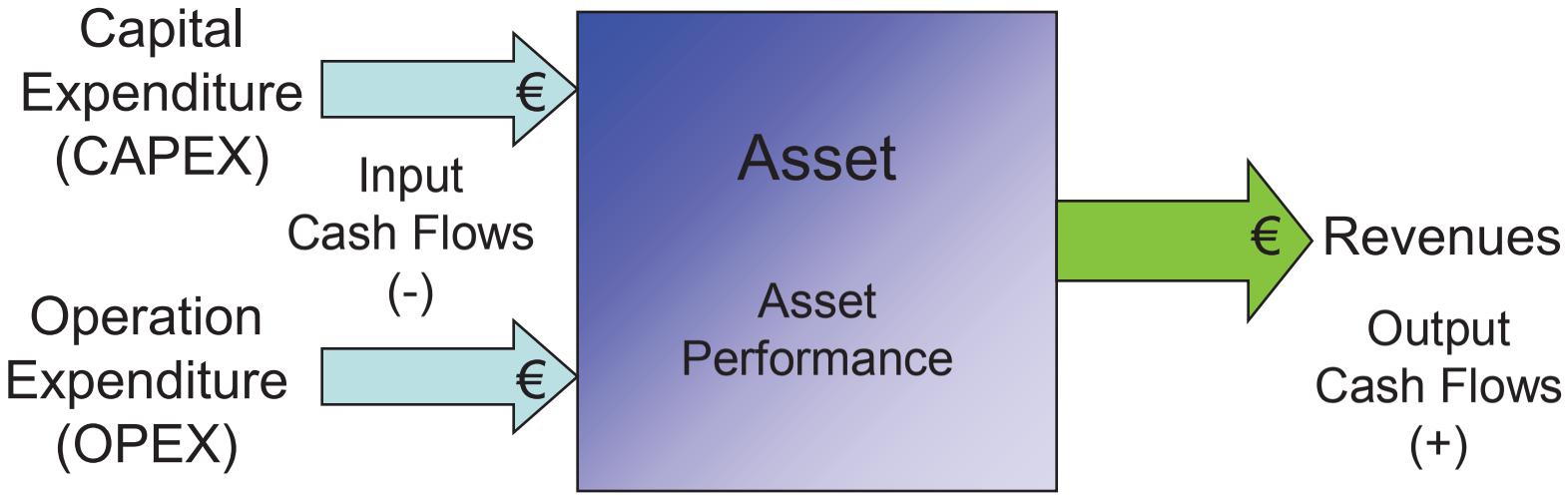
Net Present Value (NPV)



Net Present Value (NPV) = ∑ discounted in- and output cash flows

$$NPV = \sum_{n=0}^{n} \frac{Ct}{(1 + DR)^n}$$

t = the time of the cash flow
Ct = the net cash flow at time t.
DR = the discount rate (decimals)
n = the years of the project

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Major LCC Cost Drivers:

- Studies
- Requirements
- Specifications

- System
- Sub-system
- Equipment
  - Specification
  - Requisitions

- Purchasing:
- Equipment
- Materials
- Test equipment
- Factory testing
- Initial Spares
- Documentation
- Special tools

Transportation

Construction & installation

Inspection

Commissioning Start-up

Site testing & acceptance

Training

Operations/Asset Management
- Organization
- Management systems
- Monitoring systems

Utility cost
- e.g. Power

Maintenance
- Labor
- Spares
- Renewals
- Training
- Overhauls
- Spare inventory

} Preventive, Corrective, Inspections

•Downtime
- non-availability within the operating envelope

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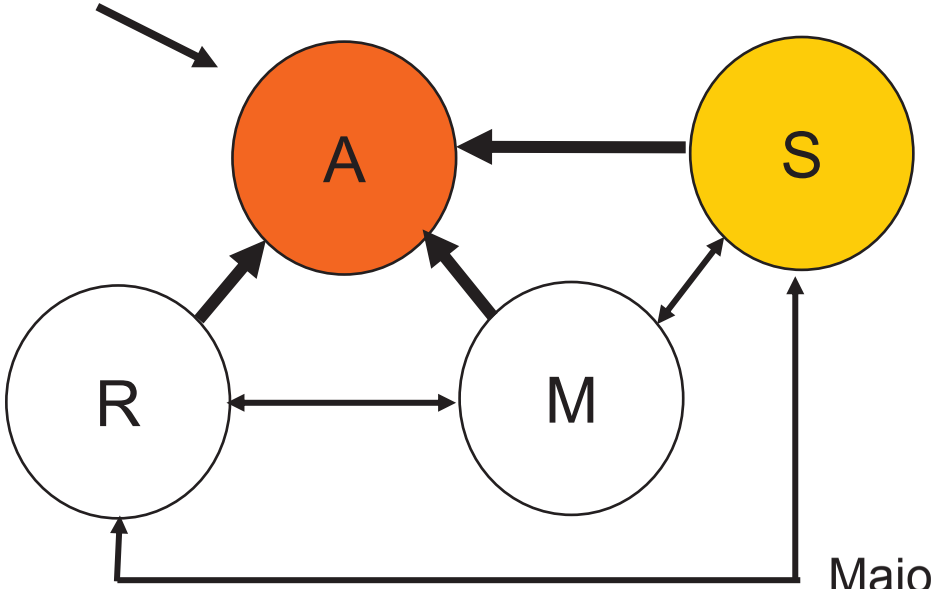
Asset Performance
RAMS

Non-Availabilty:
Unplanned Asset Downtime



Major Asset performance criteria
(Cost Drivers):

R = Rialibility
A = Availability
M = Maintainability
S = Safety

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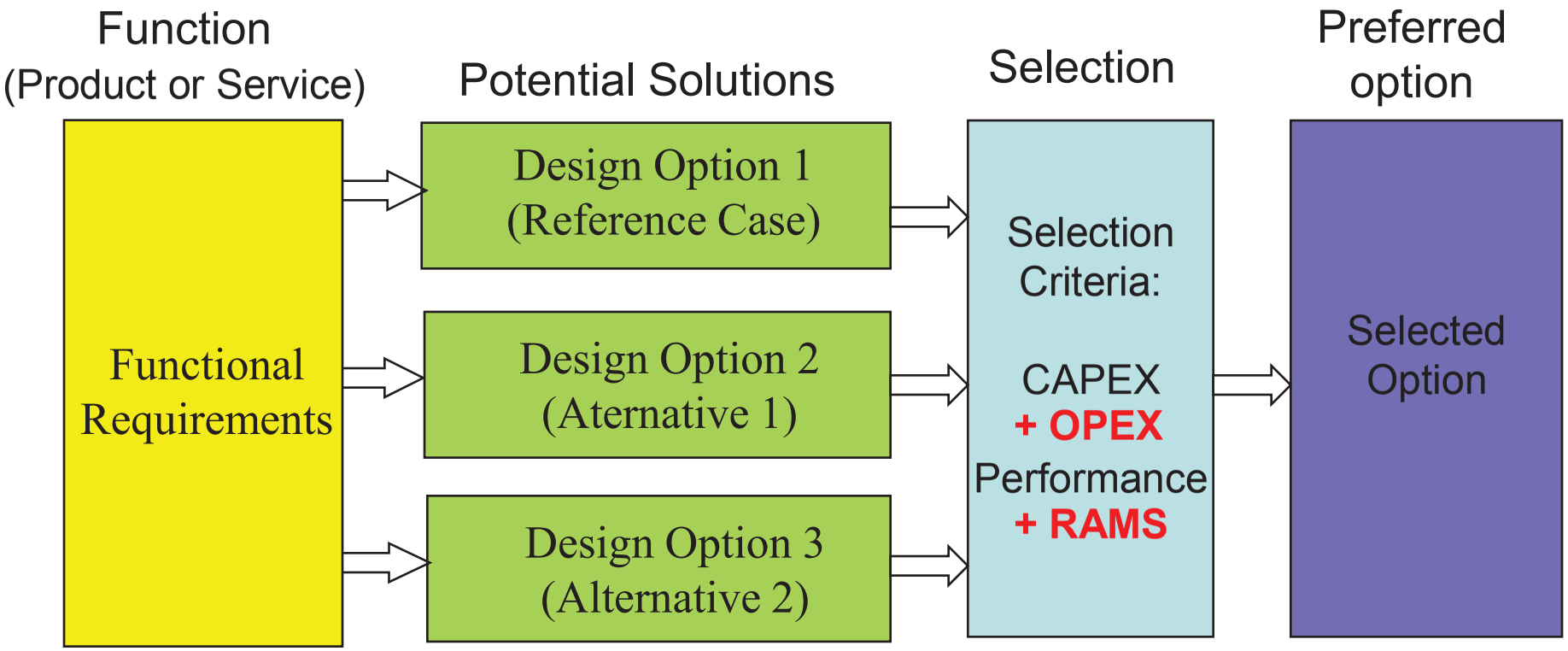
LCC Methodology
Value Engineering



Diverge process:
Transition from Functional Requirements into Design & Execution Options

Converge process

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Example LCC : Redundant Pump

A critical pump is not spared and if the pump fails, the plant shuts down. The alternative is to spare the pump and automatically switch over when the running pump fails. Calculate if it is Life Cycle Cost effective to spare this pump.

data:

Installed Cost for one pump incl. automatic switch	€ 1.000.000
Estimated plant availability increase	1%
Maintenance Cost per year	5% of installed cost.
Cost for down time	€ 100.000/stream day
Plant stream days a year:	340
Discount Rate	20%
Max evaluation period	10 years operations

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Example LCC : Redundant Pump

Benefits for less deferred production:

1% x 340 days x 100.000 =		€ 340.000/year
Additional maintenance cost =		€ - 25.000/year
Yearly OPEX savings =		€ 315.000/year (+ CF)
Investment (CAPEX)	=	€ 1.000.000 (- CF)

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Example LCC : Redundant Pump

LCC_{NPV} calculation

Redundant Pump			
Years t	Cashflow C	PV	PV (cum)
0	-1000	-1000	-1000
1	315	262	-738
2	315	219	-519
3	315	183	-336
4	315	152	-184
5	315	126	-58
6	315	105	48
7	315	87	135
8	315	73	208
9	315	61	269
10	315	51	320

← ROI ≈ 5.5 years

Cost x € 1000

Discount Rate @ 20%

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Conclusions

Ja, door een LCC benadering verbeter je het duurzaam ondernemen

- Verbeterde Asset performance
- Lagere LCC
- Verbeterde concurrentie positie
  - Verbeterde verkoop
  - Potentieel meer winst

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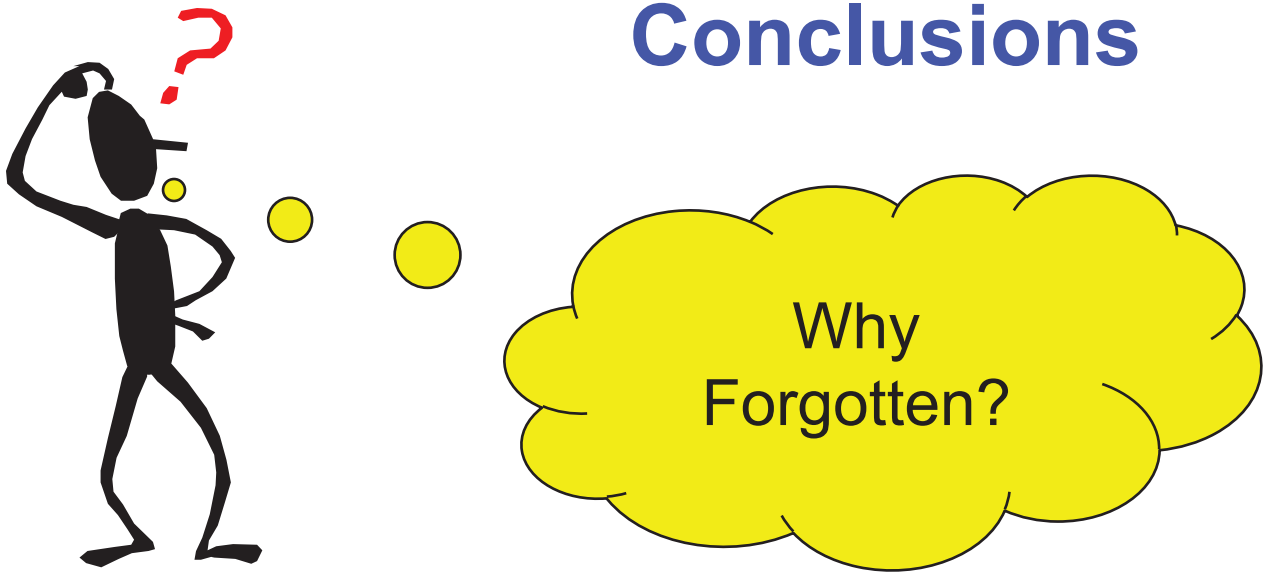
Conclusions



- Insufficient awareness benefits by management:
  - Short term focus
  - CAPEX focus
- Lack of broad focus (over development + life time)
- Schedule pressure
- Insufficient integrated knowledge & experience:
  - Technical + Value Engineering + Financial + RAMS

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Discussie

Is goedkoop altijd duurkoop?

(Goedkoop = CAPEX)

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