The value of risk for validating grid related operational and capital expenditure

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Continuon Asset Management
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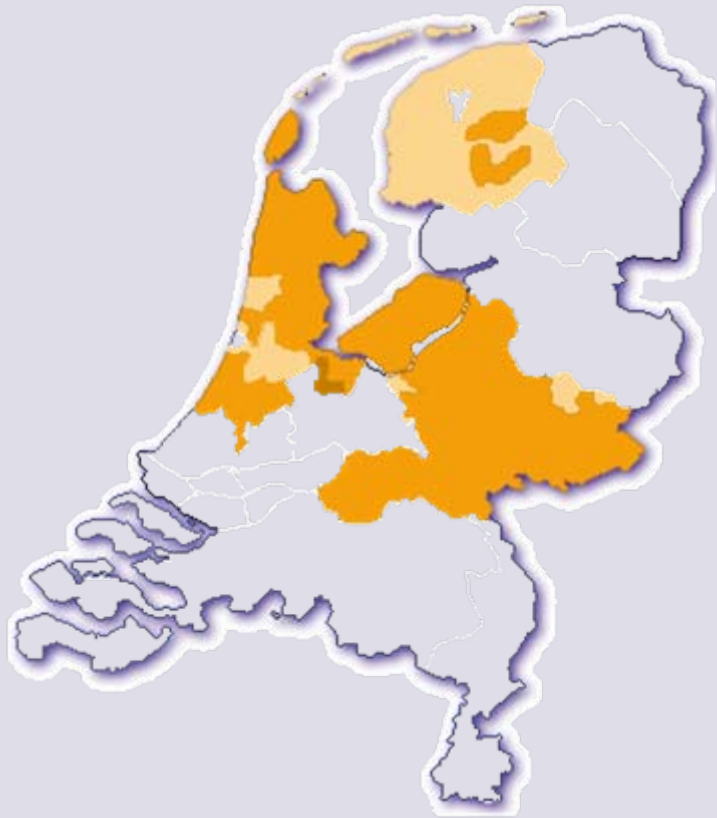
Contents

Continuon in numbers

Owner of electricity and gas distribution network

Turnover	1.2 Bil.Euro
Gross Profit	220 Mil.Euro
Personnel	230 FTE
Electricity Network	95000 km
Reliability of network	99.995%
Average interruption (CAIDI)	25.4 minutes
Gaslines	35000 km



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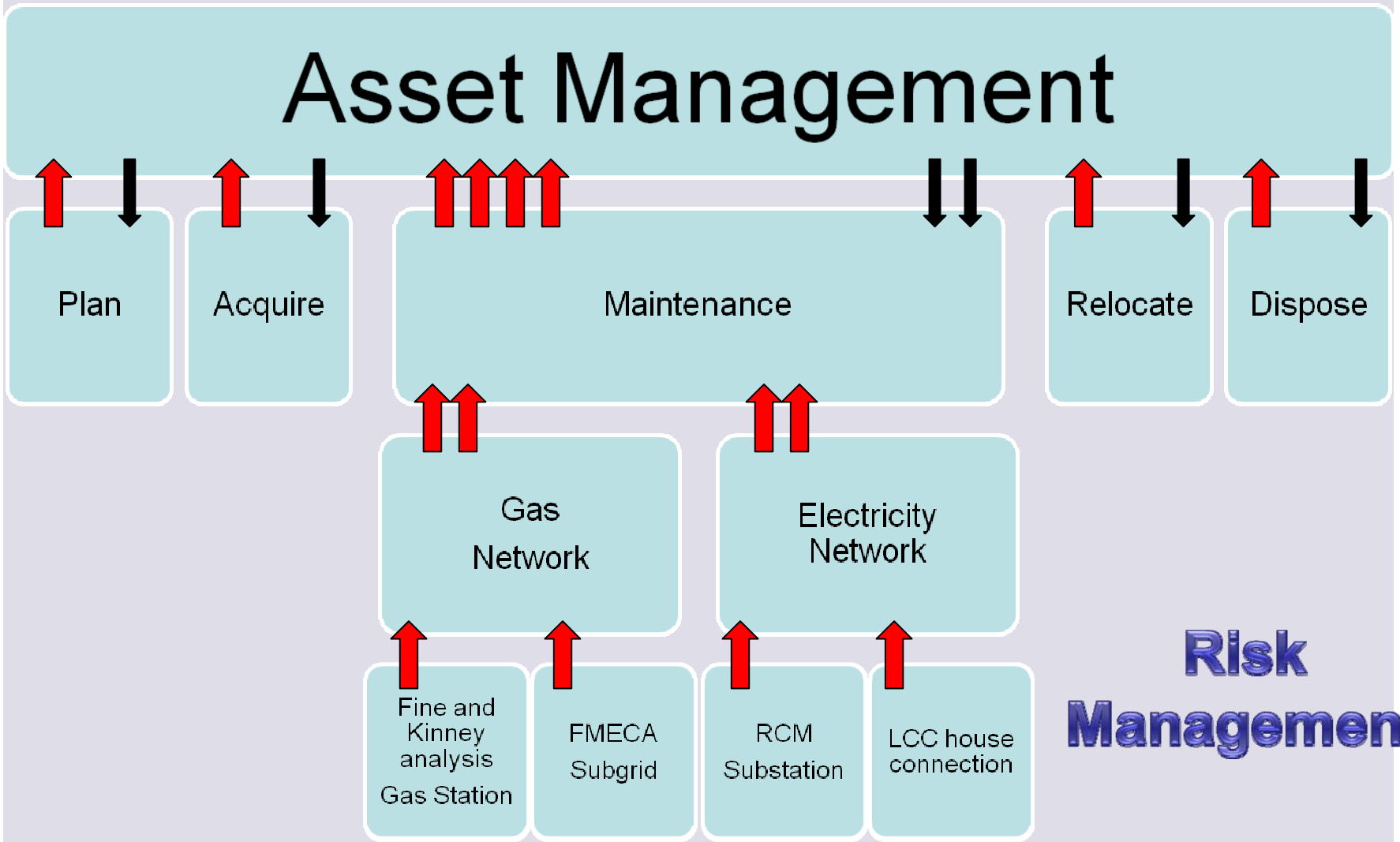
Organisational model

Asset Owner
- Sets targets
- License for oper.
- Customer relation
- Checks if targets are met

Asset Manager
- Targets -> Policy
- Investment plan
- Project owner
- Checks performance

Service Provider
- Policy Implement.
- Project planning
- Project execution
- Day to day progress

Risk Management within Asset Management



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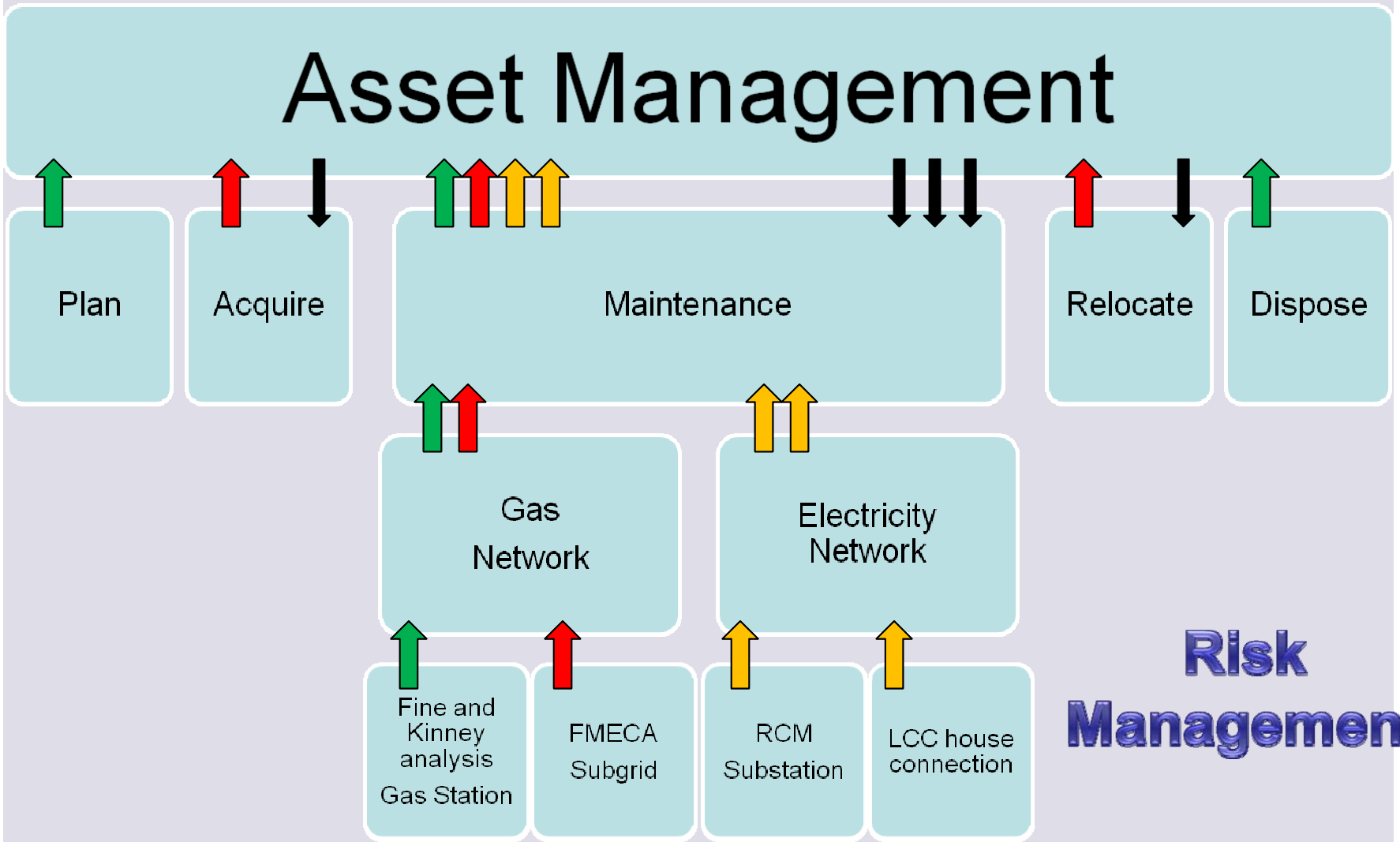
Risk Management within Asset Management



2005: Risk Management Lift Off

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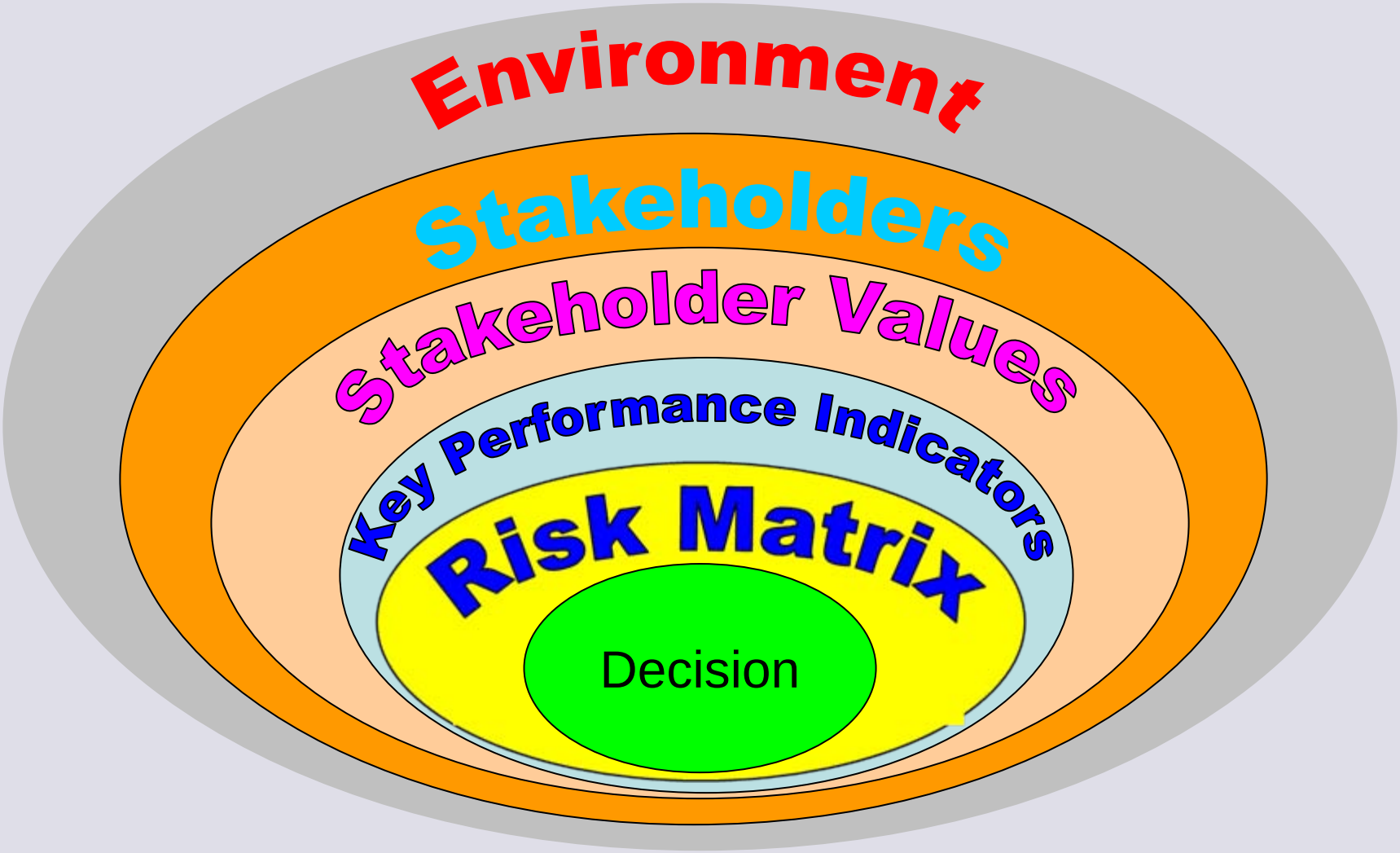
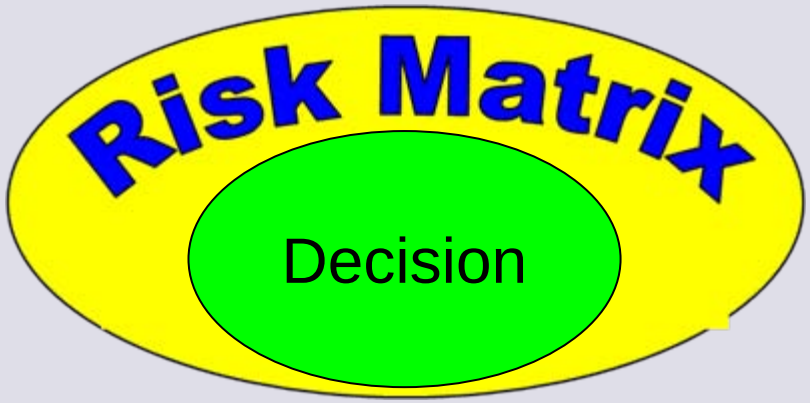
Value of Risk for Large Investments
(>250 kEuro)

Value of Risk for Projects >250 kEuro



Value of Risk for Projects >250 kEuro



Value of Risk for Projects (>250 kEuro)

	Consequence			Frequency							
	Financial	**Reliability (Minutes Lost**	**Safety**	**<0,001 x per year**	**0,001 – 0,01**	**0,01 – 0,1**	**0,1 – 1**	**1 - 10**	**10 - 100**	**100-1000**	**> 1000x per year**
Minor 3 kEuro	<10 k€	< 10 kMin	Small Injury, no work interruption								
Moderate 30 kEuro	10-100 k€	10 - 100 kMin	Sick Leave <3 days								
Serious 300 kEuro	0,1- 1 M€	0,1-1 Mmin	Prolonged Sick leave (> 3 days)								
Severe 3 MEuro	1- 10 M€	1-10 Mmin	One Casualty / Handicap								
Catastrophic 30 MEuro	> 10 M€	>10 Mmin	Multiple Casualties								

Other values: Reputation, Environment, Customer satisfaction …

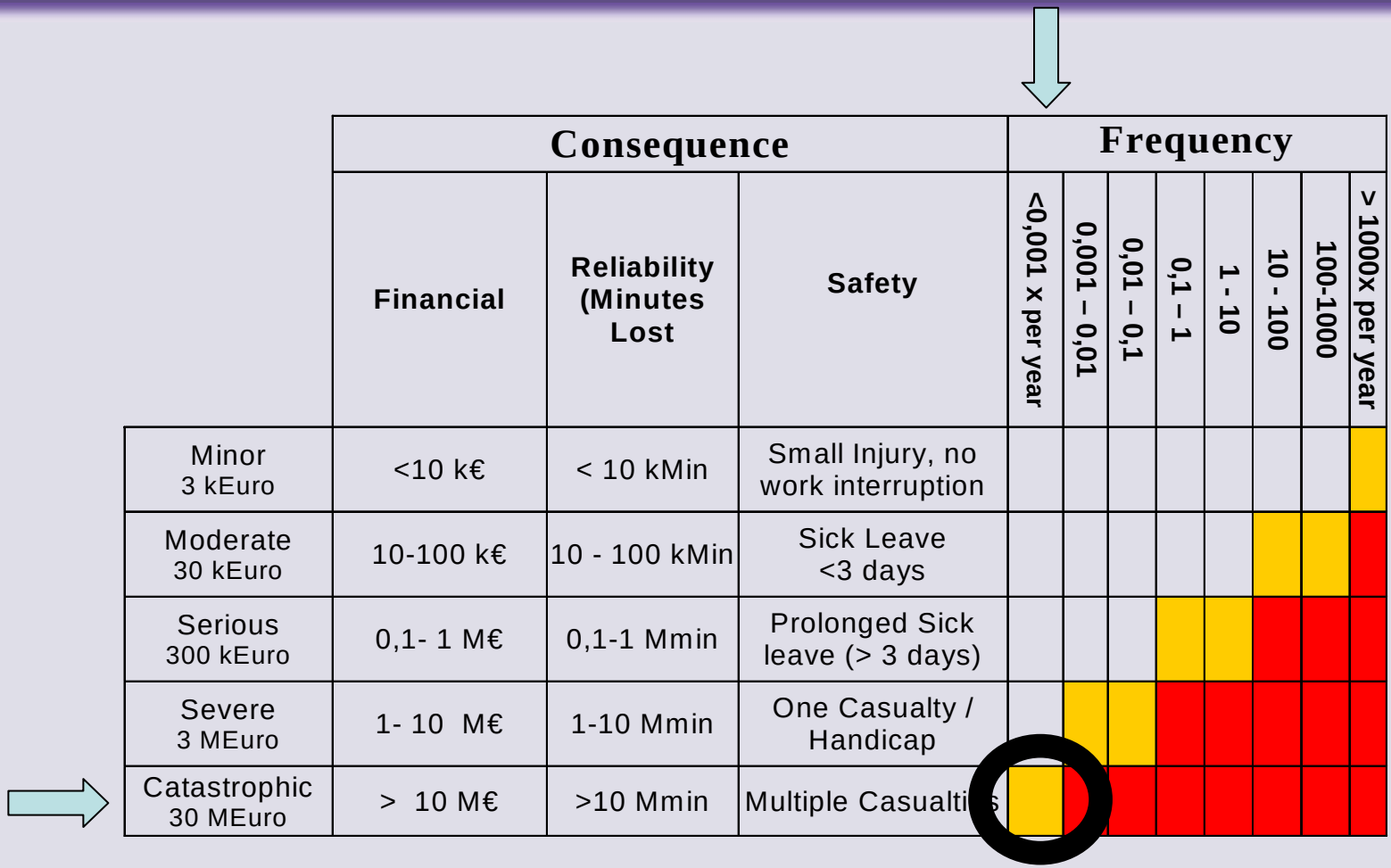
Value of Risk for Projects (>250 kEuro)

12-dec-2007

Apache Helicopter Hits

High Voltage Line

Value of Risk for Projects (>250 kEuro)



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Plane hits substation : Catastrophic event < once every 45.000 years.

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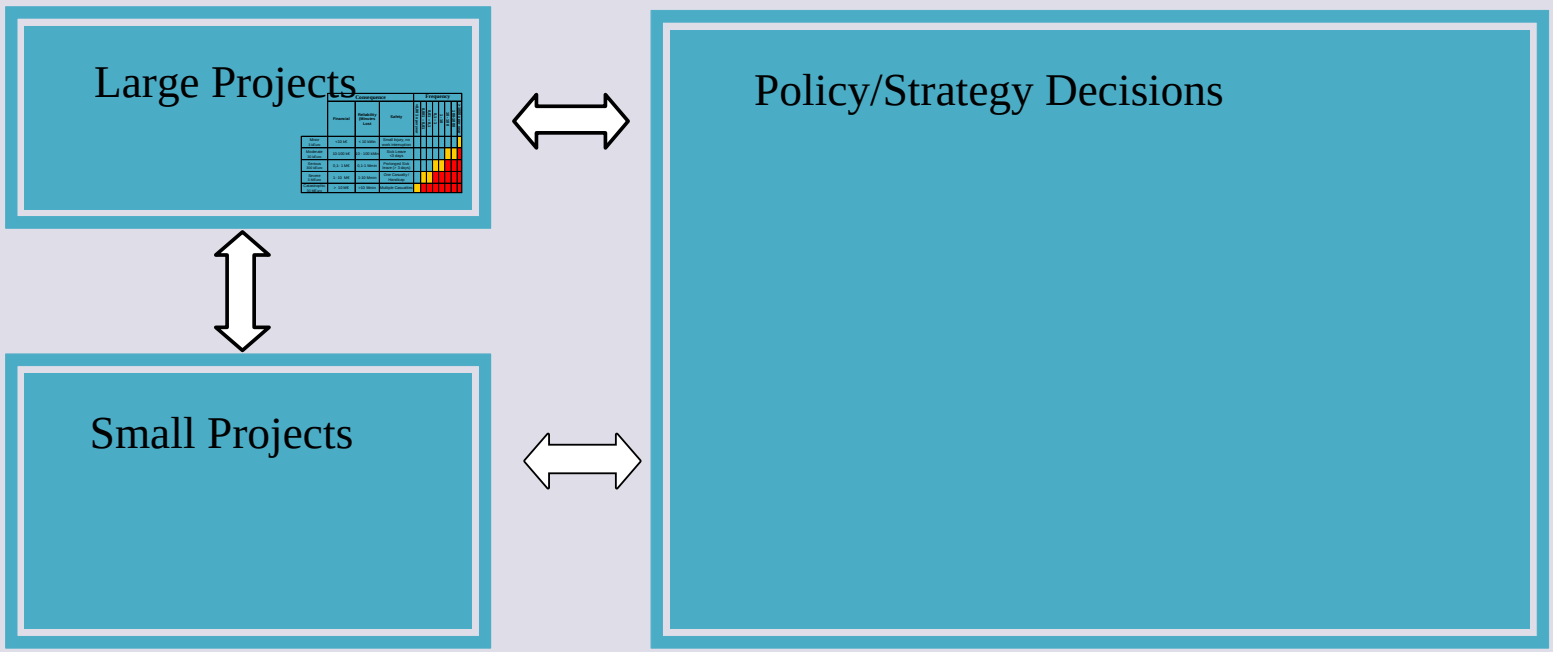
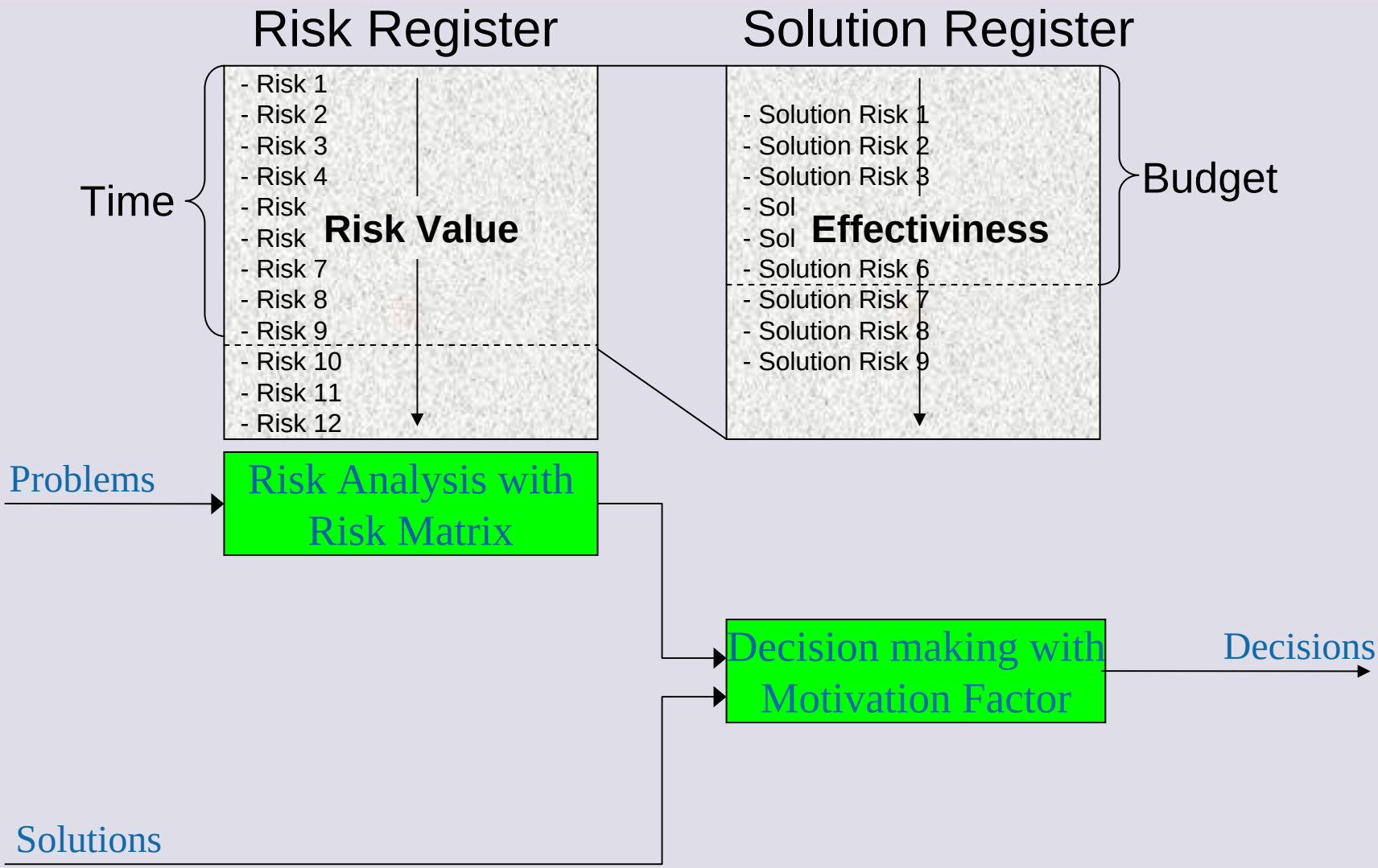
Decision Types



RM Decision Process: numerous decisions



Risk Perception

	Consequence			Frequency							
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$$Risk = \sqrt{Frequency} \cdot Consequence$$

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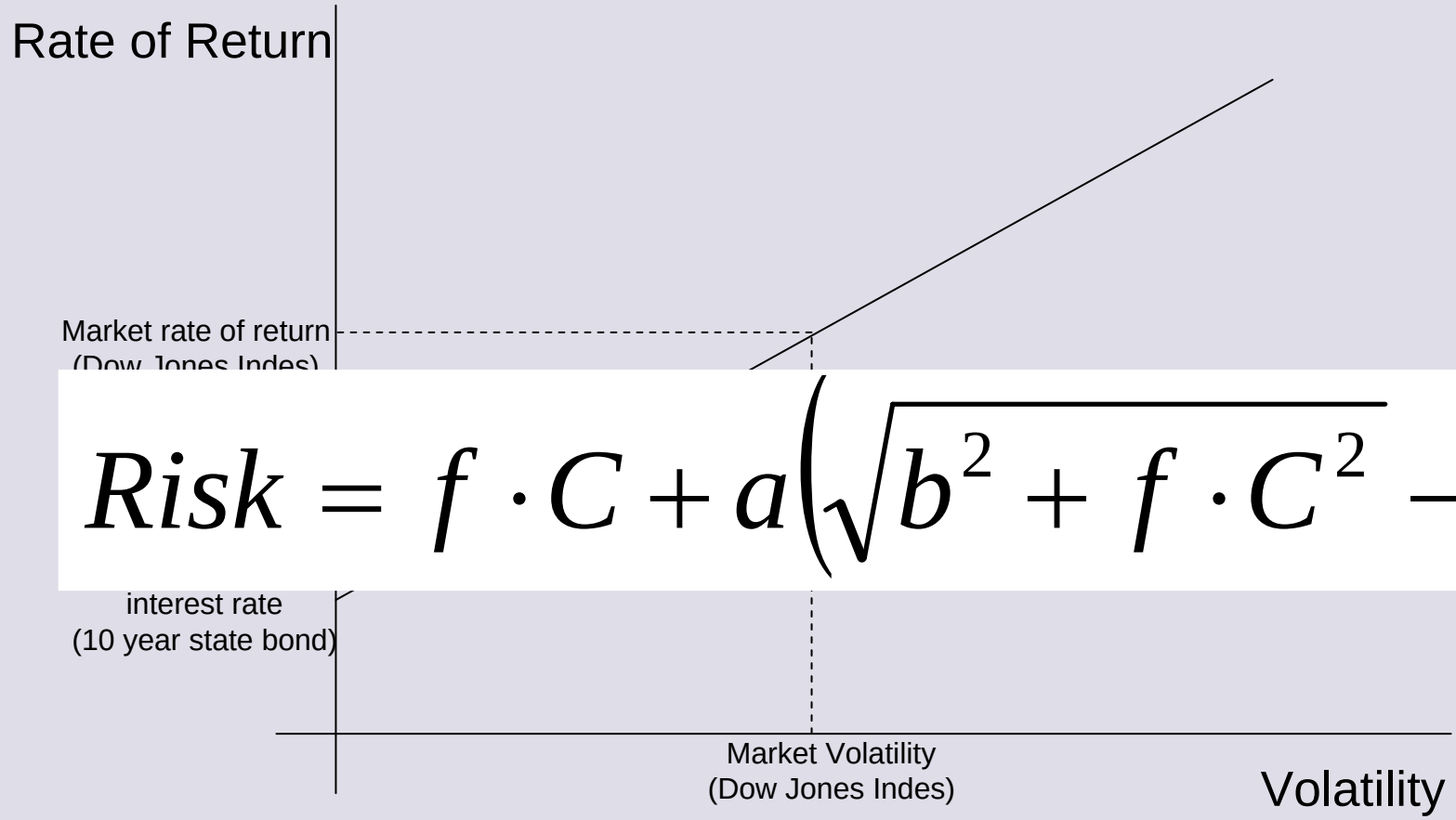
Risk Perception

Risk≠ Frequency•Consequence

Now what?

Risk Perception



$$Risk = f \cdot C + a\left(\sqrt{b^2 + f \cdot C^2} - b\right)$$

Risk Perception

Consequence	Frequency: Low	Frequency: High
High	Non Linear $Risk \propto \sqrt{f} \cdot C$	Linear $Risk \propto f \cdot C$
Low	Linear $Risk \propto f \cdot C$	Linear $Risk \propto f \cdot C$

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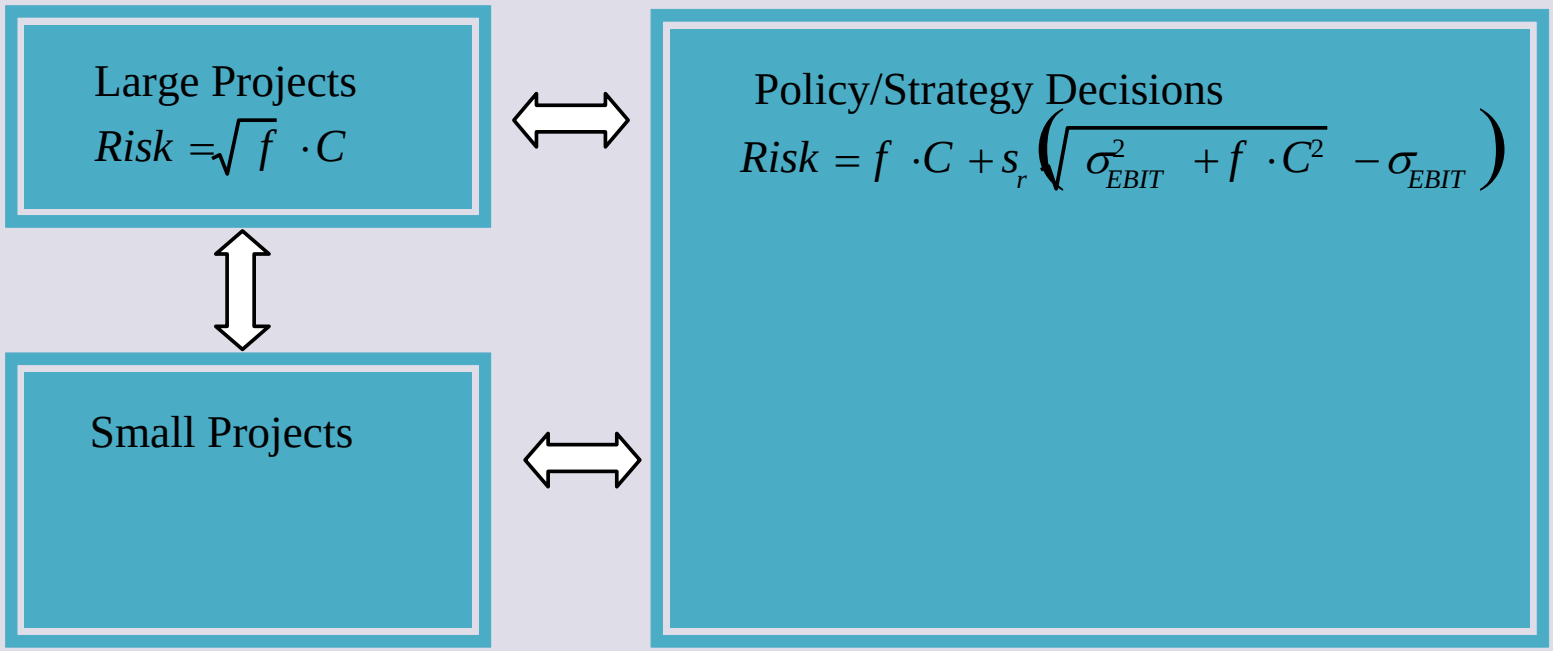
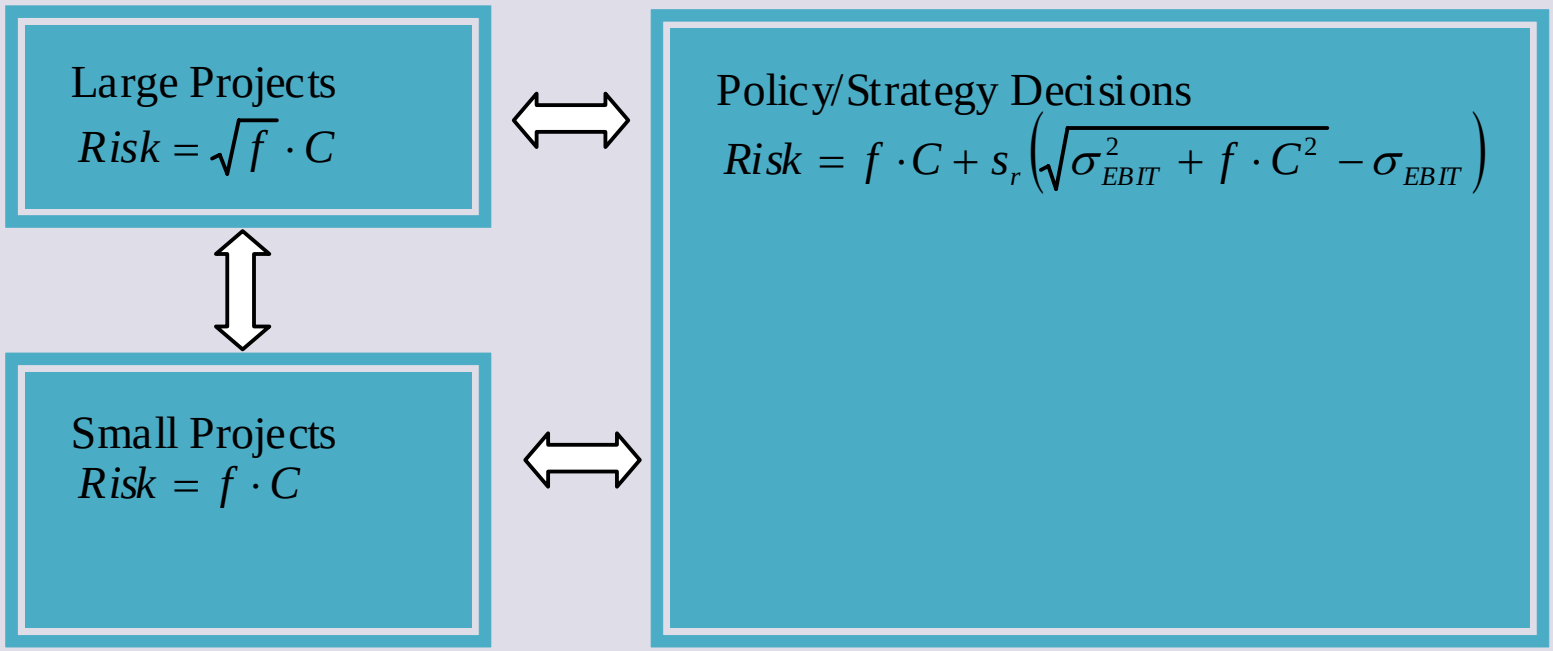
Risk Perception

	Are you willing to invest 10 Euro extra per 15.000 maintenance actions per year to deter 1 possible death every 100 years?
Linear	Definitely not
Risk Matrix	Off course I will
Shareholder value	I'm not sure, could you provide …?

Risk Value


Large Projects
$Risk = \sqrt{f} \cdot C$
Small Projects
Policy/Strategy Decisions
$Risk = f \cdot C + s_r \left(\sqrt{\sigma_{EBIT}^2 + f \cdot C^2} - \sigma_{EBIT} \right)$

Risk Value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Summary

Risk management: an integral part of Asset Management

Value of risk: calculate in expectation and variance domain

Different types of decisions: different tools for the organisation

Vital for practical implementation:

- Risk model follows sr. decision makers
- Keep it simple for the users