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The NPVI Method to Support Market Entry Strategies for Software

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1. Introduction

Society‘s increasing software dependence:

- Software-based systems replace older technologies in safety- or mission-critical applications
- Software moves from an auxiliary to a primary role in providing critical services
- Software becomes the only way of performing some function which is not perceived as critical but whose failures would deeply affect individuals or groups
- Software-provided services become increasingly an accepted part of everyday life without any special scrutiny
- Software-based systems are increasingly integrated and interacting, often without effective human control

(source: Littlewood and Strigini 2000)

Some facts

- Software size and amount/variety of software applications increases exponentially
- Increased size leads to (source: Jones 2002)
  - Higher defect potentials
  - Lower defect removal efficiencies
  - And thus: Higher defect densities at release time

Conclusion:

- Importance of software release decisions is likely to increase

But:

- Limited theory available

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Study Objective

"How to improve strategic software release decisions?"

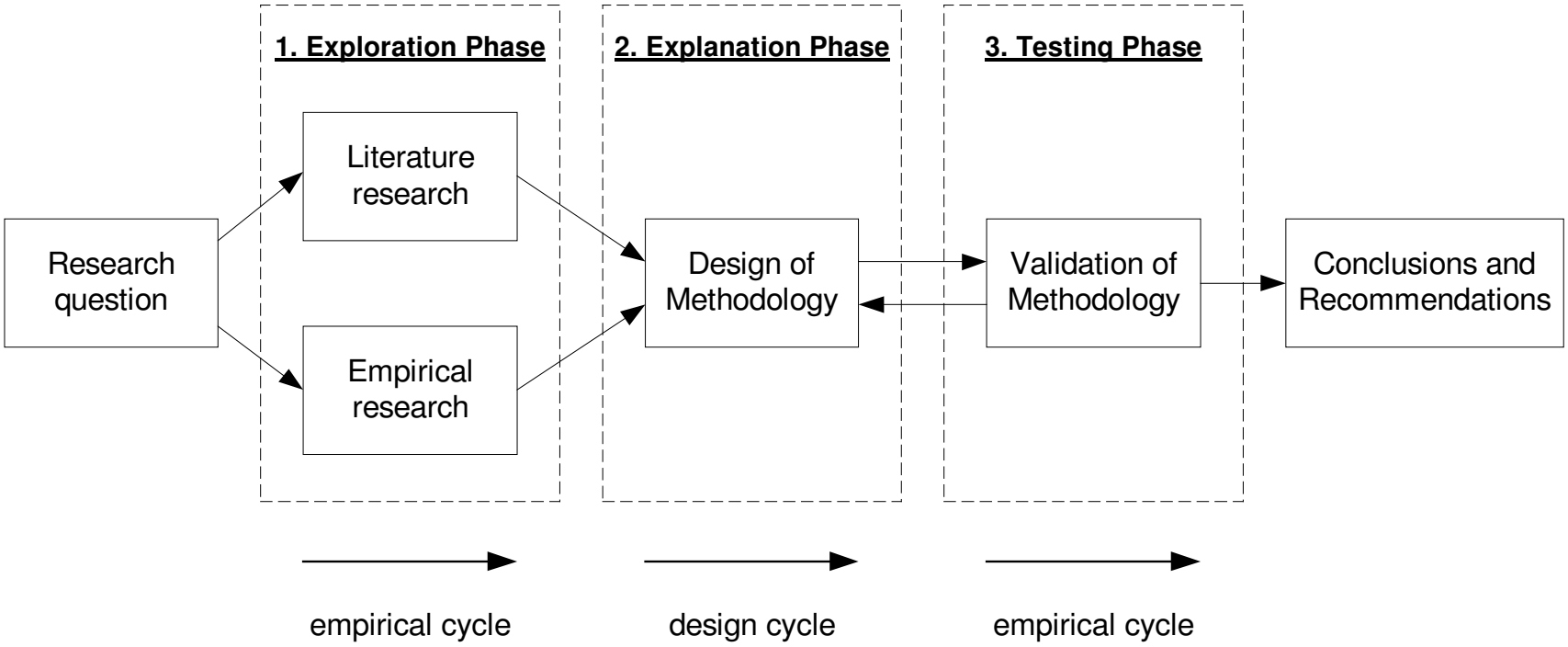
Focus on decisions with strategic value, defined as:

- Existence of large financial prospective loss outcomes.
- Including the presence of high costs to reversing the software release decision

Reason:

- Justifies applying a methodology.
- Higher relevance for society (manufacturers and users).

2. Study Overview



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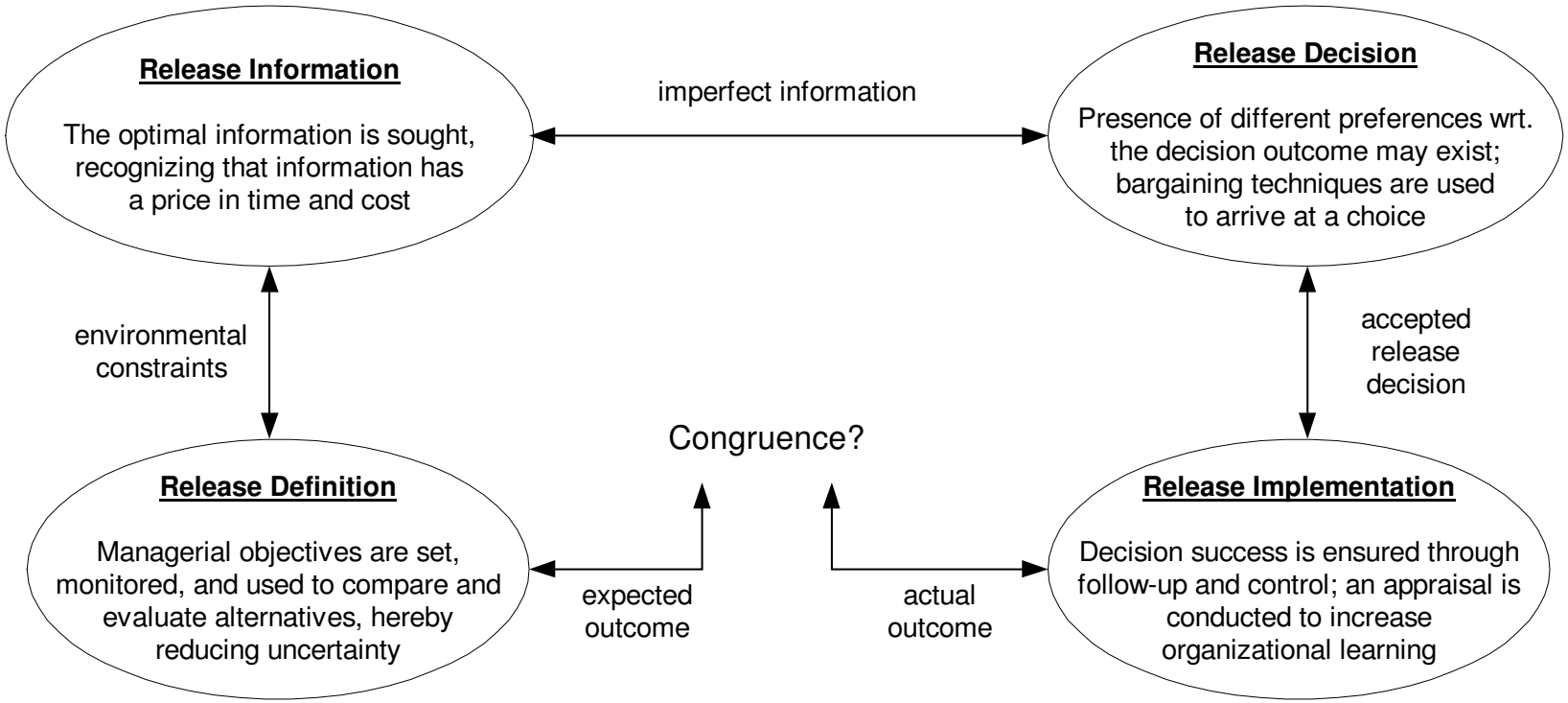
Release Decision Methodology



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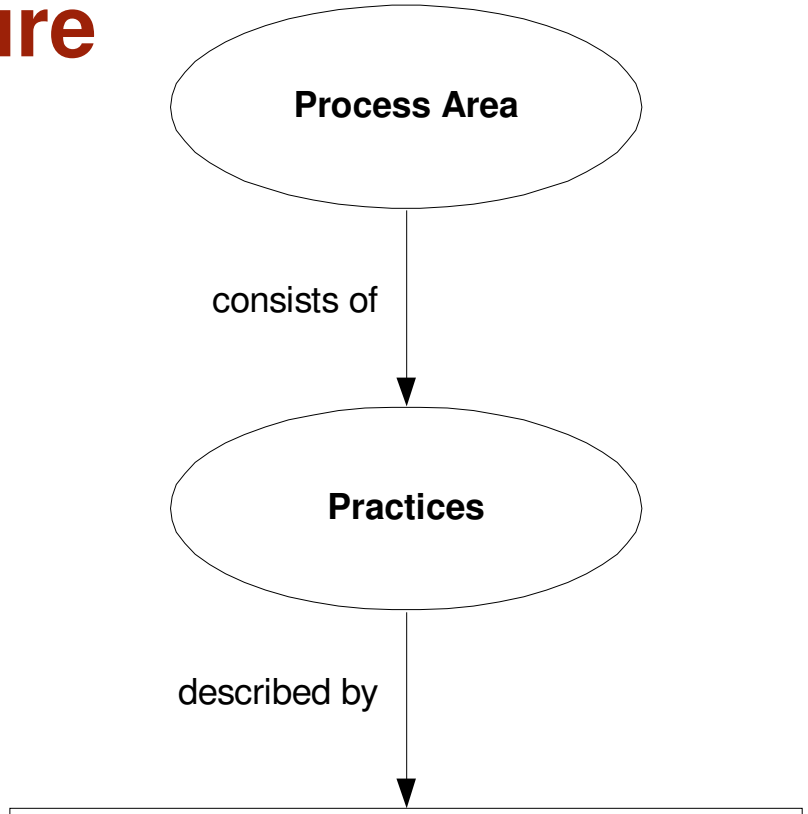
Structure


Process Area
consists of
Practices
described by
1. Description of the practice.
2. Stage(s) of a project in which the practice is of concern.
3. Primary stakeholder(s) responsible for meeting the practice.
4. Other stakeholder(s) that must be involved.
5. Examples of supporting method(s) that can be used

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This presentation

Focus on 2 Process Areas:

1. Release Definition:

   How to compare and evaluate different release alternatives?

2. Release Information

   What is the optimal level of information?

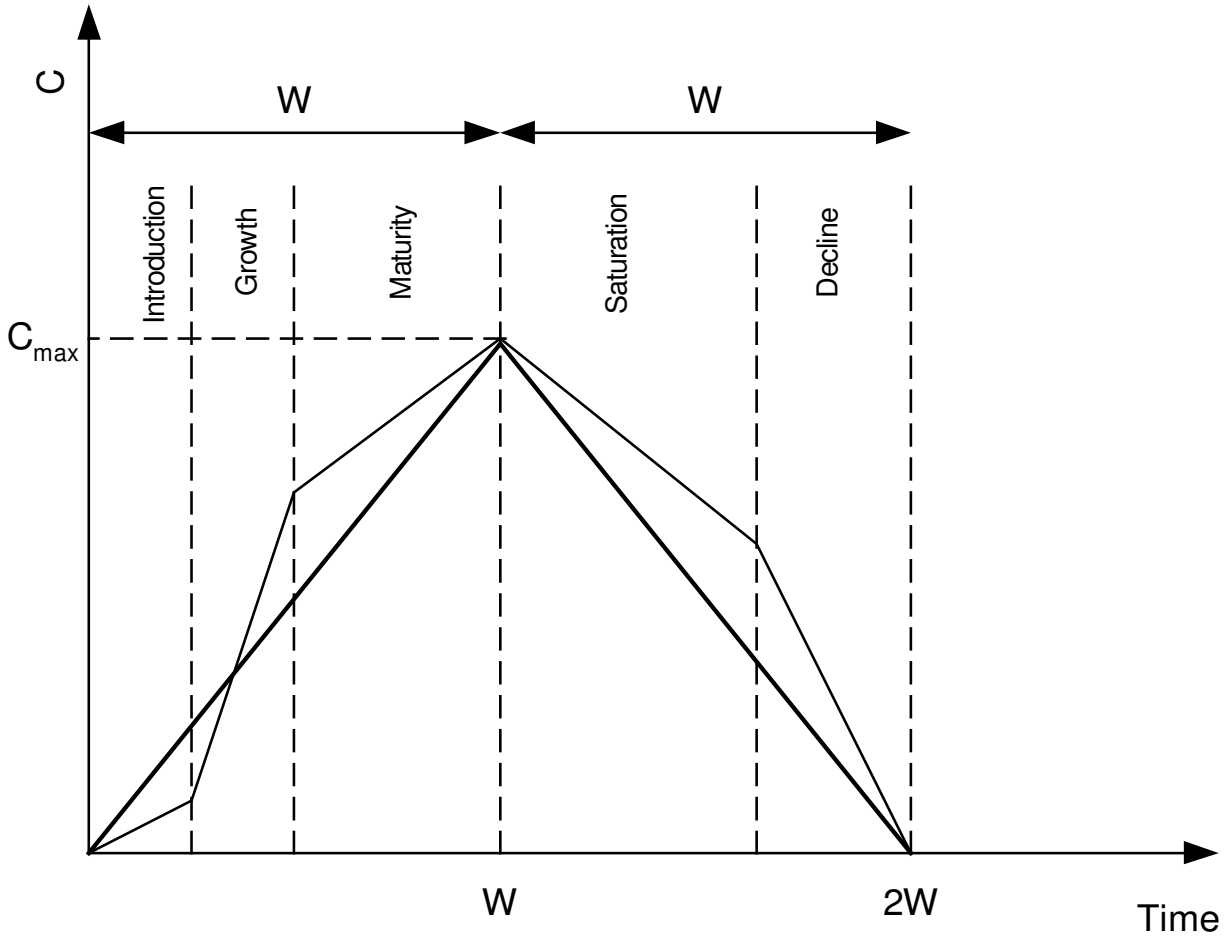
3. Market Entry Strategies

Examples:

- First mover
- Lowest development cost
- Unique features
- Highest quality

Theory:
- Limited
- General nature (single case studies, game simulation)

Simple product life-cycle



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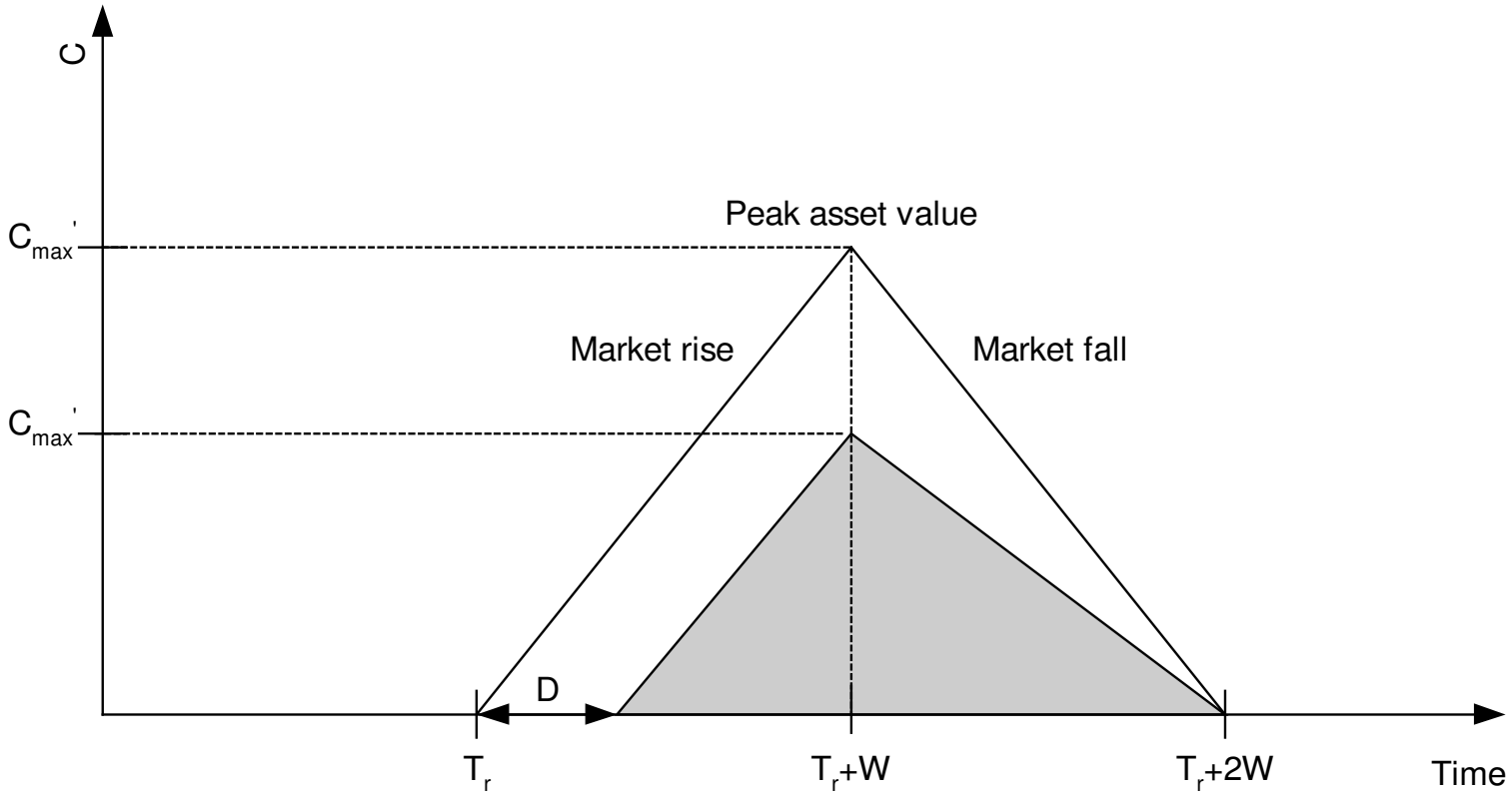
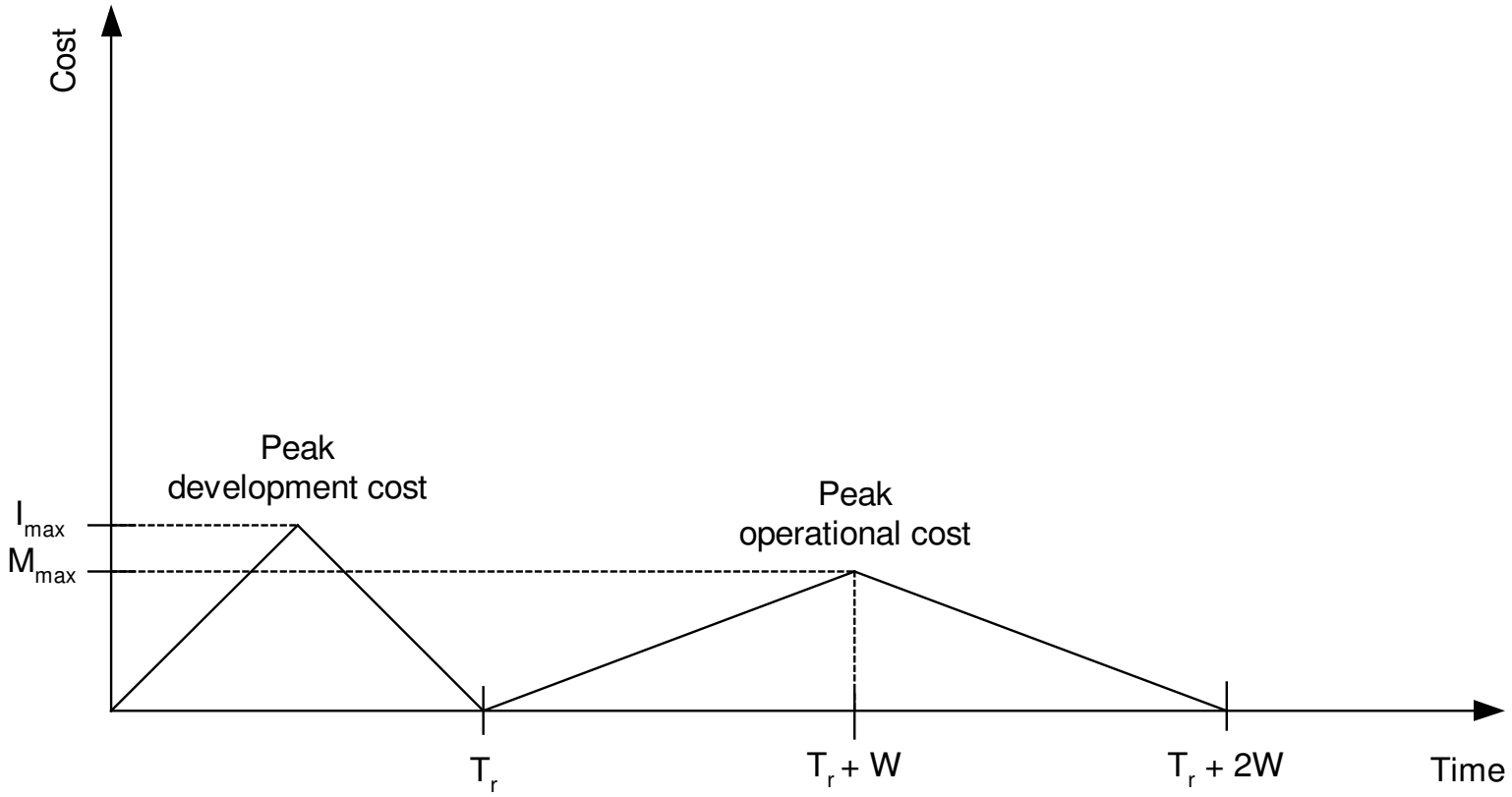
Delayed market-entry



Extended Model with Cost Functions



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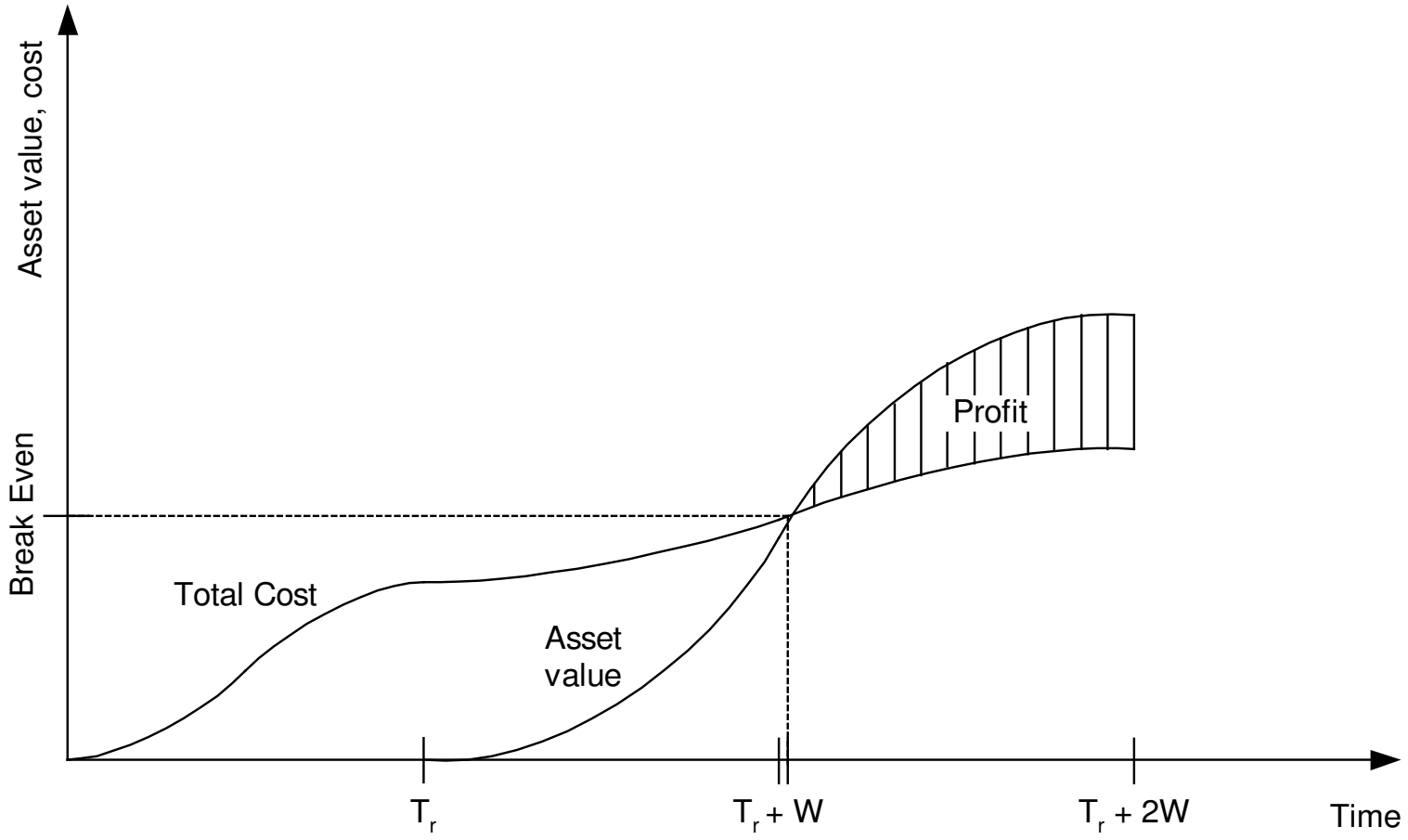
Resulting Profit Model



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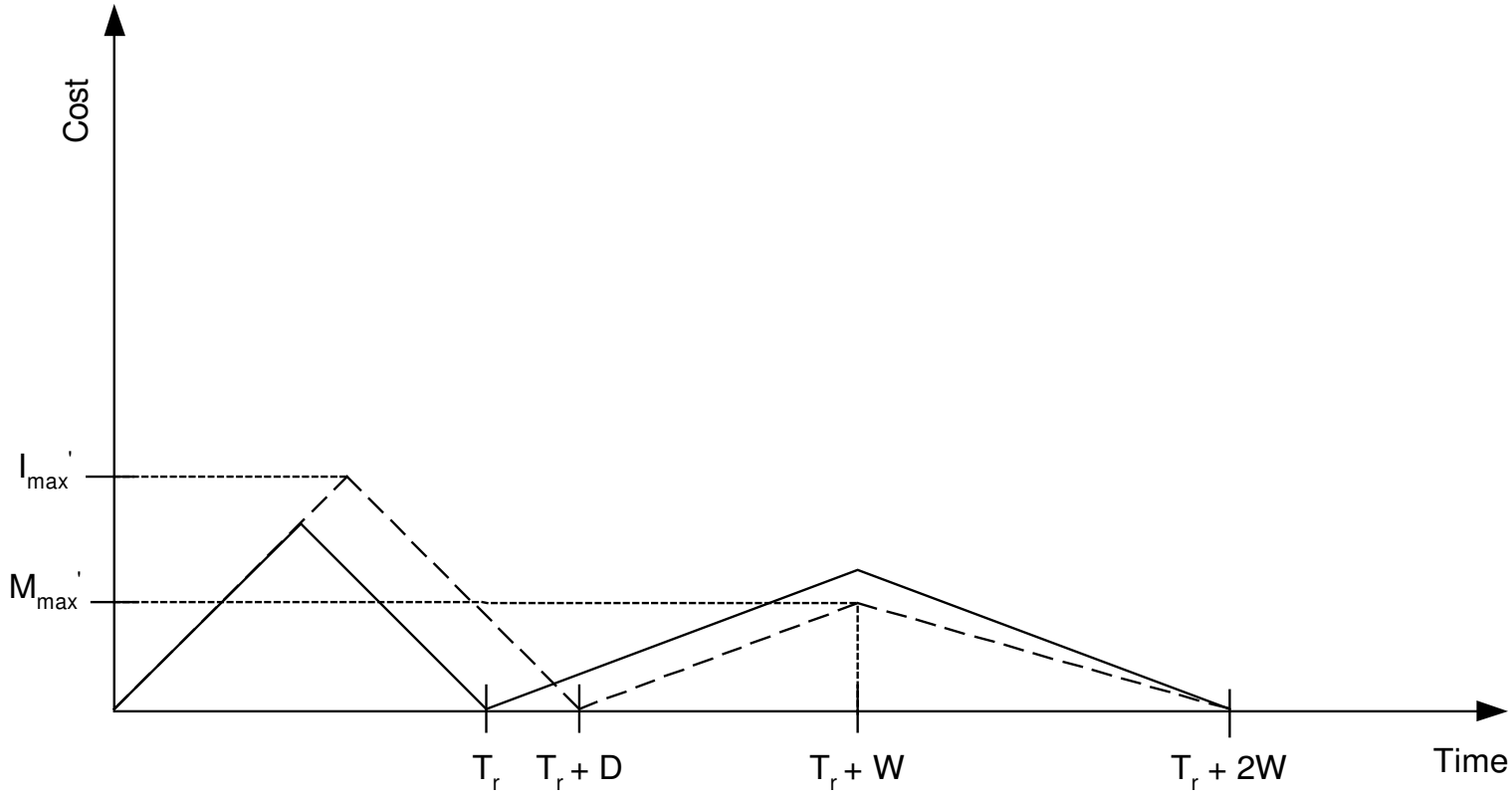
Delayed Market Entry



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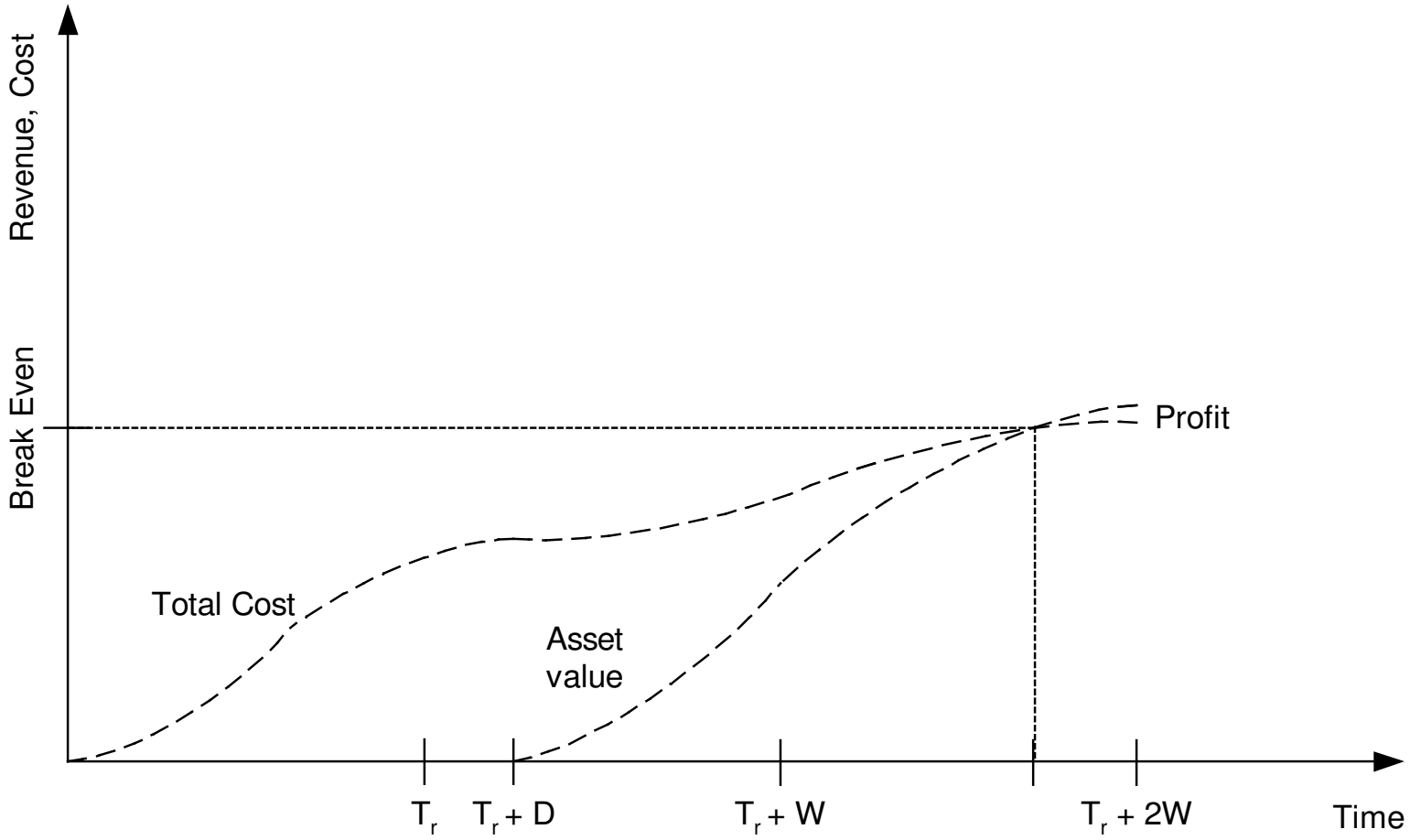
Resulting Profit Model



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Example

T_r = 50 weeks W = 50 weeks	D = 0 wk	D = 2.5 wk	D = 5 wk	D = 7.5 wk	D = 10 wk
Asset value (C)	-	-7%	-14%	-21%	-28%
Development cost (I)	-	10%	21%	32%	44%
Operational cost (M)	-	-7%	-14%	-21%	-28%
Net asset value (NAV) (C_{max} = 8, I_{max} = 5, M_{max} = 5)	-	-25%	-50%	-75%	-100%

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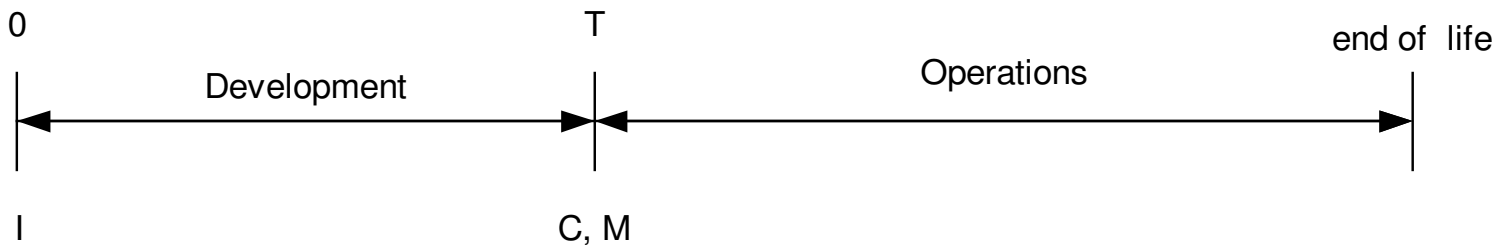
4. NPVI Method



$$NPV = -I + (C - M) / (1 + r)^{T}$$

NPVI = Net Present Value Incentive

Calculates difference in two NPVs from underlying metrics: premiums and advantages

How it works (1):

1. Determine Base strategy b
   - C_b, I_b, M_b, T_b, r_b
2. Determine Test strategy a, relative to Base strategy b
   - C_b, I_b, M_b, T_b, r_b
3. Calculate
   - Early Entry Premium *(EEP)*
   - Product Functionaliy Premium *(PFP)*
   - Product Reliability Premium *(PRP)*
   - Short-term Maintenance Premium *(SMP)*
   - Long-term Maintenance Premium *(LMP)*

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How it works (2):

4. Calculate

- Asset Value Advantage = $\log C_a - \log C_b$
  = $\log (1 + EEP + PFP + PRP)$
- Operational Cost Advantage = $\log M_b - \log M_a$
  = $-\log (1 - SMP - LMP)$
- Net Asset Value Advantage = $\log NAV_a - \log NAV_b$
- Present Value Incentive = $[PV_a - PV_b] / NAV_b$
- Net Present Value Incentive = $\frac{NPV_b - NPV_a}{NAV_b + I_b}$

  Decision rule:

  > 0: choose Test strategy = $\frac{(PV_a - I_a - PV_b + I_b)}{(NAV_b + I_b)}$

  < 0: choose Base strategy

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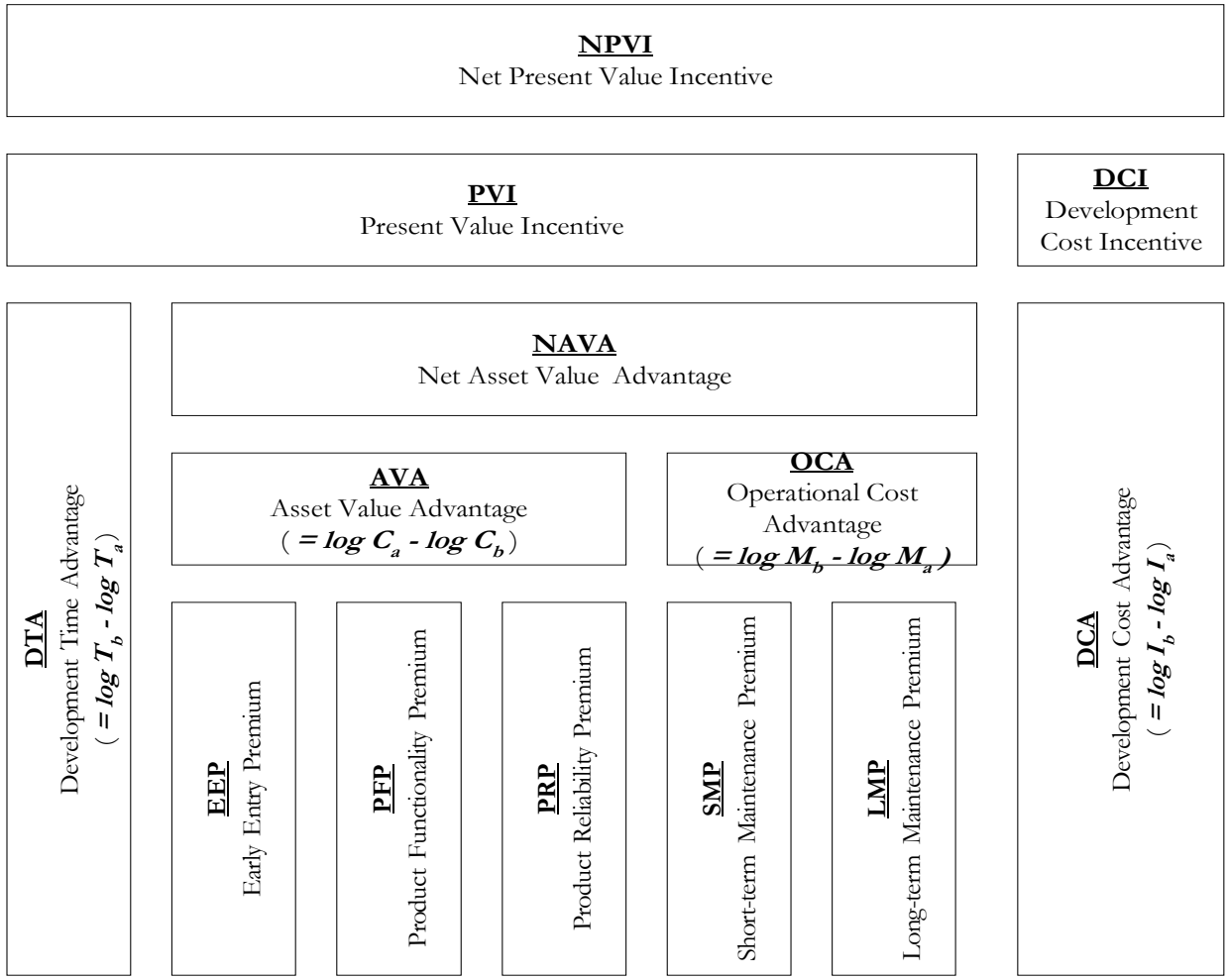
Net Present Value Incentive method



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5. Towards Informed Decision-making

Types of decision-making:

1. *Certainty*. The alternatives can be evaluated without consideration of any scenarios.

2. *Informed Uncertainty* (risk). The alternatives can be evaluated with considerations of some scenarios, whereby the chance of occurrence of each scenario can be quantified with probability or possibility values.

3. *Complete Uncertainty*. The alternatives can be evaluated with considerations of some scenarios but the chance of occurrence of each scenario cannot be quantified.

Results from case studies

1. High presence of complete uncertainty.

2. Both for routine and nonroutine market entry decisions.

3. Reactive behaviour regarding information collection (during testing phase: too late).

4. Result:
   - Market window: unknown, but high time pressure
   - Reliability: probably ‘good enough‘
   - Maintainability: unknown

5. Put differently:
   - EEP, PFP, PRP, SMP, LMP unknown
   - Limited value of NPVI method

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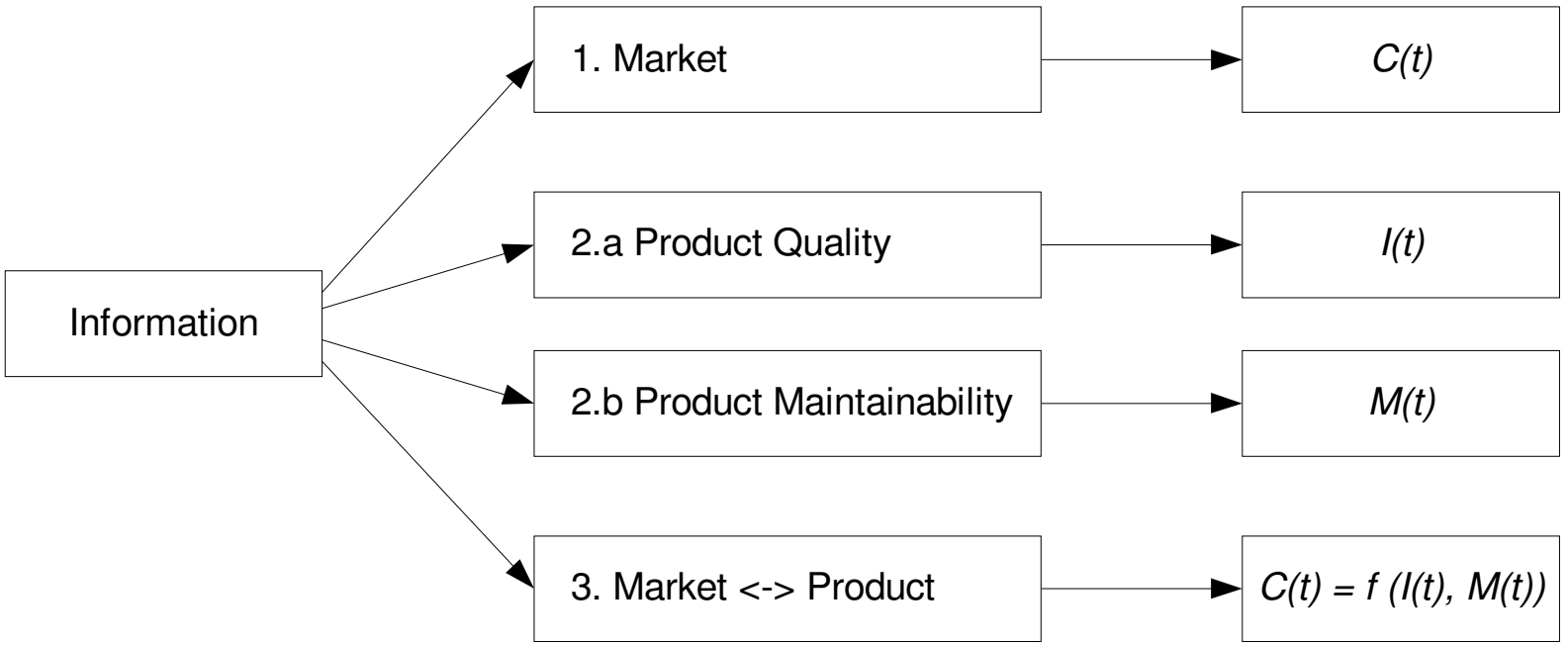
Sources of Information



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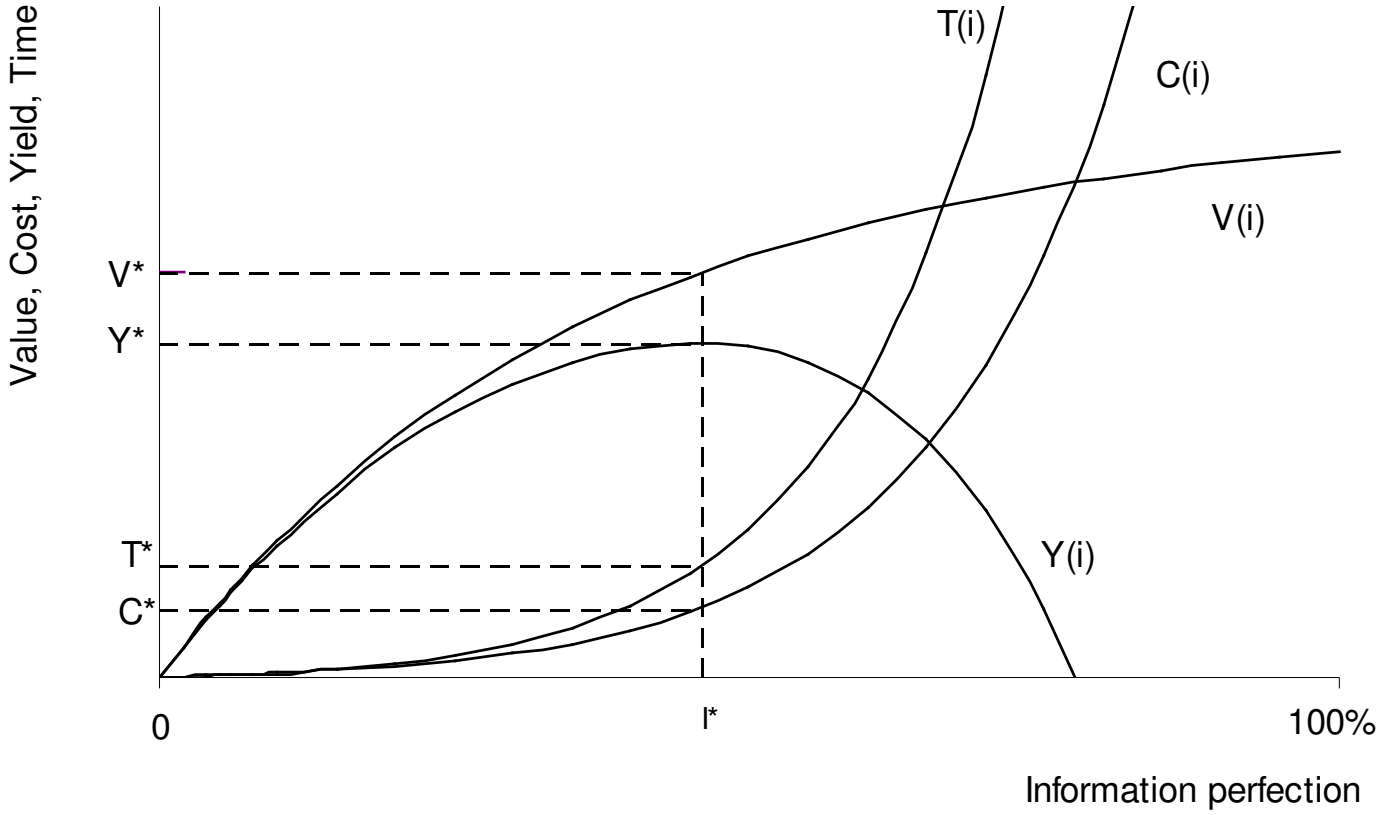
Information has Price in Cost/Time



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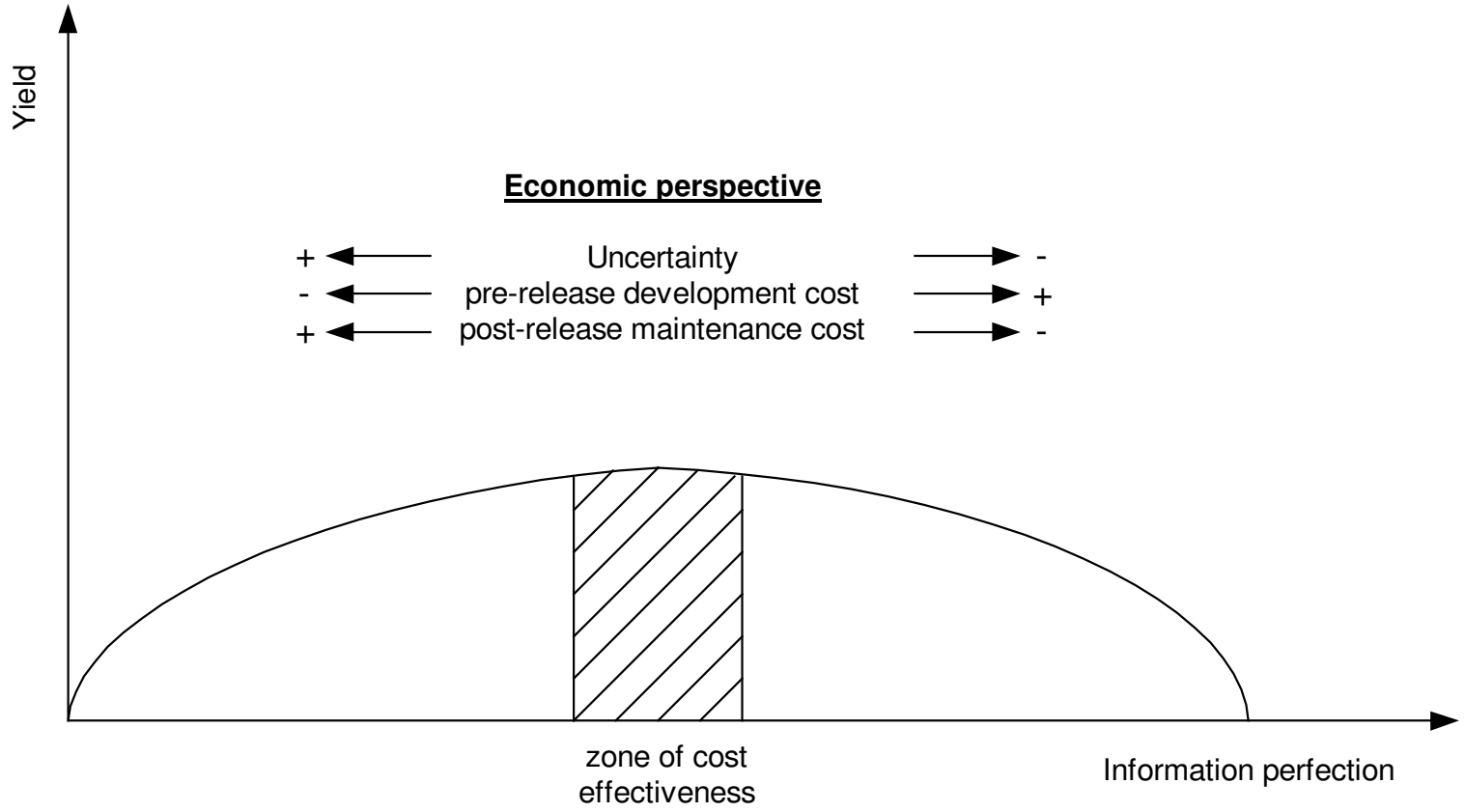
Zone of Cost Effectiveness



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Challenges Software Industry

- Focus on:
  - Business-oriented approach (numbers matter)
  - Informed decision-making: move to zone of cost effectiveness
- Understand and handle behavioural aspects
  - develop common objectives among stakeholders
  - Avoid sources of conclict
  - Will reduce potential differences in aspiration levels
- Increase organizational learning
  - Single-loop learning: more empirical data
  - Double-loop learning: increased process maturity

6. Conclusions

1. Importance of software release decisions likely to increase

2. Although a problematic area, limited theory/practice available

3. NPVI method
   - Powerful to compare and evaluate different market entry strategies

4. Information perfection
   - Three main sources of information (C, I, M)
   - Information level must be within zone of cost effectiveness

5. Increasing maturity needed to move from complete uncertainty to informed decision-making

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Further Information

Research report expected to be available late 2005

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