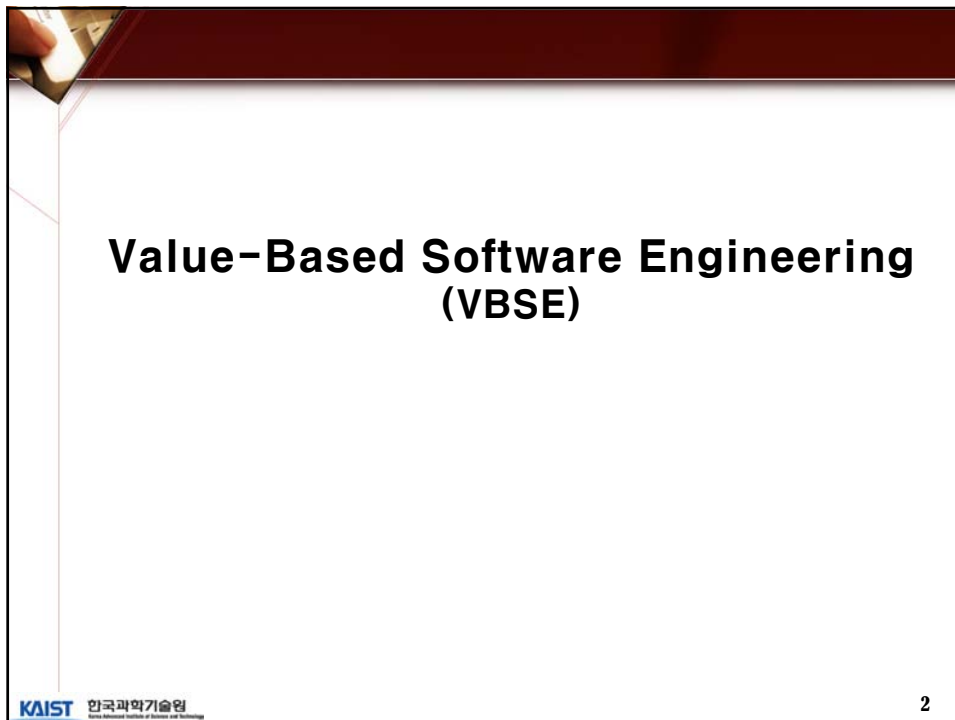




**Software Engineering  
Economics  
(CS656)**

**VBSE**

**Jongmoon Baik**



**Value-Based Software Engineering  
(VBSE)**

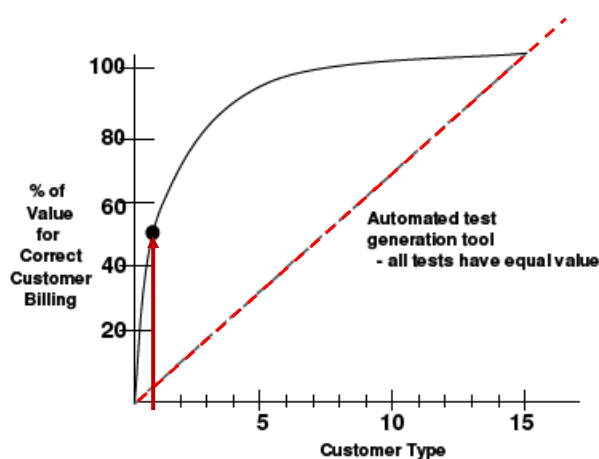


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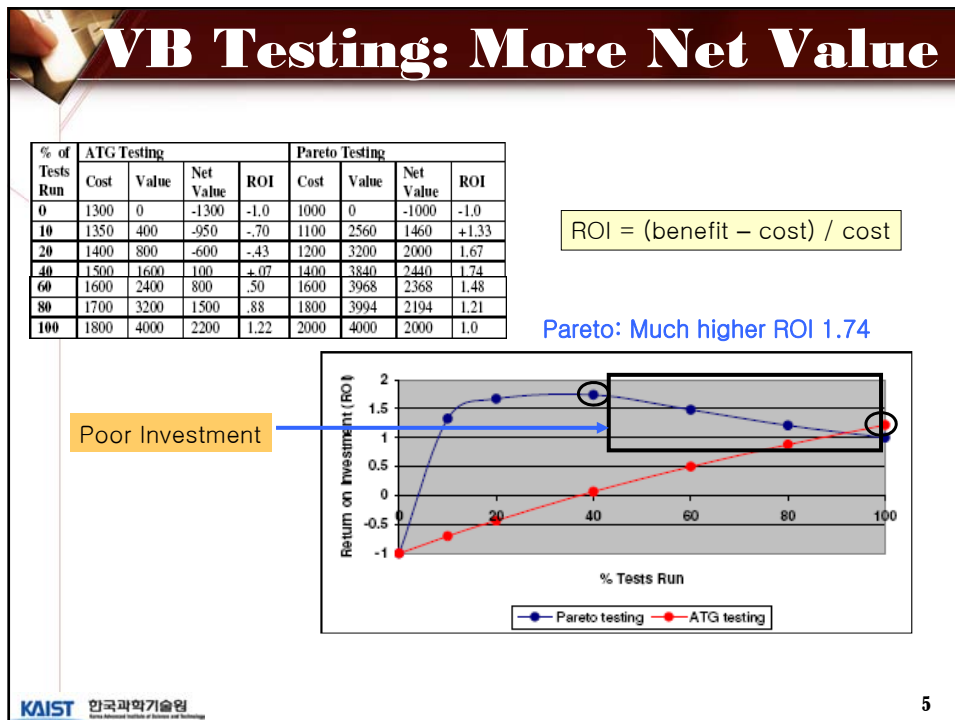
## Example: Software Testing

- Assume You're the manager of a \$2M S/W project,
- Vendor (ATG) Proposition
  - Cut your test costs in half (test cost: \$1M)
  - Provide it to you the use of the tool for 30% of your test costs (or \$300K)
  - Save 50% of your original cost (or \$500K), you're ahead of 20% (or \$200K)
- Any Concerns with vendor proposition??

## Pareto: 80% Value from 20% Components



Source: Experience Report (Bullock. 2000)



## Motivation for Value-Based

- Current SE methods are basically value-neutral
  - Every requirement, use case, object, test case, and defect is equally important
  - Object oriented development is a logic exercise
  - “Earned Value” Systems don’t track business value
  - Separation of concerns: SE’s job is to turn requirements into verified code
  - Ethical concerns separated from daily practices
- Value-neutral SE methods are increasingly risky
  - Software decisions increasingly drive system value
  - Corporate adaptability to change achieved via software decisions
  - System value-domain problems are the chief sources of software project failures

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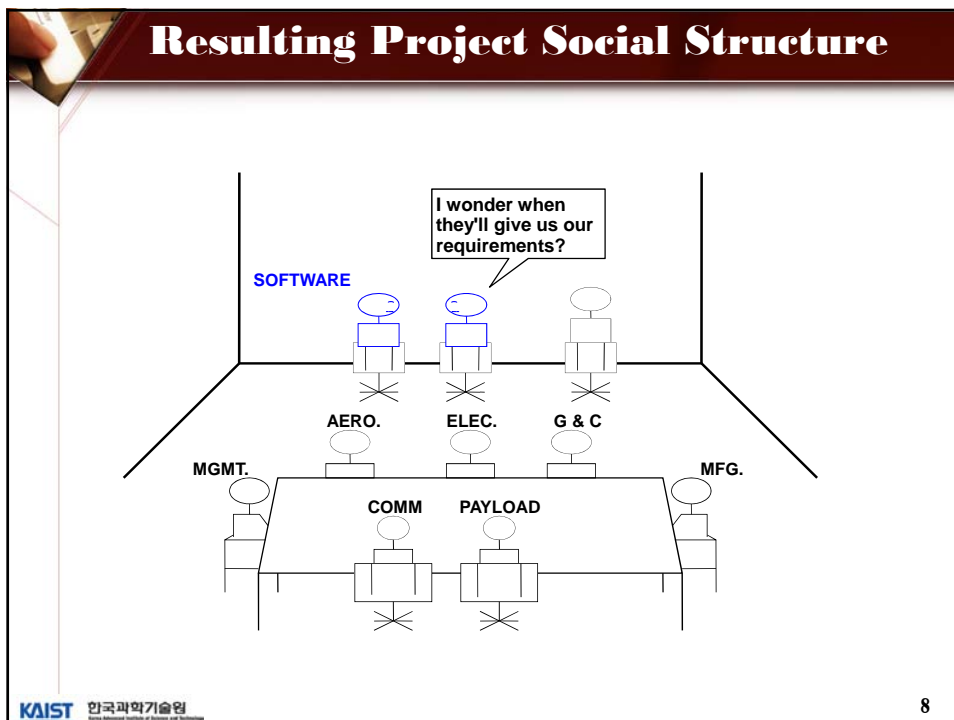
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## The “Separation of Concerns” Legacy

- “The notion of ‘user’ cannot be precisely defined, and therefore has no place in CS or SE.”
  - Edsger Dijkstra, ICSE 4, 1979
- “Analysis and allocation of the system requirements is not the responsibility of the SE group but is a prerequisite for their work”
  - Mark Paulk et al., SEI Software CMM\* v.1.1, 1993

\*Capability Maturity Model

7



## Value-Based Software Engineering

- Goal of VBSE
  - “To develop models and measures of value which are of use for managers, developers, and users as they make trade-off decisions b/w quality & cost, functionality and schedule, etc.”
  - Such decisions must be economically feasible and comprehensible to the stakeholders with differing value perspectives
- Root of VBSE
  - Early 80’s Software Engineering Economics, pioneered by Barry Boehm
- Extension of ISO SE definition with the elements from
  - Economics, Cognitive Science, Finance, management Science, Behavioral Sciences, and Decision Science, etc

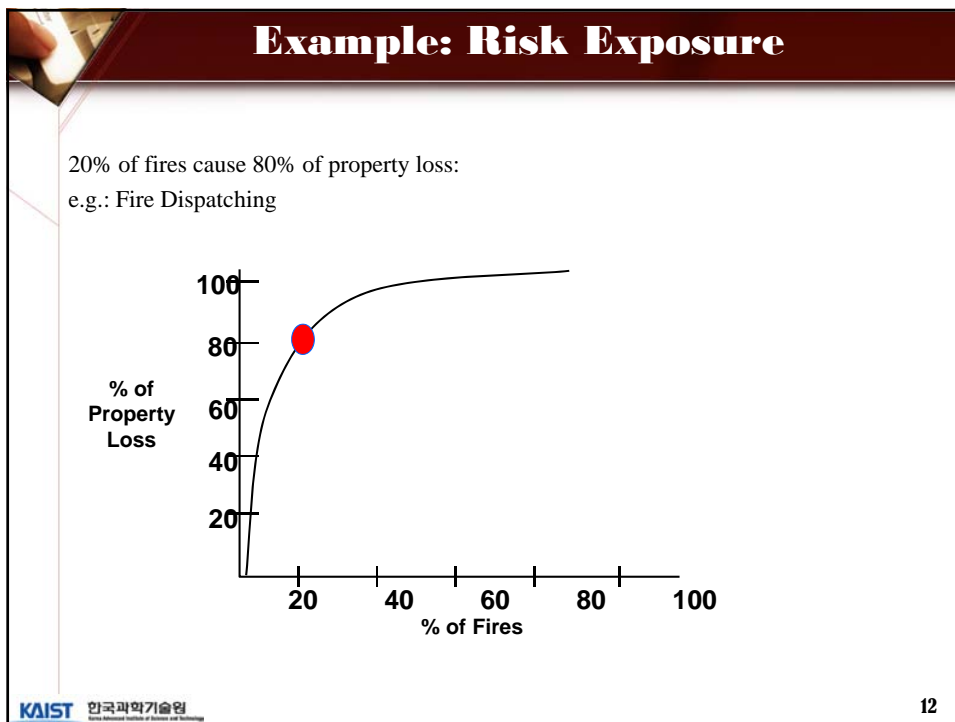
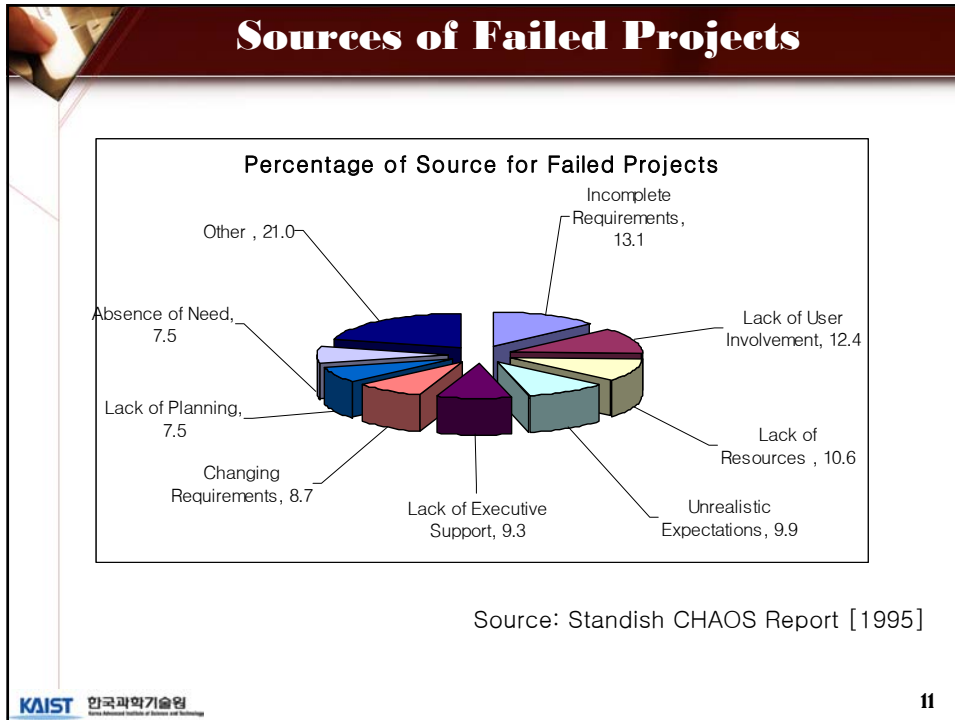
Source “Value-based Software Engineering”, Stefan Biffle et. Al., Springer-Verlag, 2006


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9

## Value-Based Software Engineering

- Unavoidable involvement with
  - Software & information system product and process technology
  - Their interaction with human values
- Uses risk considerations
  - To balance software discipline and flexibility
  - To answer key “How much is enough?” questions
- Helps illuminate information technology policy decisions
  - By identifying the quantitative and qualitative sources of cost and value associated with candidate decisions

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10






“VBSE approaches can be applied to avoid current project failures”

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13



## Value : Key Definitions

- Value (from Latin “valere” – to be worth)
  - “the quality of being useful or desirable” – yahoo dictionary
  - A fair return or equivalent in goods, services, or money
  - Relative worth, utility, or importance
- Software Validation (also from Latin “valere”)
  - Validation: “Are we building the right product”
  - Verification: “Are we building the product right”

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14

## Conclusions So Far

- Value considerations
  - Critical factor for successful software projects
- Success is a function of key stake-holder values
- Values are vary by stakeholder role
  - Value for developer, value for customer, value for user???
- Non-monetary values are important
  - Fairness, customer satisfaction, trust,...
- VBSE: integration of ethics into software engineering practice

## Understanding Source of Values



## Model-Clash Spider Web: Master Net

### Stakeholders' value propositions (win conditions)

**Users**

- Many features
- Changeable requirements
- Applications compatibility
- High levels of service
- Voice in acquisition
- Flexible contract
- Early availability

**Maintainers**

- Ease of transition
- Ease of maintenance
- Applications compatibility
- Voice in acquisition

**Acquirers**

- Mission cost/effectiveness
- Limited development budget, schedule
- Government standards compliance
- Political correctness
- Development visibility and control
- Rigorous contact

**Developers**

- Flexible contract
- Ease of meeting budget and schedule
- Stable requirements
- Freedom of choice: process
- Freedom of choice: team
- Freedom of choice: COTS/reuse

PC: Process  
PD: Product  
PP: Property  
S: Success

- Reconcile Everyone's Value Position

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17

## Maslow's Human Need Hierarchy - I

Self-Actualization

Esteem and Autonomy

Belongingness and Love

Safety and Security

Physiological (Food and Drink)

Source: A. Maslow, "Motivation and Personality", 1954

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18

## Maslow's Human Need Hierarchy - II

- Satisfied needs are not motivators
- Unsatisfied lower-level needs dominate high-level needs
- **Management Implication**
  - Create environment and subculture which satisfies lower-level needs
    - Stability, share values, community, and match to special needs
  - Tailor project objectives, structure to participants' self-actualization priorities

19

## Different Ways of Self-Actualization

- Becoming a Better Manager
- Becoming a Better Technologist
- Helping Other Developers
- Helping Users
- Making People Happy
- Making People Unhappy
- Doing New Things
- Increasing Professional Stature

20

## Projecting Yourself Into Others' Win Situations

Counterexample: The Golden Rule

- **Do unto others**
  - **Build computer systems to serve users and operators**
- .. **As you would have others do unto you**
  - .. *Assuming users and operators like to write programs, and know computer science*

- **Computer sciences world (compilers, OS, etc.)**
  - Users are programmers
- **Applications world**
  - Users are pilots, doctors, tellers

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21

## VBSE: Seven Key Elements

- Benefit Realization Analysis
- Stakeholder Proposition Elicitation and Reconciliation
- Business Case Analysis
- Continuous Risk and Opportunity Management
- Concurrent System and Software Engineering
- Value-Based Monitoring and Control
- Change as Opportunity

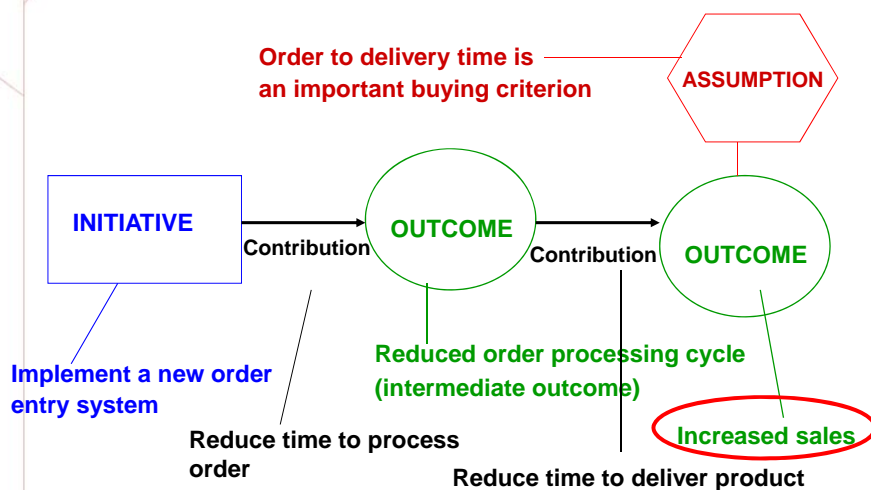
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22

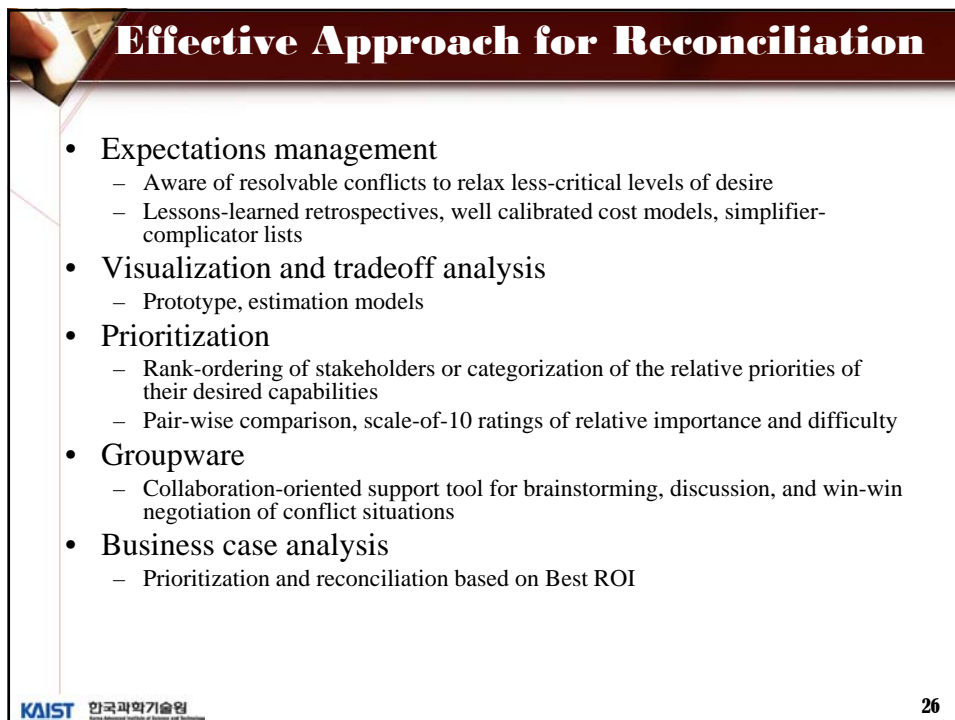
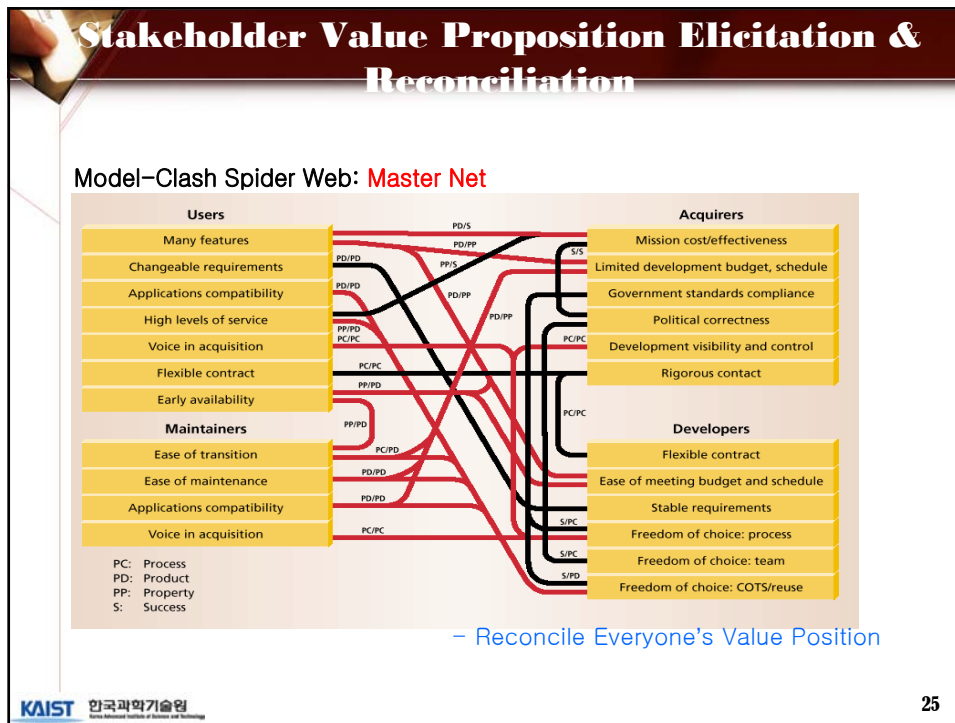
## Benefit Realization Analysis

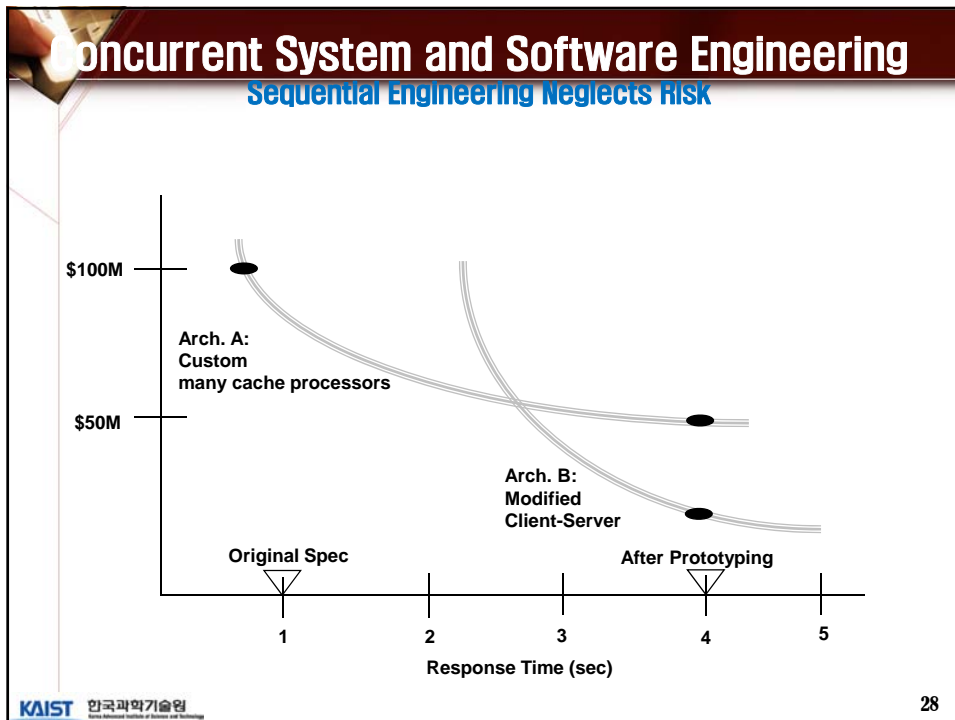
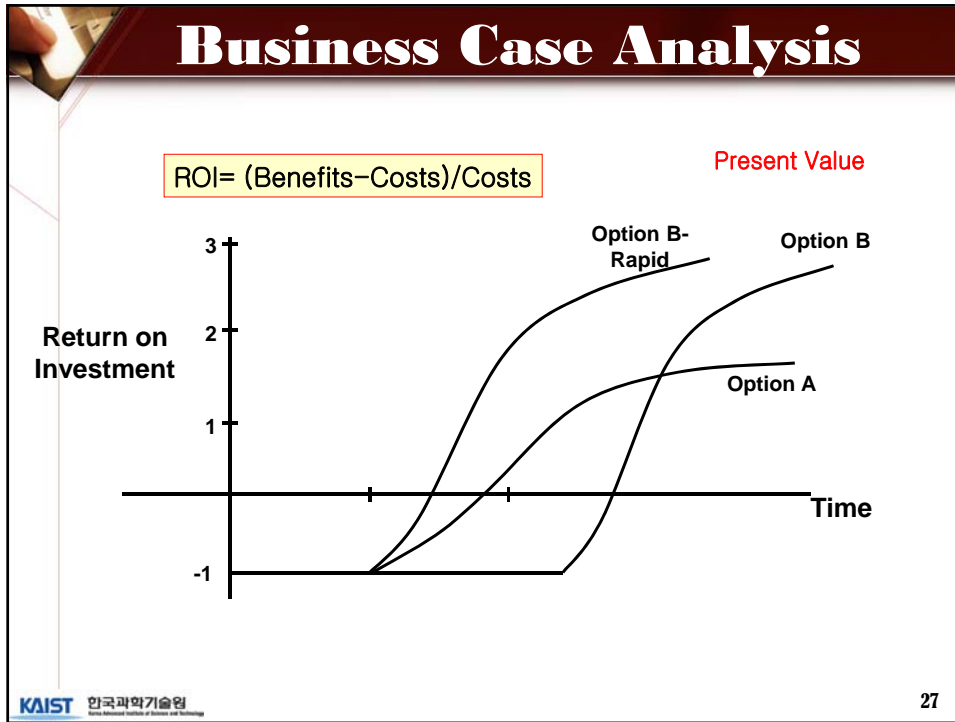
- “Field of Dreams” syndrome – a farmer story
  - In Software technology, “Build Software and Benefit will come” syndrome
  - Cause of many software project failures
- DMR-BRA
  - Determine and coordinate the other initiatives besides software and IT system development

## DMR-BRA: Results Chain



\*DMR Consulting Group's Benefits Realization Approach





## Change As Opportunity: Agile

- Continuous customer interaction
- Short value - adding increments
- Tacit interpersonal knowledge
  - Stories, Planning game, pair programming
  - Explicit documented knowledge expensive to change
- Simple design and refactoring
  - Vs. Big Design Up Front

29

## Five Critical Decision

- Represent five dimensions
- Size, Criticality, Dynamism, Personnel, Culture

The chart illustrates five dimensions of project management, each with a scale from 0 to 100. The dimensions are:

- Personnel** (% Level 1B) (% Level 2&3): Scale 0 to 40.
- Dynamism** (% Requirements change/month): Scale 0 to 1.
- Culture** (% thriving on chaos vs. order): Scale 0 to 100.
- Size** (# of personnel): Scale 0 to 300.
- Criticality** (Loss due to impact of defects): Scale 0 to 40.

The chart also includes a scale for **Comfort** (0 to 100) and **Funds** (Essential, Discretionary, Single Life, Many Levels). A large arrow labeled 'Agile' points towards the 'Agile' end of the spectrum, and a smaller arrow labeled 'Plan-driven' points towards the 'Plan-driven' end.

Source: Balancing Agility and Discipline

30

## Conclusions

- ❖ Marketplace trends favor transition to VBSE paradigm
  - Software a/the major source of product value
  - Software the primary enabler of adaptability
- ❖ VBSE involves 7 key elements
  1. Benefits Realization Analysis
  2. Stakeholders' Value Proposition Elicitation and Reconciliation
  3. Business Case Analysis
  4. Continuous Risk and Opportunity Management
  5. Concurrent System and Software Engineering
  6. Value-Based Monitoring and Control
  7. Change as Opportunity
- ❖ Processes for implementing VBSE emerging
  - CeBASE Method, CMMI, DMR/BRA, Balanced Scorecard, RUP extensions, Strategic Design, Agile Methods

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31

## Q & A



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32