IT Application Portfolio Management Under Implementation Uncertainty

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The usual disclaimer applies.
Aligning IT and business enhances firm’s ability to reform rapidly in fluid market.

Portion of the legacy systems in IT portfolio stays at high level. Legacy systems dissipate IT resources, and resist reform.

Legacy systems are migrated to package-based COTS solutions, or more recently they are used ‘as-is’ by splitting into SOA units of service.

How do we manage the IT portfolio? 3 aspects to be addressed: metrics for selection, which to migrate, and when.

Source:
IT Investment Governance

- Needs
- Selection
- Project
- Operations
- Assurance

- **Budget Mgmt**
  - Alignment
  - Accounting

- **Portfolio Mgmt**

- **Acquisition Mgmt**
  - Selection
  - Structure

- Project Management
Outline

- Research Motives
- What is Application Portfolio Management?
- APM under uncertainties – logical separation in risk structure
  - Implementation Uncertainty – legacy application migration
  - Business Uncertainty – innovative applications
- Integrated APM process framework
  - Portfolio Selection by mean-variance
  - Timing selection by Real Options Analysis
  - Selection by Risk tolerance
- Application case and Conclusions
- State-of-the-art in APM
APM Objectives

Application Portfolio Management Objectives

Maximize expected return \( E(r) \) where \( k \) = projects 1 to \( n \) in the portfolio, \( x \) = percent of total investment in the project and \( \mu \) = the mean return in project subject to constraints.

\[
\text{Maximize} : E(r) = \sum_{k=1}^{n} x_k \mu_k \quad \text{s.t. constraints}
\]

Uncertainty

The Cone of Uncertainty for External Factors

Flexible Investment Strategy Modifies Exposure

The Cone of Uncertainty for the Value of Strategic Investments
APM – New Risk Structure

- Implementation Uncertainty
  - Project success rate improved from 16.2% in 1994 to 28% in 2000 (Chaos report).
  - The ERP Conference Board Survey (2001) 92% satisfied/somewhat satisfied; 40% failed to achieve business case within 1 year, or 6 months delayed.
APM – New Risk Structure

- Business Uncertainty – Innovative applications

  - “Timing Dilemma”: adapt early paying high cost or delay losing strategic advantages
Integrated APM Process Framework

Step 1: Real Options Analysis for Optimal Timing

Step 2: Risk-Return Analysis for Efficient Portfolios

Step 3: Selection by Risk Tolerance, make the final cut

Strategy/Tactics

Projects

Monitor

Implementation Check
Optimum Timing by Real Options Analysis

Option Value = Function of
time \( t \)
growth rate \( \alpha \)
interest rate \( \rho \)

McDonald and Siegel
Optimal Timing:

\[
T = \frac{1}{\alpha} \ln \left( \frac{\rho I}{(\rho - \alpha)X_0} \right)
\]
Selection by Mean-Variance

Portfolio Selection by mean-variance

Efficient Frontier

VALUE

RISK
Selection by Risk Tolerance

Use Certainty Equivalent $C_x$ to represent risk attitude of decision maker

$$C_x = \text{Expected value} - \text{risk discount}$$

For a typical constant-risk aversion case (the negative exponential utility function $u(x) = -e^{-x/R}$), Raifa showed Certainty Equivalent:

$$C_x = \mu - \frac{\sigma^2}{2R}$$

- Begin by assuming the risk tolerance to identify the optional portfolio with Max. CE.

- Decision makers can evaluate the impact of their risk-taking behavior by changing the risk tolerance value.
## Application of the Integrated Framework

- **Candidate Projects P1-P8**

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Project Description</th>
<th>Success Probability</th>
<th>NPV Success</th>
<th>NPV Failure</th>
<th>Completion Cost</th>
<th>Expected NPV</th>
<th>Standard Deviation</th>
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<tbody>
<tr>
<td>P1</td>
<td>B2B Business</td>
<td>0.7</td>
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<td>P3</td>
<td>Human Resources</td>
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<td>10.1</td>
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<td>-4.8</td>
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<td>8.0</td>
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<tr>
<td>P7</td>
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<td>17.0</td>
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<td>P8</td>
<td>Mfg Process Control</td>
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<td>-6.7</td>
<td>11.5</td>
<td>18.1</td>
<td>8.2</td>
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</tbody>
</table>

All-project portfolio (all of projects P1 thru P8):

- **Expected NPV = 86.3, Total Completion Cost = 64.6, Standard Deviation = 27.7**
Application of the Integrated Framework

Efficient Portfolio Set

Efficient Portfolio Set & Certainty Equivalent

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Expected NPV</th>
<th>Standard Deviation</th>
<th>Expected NPV/SD</th>
<th>Certainty Equivalent</th>
<th>Project Compositions</th>
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<tr>
<td>A</td>
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<td>9.2 P5,P7</td>
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<tr>
<td>H</td>
<td>83.6</td>
<td>27.1</td>
<td>3.1</td>
<td>-8.2</td>
<td>46.9 P1,P2,P3,P4,P5,P6,P8</td>
</tr>
</tbody>
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Conclusions

- By integrating 3 techniques, addressed 3 mandatory requirements for APM
  - Optimum Timing,
  - Portfolio Selection,
  - Final cut.

- By recording corporation’s risk propensity for technological risk aversion, decision makers establish foundation to cope with future challenges
State-of-the-Art in APM

- Products for APM
  - Gartner Magic Quadrant (June 2007)

- Research Areas
  - Application of ROA
  - Portfolio analysis

Source: Gartner (June 2007)
# Real Options Analysis and Applications to IT

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<tr>
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</thead>
<tbody>
<tr>
<td><strong>Applications to IT Asset</strong></td>
<td><strong>Flexible Mfg System</strong></td>
<td><strong>EDI sys</strong></td>
<td><strong>Technology</strong></td>
<td><strong>“Hasten Investment? Mason &amp; Weeds”</strong></td>
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<tr>
<td>Triantes &amp; Hader</td>
<td></td>
<td>Taudes</td>
<td>Switch options</td>
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<td></td>
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<td>Lint &amp; Pennings</td>
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</tbody>
</table>
Portfolio of interrelated investments
- m-to-n convergent switch investments, e.g., due to capacity constraints

Portfolio Effects
- Zero correlation among switch investment - Laamanen’s model: non-additivity in option value

Multiple 1-to-1 switch investments:
- No research found, ‘brute force’ analysis
Thank you for your attention.