Solutions that answer where and how much to invest:
Project Direction
Portfolio Selection

Portfolio Simulation

November 2003
Some SmartOrg customers:

SmartOrg solutions implement proven methods developed over decades with customers.
“We have applied SmartOrg solutions to hundreds of projects, helping us reduce cost or drive growth. The cumulative impact on Boeing: hundreds of millions of dollars.”

Dave Leonhardi
Boeing
SmartOrg solutions combine systems and services.

**Decision Advisor**: A desktop application that supports real-time, in-depth project evaluation workshops.

**Portfolio Navigator**: A web-application portfolio and project evaluation system that serves people across the enterprise.

**Services**: Include management education, staff training, professional coaching, technical support, system configuration and customization, template design and development, pilot projects, workshops.
Portfolio management must address both strategy and operations:

<table>
<thead>
<tr>
<th>Strategic Layer of Process:</th>
<th>Operational Layer of Process:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Emphasize Direction and level of effort</td>
<td>• Emphasize accountability and responsibility</td>
</tr>
<tr>
<td>• Value-focused</td>
<td>• Task or document focused</td>
</tr>
<tr>
<td>• Forward-looking</td>
<td>• Current or historical looking</td>
</tr>
<tr>
<td>• Based on uncertain forecasts</td>
<td>• Based on data and transactions</td>
</tr>
<tr>
<td>• Outward-looking</td>
<td>• Inward-looking</td>
</tr>
<tr>
<td>• Consider alternative courses of action</td>
<td>• Focus on the current plan</td>
</tr>
<tr>
<td>• Seek effective solutions</td>
<td>• Seek efficient solutions</td>
</tr>
</tbody>
</table>

“Doing the right things”

Most portfolio management approaches emphasize the operational issues at the expense of the strategic.
A pilot obtains his most valuable experience through simulations of situations that occur only a few times in his career.
We will focus on a portfolio of projects (or assets or opportunities), each having two kinds of uncertainty:

- Achieving Project Success (Overcoming all hurdles)
  - In R&D or development projects this means creating a commercially viable result and passing all of the legal, regulatory and sometimes public acceptance barriers that allow a attempt at commercialization
    - This could mean creating a new drug, finding an oil or mineral deposit, creating new software, developing an idea for a movie into an actual “green light” project, etc.
  - In more general circumstances it means doing whatever it takes to get a shot at producing profits
    - For example, acquiring the right kind of firm or capability, arranging a consortium, getting agreement on an international standard or regulation, lining up a joint venture, etc.

- The Value of Commercial Success (Extracting the Value)
  - Most often characterized as an uncertain net present value, which depends on uncertainties such as market demand, competitive response, production costs, etc.
We will characterize a project with two uncertainties: technical and commercial success.

<table>
<thead>
<tr>
<th>Technical Success</th>
<th>Commercial Success</th>
<th>Business Impact (Points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success (Roll a 1)</td>
<td>Roll a 6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roll a 5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roll a 4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roll a 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roll a 2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roll a 1</td>
<td>1</td>
</tr>
<tr>
<td>Failure (Roll a 2, 3, or 4)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Key for Dice Simulation

Technical Success

White:
1 = success
2,3,4 = failure

Black:
1 = failure
2,3,4 = success

Commercial Success

Roll only if you have achieved technical success.

Red:
1–6 = payoff in points

Yellow:
1–20 = payoff in points
Two characteristics of R&D projects—technical feasibility and commercial potential—create four types of projects.

- **Bread and Butter** (High Commercial Potential, High Technical Feasibility)
- **Pearl** (High Commercial Potential, Low Technical Feasibility)
- **White Elephant** (Low Commercial Potential, High Technical Feasibility)
- **Oyster** (Low Commercial Potential, Low Technical Feasibility)
Instructions for Portfolio Simulation

• Each team gets a tray with 10 potential projects.
  – It will cost $5 per team to play (funding five projects).

• Analyze your portfolio.

• Select the five projects you want to fund.

• Simulate the results of each project (as instructed). Receive point payoff based on the commercial success of your successful projects.

• The teams that score ten points or more will each win $10; those that score less than ten points receive nothing.

• Whichever team achieves the greatest commercial success will receive an added 20 point market share bonus and $20.
Report on Analysis of Portfolio Strategy

• A table showing the mean value of each type of project

• A graph showing the risk and return of pursuing different strategies

• Analysis of the critical trade-offs implicit in choosing different strategies
The main challenge is to balance bread and butter projects and oyster projects.

- **Bread and Butter**
  - Value = 2.625
  - Commercial Potential (Why do it?)
    - Net Present Value Given Success
      - Low
      - High

- **Pearl**
  - Value = 7.875
  - Commercial Potential (Why do it?)
    - Net Present Value Given Success
      - Low
      - High

- **White Elephant**
  - Value = 0.875
  - Commercial Potential (Why do it?)
    - Net Present Value Given Success
      - Low
      - High

- **Oyster**
  - Value = 2.625
  - Commercial Potential (Why do it?)
    - Net Present Value Given Success
      - Low
      - High
The budget constraint requires you to forego valuable projects.

The CFO Chart

Cumulative Value

Cumulative Investment

Budget Limit

Pearl

Oysters and Bread & Butter Projects

White Elephant
The oyster strategy (4 oysters, 1 pearl) is riskier than the bread and butter strategy (4 bread and butter, 1 pearl).
Choosing the oyster strategy exposes you to more downside potential than choosing the bread and butter strategy.

<table>
<thead>
<tr>
<th>Chance of Winning a Prize</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oyster Strategy</strong></td>
</tr>
<tr>
<td><strong>72%</strong></td>
</tr>
<tr>
<td><strong>Bread and Butter Strategy</strong></td>
</tr>
<tr>
<td><strong>83%</strong></td>
</tr>
</tbody>
</table>
Choosing the oyster strategy gives you a greater chance of winning the market share bonus.

![Graph showing the probability of winning based on strategy choice and what others play.]

Key:
- Red line: I Choose the Bread and Butter Strategy
- Yellow line: I Choose the Oyster Strategy

<table>
<thead>
<tr>
<th>What Others Play</th>
<th>Oyster Strategy</th>
<th>Bread and Butter Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td></td>
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<tr>
<td>4</td>
<td>1</td>
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<tr>
<td>5</td>
<td>0</td>
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</tr>
</tbody>
</table>
# Portfolio Strategy Simulation Results

Team Name

Portfolio Strategy

### Funded Projects Payoff

<table>
<thead>
<tr>
<th>Type</th>
<th>S/F</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project 2</td>
<td></td>
<td></td>
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<tr>
<td>Project 3</td>
<td></td>
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<tr>
<td>Project 4</td>
<td></td>
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<tr>
<td>Project 5</td>
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<tr>
<td>Total</td>
<td></td>
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</tbody>
</table>

### Unfunded Projects Payoff

<table>
<thead>
<tr>
<th>Type</th>
<th>S/F</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project 7</td>
<td></td>
<td></td>
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<tr>
<td>Project 8</td>
<td></td>
<td></td>
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<tr>
<td>Project 9</td>
<td></td>
<td></td>
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<tr>
<td>Project 10</td>
<td></td>
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<tr>
<td>Total</td>
<td></td>
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</tbody>
</table>

### 5 best

<table>
<thead>
<tr>
<th>S/F</th>
<th>Value</th>
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<tbody>
<tr>
<td>5 best</td>
<td></td>
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</tbody>
</table>
## Portfolio Simulation Scoring Form

<table>
<thead>
<tr>
<th>Team</th>
<th>Strategy</th>
<th>Unfunded</th>
<th>Funded</th>
<th>Five Best</th>
<th>Market Share Bonus</th>
<th>Total Profit (points)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>P</td>
<td>O</td>
<td>B</td>
<td># Succ</td>
<td>Points</td>
</tr>
<tr>
<td>1</td>
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<td>2</td>
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<td>3</td>
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<td>Total</td>
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<tr>
<td>Average</td>
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</tbody>
</table>
The portfolio strategy improves the prospects for creating value.

Risk and Return of Portfolio Strategies

Mean for Funded Projects = 18
Mean for Unfunded Projects = 11

We can improve the value further by introducing pipeline management into the portfolio.
Our metric for project value starts small and *increases* as a project progresses through the pipeline.

![Diagram showing project value progression through technical and commercial phases with probabilities and business impact points.]

- **Technical Phase**
  - Success (Roll a 1) 0.875
  - Failure (Roll a 2, 3, or 4) 0.125

- **Commercial Phase**
  - Roll a 6
  - Roll a 5
  - Roll a 4
  - Roll a 3
  - Roll a 2
  - Roll a 1

- **Business Impact (Points)**
  - Roll a 6: 6
  - Roll a 5: 5
  - Roll a 4: 4
  - Roll a 3: 3
  - Roll a 2: 2
  - Roll a 1: 1

- **Project Value entering technical phase**: 0.875
- **Project Value entering commercial phase**: 3.5
A portfolio has “option value” if we can postpone committing until we know more about each project.

What are your best five projects given complete information?
The value of the portfolio increases as more information is available before project decisions are made.

Illustrated for the Oyster strategy

What is it worth paying to keep projects “alive”?

Value with option (select after technical development) = 27.8
Value without option (select now) = 18.0
Option Value = 9.2

*It is beneficial to have more projects in the pipeline than you could ever afford to commercialize!*
Capturing this option value requires an efficient pipeline and an ability to make great strategic decisions over time.

- **Intake - Ideation**
  - Fuzzy Front End
  - Market & Technical Evaluation
  - Product Development & Trial
  - Whole-Product Development

- **Scale Up**
  - 10 taken to scale

- **Commercialization**
  - 3 commercialized
  - 1 great success

1000 serious ideas

100 developed and tried

1000 serious ideas

100 developed and tried
Poor decision making results in poor pipelines and significant loss of value.

The Pipe: not enough innovation

The Bucket: too expensive

“Strategic” decisions made too early and too broadly.

No decisions—everything is funded.

Commercialization

$
Pipeline simulation—What does it take to produce one launch?

Project Through Phases:

- **Phase I**
  - 3 Projects Enter Phase I
  - 2 Projects Enter Phase II
  - 2 Failures “No Go”

- **Phase II**
  - 3 Successes “Go”
  - 1 Launch

Pipeline Shape:

- **Phase I (3)**
- **Phase II (2)**
- 1 Launch

Pipeline cost = 5
You have an infinite pool of potential projects, each with two technical hurdles:

- **Easy** = roll black die, succeed on 2,3,4
- **Hard** = roll white die, succeed on 1
- A project that passes both hurdles is launched (no commercial roll needed)
- Your objective is to achieve one launch in the lowest number of rolls.
What strategy is most like your company?

☐ Operational Strategy
Your company has a culture of operational excellence, and is committed to planning and follow-through. Projects tend to be task driven, with gate-reviews based primarily on accomplishment of plan milestones. Rarely do teams question the plan or revisit assumptions. Teams are superb at creating and meeting deliverables, and so projects are never killed. As a result, projects continue through the phases until pre-launch, at which point they are aborted if they have fatal flaws and launched according to plan if project is ready.

☐ Easy First
Your company emphasizes demonstrated successful technical results. If a project fails to demonstrate success at any point, then it is cancelled. If a project demonstrates success, then the team receives kudos and proceeds to the next phase. Consequently, project teams work on the easy hurdles first so they can demonstrate success before proceeding to the more difficult challenges. If the team can overcome these hurdles, they celebrate a launch.

☐ Hard First
Your company is full of bright people who like solving hard problems. Project teams focus on the most challenging (i.e. interesting) hurdles first, and build their milestones around achieving these goals. If the team fails to solve the hard problem, the team abandons the project to pursue another interesting challenge. If the team solves the hard problem, they move forward to finish off the easier details required to complete the project and get it launched.
What strategy produces the best results per launch?

Pipeline Cost
- Operational
- Hard First
- Easy First

Pipeline Shape
- Operational
- Hard First
- Easy First

Successes
- Operational
- Hard First
- Easy First

Failures
- Operational
- Hard First
- Easy First

My Preferred Strategy
- Operational
- Hard First
- Easy First
### Pipeline Simulation Score Sheet

**1. Set Strategy**

- **Strategy most like my company**
  - Operational
  - Hard First
  - Easy First

- **Strategy I think produces the best results**
  - Operational
  - Hard First
  - Easy First

- **Strategy I am assigned to simulate**
  - Operational
  - Hard First
  - Easy First

**2. Simulate and Tally**

- **Enter Phase I**
- **Enter Phase II**

- **Example Tally:**

**3. Compute Score**

- **Economics**
  - **Cost**
  - \( \text{Cost} = A + B \)

- **Pipeline Shape**
  - **Enter Phase I**
  - **Enter Phase II**

- **Success Experience**
  - **Successful Rolls**
  - **Failed Rolls**

- **Copy A**
- **Copy B**

- **Success = B + 1**
- **Failed = A - 1**
Follow the flowchart to conduct the pipeline simulation. To determine which die to roll, select the appropriate ones based on the strategy you have been assigned to simulate.

Start

Tally a project in phase I (box A)

Phase I: Roll die to simulate project.

Success ?

Easy First

Hard First

Yes

Success ?

Yes

No

Phase II: Roll die to simulate project.

Tally a project in phase II (box B)

Easy First

Hard First

Yes

Success ?

Yes

No

Launch!
Proceed to scoring
Only the low-cost Hard Strategy produces the desired funnel shape.

- **Commit Strategy**
  - Phase I (5.33)
  - Phase II (5.33)
  - One Launch
  - A bucket, Cost = 10.67 per launch

- **Easy Strategy**
  - Phase I (5.33)
  - Phase II (4.00)
  - One Launch
  - Cost = 9.33 per launch

- **Hard Strategy**
  - Phase I (5.33)
  - Phase II (1.33)
  - One Launch
  - A funnel, Cost = 6.67 per launch
### Pipeline Simulation: statistical results per launch

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Economics</th>
<th>Pipeline Shape</th>
<th>Success Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commit</td>
<td>Cost</td>
<td>Enter Phase I</td>
<td>Enter Phase II</td>
</tr>
<tr>
<td></td>
<td>10.67</td>
<td>5.33</td>
<td>5.33</td>
</tr>
<tr>
<td>Easy</td>
<td>9.33</td>
<td>5.33</td>
<td>4.00</td>
</tr>
<tr>
<td>Hard</td>
<td>6.67</td>
<td>5.33</td>
<td>1.33</td>
</tr>
</tbody>
</table>

- **Hard first is the lowest cost strategy**
- **Hard first has the best shaped pipeline**
- **Hard first has the fewest successful rolls, but no more failures than any other strategy.**
Hard First is the best strategy because it keeps the cost of failure low.

<table>
<thead>
<tr>
<th>Management Focus</th>
<th>Resolving Uncertainty</th>
<th>Plans &amp; Accountability</th>
<th>Operational Excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy First</td>
<td></td>
<td>Easy First:</td>
<td>Operational Excellence:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High cost of failure—too many projects get through the first phase.</td>
<td>Very high cost of failure—failures not detected until very late in the project when it is expensive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard First:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low cost of failure—most projects fail early, later stage projects have high probabilities of success.</td>
<td></td>
</tr>
</tbody>
</table>

The hard first strategy requires communicating well about uncertainty, i.e. talking clearly about what you do not know!
A strategic perspective on portfolio management:

- You cannot pick winning projects—but you can pick a portfolio with good prospects.
  - Uncertainty about which projects will be the winners is not the same as portfolio risk.
- Some rejected projects will succeed.
- If you are going to take long shots—take lots of them.
- To beat the competition you have to take long shots—conservative portfolios are unlikely to win.
  - Many organizations implicitly encourage conservative portfolio strategy, by rewarding project success.
- The discipline of quantitatively evaluating and screening projects significantly improves the portfolio—good decisions add value.
- Identify your risks and work on the hard ones first = “fail fast”
  - This requires excellent ways of communicating about uncertainty, and getting used to talking about what you don’t know.
- Great value is available from capturing the option value of projects through an efficient pipeline—but this requires superb decision making ability.
Dr. Arno Penzias on R&D

"Scientists ask me,"How do I know I'm working on a good project?"

“I say, “Simple: Imagine what you're going to do is going to be 100% successful; find out how much money it's going to be worth; multiply by the probability of success, divide by the cost, and look at the figure of merit."

“When I said this originally, everybody became hysterical. Everybody got mad, saying, 'How would we know the probability? How would we know what it's worth? What if we don't know who the customer is?'

"But if you don't know who needs something, why are you doing it? If you don't know what the chances are of success, why are you doing it? If you don't know how much it's going to cost—not just in resources but in years of your life—why are you doing it? You ought to know all three things! …"

– Dr. Arno Penzias, Chief Scientist of Bell Labs, astrophysicist, research scientist, Nobel Prize-winner and really, really smart guy, as quoted in Fortune Vol 133, No. 1, "Putting the Idiot in Idiot Savant", January 15, 1996
“In the end, we estimated that our portfolio was worth $2.6 billion more than it was when we started. This was powerful confirmation that our efforts were worthwhile.”

— Paul Sharpe
Vice President and Director
SmithKline Beecham
Successful strategic portfolio process.

Portfolio Navigator process:

- **Set up for success**
  - Provision template library.
  - Set standards for evaluations.
  - Administer portfolio and projects.

- **Define portfolio and projects**

- **Conduct project evaluations**

- **Conduct peer and expert review**

- **Allocate resources across portfolio**

- **Generate Credible Project Data**

- **Ensure Comparability**

- **Make Decisions**