Dynamic Strategic Planning
Case Studies

- **Situation**
  1) Identify critical issues
  2) Identify decisions
  3) Identify risks

- **Analytical**
  1) Define critical issues and risks in numeric terms
  2) Calculate expected values

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Dynamic Strategic Planning
Case Studies (contd)

- **Optimum Decisions**
  1) First stage decisions and options for the future

- Characterize benefits and costs of decisions
Examples

- Expansion of Established Industry
  South Africa Power

- Response to Government Regulations
  PDVSA Corporate Flight Departments

- Technology Choice
  Mass. Water Resources Authority

- Time to Market
  NASA Space Computer

Examples (contd)

- New Product Deployment
  Silicon Wafers / Ceramic Auto Parts

- Siting New Capacity
  Sydney Airport
Expansion of Established Industry

Power Station Investment in South Africa (D. A. Aberdein)

- Situation
  - Eskom: South Africa Power Utility
  - Variability in electricity demand for the future?

- Critical Issue
  - Profits for company

Expansion of Established Industry
Power Station Investment in South Africa

Excess Capacity as Percentage of Demand

Decision to use 6 x 600 MW Units
Expansion of Established Industry (contd)

- Decisions
  - How large an incremental plant size for capacity expansions
    - 6 x 620 MW or 3 x 310 MW

Expansion of Established Industry (contd) Decisions

South Africa Power

6 - 620 MW Stations

3 - 310 MW Stations

Other
Expansion of Established Industry (contd)

- **Risks**
  - Over or under capacity due to variability in electricity demand in the future
- **Optimum Decisions**
  - Smaller plants
- **Benefits and Costs of Decision**
  - Some loss of economies of scale
  - Facilitate capacity additions as needed

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**Expansion of Established Industry (contd) Decision Tree**

- **South Africa Power**
  - 6 - 620MW Stations: $28/kW
    - High Variability (620): $50/kW (0.3)
    - Average Variability (620): $20/kW (0.4)
    - Low Variability (620): $15/kW (0.3)
  - 3 - 310MW Stations: $10/kW
    - High Variability (310): $15/kW (Prob= 0.3000)
    - Average Variability (310): $10/kW (Prob= 0.4000)
    - Low Variability (310): $5/kW (Prob= 0.3000)
  - Other: $100/kW
Expansion of Established Industry (cont’)

<table>
<thead>
<tr>
<th>Incremental Plant Size</th>
<th>Cost of Electricity ($/KW)</th>
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<tr>
<td></td>
<td>Total Cost</td>
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<td>Variability Cost</td>
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<td></td>
<td>Economies of Scale</td>
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Response to Government Regulations

Petroleos de Venezuela Corporate Flight Departments (A. D. Ungredda)

- Situation
  - PDVSA: Venezuela’s state-owned oil monopoly
  - Internal corporate flight departments (CFD)
  - Government announces that all state aircraft must be sold
Response to Government Regulations (contd)

Petroleos de Venezuela Corporate Flight Departments
(A. D. Ungredda)

- Critical Issue
  - Effects on company performance from restructuring of air transportation services

- Decisions
  - Resist elimination of internal CFD
  - Spin-off CFD as autonomous entity
  - Outsource services from external suppliers

Response to Government Regulations (contd) Decisions

PDVSA's Decision

- Resistance Strategy/Justify CDFs
- Spin Off Autonomous Firm
- Out Source Air Transportation Service
Response to Government Regulations, (contd)

- **Risks**
  - Enforcement actions and punitive costs imposed by government

- **Optimum Decision**
  - Partial Compliance

- **Benefits and Costs of Decisions**
  - Mitigates costs to company
  - Potentially causes some administrative disruption

---

Response to Government Regulations (contd) Decision Tree

```
PDVSA's Decision
  $1,170M
  Spin Off Autonomous Firm $1,096M
  Out Source Air Transportation Service $1,085M
  Partial Sale
    $1,280M (Prob = 0.5000)
    High Market Forecast 0.3
    Medium Market Forecast 0.4
    Low Market Forecast 0.3
    High Initial Service Availability 0.2
    Low Service Availability 0.8
  Total Sale
    $0M (Prob = 0.1000)
  Keep All Aircraft
    $1,326M (Prob = 0.4000)
```

Dynamic Strategic Planning
Massachusetts Institute of Technology
Richard de Neufville, Joel Clark, and Frank R. Field
Case Studies
Slide 16 of 52
Technology Choice

Mass. Water Resources Authority (H. D. Nababan)

- Situation
  - $6 Billion Boston Harbor clean-up project
  - Disposal of wastewater treatment sludge
- Critical Issue
  - Optimum technology

Technology Choice, (contd)

- Decisions
  - Select Technology
    - Pelletization
    - Composting
    - Landfilling
    - Hybrid system
Technology Choice, (contd)
Decisions

- Risks
  - High cost or failure of system

- Optimum Decisions
  - Hybrid options or Parallel development efforts

- Benefits and Costs of Decision
  - Minimizes potential of ending up with ineffective technology
  - Some loss of economies of scale

MWRA Decision

Composting

Landfilling

Pelletization

Hybrid
Technology Choice, (contd)
Decision Tree

MWRA Decision

- Composting: $221 M
- Landfilling: $246 M
- Pelletization: $234 M

Hybrid: $219 M

Place here Tree 1 of case study trees
### Technology choice: Mass. Water Resources Authority

#### Expected cost for different Reliability levels

($) x 10^6

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Case 1</th>
<th>Case 4</th>
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<tbody>
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<td>R= 95%</td>
<td>R = 90 %</td>
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<tr>
<td>Single: Composting</td>
<td>221</td>
<td>231</td>
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<tr>
<td>Landfill</td>
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<td>253</td>
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<td>Pelletization</td>
<td>234</td>
<td>242</td>
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<tr>
<td>Hybrid: with Landfill</td>
<td>218</td>
<td>221</td>
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<tr>
<td>Without Landfill</td>
<td>192</td>
<td>200</td>
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</tbody>
</table>

### Technology choice: Mass. Water Resources Authority

#### Expected cost for different discount rates

($) x 10^6

<table>
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<th>Case 2</th>
<th>Case 1</th>
<th>Case 3</th>
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<tbody>
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<td>R=4%</td>
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<td>Single: Composting</td>
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<td>271</td>
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<td>Pelletization</td>
<td>263</td>
<td>234</td>
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<tr>
<td>Hybrid: with Landfill</td>
<td>239</td>
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<tr>
<td>Without Landfill</td>
<td>211</td>
<td>192</td>
<td>172</td>
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</tbody>
</table>
Time to Market

NASA Embedded Space Computer
(H. F. Benz)

- Situation
  - High performance computer for interplanetary missions
  - Must resist high levels of cosmic radiation
  - Expensive and time consuming to develop

Time to Market, (contd)

- Critical Issue
  - Meeting window of opportunity for launch date

- Decisions
  - Adopt commercial system
  - Design new system
  - Partner with firm to leverage resources
  - Hybrid approach
  - Do nothing
Time to Market, (contd)

Decisions

```
NASA Computer
  Adapt Commercial Design
  New Design
  Partner/Leverage
  Hybrid A
  Hybrid B
  Do Nothing
```

- **Risks**
  - Opportunity lost to complete new system by deadline
  - Beaten to market by competition

- **Optimum Decisions**
  - Parallel Arrangements (Hybrid)

- **Benefits and Costs of Decision**
  - Maximizes chance of utilizing window of opportunity
  - Delays and extra costs in setting up contract arrangements
Time to Market, (cont’)

Decision Tree

Adapt Commercial Design
New Design
Partner/Leverage

NASA Computer

Hybrid A

Hybrid B

Do Nothing

Early

0.96 Utility
Prob= 0.1500

0.75 Utility
Prob= 0.7500

0.15
On-Time

0.05
Late

0.05
Very Late

0.70 Utility

0.00 Utility
Prob= 0.0500

Prob= 0.0500

0.00 Utility

0.00 Utility

Place here Tree 4 of case study trees
Place here Tree 5 of case study trees

Time to Market
NASA Embedded Space Computer

Utility vs. Schedule

Utility

Schedule

-6 -4 -2 0 2 4
**Time to Market**  
**NASA Embedded Space Computer**

![Graph showing probabilities vs. schedule]

New Product Deployment

Newcomer in the Silicon Wafer Industry  
(M. Kimura)

- **Situation**
  - Japanese silicon wafer industry
  - Growing market for large diameter silicon wafers

- **Critical Issue**
  - Rate of market penetration
New Product Deployment, (contd)

Newcomer in the Silicon Wafer Industry (M. Kimura)

- Decisions
  - Price of wafers relative to leading companies
  - Type of wafer: small or large diameter
  - Capacity of plant (initial and later expansions)

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New Product Deployment: Wafers (contd) Decisions

- 8 in Dia. Wafer Plant
  - 0.5M Capacity
  - 1M Capacity
New Product Deployment: Wafers (contd)

- Risks
  - Over capacity and bankruptcy

- Optimum Decisions
  - Intermediate initial capacity for plant

- Benefits and Costs of Decision
  - Reduces risks of catastrophic losses
  - Some loss of scale economies

Place here Tree 6 of case study trees
New Product Deployment

Ceramic Automotive Parts
(F. Field)

- Situation
  - Demand for more fuel efficient automotive engines
  - Reciprocating parts
  - Ceramics have excellent properties but are difficult to manufacture
New Product Deployment, (contd)

Ceramic Automotive Parts (F. Field)

- Critical Issue
  - Rate of market penetration
- Decisions
  - Price
  - Plant size (initial and later expansions)
  - Product features: weight and reliability

New Product Deployment: Ceramics (contd) Decisions

Ceramic Valves

- Build 1M Unit Plant
  - $1.20
  - $1.70
- Build 5M Unit Plant
  - $1.20
  - $1.70
- Build 20M Unit Plant
  - $1.20
  - $1.70
- Do Nothing
  - $1.70
New Product Deployment: Ceramics (contd)

- Risks
  - Over capacity and bankruptcy

- Optimum Decisions
  - Intermediate initial capacity for plant

- Benefits and Costs of Decision
  - Reduces risks of catastrophic losses
  - Some loss of scale economies

Place here Tree 8 of case study trees
Siting New Capacity

A New Airport for Sydney Australia (R. de Neufville)

- Situation
  - Major hub of air travel
  - Many previous attempts to locate second airport during the past 20 years
  - Air transportation is central to the economy
Siting New Capacity (contd)

- Critical Issue
  - Selection of site
- Decisions
  - New sites or no new airport

Siting New Capacity, (contd) Decisions

- Sydney Airport
- Select site
- No Action
Siting New Capacity, (contd)

- **Risks**
  - Site will be unavailable when needed

- **Optimum Decisions**
  - Purchase site ahead of time for its use as an option

- **Benefits and Costs of Decision**
  - Insures ability to expand if necessary
  - Cost of acquiring and holding onto property

---

**Decision Tree**

- **Sydney Airport**
  - Select site
    - High forecast: 0.3
    - Median forecast: 0.4
    - Low forecast: 0.3
  - No Action
    - High forecast: 0.3
    - Median forecast: 0.4
    - Low forecast: 0.3