Justifying Expert Systems

Ways to Justify Expert Systems

- Competitive Advantage
- Rate of Return (cost - benefit)
- Other Models

I: Achieving Competitive Advantage

Competitive Advantage and IT

- Each organization must ask itself: To what extent can IT be used to:
  - Pursue competitive strategies?
  - Modify competitive forces?
  - Implement competitive tactics?
Justifying Expert Systems

Generic Competitive Strategies

- Generic competitive strategies?
  - Compete on cost basis
  - Compete by differentiating products/services
- Remember: Profits = Revenues - Costs

Competitive Forces Diagram

Modify Competitive Forces Using IT

- Can IT build barriers to entry?
- Can IT build in switching costs?
- Can IT change the basis for competition?
- Can IT change the balance of power with suppliers or buyers?
- Can IT generate new products?

More Competitive Strategies using IT

- Can IT move information faster?
- Can IT manage info and improve decision-making?
- Can IT make products/services "smarter"?
- Can IT preserve scarce expertise?
Justifying Expert Systems

Tactics Promoting Competitive Advantage

- Internal Innovation
  - e.g., implement expert systems
- Other Non-IT Tactics
  - Organizational growth
  - Mergers and acquisitions
  - Alliances

Competitive Framework Summary

- Modify Competitive Forces:
  - New entrants
  - Intensity rivalry
  - Encourage substitutions
  - Bargaining power of suppliers and customers

- Choose Tactics:
  - IT Innovation
  - Growth
  - M&A
  - Alliances

Pursue Competitive: Strategies
- Cost
- Differentiation

Examples

- Barriers - American Airlines SABRE
- Switching - Baxter HealthCare (hospitals); American (agents)
- Basis - Otis elevator with on-board diagnostics; FEDEX
- Suppliers - use of EDI
- New Products - Magnovox "smart" t.v.

Good Candidates for Expert Systems

- Organizations that have a high information/knowledge intensity in both product and process are best candidates for IT
  - Add to the information/knowledge content of the product
  - Use information/knowledge to improve the production process
Justifying Expert Systems

**Product/Process Info Intensity Matrix**

<table>
<thead>
<tr>
<th></th>
<th>High (HI)</th>
<th>Low (LO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Info Intensity</td>
<td>textbook manufacturing</td>
<td>cement</td>
</tr>
<tr>
<td>Process Info Intensity</td>
<td>banking</td>
<td>oil production</td>
</tr>
</tbody>
</table>

**Expert System Examples**

- Faster processing - screen loan applicants
- Better decisions - intelligent front-end to database; Bank of Boston
- Better products - Otis elevators use a type of expert system
- Preserve scarce resources - Campbell soup mix-master

**Competitive Advantage Summary**

- Look at both revenues and costs
- Ask the key questions
- If any one of the questions is true, then a good strategic reason exists for pursuing expert system development

**II. Rate of Return Justification**
Rate of Return Defined

- Rate of return is a means to compare one investment to another. It is based on the fact that money has value over time; i.e. capital in and of itself can generate cash (i.e., interest). Rate of return calculations compare a project's cash flow to what might be reasonably generated by financial markets.

Rate of Return Framework

- Assumptions
  - Assumes cost and benefits can be quantified
  - Assumes project yield is higher than cost of capital and equal to some other investment option
- Requirements
  - An estimate of cash outflows vs. cash inflows over a period

Calculation Requirements

- Payback period
- Set of outflows (costs) and inflows (benefits)
- Discount rate
  - minimum attractive return
  - based on yields of other "reasonable" investments
  - is a function of project risk

Measures

- Internal Rate of Return (IRR)
  - minimum return for any project
- Net Present Value (NPV)
  - present value of all cash flows at discount rate summed
- Payback period
  - the length of time to "break-even"
Rate of Return Example

• Which is the better investment?
  - A company is considering which bar code reader to buy. Scannex requires an initial investment of $104,000, while a second system CEA requires $150,000. Each system has a five year life cycle. Cash flows from each investment are given below. Assume a discount rate of 20%.

Rate of Return (cont1)

<table>
<thead>
<tr>
<th>Year</th>
<th>Scannex Cash Flow</th>
<th>Sum</th>
<th>CEA Cash Flow</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-104</td>
<td>-104</td>
<td>-150</td>
<td>-150</td>
</tr>
<tr>
<td>1</td>
<td>35</td>
<td>-70</td>
<td>60</td>
<td>-90</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>-25</td>
<td>65</td>
<td>-25</td>
</tr>
<tr>
<td>3</td>
<td>55</td>
<td>30</td>
<td>70</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>90</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>150</td>
<td>75</td>
<td>195</td>
</tr>
</tbody>
</table>

Rate of Return (cont2)

<table>
<thead>
<tr>
<th></th>
<th>Scannex</th>
<th>CEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>IRR</td>
<td>34.7%</td>
<td>34.2</td>
</tr>
<tr>
<td>NPV (1)</td>
<td>$34</td>
<td>$43</td>
</tr>
<tr>
<td>NPV (2)</td>
<td>$40</td>
<td>$52</td>
</tr>
<tr>
<td>Paybk</td>
<td>2.45</td>
<td>2.36</td>
</tr>
</tbody>
</table>

Setting Up a Rate of Return Calculation

• Estimate the costs of systems
• Estimate the benefits of the system and translate into dollars
• Determine the life of investment
• Choose a discount rate that is reasonable
Justifying Expert Systems

Typical Costs/Benefits for Expert Systems

<table>
<thead>
<tr>
<th>COSTS</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Shell</td>
<td>Labor savings</td>
</tr>
<tr>
<td>Development</td>
<td>Decision quality</td>
</tr>
<tr>
<td>Hardware</td>
<td>Decision consistency</td>
</tr>
<tr>
<td>Other Equipment</td>
<td>Automation of tasks</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Competitive adv.</td>
</tr>
<tr>
<td>Training</td>
<td>Perform new tasks</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Summary Rate of Return

- Puts project on equal footing with others
- Attractive when costs and benefits can be quantified
- Can be misleading
- Is not the whole story!

III. Other Project Justification Methods

Relative Ranking Justification Methods

- All essentially try to quantify "soft" benefits with a ranking system
- Somewhat subjective
- Based on the values of members of the organization
Ranking Justification Methods

- Profile Chart
- Symbolic Scorecard
- *Linear Additive Model
- Analytic Hierarchy Process

Linear Additive Model

- Assumes:
  - each dimension of value is independent
  - each dimension has an associated weight
  - total value equals sum of weighted individual values

Linear Additive Model (cont2)

- \( V_j = \sum Wi X_i \) for \( i \) from 1 to \( n \)
  - \( V_j \) is the total summed score value for a particular choice \( C_j \)
  - \( Wi \) is the weight of a value dimension
  - \( X_ij \) is the score of a value dimension for a particular choice \( C_j \)

Linear Model Example

- Assume you are trying to decide between three models of cars: Accord; Jeep; Lexus. You balance your concern with price with positive image (you like "sexy" cars), and fuel efficiency and safety. Which is the best choice for you?
Method

- Assign weights to value dimensions on a scale of 0-1 (zero net sum).
- i.e., Price = .4; Image = .3; Fuel effic. = .2; Safety = .1
- RANK each alternative (e.g., car) on a relative scale of 3-1 (3=best).
- Multiple each score by its weight for each choice (e.g., car)
- Find the sum for each car and compare.
- Pick the one with the highest overall score.

<table>
<thead>
<tr>
<th>Weights</th>
<th>Value Dim.</th>
<th>Accord (V1)</th>
<th>Jeep (V2)</th>
<th>Lexus (V3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.4</td>
<td>Low Price</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>.3</td>
<td>Pos. Image</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>.2</td>
<td>Fuel effic.</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>.1</td>
<td>Safety</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accord (V1)</th>
<th>Jeep (V2)</th>
<th>Lexus (V3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>0.3</td>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.6</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>0.2</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>2.3</td>
<td>1.9</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Justification Summary
Expert systems (or any project) require justification
Projects should be justified in several different ways
Where possible use "hard" rate of return calculations
Justify "soft" benefits with other methods