SAWKRA-LAKBI ROAD: OMAN
Constantinos Tsoucalas, Jad Karam, Lyle Paladin-Tripp

BACKGROUND
- Oil was discovered in the 70's in Oman
- The economic development underwent a period of rapid expansion
- Oil export considerably raised the standard of living in Oman

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</thead>
<tbody>
<tr>
<td>Income per Capita ($)</td>
<td>360</td>
<td>3,140</td>
<td>7,000</td>
<td>8,000</td>
</tr>
</tbody>
</table>

MODERNIZATION PROGRAM
- Sultan Qaboos Bin Saeed implemented a modernization program
- Priority was given to the country’s almost non-existent physical infrastructure
- In the form of: roads, a new deepwater port, an international airport, electricity-generating plants, desalination plants, schools, hospitals, and low-cost housing
- Oil receipts almost exclusively made this possible

THE PROJECT
- Our project involves the construction of a road that connects the two towns of Al Lakbi and Sawqra
- Sawqra is a small town of 2000 people
- It is surrounded by high mountain ranges on three of its sides, and by the sea on its fourth side
- It lacks the services and institutions that its neighboring town, Al Lakbi, possesses

PROBLEM STATEMENT
**ALTERNATIVES**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Benefits</th>
<th>Disbenefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement of citizens of Sawqra</td>
<td>Eliminates need to build new services</td>
<td>Tribal/Familial issues</td>
</tr>
<tr>
<td>Building services in Sawqra</td>
<td>Eliminates need to walk over mountain</td>
<td>Very Costly &amp; need road anyway</td>
</tr>
<tr>
<td>Road around the mountain</td>
<td>Access to Sawqra</td>
<td>Huge amounts of excavation</td>
</tr>
<tr>
<td>Road through mountain</td>
<td>Shortest path/No contact with sea</td>
<td>Eliminates need to walk over mountain</td>
</tr>
<tr>
<td>Coastal road</td>
<td>Shortest path/Least costly</td>
<td>Contact with sea</td>
</tr>
</tbody>
</table>

**CONTRACTOR’S PERSPECTIVE**

- Contractor receives advance payment of 10% of contract value
- Bill of Quantities: Contractor’s estimate of costs
- Contractor’s Income: Monthly payment from the Sultanate

**CONTRACT DETAILS**

- Successful bid: 2.5 million Omani Rials (OR)
- Project completion time: 1 year
  - Penalty for delay: 2,000 OR per day (1% of contract value)
- Guarantee: 5% of contract Value

**CASH FLOW: CONSTRUCTION COMPANY**

- Revenue
- Costs

**BENEFITS TO OMANI PEOPLE**

- Sawqra
  - Hospital Access
  - School Access
  - Commerce
- Al-Lakbi
  - Investment Opportunities
- Sultanate
  - Improved National Communication/Interaction

**OMANI’S PERSPECTIVE**

- The Ministry of Transportation pays the contractor monthly
- Benefits will be seen upon completion of the road until 50 years hence
- All benefits are a result of providing the villages with better access to each other
CASH FLOW: OMANI PEOPLE

External Uncertainties
- Social Impact
  - Local population claimed that the route encroached on their private property
- Regulations
  - After the contractor agreed to build the road, the government stipulated that 30% of the workers must be Omani
- Weather
  - Severe storms during the summer due to the Monsoon season extended in time beyond expectations
- Unpredictability
  - Tombs were discovered on the road site during construction
  - Fuel costs soared by 40% during the construction period

Internal Uncertainties
- Unforeseen Site Conditions
  - Rock Armor had lower density than expected
- Incomplete Scope
  - The local desalinization plants could not handle the demand from the contractor, which caused long delays

Benefits Evaluation
- Factors considered: health, education, and commerce
- Monetary values were assigned to each of these categories using data from official Omani records
- Missing data was obtained from neighboring countries’ records, which include Saudi Arabia, UAE, and Bahrain

Risks and Uncertainties
- Prof. Pena-Mora defines two types of uncertainty, external and internal
- External uncertainty includes: social impacts, regulations, weather, and unpredictability
- Internal uncertainty includes: unforeseen site conditions and incomplete scope

Health Benefits Analysis
- New road provides quicker access to Lakbi hospital
- This increases preventable deaths and helps reduce severity of injuries
EDUCATIONAL/COMMERCE BENEFITS

EDUCATION
- Road provides access to Lakbi schools
- This may increase the number of high-school graduates and net average income

COMMERCE
- Road provides trade-route between Sawkra and neighboring towns
- The majority of Sawkra citizens are fishermen and the road allows for the extension of their market

COMMERCE: TOURISM
- Allows tourist access to Sawkra’s beaches and Sawkra’s traditional ways of living
- Potential for population growth as the price of land may rise with the establishment of holiday resorts and an increase in economic activity

SENSITIVITY ANALYSIS: BENEFITS

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>AVG. CHANGE IN NET PRESENT VALUE (O.R.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commerce</td>
<td>500,000</td>
</tr>
<tr>
<td>Health</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Education</td>
<td>200,000</td>
</tr>
</tbody>
</table>

SENSITIVITY ANALYSIS: COSTS

- There are many uncertainties in the cost side of the analysis
- These uncertainties are discussed in great detail in our report but we will highlight the main ones which are: Preliminary delays, lack of geologic knowledge, and increase in fuel price

SENSITIVITY ANALYSIS: COSTS

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>AVG. CHANGE IN NET PRESENT VALUE (O.R.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELAYS</td>
<td>70,000</td>
</tr>
<tr>
<td>INCREASE IN FUEL COST</td>
<td>20,000</td>
</tr>
<tr>
<td>GEOLOGY COST</td>
<td>30,000</td>
</tr>
</tbody>
</table>

ENGINEERING DEDICATED TO THE LOCAL COMMUNITIES

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