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NÕUETE HALDAMINE (REQUIREMENTS MANAGEMENT)
Two main topics

- Requirements prioritization
- Traceability
Requirements Prioritisation
Basics of Prioritisation

- **Need to select what to implement**
  - Customers (usually) ask for way too much
  - Balance time-to-market with amount of functionality
  - Decide which features go into the next release

- **For each requirement/feature, ask:**
  - How important is this to the customer?
  - How much will it cost to implement?
  - How risky will it be to attempt to build it?

- **Perform Triage:**
  - Some requirements *must* be included
  - Some requirements should definitely be excluded
  - That leaves a pool of “nice-to-haves”, which we must select from.
A Cost-Value Approach

- **Calculate return on investment**
  - Assess each requirement’s importance to the project as a whole
  - Assess the relative cost of each requirement
  - Compute the cost-value trade-off:

```
| 5 | 10 | 15 | 20 | 25 | 30 | 5 | 10 | 15 | 20 | 25 | 30 |
```

![Graph showing cost-value trade-off](image-url)
A Cost-Value Approach

Calculate return on investment

- Assess each requirement’s importance to the project as a whole
- Assess the relative cost of each requirement
- Compute the cost-value trade-off:

Two approaches:

- **Absolute scale (e.g. Euro values)**
  - Requires much domain experience

- **Relative values (e.g. less/more; a little, somewhat, very)**
  - Much easier to elicit
  - Prioritization becomes a sorting problem
Some complications

- **Hard to quantify differences**
  - easier to say “x is more important than y”…
  - …than to estimate by how much.

- **Not all requirements comparable**
  - E.g. different level of abstraction
  - E.g. core functionality vs. customer enhancements

- **Requirements may not be independent**
  - No point selecting between X and Y if they are mutually dependent

- **Stakeholders may not be consistent**
  - E.g. If X > Y, and Y > Z, then presumably X > Z?

- **Stakeholders might not agree**
  - Different cost/value assessments for different types of stakeholder
Analytic Hierarchy Process (AHP)

Source: Adapted from Karlsson & Ryan 1997

Create n x n matrix (for n requirements)

- For element (x,y) in the matrix enter:
  - 1 - if x and y are of equal value
  - 3 - if x is slightly more preferred than y
  - 5 - if x is strongly more preferred than y
  - 7 - if x is very strongly more preferred than y
  - 9 - if x is extremely more preferred than y
  - (use the intermediate values, 2,4,6,8 if compromise needed)

- ...and for (y,x) enter the reciprocal.

Estimate the eigenvalues:

- E.g. “averaging over normalized columns”
  - Calculate the sum of each column
  - Divide each element in the matrix by the sum of it’s column
  - Calculate the sum of each row
  - Divide each row sum by the number of rows

This gives a value for each requirement:

- ...giving the estimated percentage of total value of the project
# AHP example - estimating costs

<table>
<thead>
<tr>
<th></th>
<th>Req1</th>
<th>Req2</th>
<th>Req3</th>
<th>Req4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req1</td>
<td>1</td>
<td>1/3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Req2</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Req3</td>
<td>1/2</td>
<td>1/5</td>
<td>1</td>
<td>1/3</td>
</tr>
<tr>
<td>Req4</td>
<td>1/4</td>
<td>1/3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>sum</td>
<td>4.75</td>
<td>1.87</td>
<td>11</td>
<td>8.33</td>
</tr>
</tbody>
</table>

Normalise columns:

- Req1 - 26% of the cost
- Req2 - 50% of the cost
- Req3 - 9% of the cost
- Req4 - 16% of the cost

Result:

<table>
<thead>
<tr>
<th></th>
<th>sum</th>
<th>sum/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req1</td>
<td>1.05</td>
<td>0.26</td>
</tr>
<tr>
<td>Req2</td>
<td>1.98</td>
<td>0.50</td>
</tr>
<tr>
<td>Req3</td>
<td>0.34</td>
<td>0.09</td>
</tr>
<tr>
<td>Req4</td>
<td>0.62</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Sum the rows:

- Req1: 0.21 + 0.18 + 0.18 + 0.48 = 1.05
- Req2: 0.63 + 0.54 + 0.45 + 0.36 = 1.98
- Req3: 0.11 + 0.11 + 0.09 + 0.04 = 0.34
- Req4: 0.05 + 0.18 + 0.27 + 0.12 = 0.62
Plot ROI graph

- Repeat AHP process twice:
  - Once to estimate relative value
  - Once to estimate relative cost

![Graph showing cost and value with points marked for high, medium, and low priorities.](image-url)
Other selection criteria

- Cost (percent)
- Value (percent)
- Above average cost
- Below average value
- Above average in both cost and value
- Above average value
- Below average cost
Take Home

- Why Prioritization is needed
  - Basic Trade-offs

- Cost-Value Approach
  - Sorting Requirements by cost/value
  - Estimating Relative Costs/Values using AHP
Exercise
AIS – Airline Information System

- Invoicing
  Rinv01. AIS should create an invoice for a booking.
  Rinv02. AIS should send a created invoice to the customer
  Rinv03. Customer should pay the invoice using AIS
  Rinv04. AIS should close a paid invoice

- Boarding
  Rboa1. AIS should create a boarding pass
  Rboa2. AIS should register a boarded customer

- Booking
  Rboo1. AIS should allow the customer to book an available flight
  Rboo2. Customer should query the airline company for available flights
  Rboo3. Customer should choose the number of seats on the available flights
  Rboo4. AIS should book an airline flight based on the booking info
Exercise
Requirements Prioritisation

- Perform requirements prioritisation
  - Use the AHP method
  - Prioritise requirements according to
    - Value
    - Cost
  - Show prioritisation results in a plot