Concept Generation

Teaching materials to accompany:

*Product Design and Development*

*Chapter 6*

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Concept Development Process

1. Mission Statement
2. Identify Customer Needs
3. Establish Target Specifications
4. Generate Product Concepts
5. Select Product Concept(s)
6. Test Product Concept(s)
7. Set Final Specifications
8. Plan Downstream Development

- Perform Economic Analysis
- Benchmark Competitive Products
- Build and Test Models and Prototypes
Concept Generation Example: Power Nailer
Concept Generation Process

- **Clarify the Problem**
  - Problem Decomposition
- **External Search**
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Concept Generation Exercise: Vegetable Peelers
Vegetable Peeler Exercise: Voice of the Customer

• "Carrots and potatoes are very different."
• "I cut myself with this one."
• "I just leave the skin on."
• "I'm left-handed. I use a knife."
• "This one is fast, but it takes a lot off."
• "How do you peel a squash?"
• "Here's a rusty one."
• "This looked OK in the store."
Vegetable Peeler Exercise:  
Key Customer Needs

1. The peeler peels a variety of produce.  
2. The peeler can be used ambidextrously.  
3. The peeler creates minimal waste.  
4. The peeler saves time.  
5. The peeler is durable.  
6. The peeler is easy to clean.  
7. The peeler is safe to use and store.  
8. The peeler is comfortable to use.  
9. The peeler stays sharp or can be easily sharpened.
Problem Decomposition: Function Diagram

INPUT
Energy (?)
Material (nails)
Signal (tool "trip")

OUTPUT
Energy (?)
Material (driven nail)
Signal (?)

Hand-held nailer

Store or accept external energy
Store nails
Sense trip
Convert energy to translational energy
Isolate nail
Trigger tool
Apply translational energy to nail
Driven nail

Energy
Nails
"Trip" of tool
External Search:
Hints for Finding Related Solutions

• Lead Users
  – benefit from improvement
  – innovation source

• Benchmarking
  – competitive products

• Experts
  – technical experts
  – experienced customers

• Patents
  – search related inventions

• Literature
  – technical journals
  – trade literature
Capture Innovation from Lead Users: Utility Light Example
Capture Innovation from Lead Users: Utility Light Example
Internal Search: Hints for Generating Many Concepts

• Suspend judgment
• Generate a lot of ideas
• Infeasible ideas are welcome
• Use graphical and physical media
• Make analogies
• Wish and wonder
• Solve the conflict
• Use related stimuli
• Use unrelated stimuli
• Set quantitative goals
• Use the gallery method
• Trade ideas in a group
Systematic Exploration: Concept Combination Table

<table>
<thead>
<tr>
<th>Convert Electrical Energy to Translational Energy</th>
<th>Accumulate Energy</th>
<th>Apply Translational Energy to Nail</th>
</tr>
</thead>
<tbody>
<tr>
<td>rotary motor w/ transmission</td>
<td>spring</td>
<td>single impact</td>
</tr>
<tr>
<td>linear motor</td>
<td>moving mass</td>
<td>multiple impacts</td>
</tr>
<tr>
<td>solenoid</td>
<td></td>
<td>push nail</td>
</tr>
<tr>
<td>rail gun</td>
<td></td>
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</tbody>
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