Innovation Management – Creativity Techniques

Univ.-Prof. Dr.-Ing. Wolfgang Maass

Chair in Economics – Information and Service Systems (ISS)
Saarland University, Saarbrücken, Germany

SS 2012
Wednesdays, 10:00 – 12:00 a.m.
Room 0.21, B4 1
Lecture Agenda

Innovation Management
1. Introduction
2. Knowledge Management (1)
3. Knowledge Management (2)
4. Guest Lecture
5. Strategic Innovation Management
6. Case Study
7. New Product Development
8. Creativity Techniques
9. Planning Product Features
10. Experimentation Strategies
11. Open Innovation
12. Diffusion and Adoption of Innovation
13. Diffusion and Adoption of Information Systems
14. Business Planning and Writing
New Product Development

Today’s lecture

How to be creative?

How to proceed when developing new products?

Where are differences between diverse product development projects and how to handle them?

Where do product ideas come from?

How to plan final features of my product?

How to test my product ideas before market launch?

How to avoid failure in product development?

Lecture, 20th of June

Lecture, 27th of June

Last lecture
Application of Creativity Techniques in Product Development

0. Planning
1. Concept Development
2. System-Level Design
3. Detail Design
4. Testing and Refinement
5. Production Ramp-Up

Identify Customer Needs
Establish Target Specifications
Generate Product Concepts
Select Product Concept(s)
Test Product Concept(s)
Set Final Specifications
Plan Downstream Development

Generate and sense many opportunities

(Ulrich & Eppinger, 2011)
Creativity in Innovation Management

- Creativity in innovation management = ability of combining elements of knowledge and experience from diverse scopes to generate new ideas / approaches for problem solving
- Overcoming of plugged-in structures and patterns of thought
- Creativity techniques = procedures for gaining new ideas underpinned by creativity-enhancing principles:
  - Associating & transferring -> intuitive development of solutions
  - Abstracting & combining -> systematic and analytical generation of new approaches

“Many creativity techniques are aids to enlarging the ‘search space’.” (Cross, 2008, p. 53)

Creativity Techniques

**Intuitive Techniques**
- Many ideas in short time
- Activation of unconscious level
- Overcoming of plugged-in structures
- Generating basis before using discursive techniques

**Discursive Techniques**
- Systematical and conscious search for solution in single and logical process steps
- Decomposition of problem into single parts

**Combinatorial Techniques**
- Combination of intuitive and discursive techniques

**Intuitive Techniques**
- Brainstorming
- Brainwriting Pool
- 635 Method
- Mind Mapping
- Metaplan Technique
- Synectics
- CATWOE

**Discursive Techniques**
- Morphological Box
- Osborn Checklist
- Relevance Tree Analysis

**Combinatorial Techniques**
- Six Thinking Hats
- Walt Disney Method
- TRIZ
- Open Space

*(Pahl & Beitz, 2002; Urban & Hauser, 1993)*
Intuitive Techniques (1) – Brainstorming and 635 Method

Brainstorming
First and well-known creativity method (Osborn, 1957)

Rules (valid for each creativity method):
• No criticism or validation of ideas
• Quantity = Quality; fuzzy ideas allowed
• Overcome inhibitions – unfolding fantasy
• Picking up ideas for further development
• Documentation of results

Procedure:
• 4-8 participants + moderator
• Flipchart, blackboard etc. for proposals
• Open, cozy atmosphere
• Idea generation = app. 15 – 20 minutes, then break; idea selection = app. 30 – 40 minutes

When?
• No product concept available that can be realized
• Physical background of possible solution unknown
• Known solutions not appropriate
• Need for unconventional solution

635 Method
Written form of brainstorming (Rohrbach, 1969)

Procedure:
• 6 participants, 3 ideas for solution per participants, 5 minutes
• Passing of ideas to neighbour
• Reading ideas and complementing them by three new ideas
• After 30 minutes: max. 108 ideas

Pro:
• Solutions more sophisticated compared to Brainstorming
• Critical ideas easier to write
• Active participation by all participants

Problem:

<table>
<thead>
<tr>
<th>1. Idea</th>
<th>2. Idea</th>
<th>3. Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Participant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date:
Synectics

Combining diverse and independent terms (Gordon, 1961)

• “Bisociation” of ideas (Koestler, 1964) = creative process of combining terms, pictures and imaginations of diverse contexts
• Similar to brainstorming – but: getting inspiration by analogies
  o 1 - direct analogies (biological solution); 2 - personal analogies (oneself as product to be designed); 3 - symbolic analogies (poetic metaphors etc.); 4 – fantasy analogies (impossible wishes achieved in magical way)

Procedure:
• More systematic procedure
• max. 7 participants + moderator

① Introduction of problem
② Analysis of problem / getting familiar
③ Understanding of problem
④ Alienation of familiar problem by means of analogies
⑤ Analysis of analogies
⑥ Comparison of analogy and problem
⑦ Generation of new idea based on comparison
⑧ Development of possible solution

Example: Development of solution for removal of stones in ureter

a. Association: umbrella – Question: How to use the umbrella principle?
b. Perforate stone, implement umbrella, open umbrella
c. Technically hard to realize – using pipe and pump it up
d. Boring hole is unreal – using pipe at side of stone, but stone could destroy ureter
e. Using second balloon
f. Embedding stone into gel and extract by means of two balloons

(Pahl & Beitz, 2002; Cross, 2011)
Morphological Box

Understand complex problems and consider all possible solutions without prejudices (Zwicky, 1971)

- Core = **multidimensional matrix** consisting of parameters and values
- e.g., energy type with values electrical, kinetic etc.

**Procedure:**
- max. 7 participants + moderator
- Duration: 30 minutes - 2 hours
- Hint: 5-10 parameters as well as values are enough

1. Specification of independent parameters regarding question
2. Definition of possible values of each parameter -> matrix of possible solutions
3. Selection of 1 value per parameter -> combination of values (n times)
4. Development of ideas based on selection

**Example: Development of table**

<table>
<thead>
<tr>
<th>Number of table leg</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Wood</td>
<td>Glass</td>
<td>Plastic</td>
<td>Cork</td>
<td>Fabric</td>
<td>Rubber</td>
<td>Aluminium</td>
</tr>
<tr>
<td>Height</td>
<td>20</td>
<td>40</td>
<td>50</td>
<td>70</td>
<td>100</td>
<td>120</td>
<td>130</td>
</tr>
<tr>
<td>Form</td>
<td>Round</td>
<td>Square</td>
<td>Quadrate</td>
<td>Oval</td>
<td>Flower</td>
<td>Kidney-shaped</td>
<td></td>
</tr>
</tbody>
</table>
**Walt Disney Method**

“... there were actually three different Walts: the dreamer, the realist, and the spoiler” (Robert B. Dilts, 1994)

**Role play:**
- **Dreamer** without boundaries and constraints; idea generation
- **Realist** with pragmatic practical point of view – “Mover and Shaker” – processing of ideas of dreamer
- **Critic** analyses ideas of realist and identifies errors; quality management; validation of ideas
- **Neutral role** by moderator

**Procedure:**
- 4 chairs marked with roles
- 1 participant:
  1. Starting with neutral role for analyzing problem
  2. Step-by-step taking each role for arguing from this point of view
  3. Changing roles until good solution was found; last position is neutral
- 4 participants:
  1. Each person takes one role
  2. Discussing of problem until joint viewpoint is achieved
  3. Changing roles and discussing again

**Six Thinking Hats**

*Playing a role (de Bono, 1986)*

- Each **Thinking Hat** has a specific color and represents an attitude
- Thinking Hat = participant

**Procedure:**
- Max. 5 participants + moderator
- Problem introduced at the beginning

**Pro:**
- Comprehensive understanding of problem
- Each participant focused on her point of view

**Con:**
- Missing information concerning time frame and objectives
- Application of technique in meeting has to be prepared comprehensively
- Participants need time to take roles
TRIZ
(Russian: теория решения изобретательских задач = teoriya resheniya izobretatelskikh zadatch) - problem-solving, analysis and forecasting tool derived from the study of patterns of invention in the global patent literature (Altschuller, 1946)

- engl. TIPS = Theory of Inventive Problem Solving
- Analysis of 40,000 highly innovative patents out of 200,000 concerning solution of problems
- Specification of 40 innovative basic solution principles and 39 technical parameters
- Problem (= technical contradiction) characterized by enhancement of parameter and therefore worsening of another parameter

Core statements:
① Large number of inventions base on small number of solution principles
② Overcoming contradictions enables innovations (compromise is no innovative solution)
③ Evolution of technical systems bases on pattern and can be partly forecasted
Combinatorial Techniques (2) – TRIZ

1. Weight of moving object
2. Weight of nonmoving object
3. Length of moving object
4. Length of nonmoving object
5. Area of moving object
6. Area of nonmoving object
7. Volume of moving object
8. Volume of nonmoving object
9. Speed
10. Force
11. Tension, pressure
12. Shape
13. Stability of object
14. Strength
15. Durability of moving object
16. Durability of nonmoving object
17. Temperature
18. Brightness
19. Energy spent by moving object
20. Energy spent by nonmoving object
21. Power
22. Waste of energy
23. Waste of substance
24. Loss of information
25. Waste of time
26. Amount of substance
27. Reliability
28. Accuracy of measurement
29. Accuracy of manufacturing
30. Harmful factors acting on object
31. Harmful side effects
32. Manufacturability
33. Convenience of use
34. Repairability
35. Interchangeability
39 technical parameters

40 innovative solution principles

15 Dynamics
29 Pneumatics and hydraulics
34 Discarding and recovering
8 Anti-weight

TRIZ Matrix

<table>
<thead>
<tr>
<th>Sich verschlechternder Parameter</th>
<th>1 Masse des beweglichen Objekts</th>
<th>2 Masse des unbeweglichen Objekts</th>
<th>3 Länge des beweglichen Objekts</th>
<th>4 Länge des unbeweglichen Objekts</th>
<th>5 Fläche des beweglichen Objekts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Masse des beweglichen Objekts</td>
<td>15, 8, 29, 34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Masse des unbeweglichen Objekts</td>
<td></td>
<td>10, 1, 29, 35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Länge des beweglichen Objekts</td>
<td>8, 15, 29, 34</td>
<td></td>
<td>15, 17, 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Länge des unbeweglichen Objekts</td>
<td>35, 28, 40, 29</td>
<td>15, 17, 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Fläche des beweglichen Objekts</td>
<td>2, 17, 29, 4</td>
<td>14, 15, 18, 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example: Wittenstein intens GmbH – Development of intelligent implants

**Problem:** external fixators affect mobility; cause heavy infections; longer stay in hospital; amputations  
**Ideal result:** system not felt by patient; no open wounds; patient can walk, sleep, going to work; bone grows 1 millimeter per day without causing pain

<table>
<thead>
<tr>
<th>Enhancing parameter</th>
<th>Deteriorating parameter</th>
<th>Solution principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 – negative side effects (danger of infection; mobility)</td>
<td>15 – durability of mobile object (just small needles, but reduction of durability)</td>
<td>15, 22, 33, 31</td>
</tr>
<tr>
<td>31 – negative side effects (danger of infection; mobility)</td>
<td>10 – power (power needed)</td>
<td>35, 28, 1, 40</td>
</tr>
<tr>
<td>39 – productivity (effective; appropriate price)</td>
<td>33 – usability (simple and secure)</td>
<td>31, 28, 7, 19</td>
</tr>
<tr>
<td>30 – negative environmental influences (danger of infection; mobility)</td>
<td>15 – durability of mobile object (no breakdown of system)</td>
<td>22, 15, 33, 28</td>
</tr>
</tbody>
</table>

- **P7:** Russian dolls -> former external system now integrated into bone  
- **P15:** Dynamics -> application of telescope cylinder  
- **P28:** Replacement of mechanical principles -> pure mechanical system transformed into electro-mechanical system with inductive energy transfer etc.

**Solution with TRIZ:** FITBONE for bone extension
Sie unterstützen einen Hersteller von mobilen Endgeräten bei der Durchführung von Innovationsworkshops. Sein Problem beschreibt er ihnen so:

„Wir stellen mobile Endgeräte für den Outdoor-Bereich her. Hier ist es wichtig, dass die Kunden immer erreichbar sind. Trotzdem sollte die Strahlenbelastung im Rahmen bleiben. Zudem sollte das Telefon handlich, robust und leicht sein."

Daraufhin formulieren sie die Beschreibung eines idealen Endresultats:

„Ein mobiles, robustes und leichtes Endgerät, welches eine 100%-ige Erreichbarkeit des Anwenders ermöglicht, allerdings bei moderater Strahlenbelastung."

Organizing Creativity Workshops – How to?

Preparation of workshop

- Invite participants at least 1 week before -> mention topic of workshop and that no preparation by participants is needed
- Optimal: 5-7 participants of diverse areas of company and user community – “kooks are welcome!”
- Discussing objective of workshop with problem owner and creating agenda proposal
- Prepare room concerning selected creativity technique(s)
- Planning time frame: 1 method = app. 1-2 hours (idea generation 20-40 minutes; remaining time: opening, introduction of problem; validation and selection of ideas)

Procedure in workshop

- Rules of brainstorming valid for all techniques
- Open documentation of ideas, process and validation of ideas by means of Flipchart, laptop/beamer etc.
- Moderator is not filter or validator of ideas; requesting confirmation of wording from idea owner
- “We have enough ideas! There is nothing more.” -> No! – hard, but most productive phase
- Stretching of idea generation phase managed by moderator -> questions; new points of view; repeating ideas from beginning
- Validation of ideas, e.g., via dots

(Geschka & Zirm, 2011)
Innovation Management

1. Introduction
2. Knowledge Management (1)
3. Knowledge Management (2)
4. Guest Lecture
5. Strategic Innovation Management
6. Case Study
7. New Product Development
8. Creativity Techniques
9. Planning Product Features
10. Experimentation Strategies
11. Open Innovation
12. Diffusion and Adoption of Innovation
13. Diffusion and Adoption of Information Systems
14. Business Planning and Writing
Books:

Papers:
Univ.-Prof. Dr.-Ing. Wolfgang Maass

Chair in Information and Service Systems
Saarland University, Germany