Towards an Integrated Design of Product and Packaging

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Agenda

- Background
- Approach and objectives
- Elements of the procedure model
  - The product
  - The packaging
  - Product innovation and the product development process
- The Integrated Product and Packaging Development (IPPD) procedure model
  - within mechanical engineering
- The potentials of the proposed concept
- Conclusions
Background

- Global marketplace
- Companies collaborate in networks
- Increased competition calls for:
  - Improved delivery service and cost reductions in distribution/transportation
  - Efficient and effective transportation, handling, and storing of intermediary and final products.
  - Increased awareness of the significance of product quality in a product life cycle perspective
Approach

- Suggested to integrate the design of product and packaging
- Established in three surveys
  - 60 Swedish enterprises
  - Mechanical, Pharmaceutical and Food areas
- Suggestion of a preliminary, generic, integration concept.
Objectives

1. Provide an integrated product and packaging design procedure model that facilitates implementation of the procedure in industry on an operational level.

2. Identify suitable methods and techniques to be used and/or to be developed in the integrated product and packaging design procedure.
Integrated Product and Packaging Development (IPPD)
Elements of the procedure model

- **Product** =
  - Something sold by an enterprise to its customers.
  - Engineered, discrete and physical.
  - The working principle is based on mechanics.
Elements of the procedure model

- Packaging =
  - A coordinated system of preparing goods for transport, distribution, retailing and end-use
  - A means of ensuring safe delivery to the ultimate consumer in sound condition at minimum cost
  - An extension of the product adding additional features to the actual product.
Elements of the procedure model

- The Product Innovation Process =

Product Innovation process
Product Development

- Activities for the development of a product
  - Design
  - Production Plan
  - Marketing Plan

- Interdisciplinary process
  - Product development procedure model
  - Methods and techniques for operational implementation
The Mechanical Product Development Process - *Ulrich and Eppinger, 2003*

- **Phase 0: Planning**
  - Corporate strategy
  - Assessment of technology
  - Market objectives

- **Phase 1: Concept Development**
  - Needs of target market
  - Alternative product concepts chosen

- **Phase 2: System-level Design**
  - Architecture of the product
  - Subsystems layout
  - Preliminary process flow diagram for assembly process

- **Phase 3: Detail Design**
  - Complete specification of the product parts
  - Process plan and tooling

- **Phase 4: Testing and Refined**
  - Prototype
  - Production needs

- **Phase 5: Production Ramp-up**
  - Production system

**Preclinical studies**
- Set objectives
- Novel chemicals synthesized
- Choice of drug candidate
- Toxicological testing
- Investigational New Drug application

**Clinical studies**
- Phase I: Clinical tests
- Phase II: Clinical tests
- Phase III: Clinical tests
- New drug Application
- Drug approval
The Packaging Development Process

- DeMaria, 2000.

1. Business Planning & Goals
2. Project Team Formed
3. Indentify Package Concepts
4. Feasibility Assessment
5. Consumer Concept Testing
6. Develop Package Prototype
7. Consumer Usage Testing
8. Final Concept Evaluation
9. Package Testing
10. Final Approval
11. Production Start-up
12. Monitor Performance
Integrated (or Coordinated) Product and Packaging Development

Product Development → Production → Packaging Development

Product and Packaging Development time

Product Development → Production → Packaging Development

Product and Packaging Development time
Expected advantages

- Time reduction
- Cost reduction
- Improved resource utilisation
- Functional decomposition between product and packaging
- Value addition
The Integrated Procedure Model

A – co-ordination of product planning and packaging planning

- Joint project mission statement.

- Technique for integrated evaluation of packaging influences on expected yield and product market potential.

- Synchronize information regarding product plan, project timing and resource allocation.
B – co-ordination of concept development planning and packaging planning

- Perform identification of customer need and establishment of target specification
  - with reference to packaging
  - and before packaging concepts are established.
- Coordinate information of packaging feasibility to generation of product concepts and selection of product concepts.
- Coordinate concept tests.
- Integrate packaging into the final product specification.
- Establish function decomposition.
C – co-ordination system-level design and packaging planning

- Concurrent decision of package choice/design and product architecture.
- Corresponding geometrical layouts of packaging for each subsystem.
- Adapt distribution and production requirements to secondary and tertiary packaging.
D – co-ordination detail design and packaging planning

- Marketing complies regulations and restriction on both product and packaging.
- Calculate costs associated with both product and packaging.
- Production should optimise product and packaging features and minimise failures.
- Suitable materials for product and packaging should be chosen based on product and packaging interactions and packaging-production life cycle requirements.
E – co-ordination of testing and refinement and proving functionality

- Coordinate information for the establishment of test plan – ensure that every detail has been tested.

- Facilitate field testing of product and packaging and packaged product.

- Share information (and guarantee) of regulatory approvals for product, packaging and interaction product-packaging.
F – co-ordination of production ramp-up and package launch

- Share test production results to packaging development – used to decide upon material and/or installation of additional equipment.

- Share tests results of packaging manufacturing to product development – establish how well packaging performs technically.

- Marketing function places early production examples with key customers – packaged product!

- Design function evaluate production outputs and start training work force.
Example

The gasoline pump

- Swedish manufacturer introduces transports to eastern Europe
- Products are severely damaged during transport

Redesign

- Improve strength of damaged pump parts
  - Increased cost of pump
- Redesign a more effective load carrying package.
  - Less modules of pump design
  - “Significant” reductions in costs and lead-time.
Example

The IKEA Case
### The IKEA Case - a redesign project

<table>
<thead>
<tr>
<th></th>
<th>OLD</th>
<th>NEW</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pallet Quantity</strong></td>
<td>4</td>
<td>18</td>
<td>350,0%</td>
</tr>
<tr>
<td><strong>Pallets/Container</strong></td>
<td>42</td>
<td>21</td>
<td>-50,0%</td>
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<tr>
<td><strong>Pieces/Container</strong></td>
<td>168</td>
<td>378</td>
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<tr>
<td><strong>Pallets/Year</strong></td>
<td>32,500</td>
<td>7,222</td>
<td>-25,278</td>
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<tr>
<td><strong>Containers/Year</strong></td>
<td>773,8</td>
<td>343,9</td>
<td>-429,9</td>
</tr>
</tbody>
</table>

**Savings**

- **Containers**: $859,788
- **Pallets**: $25,278
- **Year**: $885,066
- **Handling**: $328,611
- **Year Total**: $1,213,677
Conclusions

- Do not forget the role of the packaging!

- There are potentials with this concept!
  - Time
  - Cost
  - Quality…

- The IPPD procedure model for mechanical products is to be implemented in industry.
  - further evaluated and validated in industry.

- Future research will also include further elaboration on actual methods and techniques necessary on an operational level.
The End
The Package Must Save More Than It Costs.
Ruben Rausing

- Complex Systems
- E-commerce (B2B, B2C)
- Design Process
- Environmental Aspects
- Information Technology
- Modelling and Simulation Techniques
- Packaging Logistics
- Traceability

ICED05
15-18 August, Melbourne

Department of Design Sciences
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The role of the packaging in the Product life cycle

- Mechanical product
- Complement the product’s (content) design.
- Part of the Product System = Product + Packaging
- Extension of the product
Background to presentation - data publicised in:

- Bramklev, Caroline (2004)
  *Concurrent Development of Product and Packaging – towards an integrated development procedure*,
  Engineering Licentiate Dissertation no. 08/2004,
  Div. Packaging Logistics, Lund Institute of Technology (LTH) at Lund University, ISBN 91-974611-4-8

- Bramklev, Caroline; Bjärnemo, Robert; Jönson, Gunilla; Johnsson, Mats (2005)
  *Towards an Integrated Design of Product and Packaging*,
  Proceedings of the International Conference on Engineering Design (ICED05), Australia: Melbourne, 15-18 August 2005