Service Engineering: A New Engineering Discipline for Industries toward Sustainable Consumption

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Contents
1. Need for Engineering on Service
2. Our Service CAD
3. Application to Industrial Services
4. Conclusion & Future Works

Problems of The Current Mass Production Paradigm

Natural Resource Limitations
Mass Product Sales-Based
Environmental Problems
Product Sales Decrease
Consumers’ Changes

Remarks
- Causal Relations
- Characteristics
- Outer Factors

New Services from Manufacturers

Renting Home Appliances
(Toshiba Techno Network Co.)
- Take Back and Rent Again
- From Product Selling to Function Selling
- Reduction of Cost and Risk of Customers

Cleaning Home Appliances
(Toshiba Techno Network Co.)
- From Repairing to Cleaning
- Commercialization of Knowledge and Skills
- Utilization of Products: from Contents to Channels

Consumers’ Changes

Expenditures of Consumers (Singles) in Japan [PMHAPT]

Traditional Service Design Processes

Problem of Decoupling
Customer Segment
Analyzing Customer
Values to be Provided
- Product Roles
- Conceptual Design
Functions
Embodiment Design
Structure
Detailed Design
Test Marketing

Products to be Sold
Tasks in Marketing World
Tasks in Engineering World
Service Engineering

- Traditional Engineering:
  - Artifacts are Main Body of Value Creation
  - CAD (Computer Aided Design) for Products e.g. Pro/Engineer, TRIZ

- Service Engineering: Engineering Discipline to Increase the Value of Service with Artifacts While Decreasing Environmental Loads Providing
  1. Basic Understanding of Service
  2. Design Methodology for Services
  3. CAD for Service
    - Artifacts are Medias in Value Providing Process
    - "2.5th Industry"

Definition of Service

- Elements of Service
  - Provider
  - Receiver
  - State change
  - Contents
  - Channel

- Definition of Service
  A Provider Causes, Usually with Consideration, a Receiver to Change from a State to a New State that the Receiver Desires Where Both Contents and a Channel are Means to Realize the Service

- PSS (Product Service System) is a Method for the Service.

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Definitions in a Dictionary

- Service
  1. A System that Provides Something that the Public Needs, Organized by the Government or a Private Company.

- Engineering
  1. The Activity of Applying Scientific Knowledge to the Design, Building and Control of Machines, Roads, Bridges, Electrical Equipment, etc.

Service Explorer

- A Prototype of Service CAD
- System Architecture

Design Flow Using Service Explorer (1)

1. Figure Out Customers
2. Represent a Service Target
3. Describe a Realization Structure
   - Evaluate a Service
   - Modify a Service
   - Create a Service

Design Flow Using Service Explorer (2)

1. Figure Out Customers
2. Represent a Service Target
3. Describe a Realization Structure
   - Evaluate a Service
   - Modify a Service
   - Create a Service

Design Flow Using Service Explorer (3)

1. Figure Out Customers
2. Represent a Service Target
3. Describe a Realization Structure
   - Evaluate a Service

Design Flow Using Service Explorer (4)

1. Figure Out Customers
2. Represent a Service Target
3. Describe a Realization Structure
   - Evaluate a Service
   - Modify a Service
   - Create a Service
To Store Knowledge on Service...

- Service Engineering Forum
  - Industry-University Collaboration for Service Engineering
  - The "Place" for Exchanging Knowledge and Co-creation for New Services
  - http://www.race.u-tokyo.ac.jp/seforum/

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Application to a Hotel Service

- Accommodation Service Provided by “Hotel Duca d’Aosta”, Located in Pescara, Italy

This Hotel is Keen to Make the Service More Attractive by being Greener.

The Described Flow Model

The Described View Model (Partial)

The Weighting on RSP (Partial)

<table>
<thead>
<tr>
<th>RSP (Receiver’s State Parameter)</th>
<th>Weight</th>
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<tbody>
<tr>
<td>创伤安全環境</td>
<td>9.0</td>
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<tr>
<td>舒适度</td>
<td>9.0</td>
</tr>
<tr>
<td>睡床的卫生</td>
<td>9.0</td>
</tr>
<tr>
<td>始终保持环境温湿度</td>
<td>9.0</td>
</tr>
<tr>
<td>清洁的床单和被罩</td>
<td>9.0</td>
</tr>
<tr>
<td>良好的照明（自然和人工）</td>
<td>9.0</td>
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<tr>
<td>减少废物的产生</td>
<td>8.8</td>
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<tr>
<td>使用可再生资源</td>
<td>8.8</td>
</tr>
<tr>
<td>节能</td>
<td>8.8</td>
</tr>
<tr>
<td>高效能的卫生设施</td>
<td>8.7</td>
</tr>
<tr>
<td>价格和帐单</td>
<td>8.7</td>
</tr>
<tr>
<td>友好的接待</td>
<td>8.7</td>
</tr>
<tr>
<td>减少污染物的排放</td>
<td>8.6</td>
</tr>
<tr>
<td>能源消耗</td>
<td>8.6</td>
</tr>
</tbody>
</table>

- Freshness of towels and bed linen 9.8
- Clean rooms 9.7
- Correct billing 9.5
- Rooms free of unpleasant odours 9.5
- Indoor air pollution level 9.4
- Everything in working order in room 9.4
- Comfortable bathrooms provided with various amenities 9.4
- Room ready at arrival 9.4
- Comfortable beds 9.4
- Prompt, competent and attentive staff 9.3
- Quiet rooms 9.3
- Friendly and polite staff 9.3
- Fast and efficient check-out 9.2
- Adequate heating and/or air-conditioning 9.2
- Comfortable and spacious rooms 9.1
- Efficient booking 9.0
- Well-furnished and attractive rooms 9.0
- Quality of food and beverages at breakfast 9.0
- Friendly welcome at arrival 9.0
- Reduced release of pollutants into the environment 8.9
- Good lighting (both natural and artificial) 8.8
- Fast and efficient check-in 8.8
- Reduced waste generation 8.7
- Use of materials from renewable resources 8.6
- Energy saving 8.6
### The Importance of Design Parameters (Partial)

<table>
<thead>
<tr>
<th>Function Parameter</th>
<th>Relative Importance</th>
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</thead>
<tbody>
<tr>
<td>Temperature of the light room</td>
<td>3.4</td>
</tr>
<tr>
<td>Temperature of the bed</td>
<td>3.2</td>
</tr>
<tr>
<td>Shortness of air in the bed room</td>
<td>2.2</td>
</tr>
<tr>
<td>Shortness of air in the bed room</td>
<td>2.2</td>
</tr>
<tr>
<td>Comfortable of the bed in the hotel</td>
<td>1.2</td>
</tr>
<tr>
<td>Comfortable of the bed at the bed room</td>
<td>1.2</td>
</tr>
<tr>
<td>Minimality of the air in the hotel</td>
<td>1.0</td>
</tr>
<tr>
<td>Minimality of the air at the bed room</td>
<td>1.0</td>
</tr>
<tr>
<td>Amount of the trash</td>
<td>0.9</td>
</tr>
<tr>
<td>Amount of used amenities</td>
<td>0.9</td>
</tr>
<tr>
<td>Amount of the energy used to heat water</td>
<td>0.9</td>
</tr>
<tr>
<td>Amount of the energy used for air-condition</td>
<td>0.9</td>
</tr>
<tr>
<td>Amount of the water pumped up</td>
<td>0.9</td>
</tr>
<tr>
<td>Amount of the air in the bed room</td>
<td>0.8</td>
</tr>
<tr>
<td>Air-condition in the bed room</td>
<td>0.8</td>
</tr>
<tr>
<td>Amount of the air in the hotel</td>
<td>0.8</td>
</tr>
<tr>
<td>Amount of the light</td>
<td>0.7</td>
</tr>
<tr>
<td>Amount of the light</td>
<td>0.7</td>
</tr>
<tr>
<td>Cleanliness of the toilet</td>
<td>0.7</td>
</tr>
<tr>
<td>Appearance of the mirror</td>
<td>0.7</td>
</tr>
<tr>
<td>Amount of electricity</td>
<td>0.6</td>
</tr>
<tr>
<td>Amount of amenities</td>
<td>0.6</td>
</tr>
</tbody>
</table>

### Design Solutions for the Hotel Service

- Room Temperature Control by Using Light Shielding Window Films
  - Energy Saving & View from Window
- Natural Light Illumination by Using Optical Ductwork System
  - Energy Saving & Feeling Nature
- Bed Linen and Towel Cleaning with “Cash-back per Unwash” System
  - Reduction of Environmental Burdens and Cost
- Various Renting Service
  - Saving Transport Load, Adding New Values (Joy of Using Something New)
  - Wardrobe for Business
  - Cosmetics
  - Hobby Goods (DVD, CD, etc.)

### Product EcoDesign vs Service Design

Value Creation Process is Added.

Service Design

- Function as a Realization Method
- Value Creation: Target: Value / Cost
- Use: Maintain: Dispose

Product Design

Product EcoDesign

- More Design Parameters: RSP, Agent

### Application to Service in Manufacturing Sector

- Industries Need Engineering on Service.
- Service Explorer can Help Industries with Designing Services Effectively.
- Empirical Studies are Needed.

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On-Going Works (1)

- Figure Out Customers
- Represent a Service Target
- Categorization
- Scenario Making
- RSP Identification

Persona Model by Alan Cooper

On-Going Works (2)

- Abductive Reasoning (AI Technique)
- Create a Service

Thank You for Your Attention!

Service Engineering Forum:

www.race.u-tokyo.ac.jp/seforum/