The Extended Product Paradigm as an Enabler for Implementing Remanufacturing Systems.

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Presentation

Presentation Objectives
- Shared understanding of the Extended Products concept
- Recall the changed ownership model
- Highlight the characteristics of the Extended Products concept and challenges and benefits in relation to remanufacturing systems.

Presentation Content
- Base concept
  - Extended Products
  - From ownership to access
  - Examples
- Applications in Remanufacturing
**Extended Products**

*Where did it come from?*

The “Extended Products” concept / term was first introduced at a meeting in at VTT in November 1999 in association with Helsinki IST 1999 Conference.

The activity subsequently lead to the EXPIDE project

- The base concept of Extended Products was formalized in the project

The concept has been accepted in the research domain

Several additions and views have been created
Concept of an „Extended“ Product
(From Klaus-Dieter Thoben / BIBA & Expide)

Core Product  →  Tangible Product  →  Tangible and Intangible Product Assets

Shift of Business Focus

Manufacturing of Parts / Raw Materials  →  Provision of Products  →  Provision of Problem Solutions  →  Provision of Benefits
Extended Product Characteristics

- A combination of a physical product and associated services or enhancements.
- Often include intangible products, that are information and knowledge intensive.

Delivering Extended Products

- Extended product are difficult to produce alone.
- Extended products are often produced by enterprises networks.
Potential Services Along the PLC

Requirements Phase
- Formalisation of the needs
- Consultancy services
- Co-development
- Product dependent or independent services
- Services to support co-operations of enterprises
- Customer integration into realisation phase
- Qualification and training
- Operation support

Realisation Phase
- Evaluation and benchmarking services

Usage Phase
- Repair

Maintenance Phase
- Financial services
- Collection services
- Collation of materials
- Dismantling services

End of Life Phase
- Disposal of hazardous materials
- Routine Maintenance
- Dismantling services

Usage Phase
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Different types of product extensions

Product physical extensions
- Add on parts
- Accessories, packing
- Equipment needed for use & maintenance
- Spares & wares

Service extensions
- Warranty
- On request service – reactive service
- Maintenance service – preventive service
- Availability services – predictive services
- Performance service – proactive service

Economic & Financial extensions
- Lifecycle cost insurance
- Business outcome share – B2B2B
- Financing & External funding arrangements
- Product ownership, rental, leasing, capacity, franchising

Life-Cycle services
- Pre-sales services, feasibility study, design
- Delivery project management
- Installation, start-up,
- Training
- Information and expertise to using the product
- Operational service (actually operating the product)
- Revision change, upgrade
- End of life services, recycling

Social product extensions (other forms of extensions)
- User communities
- News services
- Experience sharing
- Brands, creating brands
- Emotional, excitement
### Extended Products

#### Service Extensions, Examples

<table>
<thead>
<tr>
<th>Service extensions</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warranty</td>
<td>Protects the user from costs due to inferior quality of the product. Warranty is a liability period, where if there was a defect it will be fixed for free or as the contract states.</td>
<td>Washing machine warranty 1 year, if the bearing is defected it will be replaced for free</td>
</tr>
<tr>
<td>Spares &amp; wares</td>
<td>On request service – reactive service. Delivery of spare parts and wearing parts</td>
<td>Spare parts delivery</td>
</tr>
<tr>
<td>Maintenance service</td>
<td>Preventive service. Service agreements</td>
<td>Testing, trouble shooting, repair</td>
</tr>
<tr>
<td>Availability services</td>
<td>Predictive services. Service level agreement</td>
<td>95% availability of machinery</td>
</tr>
<tr>
<td>Guarantee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance service</td>
<td>Proactive service</td>
<td>Capacity base services</td>
</tr>
</tbody>
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Extended Products and Remanufacturing

An Extended Product is a combination of
- Core physical product
- Physical product extension
- Intangible product
- Intangible service

Physical products: need often repair, services or remanufacturing
Intangible product: can be copied, duplicated or multiplied
  - May need updates & revisions
Intangible services:
  - Used once, non reusable
  or
  - Repeatable (may need updates & revisions)
“From ownership to access”

Example of a mobility concept transferred to manufacturing industry and extended products
Example: Mobility concept

Personal mobility requirements

- Move people
  - Family car

- Have fun
  - Sports car

- Move goods
  - Van

Ownership border

Car manufacturers

From Klaus-Dieter Thoben / BIBA mobility concept
Example: Mobility concept

VISION
Removed ownership border

If the “ownership” border is remove, then there will be room for new business models - rental, leasing, time share, pools, service, cleaning, delivery, reservation……. but also development and new research issues - financial, legal, organisation, IT, knowledge, learning….
Mobility concept transferred to manufacturing industry

AS-IS

Customer, User

Function needed

Function needed

Function needed

Tool / Machine

Own & use

Sell
Maintain

Equipment Manufacturer

Ownership border

?
Mobility concept transferred to machine industry

Providing Access can be a service attached to the product
Providing Access through an Extended Product

Customer, User

Function Needed | Function Needed | Function Needed

Use

Extended Product

Tool, Machine

Equipment Manufacturer

Removed Ownership Border
From Ownership to Access

Examples

- If the interest is on the output produced, the ownership border can be different, e.g. getting:
  - thrust power and flying hours ↔ aircraft engine
  - electricity ↔ power plant
  - transportation service ↔ ships and lorries
  - logistics services ↔ warehouse space
  - information ↔ books and computers
  - expertise ↔ people
  - experience ↔ leisure flight tickets
  - business opportunity ↔ research results

When the ownership is replaced by access to the product and service, then there will be room for new innovative and knowledge-based business models.
The transformation of the business model will influence the entire life cycle of the product and related service.

For example: The engineering phase will have to take into account that the same physical product can be used by

- several customers and
- have to be re-configurable for different kinds of production needs.

The design criteria for the product change.

New innovative product can be developed

- Life cycle design (design for remanufacturing)
- Modularisation and flexibility (remanufacturing of components / modules)
- Different optimisation criteria (optimise for remanufacturing!)
- Shared usage
- Financing and funding
Large Extended Products are Often Produced by Networks

Possible Network Partners, e.g.
- Design & Engineering
- Manufacturing (OEM)
- Software development
- Installation & Start up
- Maintenance
- Project Management
- Financing & Funding

Providing “access” through an Extended Product offering: The partner to manage the “changed ownership business model” (rental, leasing, franchising) could be:
- Manufacturing (OEM)
- Financing & Funding organisation
- Third party

If remanufacturing is included in the business model a partner is needed for it, could be *)
1. OEM -> OER (Original Equipment Remanufacturer)
2. Contracted Remanufacturer
3. Independent Remanufacturer

*) Lund, Sundin et. al.
Benefits of the change ownership business model

- Increased control over returned “cores”
- More steady flow back and larger volumes of cores
- Access to usage history
- Possibility to design for remanufacturing
- Changed and better suited optimisation criteria on product design
- Regular contact with the customer, the real user

All these features are very good for successful remanufacturing & dematerialisation
Extended Product and the included “Intangible product” and “Intangible service” extensions cannot be remanufactured.

However, the Extended Product paradigm and the changed ownership business model can boost the uptake and acceptance of remanufacturing!
Thank You for Your Attention

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