How to integrate remanufacturing in companies through new business models

Presentation at Grenoble ERN Workshop

Erik Sundin

Division of Manufacturing Engineering
Department of Management and Engineering
Linköping University
Sweden

2016-03-15

LiU EXPANDING REALITY
Funded by the Horizon 2020 Framework Programme of the European Union

Erik Sundin, Associate Professor
Department of Management and Engineering
Division of Manufacturing Engineering
Linköping University
Tel: 013-286601
E-mail: erik.sundin@liu.se

Research areas:

Design for remanufacturing

Product Service Systems

Remanufacturing

EcoDesign

Cleaner Production

Recycling

Funded by the Horizon 2020 Framework Programme of the European Union

Objectives of Business Model Survey

- To describe how companies include remanufacturing in their **business models** and how this in turn changes **product design** to facilitate remanufacturing and what **remanufacturing processes** are used.
- To review in **which ways the cores being remanufactured are retrieved** e.g. traditional product sales and/or through selling a service/function that the product fulfils e.g. through leasehold contracts.
- To examine the pros and cons of business models that includes remanufacturing from **economic and environmental perspectives**.
- To describe which **business model challenges** that the remanufacturing companies experience, including longer product life and materials requirements for critical materials security.

=> **Business Model Landscape report**

Funded by the Horizon 2020 Framework Programme of the European Union

Metodology and activities

- August 2015: Business Model Case study started by **designing interview questions** about remanufacturing company business models.
- September 2015: Around **100 companies** mainly in Germany, The United Kingdom, Holland and Sweden **were targeted** for the interview mainly based on data from the ERN Market Study.
- December 2015: around **40 business models surveys** conducted.
- January 2016: **Validation of the business model descriptions** and additional interviews.
- March 8th 2016: **30 business model descriptions validated**.

Partners

Linköping University

University of Strathclyde Glasgow

Circle Economy

Funded by the Horizon 2020 Framework Programme of the European Union

Business Model Descriptions

- Company / Location
- Type of Remanufacturer
- Experience in reman
- Sector / Product
- Contact / Website
- Core sourcing
- Business model
  - value chain
  - reman process
  - customer value
  - economic benefits
  - economic challenges
  - key resources
- Environmental benefits
- Social benefits
- Advanced materials recovery

Business Model

Company: Autoelectro
Location: UK
Type: Third-party / Independent Remanufacturer (IR)
In reman: Since 1988
Contact: Tony Khogal (Director)
Phone: +44 (0) 1274 651101 E-mail: tony@autoelectro.co.uk

AUTOELECTRO
STARTER MOTORS & ALTERNATORS

Product

Starter motors and alternators

Core Sourcing

The cores are retrieved from automotive part wholesalers across UK through service exchange scheme where surcharge is involved.

Business Model (including value chain and reman process)

Autoelectro is a remanufacturer of starter motors and alternators for cars and light commercial vehicles. The Autoelectro remanufactures a large variety of starter motors and alternators which can fit various automotive brands such as Audi, BMW, etc. and is now the largest independent remanufacturer and supplier of Rotating Electrics in the UK.

Manufacturer → Customers → Remanufacturer → Customers

The starter motors and alternators are retrieved via the service (service exchange) between direct order and deposit-based system where the remanufactured products are sold with surcharge to customers and the customers will get the surcharge back once they returned the remanufactured products. The remanufacturing processes for the cores involves full strip down, cleaning, internal component checking, replacement of wear components and faulty parts, re-assembly and testing to original equipment (OE) specifications on computerised test benches. The remanufactured products were issued with 2 years warranty which is longer than the OE equipment. The customers targeted are mainly UK aftermarket and the price of the remanufactured product varies significantly depending on the market. The main challenge for this business nowadays is the cloned products with inferior quality from Far East. The remanufactured products also have to compete with the price of these cloned products in the market although the remanufactured products possess higher quality contributed from strict remanufacturing and testing processes. The interviewee addresses that market needs to understand the difference between the remanufactured products and cloned products in order to promote remanufacturing business.

Economic Benefits

Autoelectro has an internal management system on financial and accounting to monitor business performance on daily, monthly and/or annually basis in order to set correct pricing strategy. The economic benefits for publics are customers get high quality (equivalent to OE) of remanufactured products with cheaper price. So customers has additional option to purchase: the new product from original equipment manufacturer (OEM) with higher price; the remanufactured products in equivalent OE quality with cheaper price; or the cheaper cloned products from Far East with inferior quality and potentially with shorter life span.

Environmental Benefits

Remanufacturing starter motors and alternators have definite energy saving compared to manufacture new ones. The amount of energy saving is unknown. The company has ISO14001 accredited and has recently won Green Apple Environmental Award, an international environment award for the greenest companies, councils and communities.

Social Benefits – Jobs, Upscaling, etc.

The remanufacturing business is labour-intensive so the business creates a lot of job opportunities and also the remanufactured products have pricing benefit for general public compared to new manufactured products.

Advanced Materials Recovery

In remanufacturing process, the starter motors and alternators were first diagnosed with economically remanufacturable and unremanufacturable. The ones without economic benefit for remanufacturing were scrapped off and sold to recycling company. So the aluminium, copper, iron and other metals in the components will be separated for reuse and/or recycling.

Developed for ERN – European Remanufacturing Network

Funded by the Horizon 2020 Framework Programme of the European Union

30 case companies

ACES	Inrego	Schmitz+Krieger
ARP Suppliers	IT-Lyftet	SCM Turbo
ATP Industries	Leapp	Siemens ITAB
Autoelectro	Linde	Stone Computers
Borg Automotive	Oerlikon LV	Storebro Industrier
Büroservice Hübner	Polyplank	Ståthöga MA Teknik
Carwood	PSS	Toyota MHS
Desko	RDC	UBD Cleantech
ES Power	RobotIF	UBD Cleantech
Hitachi CME	Scandi-Toner	Vector Aerospace

Funded by the Horizon 2020 Framework Programme of the European Union

Location of companies

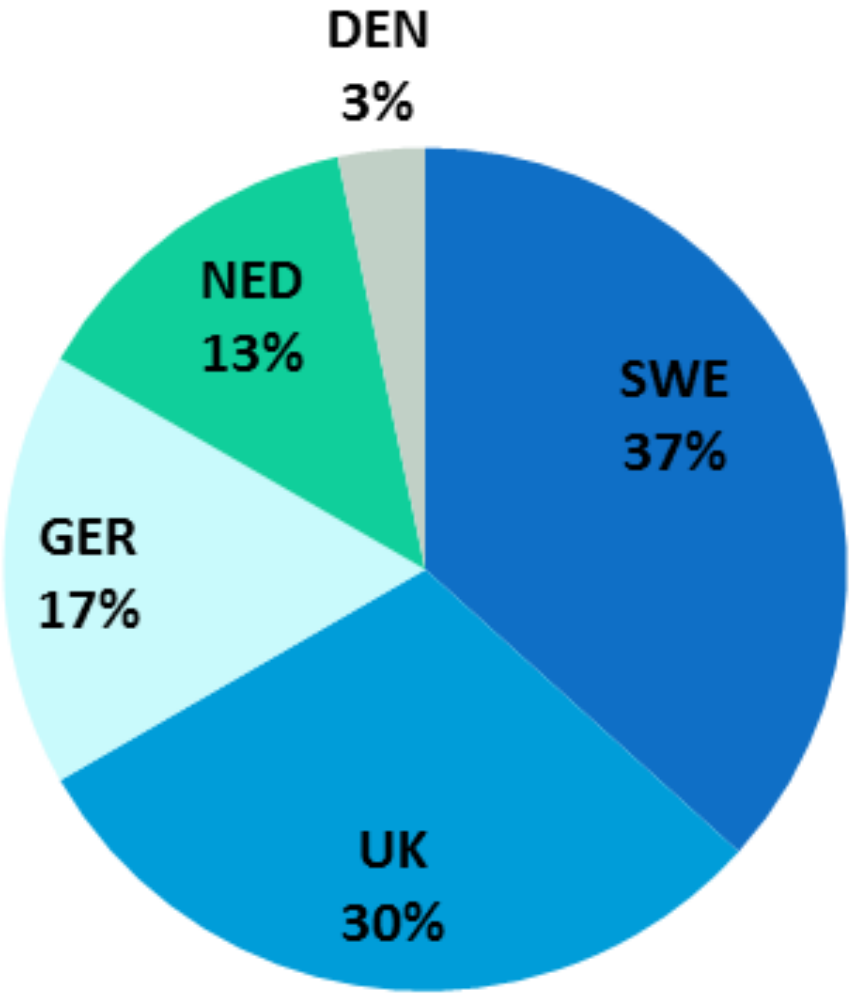

Fig 1. The location of the remanufacturing company facility/headquarter analysed in the business model case study (Business Model Landscape report).

Funded by the Horizon 2020 Framework Programme of the European Union

Type of Remanufacturer

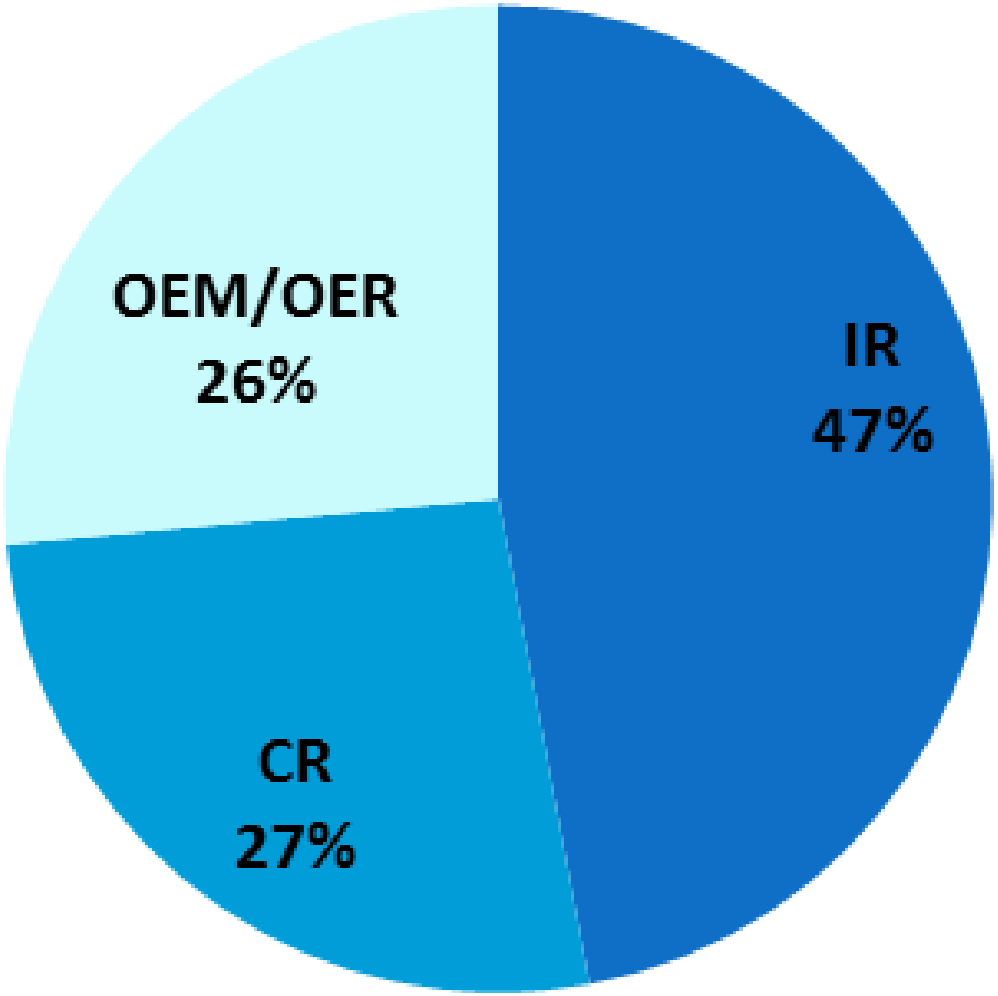

Fig 2. The type of remanufacturing company analysed in the business model case study (Business Model Landscape report).

Funded by the Horizon 2020 Framework Programme of the European Union

Experience in Remanufacturing

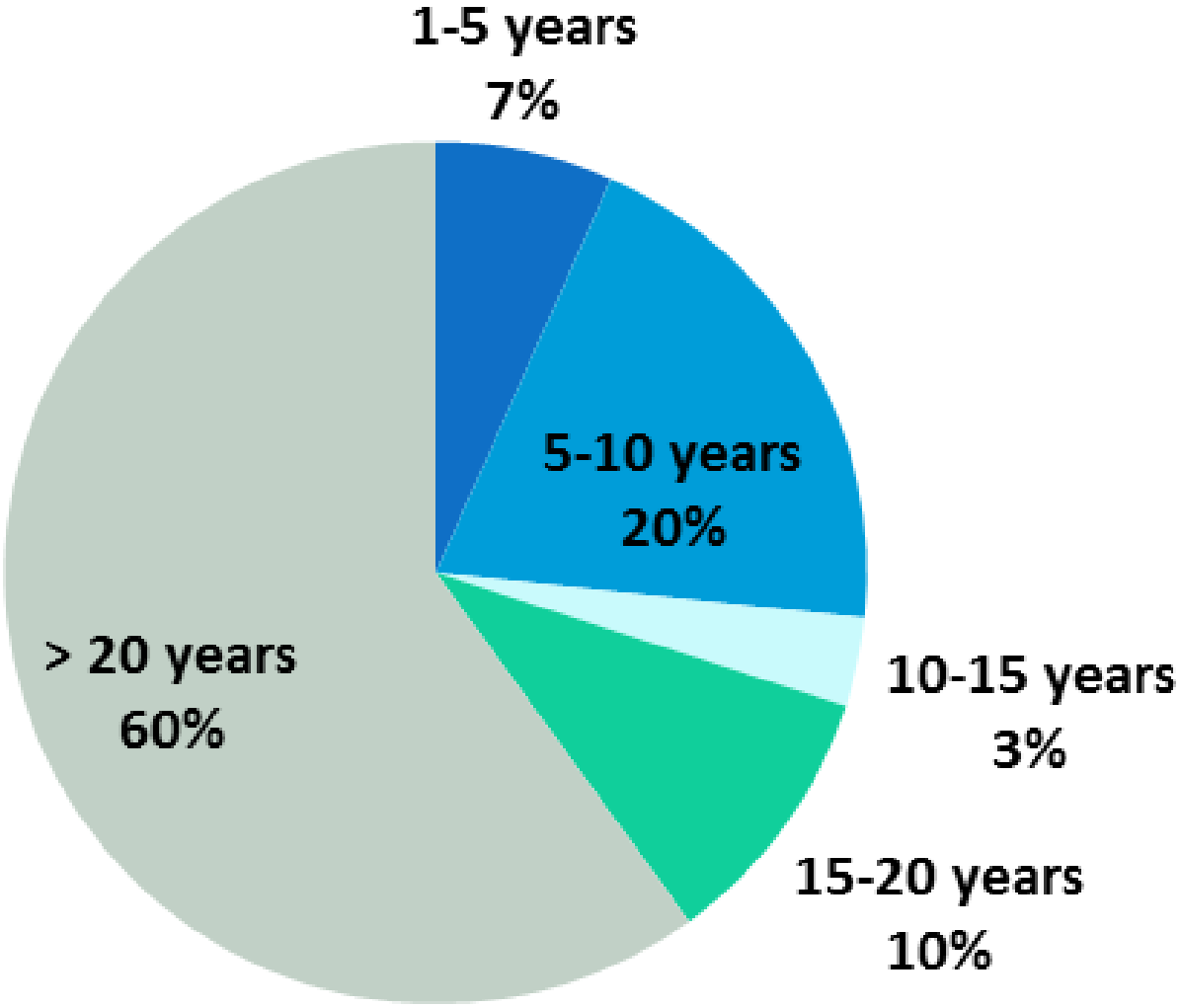

Fig 3. The amount of experience the analysed companies have of remanufacturing in the business model case study (Business Model Landscape report).

Funded by the Horizon 2020 Framework Programme of the European Union

Industrial sectors

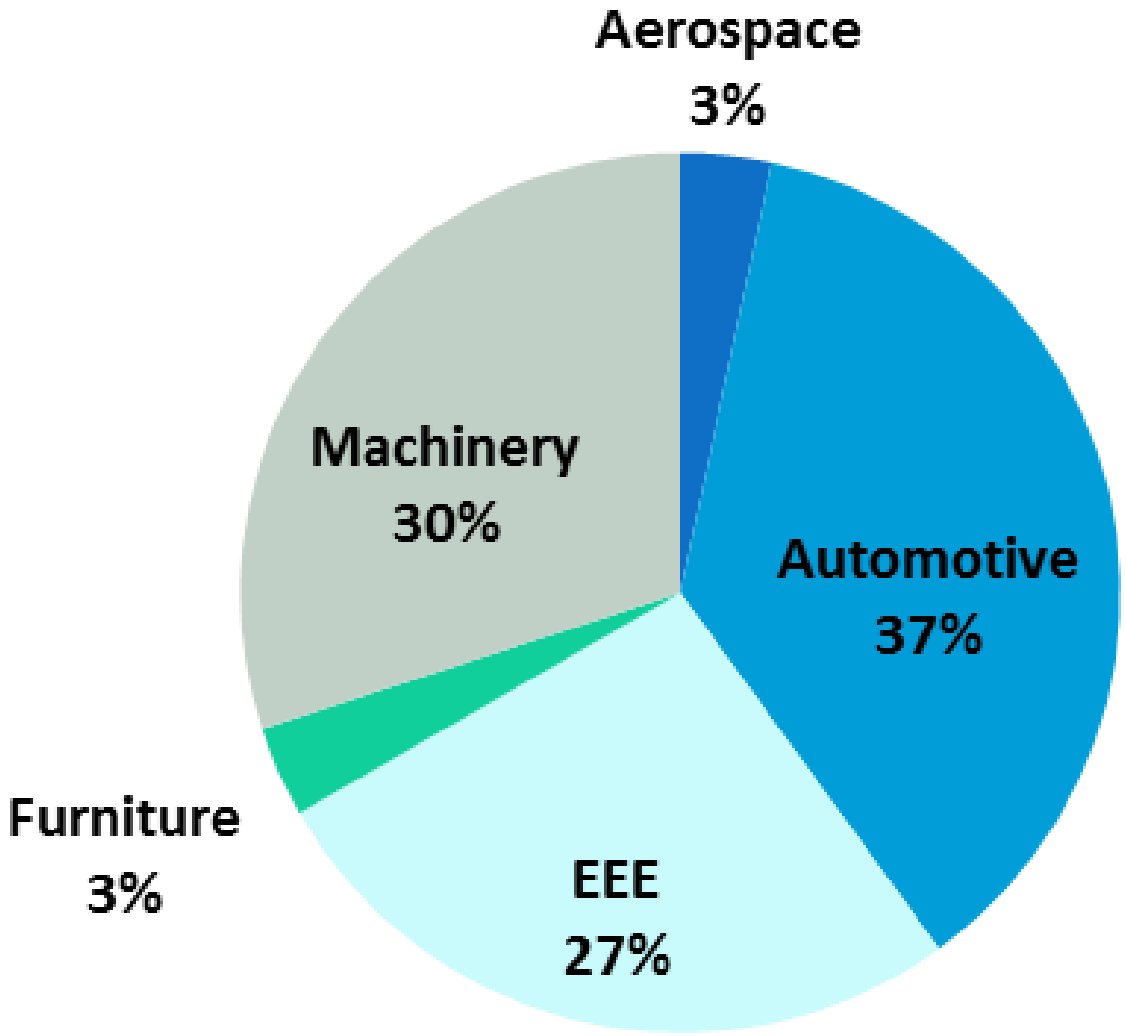

Fig 4. The industrial sectors from which the analysed companies have of remanufacturing in the business model case study (Business Model Landscape report).

Funded by the Horizon 2020 Framework Programme of the European Union

Core sourcing

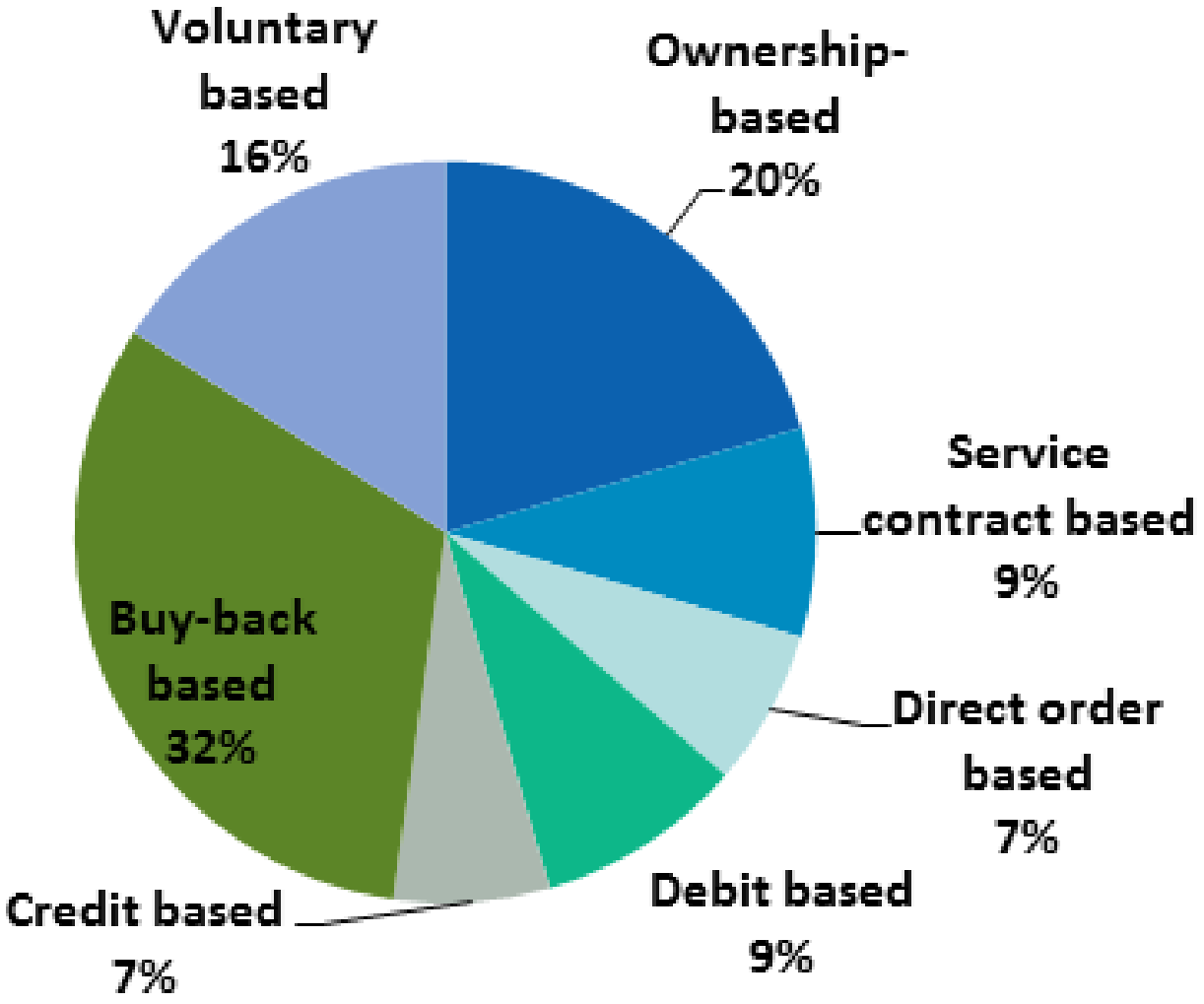

Fig 5. The sources of cores for the analysed companies within the business model case study (Business Model Landscape report).

Funded by the Horizon 2020 Framework Programme of the European Union

Customer values and Economic benefits

Main values: Lower price - High quality - Long warranty - Higher up-time

- Most say it is a **price-worthy option** in comparison to new products.
- **Lower price** but with **same** or **better quality** (Case 5, 11, 12, 14, 15, 17, 27, 28, 29). Better quality than the **cloned products** they compete with (Case 4).
- **Only option** since new products are not manufactured (Case 5).
- **A faster solution** (Case 14, 17, 21, 22, 26) than ordering new parts meaning that **up-time is higher** and the **out-of-service times are lower**.
- **A good option to get rid of used products** (Case 8, 11, 12, 24).

Economic benefits:

- The economic benefits are lower costs to remanufacture a product in comparison to new manufacturing. This means that the prices also can be set to a lower level. Most of the remanufacturing companies claim **more than 50% lower costs than new manufacturing**.

Funded by the Horizon 2020 Framework Programme of the European Union

Economic challenges

Main five challenges: Core access – Customer awareness – Design issues – Profitability – Process efficiency

- Seven of the companies state that they have **challenges within core access and/or management** (Case 3, 5, 14, 17, 21, 25, 27)
- Five of the companies are mentioning the **lack of customer awareness** of the benefits of remanufactured products (Case 4, 6, 10, 13, 20).
- Five of the companies have **design issues** make their remanufacturing business troublesome (Case 3, 9, 19, 21, 28)
- Three state that they have **problems of staying competitive** (Case 14, 22, 28) while two other mentioned **staying profitable is a challenge** for them (Case 3, 7).
- Three of them says they have a **challenge to improve their process efficiency** (Case 3, 6, 29).
- Many of the companies have not stated **any economic challenges**.

Funded by the Horizon 2020 Framework Programme of the European Union

Key resources

Main four key resources:
Technical and business staff – Access to cores –
Remanufacturing know-how – Equipment and facilities

- Nine of the companies state **technical and/or business staff** (Case 3, 6, 14, 15, 17, 19, 20, 24, 29)
- Seven of the companies mention **access to cores** (Case 3, 5, 6, 13, 20, 24, 29)
- Four of the companies say **facilities, machinery and equipment** (Case 1, 3, 17, 28)

Malcolm Morris (OEM Sales Manager) of ATP Industries Group: ***"Core is king!"***

Funded by the Horizon 2020 Framework Programme of the European Union

Environmental benefits

Most companies claim that there are environmental benefits of their business in comparison than new manufacturing

- 13 companies state **Reuse of raw materials** (Case 1, 3, 6, 7, 10, 12, 14-17, 20, 26, 27)
- 12 companies state **Reduced CO_2 emissions** (Case 3, 5, 8, 11, 16, 18, 20, 22, 23, 27-29)
- 8 companies state **Reduced energy consumption** (Case 3, 5, 7, 10, 17, 21, 22, 26)

Three companies have won **environmental awards** (Case 4, 18, 24)

Funded by the Horizon 2020 Framework Programme of the European Union

Social benefits

Main social benefits:
Job creation – Higher access to products – Charity

- All remanufacturing companies **create job opportunities**, both at the **remanufacturing company** but also in the surrounding partners in the **reverse supply chain** (Case 1-30).
- Seven companies claim that their remanufacturing business **makes it possible for those unable to buy new products being able to buy and use those products** (Case 11, 12, 13, 15, 18, 24).
- Four companies arrange **social activities and/or work with charity**
(Case 3, 18, 22, 24).

- 10 jobs (20,25)
- 15 jobs (3)
- 20 jobs (19,28)
- 40 jobs (29)
- 50 jobs (8,24)
- 80 jobs + more (11)
- 100 jobs (13)
- 380 new jobs (18)
- 600 jobs (10)
- 800 jobs (30)
- Around 25 x 35 jobs in Europe
- 1200 jobs (5)
- High-skilled job (30)

Funded by the Horizon 2020 Framework Programme of the European Union

Advanced Material Recovery

Not always an easy question to answer!

Metals:

- Alloys (3,22)
- Aluminum (3,4,5,20,22,28)
- Copper (4,5,11)
- Iron (4,5,22,28)
- Other metals (4)
- Rare earth metals (5,11)
- Steel alloys (8,20)
- Precious metal (11)
- Tin (11)
- Metals (17,24,25)
- 100% recycling and recovery of materials (18)
- Titanium (22,30)
- Advanced materials, such as low-maintenance materials, high-temperature resistance materials, super alloys, and coated materials (23)
- Platina, Palladium or Rhodium is recovered as well stainless steel (29)

No AMR mentioned (Case 1, 2, 6, 7, 9, 10, 13-15, 19)

- Plastics (11)
- Electronics (3)
- Lesser need of using advanced materials (12)
- Advance composites (30)

Business Model Descriptions

- Company / Location
- Type of Remanufacturer
- Experience in reman
- Sector / Product
- Contact / Website
- Core sourcing
- Business model
  - value chain
  - reman process
  - customer value
  - economic benefits
  - economic challenges
  - key resources
- Environmental benefits
- Social benefits
- Advanced materials recovery

Business Model

Company: Autoelectro
Location: UK
Type: Third-party / Independent Remanufacturer (IR)
In reman: Since 1988
Contact: Tony Bhogal (Director)
Phone: +44 (0) 1274 651101 E-mail: tony@autoelectro.co.uk

AUTOELECTRO
STARTER MOTORS & ALTERNATORS

Product

Starter motors and alternators

Core Sourcing

The cores are retrieved from automotive part wholesalers across UK through service exchange scheme where surcharge is involved.

Business Model (including value chain and reman process)

Autoelectro is a remanufacturer of starter motors and alternators for cars and light commercial vehicles. The Autoelectro remanufactures a large variety of starter motors and alternators which can fit various automotive brands such as Audi, BMW, etc. and is now the largest independent remanufacturer and supplier of Rotating Electrics in the UK.

Manufacturer → Customers → Remanufacturer → Customers

The starter motors and alternators are retrieved via the service (service exchange) between direct order and deposit-based system where the remanufactured products are sold with surcharge to customers and the customers will get the surcharge back once they returned the remanufactured products. The remanufacturing processes for the cores involves full strip down, cleaning, internal component checking, replacement of wear components and faulty parts, re-assembly and testing to original equipment (OE) specifications on computerised test benches. The remanufactured products were issued with 2 years warranty which is longer than the OE equipment. The customers targeted are mainly UK aftermarket and the price of the remanufactured product varies significantly depending on the market. The main challenge for this business nowadays is the cloned products with inferior quality from Far East. The remanufactured products also have to compete with the price of these cloned products in the market although the remanufactured products possess higher quality contributed from strict remanufacturing and testing processes. The interviewee addresses that market needs to understand the difference between the remanufactured products and cloned products in order to promote remanufacturing business.

Economic Benefits

Autoelectro has an internal management system on financial and accounting to monitor business performance on daily, monthly and/or annually basis in order to set correct pricing strategy. The economic benefits for publics are customers get high quality (equivalent to OE) of remanufactured products with cheaper price. So customers has additional option to purchase: the new product from original equipment manufacturer (OEM) with higher price; the remanufactured products in equivalent OE quality with cheaper price; or the cheaper cloned products from Far East with inferior quality and potentially with shorter life span.

Environmental Benefits

Remanufacturing starter motors and alternators have definite energy saving compared to manufacture new ones. The amount of energy saving is unknown. The company has ISO14001 accredited and has recently won Green Apple Environmental Award, an international environment award for the greenest companies, councils and communities.

Social Benefits – Jobs, Upscaling, etc.

The remanufacturing business is labour-intensive so the business creates a lot of job opportunities and also the remanufactured products have pricing benefit for general public compared to new manufactured products.

Advanced Materials Recovery

In remanufacturing process, the starter motors and alternators were first diagnosed with economically remanufacturable and unremanufacturable. The ones without economic benefit for remanufacturing were scrapped off and sold to recycling company. So the aluminium, copper, iron and other metals in the components will be separated for reuse and/or recycling.

Developed for ERN – European Remanufacturing Network

Funded by the Horizon 2020 Framework Programme of the European Union

Schmitz + Krieger GmbH

- **Schmitz + Krieger GmbH / Germany**
- **Contracted remanufacturer**
- **In reman since 1911**
- **Products:**
  Engines, transmissions, and other components for automotive assemblers. Injection equipment and high-pressure pumps
- **Core sourcing:**
  Service exchange: the customer returns the used product to the remanufacturer, the product is remanufactured and the customer gets the same quality of the same product model back (if it is possible to perform a remanufacturing operation).

Funded by the Horizon 2020 Framework Programme of the European Union

Schmitz + Krieger GmbH

- **Business model elements:**
- **Remanufacturing process:** 1) Reception of cores, 2) Visual check of the cores' quality, 3) Stock, 4) Disassembly, 5) Cleaning, 6) Check of quality, 7) Machining (e.g. grinding), 8) Mounting, 9) Testing, and 10) Shipment.
- **Company drivers:**
  1) Economics, 2) Environmental sustainability, 3) Customer satisfaction
- **Customer benefits:**
  1) Lower price, 2) Increased availability, 3) Improved environmental image
- **Value chain collaboration:**
  Company works directly with customers and collaborates with logistics providers and spare part providers.
- **Challenges:**
  1) Access to measurable data and information about products and processes, 2) core management (optimizing the stock levels), 3) dealing with electronic products in general.
- **Key resources:**
  The remanufacturing personnel

Funded by the Horizon 2020 Framework Programme of the European Union

Schmitz + Krieger GmbH

- **Economic benefits**
  For customers: reman products are 20-30% cheaper than new ones.
  In general: using already existing raw materials and using less inputs for the process (e.g. staff, information, machines) is perceived as source of economic benefits.
- **Environmental benefits/drawbacks**
  Benefits: Less materials used and less energy usage
  Drawbacks: Dirt from cleaning parts (can be hazardous)
- **Social benefits**
  Job creation is major benefit to society
- **Advanced materials recovery**
  No such materials are recovered

Funded by the Horizon 2020 Framework Programme of the European Union

Toyota Material Handling Sweden

- **Toyota Material Handling Sweden / Mjölby, Sweden**
- **Original Equipment Remanufacturer**
- **In reman since 2003**
- **Products:**
  Forklift trucks
- **Core sourcing:**
  Around 90% of the used forklift trucks come from rental agreements and the rest is bought from the market. The rental contracts run from one month up till 10 years.

TOYOTA

TOYOTA MATERIAL HANDLING SWEDEN

Funded by the Horizon 2020 Framework Programme of the European Union

Toyota Material Handling Sweden

- **Business model elements:**
- **Remanufacturing process:**
  1) Inspection, 2) Cleaning, 3) Repairing, 4) Repainting, and 5) Testing.
- **Rental agreements:**
  Benefits: 1) Keeps control over the products during use, 2) Better relation to the customers, 3) Possibility to remanufacture products several times
  Drawbacks: Higher risk by owning the products
- **Economic benefits:**
  1) Retrieve good cores that are easily remanufactured and sold to a next customer, 2) Reaching new customer segments
- **Customer benefits:**
  Price-worthy forklift trucks that have been treated well during their previous usages under the control of Toyota.
- **Challenges:**
  1) Knowing what value the forklift truck have, 2) Uneven amount of cores, 3) Sales companies are mostly measured in new product sales.

Funded by the Horizon 2020 Framework Programme of the European Union

Toyota Material Handling Sweden

- **Environmental benefits**
  Remanufactured products are 20-30% less resources are used in remanufacturing in comparison to new manufacturing.
- **Social benefits**
  It creates much work since all processes in the remanufacturing process is done manually. The forklift trucks are too complicated to perform automation on.
- **Advanced materials recovery**
  No such materials are recovered

Funded by the Horizon 2020 Framework Programme of the European Union

How to integrate remanufacturing in companies through new business models

Presentation at Grenoble ERN Workshop

Look out for the Business Model Landscape report on:

www.remanufacturing.eu

Thank you for listening!

LiU EXPANDING REALITY
Funded by the Horizon 2020 Framework Programme of the European Union