Remanufacturing in Europe – Status quo and perspectives

Situación actual y perspectivas de la remanufactura en Europa

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GEORG SIMON OHM

Introduction

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- **Name:** Sebastian Schötz
- **Education:** Diploma in Mechanical Engineering, Doctorate in Engineering
- **Activities in Remanufacturing:**
  - Research in EU/national funded projects (remanufacturing, circular economy)
  - Consulting projects with remanufacturing companies globally

    (focus: process optimization, business development, factory planning)
  - Sectors: Machinery, Automotive, Heavy duty and off-road, Rail ...

Picture: Bayreuth University

Turnover in Remanufacturing – Sectors

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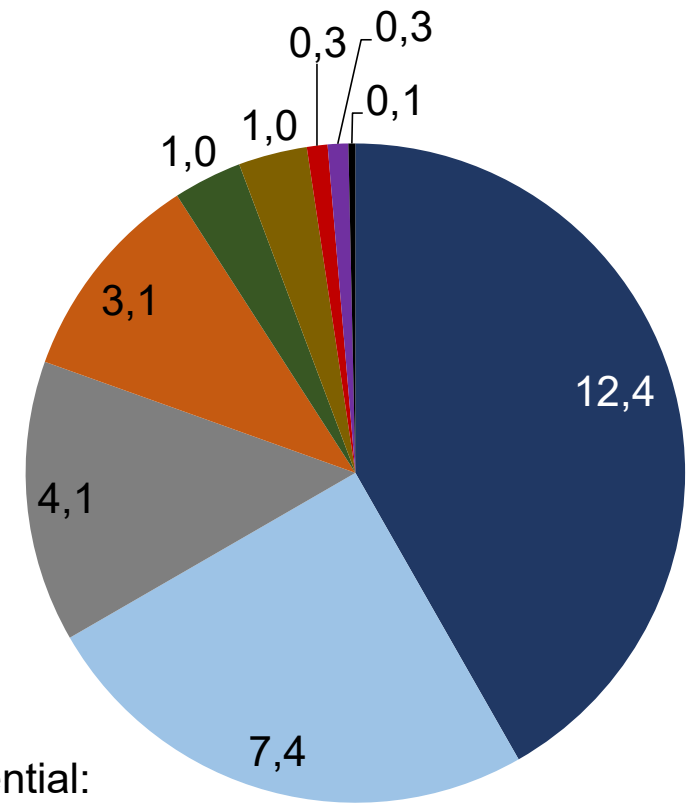
Turnover/a in EU-28 (in Billion €)



- Aerospace
- Automotive
- Heavy duty and off-road
- Electronic and electrical engineering
- Medical equipment
- Machinery
- Furniture
- Rail
- Marine

EU market potential:
~€70bn - ~€100bn by 2030

Reference: Parker D.; Riley, K.; Robinson, S.; Symington, H.; Tewson, J.; Jansson, K.; Ramkumar, S.; Peck, D.; Remanufacturing Market Study, 2015.

Case Study

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Herrenknecht AG, Kehl (Germany)

Remanufacturing components of tunnel boring machines

Case Study:
Herrenknecht AG

The Herrenknecht AG is the world wide market leader for the production of tunnel boring systems.

Company and Business Model

The Herrenknecht AG is an international operating company for the production of tunnel boring machines (TBM). The business model is to develop and manufacture tunnel boring machines according to specific project requirements.

After a tunnelling project is finished, the machine typically did not reached its technical life time. Therefore, Herrenknecht conducts a machine analysis, rebuys the complete TBM or the reusable components and takes them back to the Herrenknecht Rebuilt Services in Kehl (Germany). The fact, that all tunnel boring machines are custom made for the individual geological requirements and generally designed for several project life cycles, makes the buyback economically and the reuse reduce the consumption of resources.

Products

The products in the remanufacturing process are originally produced by Herrenknecht. Due to individual project requirements such as the tunnel diameter, most of the machine components are individual designed. For bought-in components like hydraulic pumps or electronic motors, Herrenknecht reduces the number of variants.

Remanufacturing Process

In this case, the remanufacturing process differ from other industries caused by the extraordinary product size and the business model.

After the delivery of the TBM or reusable components to Kehl, the identification, disassembly, initial analysis on component level and the preservation for storage starts. Then they are stored at the open storage area or weather protected in the warehouse.

If a customer wants to buy a new tunnel boring machine, Herrenknecht starts a calculation in order to define the selling price. In this way, they try to integrate reman components from the current stock in the new TBM to reduce the offered price to the customer. They start to analyze which of the available components match to the TBM technical specifications and requirements and could be remanufactured for the offered tunnel boring machine.

After the customer releases the order, the designing of the TBM including the integration of the reman parts starts. Here, they define the remanufacturing orders for the workshop and suppliers. If the remanufacturing process with its further disassembling, cleaning, remanufacturing, sandblasting, painting and reassembling with new spare parts is finished, the components are delivered to the Herrenknecht headquarter in Schwanau in Germany. At these location, the company starts with the final workshop assembly, testing and certification of the TBM. Caused by the different types and sizes of the components, the remanufacturing process has different loops of cleaning, disassembling and product analyzing steps.

Unique Characteristic

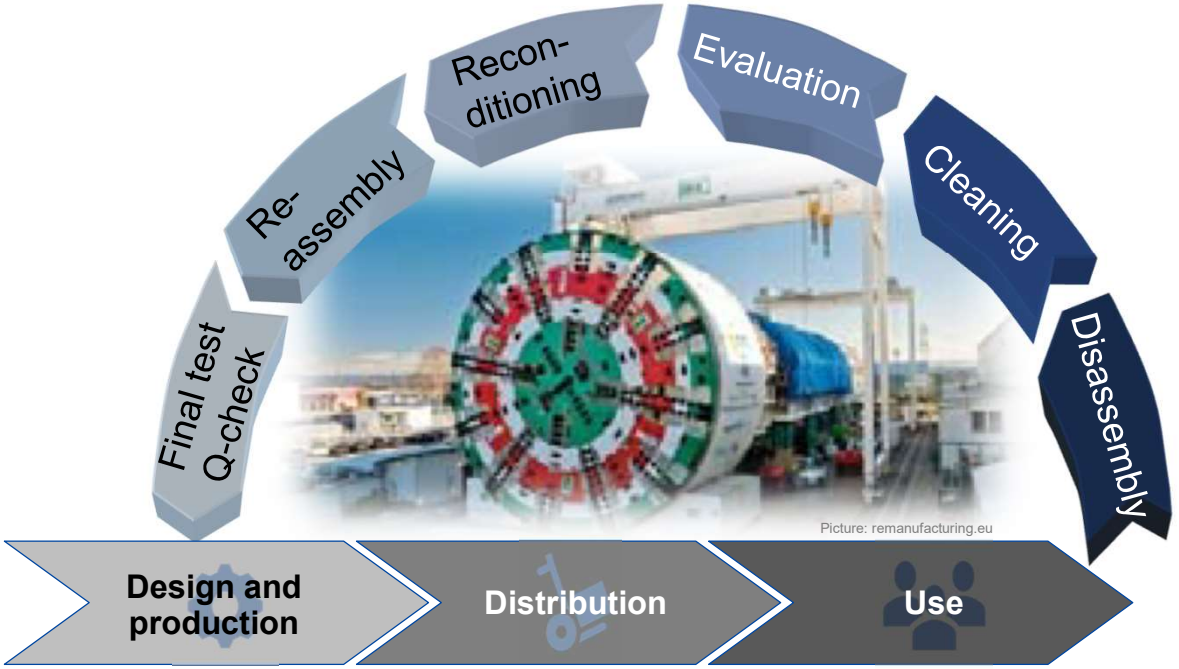
The unique characteristic for Herrenknecht is the opportunity to design for reman because they use predominantly the similar key components for drilling machines.

Contact Herrenknecht AG

Contact Fraunhofer

Picture: remanufacturing.eu

More remanufacturing case studies: remanufacturing.eu



Picture: remanufacturing.eu

- Tunnel boring machines produced by Herrenknecht AG
- Design for Remanufacturing

References: https://allaround.herrenknecht.com/en/issue-6.html (2022-05-25); https://www.remanufacturing.eu/studies/c23028c4f9471ce7175c.pdf (2022-05-25)

Motives and Barriers

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Top 3 Motives:

- Company profitability
- Environment responsibility
- Strategic advantage

Top 3 Barriers:

- Customer recognition
- Volume/availability (cores)
- Quality of feedstock

Reference: Parker D.; Riley, K.; Robinson, S.; Symington, H.; Tewson, J.; Jansson, K.; Ramkumar, S.; Peck, D.; Remanufacturing Market Study, 2015.

Barriers and Perspectives

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Customers need to be aware of

- *the environmental benefits*
- *the quality of remanufactured products*

Picture: Eguren J. A., Oechsle, O., Justel D., Grosse Erdmann J., Larrinaga G., Elgorriaga A., Guidelines for Excellence in Remanufacturing: Case Study of Industrial Companies in Spain's Basque Region, 2021;

Guide for excellence in remanufacturing

Goal: Enhancing efficiency in reman businesses and approve excellence of reman companies by third party audits

Conducted by: *iHobe, Mondragon University, Fraunhofer IPA*

Validated at: *Basque Reman-SMEs*

(Machinery and automotive sector)

Top 3 Barriers:

- Customer recognition
- Volume/availability (cores)
- Quality of feedstock

Significance

References: Eguren J. A., Oechsle, O., Justel D., Grosse Erdmann J., Larrinaga G., Elgorriaga A., Guidelines for Excellence in Remanufacturing: Case Study of Industrial Companies in Spain's Basque Region, 2021; Parker D.; Riley, K.; Robinson, S.; Symington, H.; Tewson, J.; Jansson, K.; Ramkumar, S.; Peck, D.; Remanufacturing Market Study, 2015.

Barriers and Perspectives

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Need for improved reverse logistics

Business model evaluation (combined with process evaluation)

Conducted by:

iHobe, Fraunhofer IPA

Conducted at:

Various companies in the Basque country (Sector: Machinery, Automotive, Rail, EEE)

Picture (and Logo): emicabombas.com

Logo: talleresaltube.com

Top 3 Barriers:

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Barriers and Perspectives

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Need for proper core quality

More remanufacturing case studies: remanufacturing.eu

Picture: remanufacturing.eu

Innovative sorting and inspection processes

Example: Knorr Bremse Commercial Vehicle Systems, Liberec (Czech Republic)

- Comprehensive sorting of incoming goods
- Grading according to different criteria (e.g. core class, quality)

…only proper cores are being remanufactured.

Top 3 Barriers:

- Customer recognition
- Volume/availability (cores)
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Significance

References: https://www.remanufacturing.eu/studies/89f63fb13fb7757579be.pdf (2022-05-25);
Parker D.; Riley, K.; Robinson, S.; Symington, H.; Tewson, J.; Jansson, K.; Ramkumar, S.; Peck, D.; Remanufacturing Market Study, 2015.

Thank you very much for your attention!

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