



A report by the partners of:



D6.3 Targeted Recommendations

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D6.3 Targeted Recommendations

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Glossary

B2B	Business-to-business
B2C	Business-to-consumer
CE	Circular Economy
CER	Conseil Européen de Remanufacture
CLEPA	Comité de Liaison de la Construction d'Equipements et de Pièces d'Automobiles (European Association of Automotive Suppliers)
CR	Contracted Remanufacturer
DoA	Description of Actions
DfRem	Design for Remanufacturing
EC	European Commission
EEE	Electrical and Electronic Equipment
ELV	End-of-Life Vehicles
ERN	European Remanufacturing Network
EoL	End of Life
HDOR	Heavy-Duty and Off-Road equipment
IR	Independent Remanufacturer
KPI	Key Performance Index
MS	Member State (of the European Union)
OEM	Original Equipment Manufacturer
OER	Original Equipment Remanufacturer
PSS	Product Service System
VDA	Verband Der Automobilindustrie E.V. (German Automobile Industry Association)
WEEE	Waste Electrical and Electronic Equipment
WP	Work Package

Contents amendment record

This report has been amended and issued as follows:

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1 Introduction

Remanufacturing is an important component of a resource efficient manufacturing industry. Remanufacture involves dismantling a product, restoring and replacing components and testing of the individual parts and whole product to ensure that it is within its original design specifications. The performance after remanufacture is expected to be the same as the original performance specification and the remanufactured product generally offers a warranty.

By keeping components and their embodied material in use longer, significant environmental benefits can be realised. Remanufacturing also provides opportunities to create highly skilled jobs and economic growth. Despite these accolades, remanufacturing is an undervalued part of the industrial landscape and an under-recognised industry.

To encourage more remanufacturing activities, the European Commission (EC) has funded a project to form, coordinate and support a European Remanufacturing Network (ERN). This Horizon 2020 project takes place over a period of two years, with the ambition to:

- encourage new businesses to take up remanufacturing
- help existing remanufacturers improve their operations
- improve competitiveness of remanufacturers domestically and internationally
- create greater awareness of remanufacturing to increase demand and address barriers.

1.1 Task 6.3: Recommendations

In ERN DoA (Description of Actions) the objective of Task 6.3 is described as:

“The aim of this task is to provide targeted recommendations to key actors, such as policy makers, product designers and remanufacturers. Specific activities within this task will involve:

- Consolidation of relevant information from the previous WPs and acquired market knowledge on remanufacturing. The identified gap and development needed will be translated into targeted recommendations and future action planning.
- The recommendations will address the different stakeholders individually. The time frame for implementing the recommendations will be taken into account in order to have a realistic action plan with the maximum impact by key actors such as EC, Governments, industries, policy makers, the research and academic community and society.
- Delivery of a European remanufacturing action plan. As a result, a remanufacturing development path towards large scale European uptake of remanufacturing will be developed.”

This report describes the methodology, information sources and the results of the recommendation definition.

1.2 Context of this work element

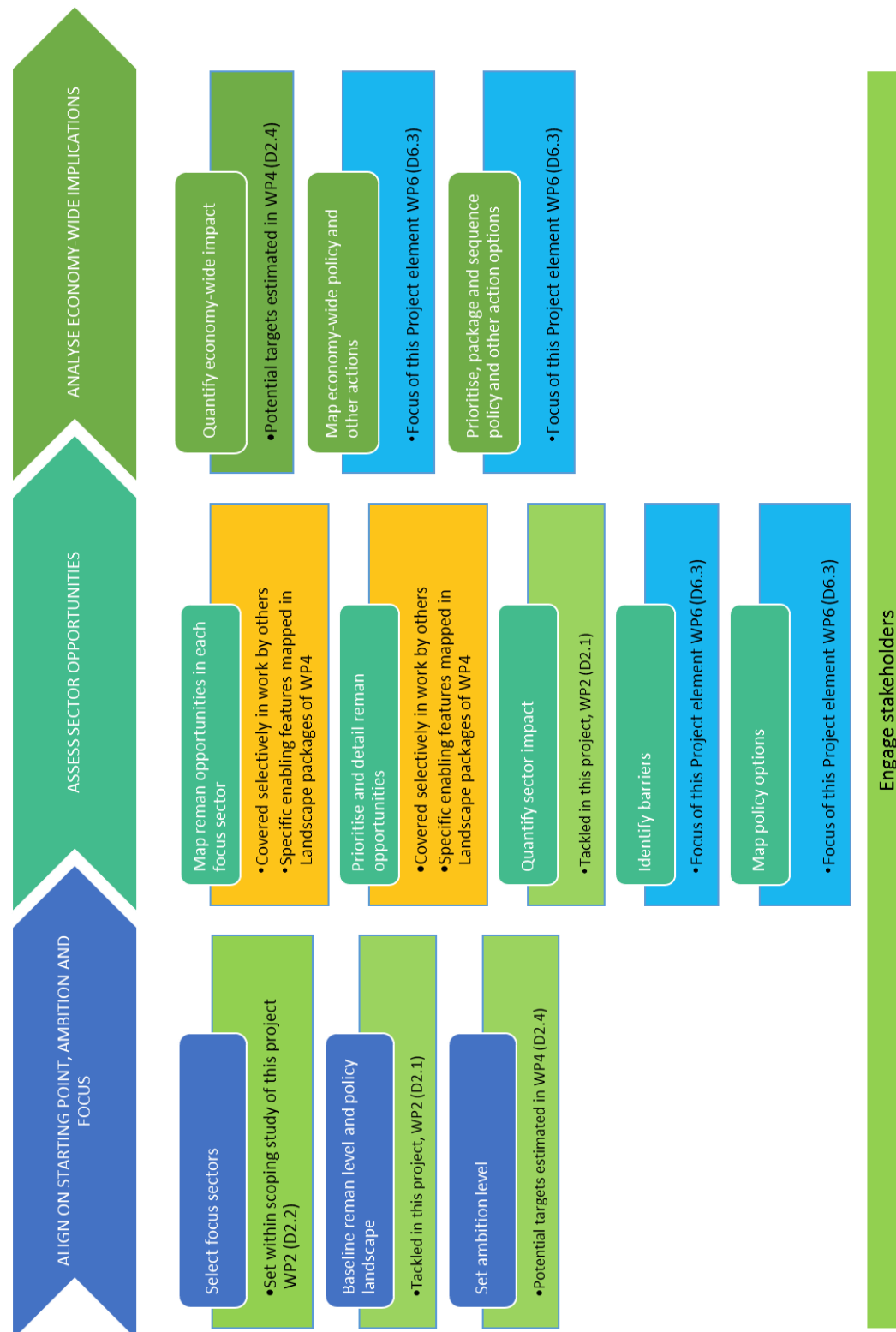
This work package represents a distinct element in the process of building a greater remanufacturing competence within Europe. It has been well described that remanufacturing can play a high value role in the realization of the Circular Economy ambition within Europe and, accordingly, we have adapted a framework created by the Ellen MacArthur Foundation [16] to illustrate this. Our purpose is to show both how this project has addressed the policy and action steps required to generate change; and to indicate the relationship to other work outside of this project.

In referencing the Foundation's diagram, we have adapted it to address the topic of remanufacturing as a specific instance of the Circular Economy. In most cases, this simply requires a replacement of terms but, in addition, the focus and order of process elements has been adjusted.

Figure 1 summarises relevant aspects covered in ERN work packages as well as references to outside activity.

Chapters 1 to 6 of this document describe the objectives, method and intermediate workings of the process to generate recommendations for action. Policies and actions themselves are described in Chapter 0 of this report. Chapter 8 goes on to place these within a broad action plan, presented in the form of a simplified roadmap. This roadmap orders the actions by actor within a timeframe, but also in relation to the nascent responsibilities of the Conseil Européen de Remanufacture (CER) (European Remanufacturing Council), one of the final outcomes of this project which seeks to harness commercial desire for progress on remanufacturing.

Figure 1: Remanufacturing policy and action framework mapped to the work of the current project and of others

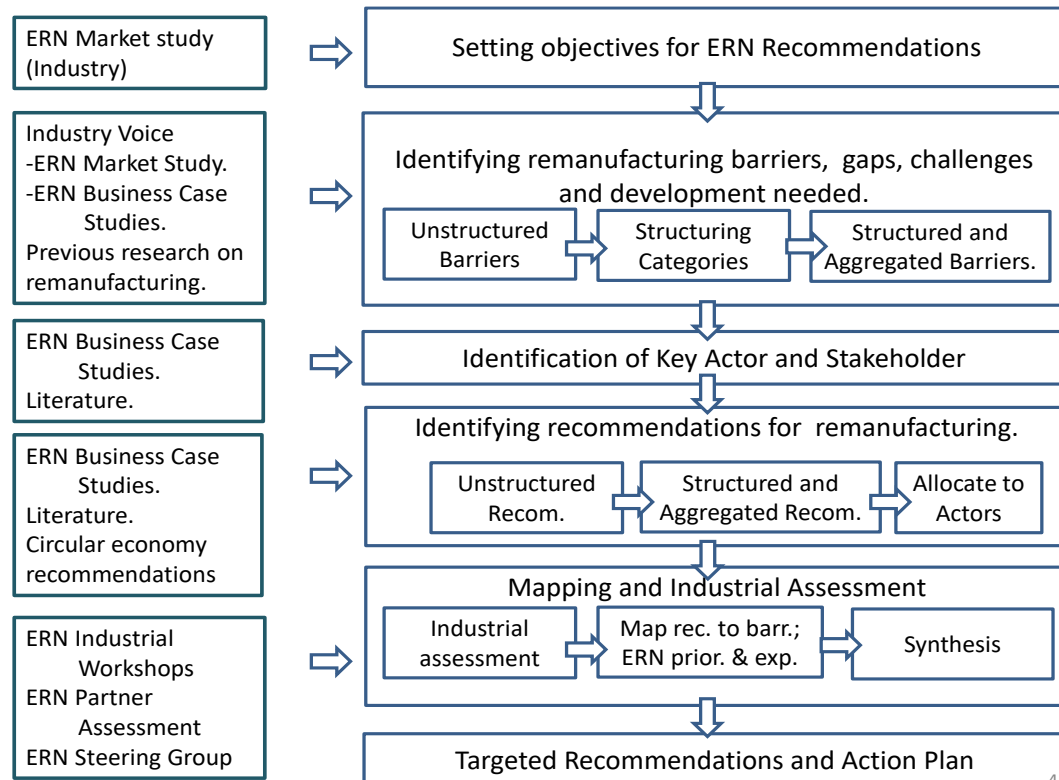


Note: Adapted from Ellen MacArthur Foundation [16]

2 Methodology

The methodology for the definition of the recommendations and the action plan is described in Figure 2 below. The main steps in the methodology are shown in the larger boxes on the right side, while the source of information is shown in the smaller boxes on the left.

Figure 2: Methodology for Recommendations and Action plan definition.



The methodology contains the following steps:

- Setting objectives for ERN recommendations:
 - The objectives are described in Section 2.1.
- Identifying remanufacturing barriers, gaps, challenges and development needed:
 - This step involves the collection of information from previous work in the ERN project, including industrial viewpoints, and from a number of other sources.
 - The information sources and information collation and structuring process are described in Chapter 3.
 - The aggregated and structured list of barriers for remanufacturing is included in Annexe A.
- Identification of key actors and stakeholders:
 - A list of key actors and stakeholders is provided in Chapter 4. The targeted recommendations address these actors and stakeholders.

- Identifying recommendations for remanufacturing:
 - This entails the collection of information from previous work in the ERN project and from a large number of other sources.
 - The information sources and information collection and structuring process are described in Chapter 5.
 - The same structuring schemes and categories as for barriers are also used for recommendations.
 - The aggregated and structured recommendations are allocated to key actors and stakeholders
 - The aggregated and structured list of recommendations for remanufacturing is included in Annexe B.
- Mapping and industrial assessment:
 - A workshop was arranged for identifying additional barriers and recommendations. Industrial assessment of the barriers and recommendations took place at the ERN Industrial workshop in September 2016, in Glasgow.
 - The ERN partners each selected 10 recommendations which they considered most important.
 - The recommendations were mapped to barriers. As a result, the recommendations having highest impact and the barriers having insufficient recommendations were identified.
 - The prioritization coming from different assessment sources were consolidated to identify the most important recommendations.
 - Where identified barriers could not be mapped to appropriate recommendations via previous steps, the ERN consortium was consulted to generate suggested recommendations.
 - ERN Steering Group discussion.
- Targeted recommendations and action plan
 - Development of a European remanufacturing action plan / development path targeted at different actors. Reporting in D6.3, this report.

In the methodology used, the **“The Voice of Industry”** is emphasised. In the process the results of the previous work packages (market study, processes, business models, design) as well as ERN industrial workshops are used. Additionally, literature regarding remanufacturing and the Circular Economy has been studied. The main sources are listed in the next chapters.

The industrial voice comes from more than 600 people through several channels including:

- The ERN Market Study is based on an industrial questionnaire with more than 200 industrial partners (see ERN Deliverable D2.2).
- The ERN Case Studies. More than 50 industrial companies were interviewed and visited by ERN Partners (see ERN Deliverable D3.1, D3.2 and D3.3).
- The six ERN Industrial Workshops in different countries attracted more than 300 participants (see ERN Deliverable D5.2).
- The interactive workshops on remanufacturing held at industrial fairs¹ in which in total approximately 100 people participated (see ERN Deliverable D5.3).

¹ The three interactive workshops were held at World Remanufacturing Summit in Amsterdam (2015), APRA European Remanufacturing Symposium in Birmingham (2016) and Automechanica in Frankfurt (2016).

The basis for the process is the objective and vision for remanufacturing in Europe which has been set up in the ERN market study.

The main idea in identifying recommendations is to study what are the current barriers and challenges for remanufacturing and to define the actions based on them:

How to overcome barriers and what actions are needed, by whom, to achieve this?

It is also important to understand that, in addition to companies active in remanufacturing, other organizations and actors can contribute to the success of remanufacturing. Thus, different stakeholders and key actors were identified.

The consolidation of barriers and recommendations from different sources resulted in two 'long lists'. To make the information more usable both long lists were analysed to structure them into three categories, following the ERN structures (business models, design, processes). Also, overlapping barriers and recommendations were aggregated, thus making it easier to assess them.

In each phase the results were given to the project consortium for comments, corrections and additions. The final industrial assessment was performed as part of the ERN industrial workshop in Glasgow in September 2016. In the workshop, the actions/recommendations were mapped to the barriers and the timeline and importance of the actions were assessed by the workshop participants. After the workshop the results from different workshop groups were consolidated.

2.1 Objectives and timeline

In the ERN Remanufacturing Future Market Report (Deliverable D2.4) the following scenarios for remanufacturing in Europe in 2030 were defined:

- **Base case:** Assumes approximate current growth rates through to 2030 for the remanufacturing intensive sectors discussed in the D2.4 report. An increased understanding of remanufacturing value both from manufacturers and from consumers supports continuing growth resisting some of the downward pressure exerted on the wider manufacturing industry in Europe. This does not incorporate any step-change in the remanufacturing industry; rather just positive organic growth for the industry.

The Base scenario would yield a production value of €46 billion, employing some 300,000 people and averting 11 million tonnes of carbon dioxide equivalent. This is a little over a 50% increase in remanufacturing from today's levels.



- **Stretch case:** A scenario in which the value of remanufacturing from the perspectives of creating high skill jobs and environmental benefits is well understood by policy makers, industry and consumers alike. Remanufacturing is thus incorporated as an important strategy within a wider circular economy plan for the EU. Appropriate policies and promotional activities to foster growth in the remanufacturing industry are adopted resulting in a higher intensity of remanufacturing as a proportion of manufacturing.

The Stretch scenario yields more than double today's levels with a value of €73 billion, employing 450,000 and averting 16 million tonnes of carbon dioxide equivalent.



- **Transformation case:** A scenario in which remanufacturing becomes a key strategic pillar for the EU, taking much of the investment and effort away from lower level waste hierarchy activities (Recycle, Recovery and Disposal) and focusing on remanufacturing and reuse activities. This would be done based on the belief that remanufacturing and reuse would create significant numbers of high skilled jobs, ability to avert waste to landfill and associated greenhouse gas emissions. The significant effort results in very significantly increased intensity of remanufacturing as a proportion of manufacturing by 2030.

In the Transformation scenario, by 2030 the value of European remanufacturing would be close to €100 billion employing over half a million people and averting some 21 million tonnes of carbon dioxide equivalent. In this scenario, there will be a change of paradigm for manufacturing systems:

- A distributed 'raw material' instead of a well identified provider.
- An unknown state of this raw material.
- A remanufacturing system that is really and able to manage the variety of the incoming cores and the variation of the flux.








The Base scenario is assessed to be achieved following the current development. Thus, the actions and recommendations defined in this document aim to exceed the Base scenario, up to the Stretch scenario or even the Transformation scenario. The period under review extends to 2030.

3 Identification of barriers

3.1 Information sources

The identification of barriers for remanufacturing started with the analysis of ERN project documentation. The following documents have been used as source of information:

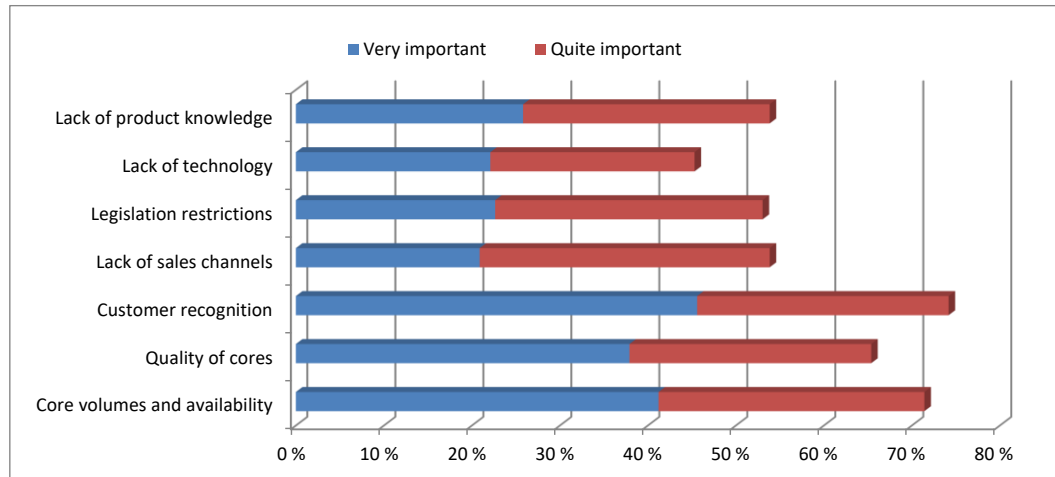
<ul style="list-style-type: none">• ERN Market Study including the ERN questionnaire	
<ul style="list-style-type: none">• D2.2 Market Study Report• D2.3 Advanced Material Report• D2.4 Future Market Report	
<ul style="list-style-type: none">• ERN Landscaping reports	
<ul style="list-style-type: none">• D3.1 Map of remanufacturing business model landscape• D3.2 Map of remanufacturing product design landscape• D3.4 Map of remanufacturing processes landscape	
<ul style="list-style-type: none">• ERN Industrial Use Cases	
<ul style="list-style-type: none">• D4.1 Remanufacturing Business Model Success Stories• D4.3 Remanufacturing Design Success Stories• D4.5 Remanufacturing Process Case Stories	
<ul style="list-style-type: none">• ERN Industrial workshops	
<ul style="list-style-type: none">• Remanufacturing challenges, obstacles and barriers have also been collected from the presentations and discussions in the industrial workshops conducted	
<ul style="list-style-type: none">• General Remanufacturing and Circular Economy Literature	

Remanufacturing literature is replete with descriptions of different types of remanufacturing challenges, obstacles and difficulties. However, in collating these it becomes apparent that there is a high degree of overlap in a substantial fraction of them. The sources [1] [2] [3] [4] listed in the References section have been used.

3.2 ERN market study: the ‘Industrial Voice’

The ERN Market Study included the question: “How important are the following barriers to remanufacturing to your company? (1=Not important, 4=Very important)”. Taking the top two highest ranked classifications (*Quite* and *Very Important*), Figure 3 shows the industrial view of importance of remanufacturing barriers as percentage of all responses.

Figure 3: Importance of Remanufacturing Barriers in ERN Market Study



3.3 Compiling a 'long list' of remanufacturing barriers

The sources of Section 3.1 yielded a list of almost 300 barriers, which is not feasible to use for targeted recommendations. Accordingly, the 'long list' needed restructuring to produce a shorter, more manageable list.

3.4 Structuring and aggregating the 'long list'

3.4.1 Structuring scheme

To structure the long list of barriers, the same three themes used throughout the ERN project were applied, namely Business Model, Design for Remanufacturing and Process. The three categories were further structured into subcategories:

- Business Model:
 - Need for capital investment
 - Definition of remanufacturing
 - Intellectual property and knowledge issues
 - Consumer awareness and perception, remanufacturing reputation
 - Institutional barriers
 - Liability, regulations, legislation, standards
 - Low cost competition
 - Reman costs
 - Market size, marketing, cannibalising primary markets.
- Design for Remanufacturing (DfRem):
 - Demand for remanufacturable products
 - OEM investment in remanufacturing
 - Knowledge of DfRem principles
 - Integration of End-of-Life learning into product design.
- Process:
 - Lack of control of core collection, Reverse logistics, Quality of cores
 - Availability of spare parts

- Increasing technological complexity, New technology and innovations, More electronics
- Skills, infrastructure, capacity
- Process efficiency and flexibility.

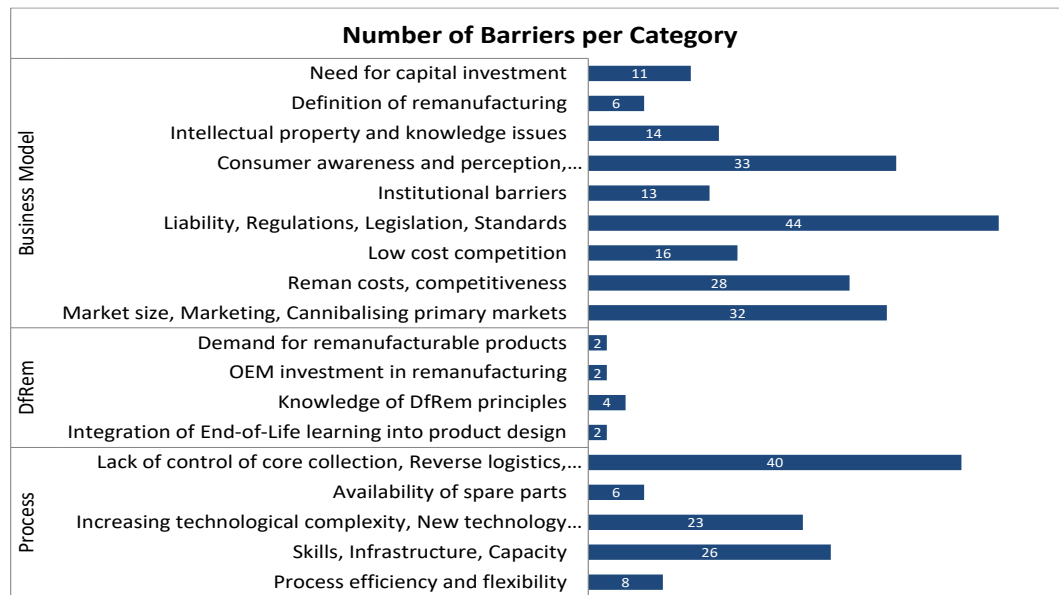
3.4.1.1 Organizing barriers to structures

Most of the barriers could be readily assigned to the appropriate subcategory. However, in some cases a barrier was assigned to two different subcategories. All the identified barriers were allocated to the main structures as follows:

1. Business Model: 197 barriers.
2. Design for Remanufacturing: 10 barriers.
3. Process: 103 barriers.

More details of the distribution of barriers can be seen in Figure 4 below. Note that the numbers do not directly express the importance of each barrier. Thus, for example, the lower number of barriers for Design for Remanufacturing (DfRem in the figure) arises mainly from novel elements of this subject. Companies might not understand the real need for DfRem since they already manage to remanufacture products. If manufacturers were asked the same question the responses might be different. One reason why more product types are not remanufactured is that their design does not facilitate remanufacturing [17]. In addition, the design problems are likely to be more severe for independent remanufacturers that do not have the full product knowledge and need to undertake reverse engineering to understand how to remanufacture the product effectively.

Figure 4: Number of barriers to remanufacturing per category (= Business Model, Design for Remanufacturing and Process)



3.4.1.2 Aggregation of barriers

After the barriers were put into their structuring categories, the number was reduced by removing overlaps, and merging and reformulating barriers with similar content. Some generalization was also made. By doing this, the reference to the original source was lost. The aggregation process generated a list of 74 remanufacturing barriers (Annexe A).

4 Actors

4.1 Identification of actors

As identified in literature, remanufacturing requires many different competences and capabilities. Thus, collaboration between different companies along the supply chain is typically needed to perform remanufacturing processes. There are different collaboration forms, depending on the remanufacturing “network manager” (OEM, contracted, independent), product type, location etc.

To make progress in remanufacturing, however, it is not only the companies already active in manufacturing and remanufacturing that are needed. The whole product lifecycle should be involved, thus taking the remanufacturing option into account in product design, sales and lifecycle services (including end of life). By doing so, information about the product being remanufactured can be shared instead of getting lost along the way and resurrected at the remanufacturing stage. See, for example, [19].

In many business fields the role and activity of customers is increasing and companies need to be more aware of customer needs and preferences. Perhaps remanufacturing could be increased through better customer awareness and participation?

Additionally, stakeholders not directly involved in the product lifecycle could contribute. The role of government regulation is often mentioned in Circular Economy literature, but also different types of support organizations (like industry associations, research & education), even different communities can influence the future development.

The four categories of Key Actors presented in the ERN DoA were selected and agreed on in the ERN consortium meeting. The following grouping were used: Business Enterprises and Industries, Policy Makers, the Research and Academic Community, and the General Public. The main categories of Key Actors were further structured into more detailed subcategories, as presented in Table 1 overleaf.

Table 1: Key actors in remanufacturing



Remanufacturing Key Actors	
Business enterprises and industries	
	Original Equipment Manufacturer (OEM)
	Original Equipment Remanufacturer (OER)
	Contracted remanufacturers (CR)
	Independent remanufacturers (IR)
	Reman specific service providers; cleaners, disassemblers, testers etc.
	Logistics providers; transport and storage
	Core dealers, brokers, collectors and sorters
	Maintenance partners
	Spare part providers
	Disassemblers and scrap collectors
	Reman products sales partners, marketplaces
	Recycling companies
	Finance
	Software developers
Policy makers	
	European Commission
	Governments
	Authorities
	Standardisation bodies
	Conseil Européen de Remanufacture (CER)
	Industrial associations
	Lobbying organizations
	Consultants
The research and academic community	
	Research Centres
	Research funding organizations
	Universities and Polytechnics
	Private education and training
	Colleagues? within European Remanufacturing Network (ERN) project?
General public	
	General public
	Media
	Other

5 Identified recommendations

For the first identification of recommendations for remanufacturing, a process analogous to that in the identification of barriers was used.

5.1 Information sources

The following documents have been used as sources of information:

ERN Landscape reports	
<ul style="list-style-type: none">• D3.1 Map of remanufacturing business model landscape• D3.2 Map of remanufacturing product design landscape• D3.4 Map of remanufacturing processes landscape	
General Remanufacturing and Circular Economy Literature	

There is also a wealth of literature on different recommendations for Remanufacturing, Circular Economy and Critical Materials. The sources [1] ... [16] listed in the References section have been used.

5.2 Identifying unstructured remanufacturing recommendations

Analysing the above listed information sources resulted in a list of 120 recommendations. As with barriers, the information had to be structured and reduced to a more manageable list.

5.3 Structuring and aggregating the ‘long list’

The same structure as for barriers was used; namely, the ERN categories Business Model, Design for Remanufacturing and Process. In addition to the ERN three main structures, a fourth category “Other” was added for recommendations that are more general or do not otherwise fit within the ERN categories. The “Others” have the following subcategories:

- Critical materials.
- Circular Economy.
- Communication, collaboration.
- Other Recommendations.

The same methodology and tools as used for barriers were also used to structure the recommendations. In some cases, the text describing and motivating the recommendation was quite long. A laborious task was undertaken to remove overlapping recommendations and to aggregate and merge them into a more manageable list. During the aggregation process each recommendation was also mapped to one or several actors. The list of key actors given in Chapter 4 was used.

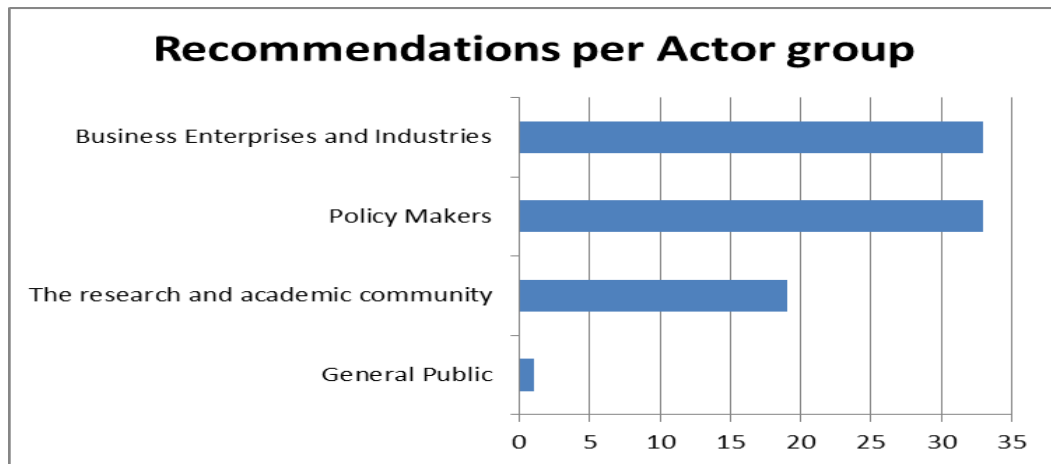
After the aggregation process a structured list of 67 recommendations for remanufacturing was reached. The list is included in Annexe B.

5.4 Analysis of recommendations

5.4.1 Recommendations assigned to actors

After the aggregation, as described above, the recommendations were assigned to one or more actors (or group of actors, as described in Table 2). The following graph in Figure 5 shows the distribution of recommendations per actor.

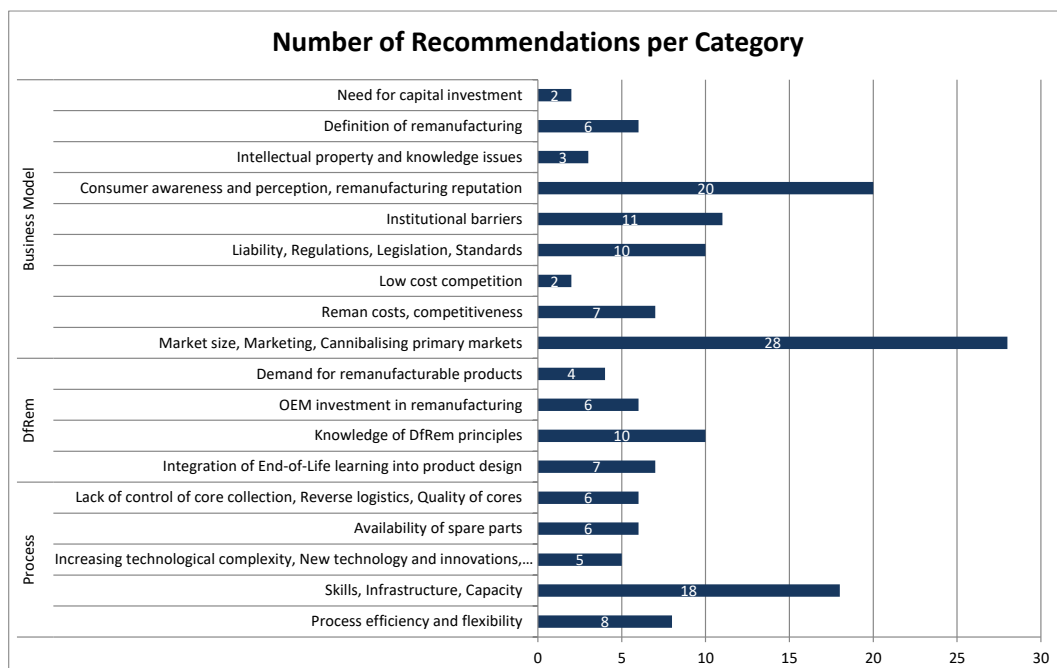
Figure 5: Number of recommendations for remanufacturing per group of actors



5.4.2 Organizing the aggregated recommendations

A MS Excel tool was used to analyse how the aggregated recommendations fall into the chosen structure. Details of the distribution of recommendations can be seen in Figure 6 below. As for remanufacturing barriers, the absolute number of recommendations does not directly indicate the importance of each aggregated recommendation.

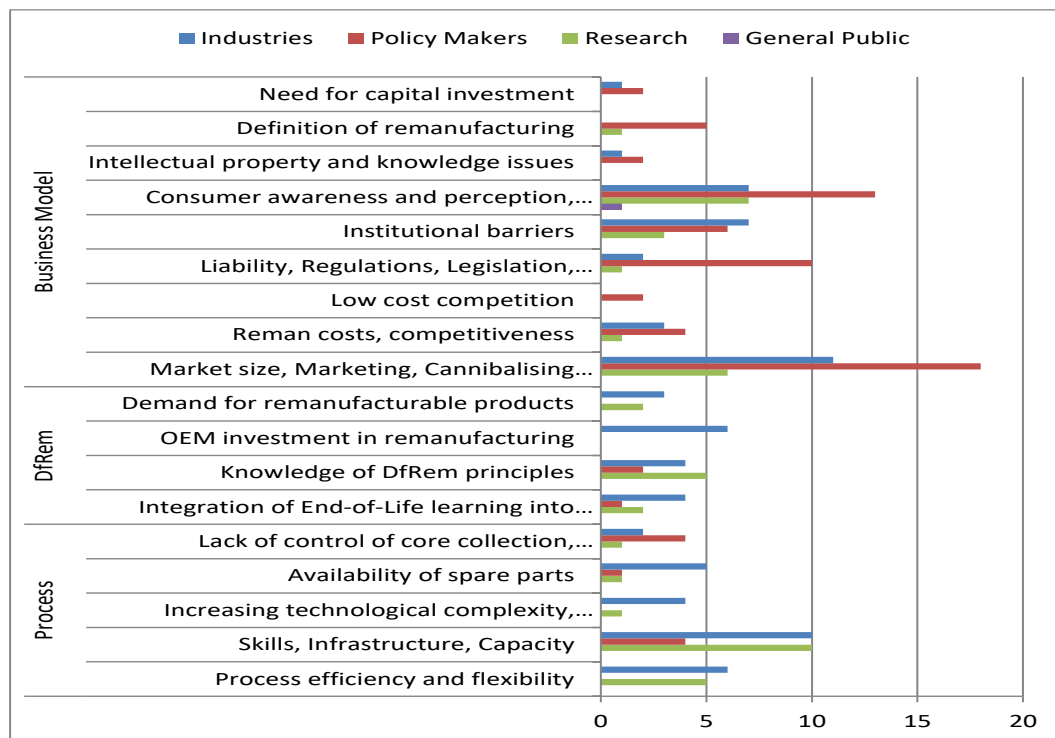
Figure 6 Number of recommendations for remanufacturing per category (= Business Model, Design for Remanufacturing and Process)



5.4.3 Analysing aggregated recommendations and actors

Further analysis was conducted to check whether a specific group of actors can be seen as responsible for certain categories of recommendations. Figure 7 shows the number of recommendations per actor and category (Business Model, DfRem and Process). From the graph it appears that *Business Enterprises and Industries* are seen as responsible for developing remanufacturing processes, while *Policy Makers* are seen as responsible for developing the business opportunities for remanufacturing. However, the distinction is not very clear.

Figure 7 Number of recommendations per actor group and category



6 Mapping and industrial assessment of recommendations

Three different methods for selecting the most important recommendations have been used:

1. Desktop analysis - combining and cross checking recommendations and barriers.
2. Industrial assessment done in the Strathclyde ERN and Automechanika workshops in Glasgow and Frankfurt, respectively.
3. ERN consortium partners' opinions and ratings of the most important recommendations. The ERN consortium partners also contributed with their knowledge for additional recommendations for barriers with missing recommendations.

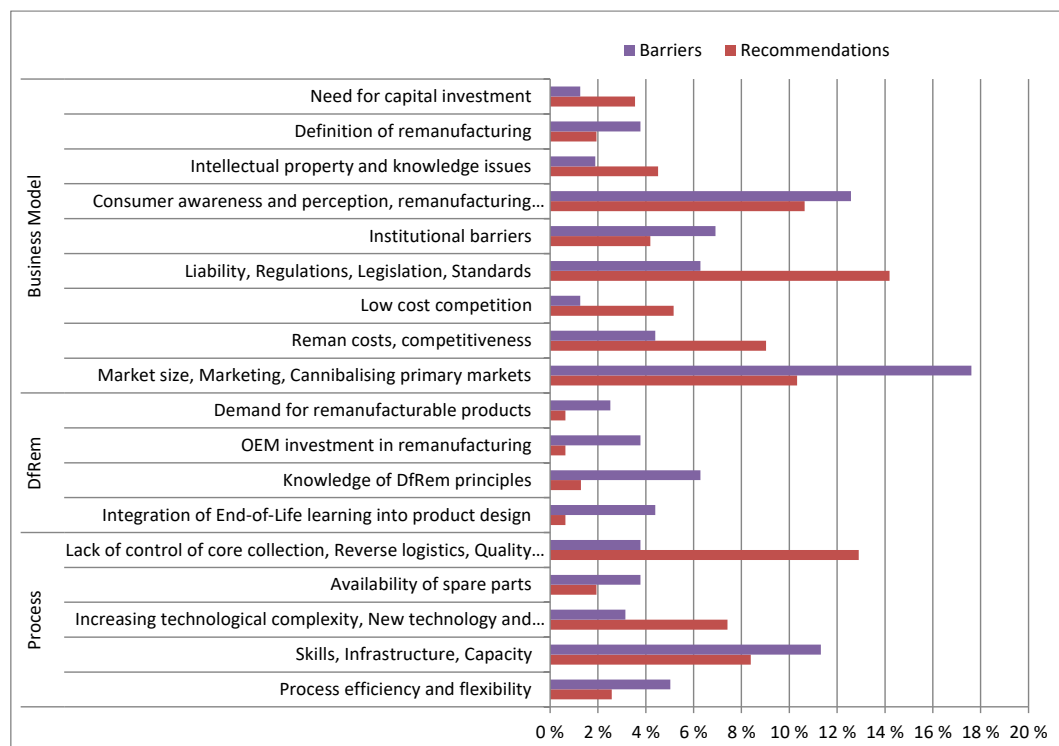
Finally the three approaches are combined to identify the main targeted recommendations.

6.1 Desktop analysis

6.1.1 Correlation between number of barriers and number of recommendations

The results from Figure 4 (number of barriers per ERN grouping category) and Figure 7 (number of recommendations per ERN grouping category) were put into a single graph. To enable comparison of the results, the numbers were normalized using a % distribution. From the figure it can be concluded that there is a fairly good correlation between the two data sets. The areas perceived as problematic, with many barriers, also receive attention in the form of a large number of recommendations (Figure 8). The conclusion is that the structure of categories in the ERN grouping was well chosen.

Figure 8: Analysis of correlation between barriers and recommendations



6.1.2 Mapping recommendations to barriers

Mapping recommendations to barriers means identifying the link between the recommendations and the barriers: which barrier is removed with which recommendation / action? The analysis may give two kinds of useful information:

- Which recommendations / actions decrease or remove multiple barriers. These actions may have high impacts.
- Which barriers have no associated recommendation / action? What additional actions are needed / could help?

Even after the structuring and aggregation, the number of barriers (74) and recommendations (67) is quite high to compare each individual recommendation to each barrier. Thus first the idea was to perform the mapping within the broad ERN categories (Business model, DfRem or Process); thus, for example, the recommendations / actions related to business models were compared with the barriers related to business models.

It soon became apparent that this kind of analysis does not – by itself – give the correct view on the impact of the actions on the barriers. Clearly some recommendations could affect different types of barriers. Thus it was decided not to restrict the desktop mapping to within the categories but to cross-check between the other categories. In this analysis all the structured recommendations were reviewed to identify the barriers they affect. In total, about 100 links were identified, of which about one quarter spanned ERN categories: for example, some recommendations relating to barriers associated with business models also influence barriers associated with processes.

Figure 9 shows the ‘top’ recommendations based on number of linked barriers; each of the recommendations listed helps to mitigate at least three different barriers.

Figure 9: List of recommendations influencing three or more barriers



6.1.3 Barriers which have no or few mitigating recommendations

Another objective was to identify barriers for which insufficient recommendations were given. The following three potentially missing subjects were identified: these are addressed by new recommendations coming from the ERN Partners in Section 6.4 below.

1. Tensions and insufficient collaboration between OEMs and third party remanufacturers.

Related barriers include challenges in OEM attitude against third parties, IPR issues and patents, lack of product knowledge and technical documentation (not available to third parties), OEMs preventing remanufacturing, lack of information feedback from third parties to OEM, third parties having lack of spare.

To overcome this barrier, the following action for Business Enterprises and Industries is required:

Collaborate in design, manufacturing and remanufacturing to create sustainable solutions.

This is considered as to some degree too generic. However, for policy makers (e.g. writers of EU Directives) this might be a spur to strengthen EPR-type EU Directives that motivate companies to collaborate within the value chains.

2. Safety and security in remanufacturing.

This topic has two dimensions:

- i. The safety of remanufactured products: in many industries (for example aerospace, rail, marine and medical), safety is very important and there are regulations on how to ensure it. Are companies and consumers ready to trust in remanufactured products?
- ii. Securing data: consumers and companies may doubt if their data is wiped properly when discarding their computers. This results in physical destruction of the device instead of refurbishing or remanufacturing.
(B5.2-3, B6.1-3)

The listed recommendations do not include any actions related to safety and security.

3. Remanufacturing resources.

There are barriers related to insufficient resources for remanufacturing. These include capital, capacity, knowledge & skills, reverse logistics etc.

To overcome this barrier, the following recommendation has been given:

For Educators and Researchers:

Improve cross-disciplinary teaching and education for remanufacturing.
and
Help business to incorporate remanufacturing.

and for Business Enterprises and Industries:

Stimulate investment in remanufacturing industry by promotion to third party investors.

However, this is an action for remanufacturers themselves, thought it might be in concert with others through a sector level initiative. In the final recommendations, this has been given a lower priority because it is a diffuse action of lower impact than core recommendations.

6.2 Industrial recommendations assessment workshop

The Strathclyde ERN workshop on September 2016 was attended by about 25 representatives from Scottish industry and ERN partners and followed the agenda below. Groups of 4-5 participants in the workshop were asked to review the identified barriers and recommendations.

- Short introduction (objectives of workshop, identified barriers, recommendations to tackle barriers, setting group working task).
- Group Working 1 – Check barriers, identify additional barriers.
- Discussion on missing barriers.
- Group Working 2 – Mapping recommendations to barriers, identify additional recommendations, propose recommendations for barriers with missing recommendations.
- Discussion on recommendations and actors.
- Group Working 3 – Select recommendations with highest priority and timeframe.

Figure 10: Group working session at the ERN Strathclyde Industrial Workshop



The workshop formulated, in all, ten new recommendations. In addition, four working groups in the workshop indicated the five most important recommendations. Due to the limited time available, each working group focused on only one category (Business model, DfRem or Process). In fact, the working groups were not even able to review all recommendations within one category. Table 2 shows the selected recommendations.

Table 2: Recommendations selected and formulated from outcome of the workshop

Priority	Recommendation
Group 1	
1	Government regulations to level playing field with linear business - public procurement, fiscal incentives, trading standards
2	Certifications + standards to drive up consumer confidence + awareness
3	Increase demand market through public procurement regime + Reman market awareness
4	Invest in Reman without restrictions of state aid
5	Change from growth to sustainable development - RE for economy
Group 2	
1	Improve cross disciplinary teaching and education for remanufacturing
1	Established Remanufacturing Chairs and curricula.
1	Help businesses to incorporate remanufacturing
2	Improve and incentivise collecting used items
3	Provide remanufacturing services
4	Highlight key issues within the industry
5	Develop extended producer responsibility on purchased products
Group 3	
1	Tackle non-tariff trade
2	RTD New materials repair
3	Access to parts
4	Release know-how OEM to trusted 3rd Party
5	Propose new shared business models
Group 4	
1	Promote products suitable for remanufacturing
2	Develop DfRem guidelines
3	World-wide Reman standards
4	Investigation of Contract remanufacturers and DfRem
5	DfRem tool

The recommendations were later compared with the list of structured recommendations, a correspondence between most of which was found. Table 3 lists the corresponding recommendations.

Table 3: Corresponding recommendations from the Strathclyde Industrial Workshop

Recommendations	Descriptors
Group 1	
R4.2	Create a certified mark for remanufacturing
R4.5	Organize campaigns to increase purchasing and leasing of remanufactured products
R1.1	Increase investment and funding in remanufacturing industry
R22.2	Place more policy emphasis for reuse and remanufacture
Group 3	
R17.4	Improve cross disciplinary teaching and education for remanufacturing
R17.5	Established Remanufacturing Chairs and curricula
R17.3	Help businesses to incorporate remanufacturing
R14.5	Improve and incentivise collecting used items
R16.2	Provide remanufacturing services
R17.8	Highlight key issues within the industry
R14.2	Develop extended producer responsibility on purchased products
Group 3	
R14.3	Increase international access to used products
R19.3	Research into advanced material repair technology
R15.1	Improve availability of spare parts
R22.1	Mobilise supply chain communication
R9.2	Benefit from the service-based businesses
Group 4	
R10.1	Promote products suitable for remanufacturing
R12.2	Develop DfRem guidelines
R19.4	World-wide Reman standards
R11.1	Investigation of Contract remanufacturers and DfRem
R13.2	DfRem tool

6.3 Industrial recommendations from the Automechanika workshop

During Automechanika in Frankfurt, on Friday 16 September 2016, the European Remanufacturing Network hosted a workshop on remanufacturing for the automotive sector. 15 participants with remanufacturing expertise discussed the big challenges ahead. They all agreed there is great potential for remanufacturing in the future of the industry.

Erik Sundin, Associate Professor at Linköping University, introduced the topic of remanufacturing and – based on Östlin *et al.* (2008) – the ‘win-win-win’ that a company can achieve in terms of profit, policy and the environment. In the discussion that followed, a number of barriers that prevent remanufacturing from taking place on a large scale were mentioned by the participants. These include:

- Traditional mind-set of OEMs.
- Benefits of remanufacturing are not understood and accepted.
- Remanufacturing companies are not visible.
- Market simply demands cheaper products and parts.
- Gaining access to cores is difficult.
- Trade barriers.
- Suppliers do not want to share information about their products, so remanufacturing companies need to perform more reverse engineering than necessary.

A more in-depth discussion, led by Ben Kubbinga from Circle Economy, focused on two key barriers that all participants face: 1) changing the traditional mind-set of OEMs, 2) gaining access to cores. A reference to 'similar' or 'related' recommendation(s) has been added in the form of (Rx.x) in the list below.

1. Traditional mind-set of OEMs

Key issues for remanufacturing:

- OEMs see remanufacturing as cannibalisation on their own business.
- OEMs do not want to compete with their customers (e.g. product retailers).
- Some OEMs refuse to provide repair services e.g. for automotive injection systems.
- Remanufacturing companies, mostly SMEs, do not have access to OEMs.
- Dealerships are not allowed to sell parts to others.

Solutions for remanufacturing companies:

- Increase awareness amongst OEMs about the benefits of remanufacturing, including:
 - getting more know-how about their own products (R4.8);
 - creating long-term relationship with customers (R4.1); and
 - adapting to changing ownership models (R4.5).
- Make remanufacturing attractive, follow Tesla's example of a production plant in Nevada (R4.1).
- Support small remanufacturing companies to get high-level access to OEMs (R11.1).
- Sell information that comes from remanufacturing process back to OEMs (R14.6).
- Suppliers need to introduce design for remanufacturing to OEMs (R12.3).

2. Limited access to cores

Key issues for remanufacturing:

- Not enough cores available to do proper research/reverse engineering.
- Lack of constant/stable flow of core.
- Surcharging consumers is not accepted on all parts, this also depends on surcharge amount.
- A lot of cores - i.e. capital - need to be stored in warehouses.
- Hardware development goes too fast for materials to be modular.
- Issue for independent remanufacturer when ownership models change.
- Quality of cores varies per country.
- Trade barriers: duties and laws prohibiting import of cores.
- Core "disappears" to other countries where there is less regulation.
- Low cost/unskilled labour countries preferentially repair, often leaving core unsuitable for remanufacture.
- Some companies do not impose a surcharge, so creates a disadvantage for those who do.

Solutions for remanufacturing companies:

- Set up a marketplace for core suppliers and buyers (R14.1).
- Make use of 'infill' i.e. new parts to make business run (R??).
- Ensure you are added as an official OEM supplier (R14.5).

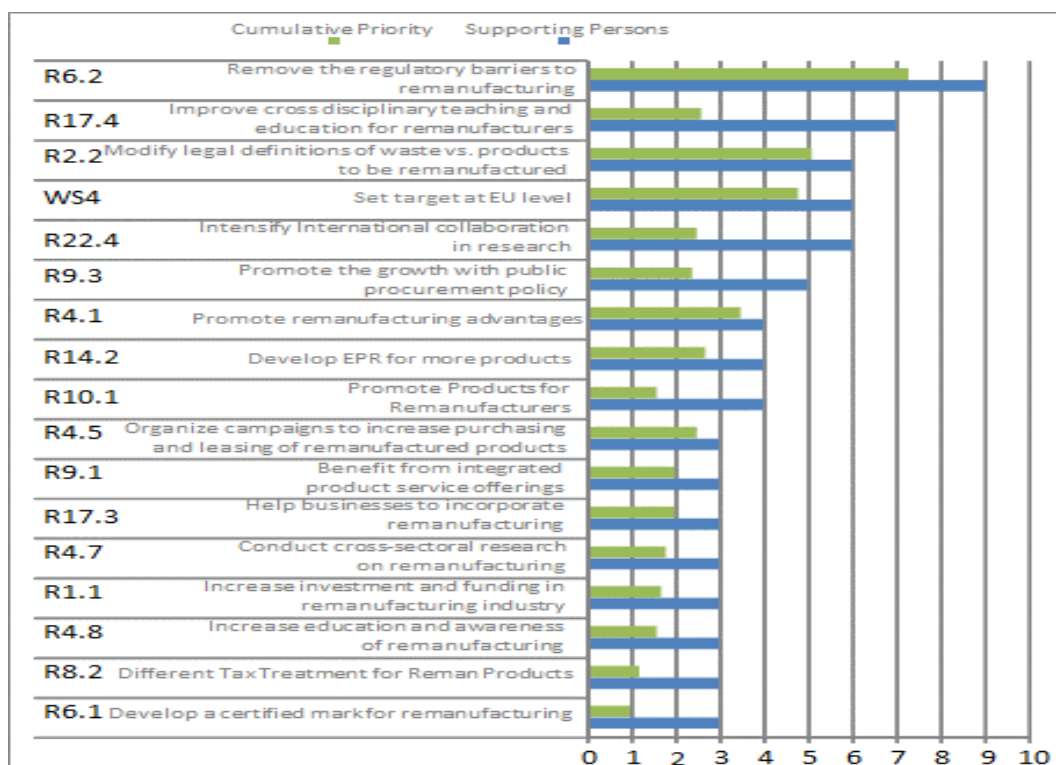
- Introduce surplus charges. Offer a discount on new products when customer hands in the old product, instead of imposing a surcharge. This is valid for instance in South Africa, where surcharge has a negative perception (R14.5).
- Introduce a tax reduction on remanufactured products (like the upcoming repair law in Sweden) (R8.2).
- Introduce laws that make return of cores mandatory (R14.2).
- Become a Tier 1 supplier or work in close cooperation with manufacturer to become part of the supply chain (R14.5).
- Independently create new parts for remanufacturing, that you can even sell to competitors (R10.1).
- Increase awareness: organisations like CLEPA and VDA are lobbying for remanufacturing to become more recognized (R4.8).

6.4 ERN partners' view on recommendations

6.4.1 ERN partners selection of main recommendations to mitigate barriers for remanufacturing

The new recommendations uncovered at the industrial workshop were added to the structured list of recommendations. All ERN partners were then asked to highlight their own (at most) 10 key, ranked recommendations to address barriers to remanufacturing in Europe. Figure 11 shows the recommendations receiving the most attention (i.e. at least three persons have selected the recommendation). The graph also shows the cumulative priority presented as the sum of the priorities given by partners. The recommendation placed as 'top' by a partner got 10 'points', the next 9 'points' etc. In the Figure 11, 'Cumulative Priority' represents the points added together and divided by 10.

Figure 11: Recommendations selected by ERN partners



The graph indicates a fairly good correspondence between the number of supporting persons and cumulative priority.

6.4.2 ERN partners additional recommendations for barriers with missing recommendations

Section 6.1 above identifies barriers linked with missing or few recommendations. To tackle these barriers, the ERN partners were asked to give additional recommendations. The following views and recommendations were given to the following issues:

6.4.2.1 *Tensions and insufficient collaboration between OEMs and third party remanufacturers*

The subject was seen as complex and important.

The recommendation identified for Business Enterprises and Industries to increase *Collaborate in design, manufacturing and remanufacturing to create sustainable solutions* was considered as not specific enough. Tension arises where third parties recognise that the OEM is missing an opportunity to collect, process and resell its own product and the third party then grows sufficiently to be noticed by the OEM. Is there a public interest to intervene in this conflict? The partners say there is, because of the resource efficiency advantages arising from remanufacturing. The OEM may object on the grounds that it needs to protect its brand, IP etc. so addressing “industry” with a recommendation imploring that “they” collaborate does not seem helpful. As a minimum the partners want “industry” to at least consider the question of whether to take back any of their products. If they decide there is no value in doing so, then at least they have asked themselves the question. Perhaps the recommendation is aimed at those that operate a formal quality management system such as ISO 9001 – in which case a recommendation might read *“For organisations that supply products and that use formal management systems – consider once every three years the possible commercial benefits in take-back of products”*.

Another, to some degree controversial, way to address the issue is to create a managed website on which third parties can identify the OEMs and specific products that are made difficult or impossible to remanufacture. This act of naming (and shaming) brands and OEMs in a public forum – using the detailed knowledge of third parties – may give a sense of empowerment to the independent third parties, embarrass some OEMs and lead to a better dialogue. Managing the public forum would be difficult but not impossible.

For Policy Makers the ERN consortium partners recommended to extend existing policy tools to encourage cooperation between producers and remanufacturers and stop producers incorporating specific design features or manufacturing processes that prevent products from being reused – c.f. Article 4 of the WEEE Directive. Moreover, Policy Makers can affect legislation and taxes to facilitate better collaboration, e.g. lower taxes for sending cores and remanufactured products over country borders. In addition, the ELV Directive demands that OEMs must report what materials are used in products. This could be a way to force the different actors within the product value chain to collaborate through the EU Directives. However, it is preferable that the companies collaborate without pressure from the EU but do so spontaneously to make the product value chain including remanufacturing more material- and information-efficient.

It was also proposed to take collaboration into account in the funding of remanufacturing to encourage OEM and third party remanufacturing to work together in designing and manufacturing product.

For the Research and Academic Community, the ERN consortium partners recommended the development of new or revised business models to collaborate with each other in way that could mutually benefit both producers and remanufacturers. Research throughout the product value chain is also needed to avoid sub-optimization. Networking events which are organized by academic institutions should be financially supported by policy makers and/or industry associations.

The General Public could increase purchases of remanufactured products, which leads to more activities within the industry sector and therefore also pushes OEMs to work together with remanufacturing experts.

6.4.2.2 *Safety & security in remanufacturing*

The trust of consumers in remanufactured products was seen as being of vital importance.

To address this issue, the partners recommended that remanufacturing processes should be certified to guarantee the safety of remanufactured products and the security of data, as it is done for new products. In the Business Model Landscape report (D3.1), computer remanufacturer Inrego exemplifies a problem related to **security**. Inrego provides a certified data removal process to assure its customer that their data will not get into the wrong hands. These issues are likely to become even more prominent as device connectivity ('Internet of Things') and 'smartness' increase. Regarding **safety**, issues of concern related to remanufactured components delivered to clients in the aviation, marine and high speed rail have been well addressed. Establishing credible standards, regulations and certified processes that tackle safety and security assurance across all sectors will be key elements underpinning growing the remanufacturing sector from its established base in the B2B sector to the B2C sector.

As a new approach, the 'Open book policy' was proposed. Companies should give details, with track record (e.g. testing data sheet of the remanufactured product etc.), of how they remanufacture products. The aim is to gain the confidence of consumers/end-users to encourage them to buy remanufactured products.

6.4.2.3 *Remanufacturing resources*

For Researchers and Academics, the recommendations to *Improve cross-disciplinary teaching and education for remanufacturing* and to *Help business to incorporate remanufacturing* were considered to be sufficient with the addition of more research on how to remanufacture new products.

For Industry the partners recommended to conduct more research on how to remanufacture new products and to allocate more time to investigate how to remanufacture new products (e.g. through reverse engineering) and possibilities to collaborate within the product value chain. A new European Remanufacturing Centre of Excellence could support this.

6.5 Synthesis and commentary

As mentioned in the beginning of this chapter, three different approaches for selecting the most prevalent recommendations were used:

1. Desktop analysis. Combining and cross checking recommendations and barriers.
2. Industrial assessment done in the ERN Glasgow and Automechanika Frankfurt workshops
3. A collection of ERN consortium partners' opinions and ratings of the most important recommendations and recommendations for barriers with missing recommendations.

These views were put into a common table (Table 4). Column A shows the results from the desktop analysis, i.e. recommendations influencing at least three barriers. Column B contains recommendations selected by the working groups in the two industrial workshops, and column C contains recommendations selected and rated by at least three persons from the ERN partners.

Table 4: Recommendations getting most support by three approaches

		A	B	C
	Remanufacturing Recommendations	Cross checking recommendations and barriers	Two Industrial Workshops	ERN Consortium partners' rating
Id	Short name			
R1.1	Increase investment and funding in remanufacturing industry	x	x	x
R4.1	Promote remanufacturing advantages	x	x	x
R9.1	Benefit from integrated product service offerings	x	x	x
R10.1	Promote products suitable for remanufacturing	x	x	x
R17.4	Improve cross disciplinary teaching and education for	x	x	x
R4.2	Create a certified mark for remanufacturing	x	x	
R22.1	Mobilise supply chain communication	x	x	
R22.2	Place more policy emphasis for reuse and remanufacture	x	x	
R22.4	Intensify International collaboration in research	x		x
R4.5	Organize campaigns to increase purchasing and leasing of		x	x
R4.8	Increase education and awareness of remanufacturing		x	x
R14.2	Develop extended producer responsibility for returning products		x	x
R17.3	Help businesses to incorporate remanufacturing		x	x
R8.1	Create sustainable solutions in co-operation	x		
WS10	Develop Eco-Design directives for Remanufacturing	x		
WS16	Engineering manuals platform	x		
R17.2	Disseminate and share best practice and skills for	x		
R11.1	Integration of Contract remanufacturers in DfRem		x	
R12.1	Publish DfREM success stories		x	
R12.2	Develop DfRem guidelines		x	
R12.3	Improve DfRem knowledge		x	
R13.2	DfRem tool		x	
R14.1	Develop online platforms for core exchange		x	
R14.3	Increase international access to used products		x	
R14.5	Improve and incentivise collecting used items		x	
R14.6	Establish a forum to share best practice		x	
R15.1	Improve availability of spare parts for independent		x	
R16.2	Provide remanufacturing services		x	
R17.5	Research into advanced materials repair technology		x	
R17.6	Highlight key issues within the industry		x	
R19.3	Research into advanced material repair technology		x	
R19.4	World-wide reman standards		x	
R2.2	Modify legal definitions of waste vs. products to be			x
R4.7	Make a cross-sectoral research about remanufacturing			x
WS4	Set target at EU level.			x
R6.1	Develop a certified mark for remanufacturing			x
R6.2	Remove the regulatory barriers to remanufacturing			x
R8.2	Differentiate the taxes for remanufacturers			x
R9.3	Promote the growth with public procurement policy			x

From the table we can draw the following observations:

- Five recommendations were supported by all the three approaches: Investment, Promoting remanufacturing advantages, Using integrated service offerings, Improving cross-disciplinary education and Promoting products suitable for remanufacturing.
- Eight recommendations were supported by two approaches: Creating a certification mark, Mobilising supply chain communications, Raising the policy profile of remanufacturing, Boosting international research and education, Promoting leasing as an enabler, Developing EPR and Directly assisting businesses to incorporate remanufacturing.

However, it should be noted that these represent a mixture of issues, actions and potential desired outcomes. The challenge is to unpick these into underlying issues which can then be attributed with specific actions and – importantly – sponsors who will take up these actions, believing them to be both practical and valuable. That is the subject of the next section.

7 Targeted recommendations

The previous chapters have described the process of discovering and clustering the main issues, concerns, desired outcomes and potential actions apparent to remanufacturers, academics and other stakeholders. The challenge of this chapter is to unpick the essential aspect of those issues and to propose exemplifying actions that might be taken to address them. Such actions must be well specified in their content, who they are aimed at and who carries them out. In addition, it should be clear about how rapidly they might be implemented.

This project and the proceeding analysis has tried to be as inclusive as possible of the views of different practitioners in different sectors. It is important to recognise that – because of the availability of representatives – not all such views have necessarily been accommodated; and, even where they are, there will be notable differences in preference between remanufacturers and OEMs and so on. In addition, the eventual end markets for remanufactured goods – be they business, public sector or consumers – also operate with different mind-sets, openness to the possibilities of remanufacture and are more or less well-functioning in the economic sense. Recommendations may therefore not apply equally across all products and markets. As a consequence, we have attempted to distil from the candidate ‘issues’ those which can have a broad applicability, and caveat where the approach may have an impact limited to specific circumstances.

Taking these factors into account, further refinement of the candidate recommendations has been necessary. A supplementary test which accounts for practicality and sensitivity to the political appetite for intervention is also required to avoid accusations of being idealistic or generalistic. The recommendations presented below represent this combination of practicality, impact and potential attribution to specific actors who will own and execute them (by which categorisation they are presented). This test has been applied by consultation also with the project’s Steering Group.

The key recommendations derived do not include ones for companies and businesses, except under ‘multiple actors’. This is because we believe that company actions will arise largely as a response to the correct legal and policy framework and with sufficient knowledge to make decisions, hence the recommendations’ focus on these areas. In response, companies and the wider supply chain may take further actions to promote their cause, but probably on a case-by-case basis. These further supporting ‘actions’ are presented in Annexe C. In addition, some of these actions do not – at this stage – have a clear sponsor or require several collaborators.

The recommendations are assigned a rough timescale which recognises the complexity of their implementation. In the main, this is because such actions require varying degrees of dialogue, regionally or globally, of a more or less contentious nature. However, in some areas – such as the development of remanufacturing standards – there has been extensive pre-work, so an acceleration might be expected. For the purposes of this work, the following rough timescale classification is applied:

- Immediate Within 2 years
- Short 2 to 5 years
- Medium 5 to 10 years
- Long 10 years or more

Note that the creation of the European Remanufacturing Council (CER) as a catalytic forum has not been included as it is already underway as a part of the current project. It is implicit that the CER will take a role in providing a voice and a platform for engaging underlying and

supporting information in pursuit of the cause of remanufacturing under a number of the recommendations.

7.1 Recommendations for policymakers

7.1.1 Set ambition, targets and measurement systems for effective reman CE policy

Issue	Remanufacturing is not a targeted element of the Circular Economy within the EU.
Diagnosis	Although the role of remanufacturing as a contributor to Circular Economy development across the EU has been quantified, it is not embedded meaningfully within either the existing waste and resource policy frameworks, or accounted for explicitly within economic and material accountancy systems. This means that targets, actions and progress towards the targets cannot be meaningfully tracked, thus hampering meaningful debate on the issue. Actions to tackle both these aspects are required.
Action POL1	<p>Set an escalating target for remanufacturing activity at EU level.</p> <p>Current activities level of remanufacturing are presently around 2.5% of manufacturing, but could be much higher. It is known that remanufacturing-based service models can provide material and energy impacts far in excess of recycling, for example, yet recycling has received extensive promotion at policy level to drive to somewhat arbitrary targets in excess of 50%, with little or no critical examination of their true benefits compare to alternatives. Even a modest remanufacturing target would have a net resource impact comparable to recycling and offer inherently much higher value returns even on a €/kg recovery basis.</p> <p>The target will draw focus to remanufacturing as an enabler of circular economy modes of operation and contribute to decisions supporting remanufacturing.</p>
Target	MS/EU Level policy and governance.
Timescale	Short-medium term.
Action POL2	<p>Collect structured economic data on European remanufacturing.</p> <p>It is axiomatic that what is not measured cannot be controlled. Remanufacturing is not identified explicitly as a sub-category of industrial activity within any Standard Industry Classification scheme. Introducing such as classification and gathering statistics would provide more direct information about the levels of activity and impact of actions that have been taken. Remanufacturing statistics can also enable a clearer picture of the business trends and help identify emerging remanufacturing areas.</p>
Target	MS/EU Level policy and governance.
Timescale	Medium-long term.

7.1.2 Ensure a consistent EU fiscal and regulatory regime is in place

Issue	Remanufactured products and processes do not enjoy the same financial incentives
Diagnosis	Relatively high European cost levels can create problems of staying competitive against imports. A challenge for remanufacturing is that the manual work needed for remanufacturing (disassembly, cleaning, inspection, testing) and the reverse logistics can create high costs. Additionally, ambiguity over whether the activities undertaken during remanufacturing are considered 'waste processing' may affect remanufacturers. The requirement to control and process products that are legally considered waste adds additional administrative and compliance costs to a business.

Action POL3	<p>Create financial incentives which support remanufacturing.</p> <p>Options for financial incentives include: differentiating the taxes for remanufacturers, (e.g. VAT-free remanufacturing); extending government grants for energy efficiency to remanufactured products; and implementing selective landfill bans or waste charges to increase recycling and remanufacturing.</p> <p>It is possible that such financial measures are seen as arbitrary and presumptive in favouring one technique over another, and overly interventionist. It may be better to explore mechanisms that level the competitive environment by linking remanufacturing, reuse and recycling in a common and – preferably – internationally defensible framework. Examples of this could be those based on carbon impacts or savings which are outcome oriented, rather than process specific. The generation of circularity indicators may provide another route to rewarding such outcomes.</p>
Target	MS/EU Level policy and governance.
Timescale	Medium-long term.

Action POL4	<p>Clarify legal definitions of waste vs. products to be remanufactured.</p> <p>Develop guidance on the Legal Definition of Waste to distinguish a product that is due to be remanufactured as being exempt from those products considered as waste. This will ensure that they do not fall within the remit of waste regulations. In addition, ensure clarity that products undergoing third party remanufacture as not mis-represented as OEM products, as required in some MS.</p>
Target	MS/EU Level policy and governance.
Timescale	Medium term.

Action POL5	<p>Develop extended producer responsibility to strengthen take-back obligations for products.</p> <p>Strengthening take-back obligations would force manufacturers to consider more deeply what happens to products at end of life. A major issue is obtaining core hence, once having hold of it, manufacturers would then need to consider how best to extract value. This might feasibly lead to redesign for dismantling, for example; even if this did not lead to remanufacture, it would enable recycling. A 'sunset clause' should also be considered: beyond warranty or a certain age, products would be free for treatment (including remanufacture) by recognised third parties.</p>
Target	MS/EU/international Level policy and governance; manufacturers.
Timescale	Medium-long term.

7.1.3 Tackling international trade issues

Issue	Internationalisation of remanufacturing is being hampered by different national policies, tariff barriers, standards and definitions.
Diagnosis	<p>There are restrictions related to trans-border shipments of both remanufacturing used parts (core), which is often classified as waste; and remanufactured products themselves, and which may be affected by perceptions of still being waste or as being 'dumped'. These affect the transport of used parts and remanufactured products into or out of the country because of prohibitions or imposed levies. Such trade barriers limit the potential for remanufacturing being able to move goods across borders because supply and demand may not be in the same country.</p> <p>A suite of international actions is needed to address the issues of creating a level international playing field. Whilst the issue of remanufacturing definitions could be tackled within the EU, this is pointless if a further round of equivalent negotiations is then required to address the international dimension, which is arguably the more pressing issue.</p>

Action POL6	<p>Clarify and disseminate international definition on remanufacturing and related standards.</p> <p>Moves have been under way to produce definitions of remanufacturing and relate these to standards in various sectors. For example, the automotive sector has proposed a definition; and BS 8887 in the UK has tackled the issue. Activities are in progress via US channels to elevate this to an ISO level. Acknowledging activity is in progress, there is a clear need to ensure these diverse activities are aligned, particularly if an ISO standard is to be the outcome.</p>
Target	All practitioners and users.
Timescale	Medium-long term.

Action POL7	<p>Identify and remove the regulatory barriers to remanufacturing.</p> <p>Different regulatory barriers exist for different remanufacturing markets and products. A systematic analysis should be conducted to identify these barriers and explore mechanisms for removing them. A case in point is the inconsistency in national policy permitting the trans-border flow of core and remanufactured products.</p>
Target	MS/EU/international Level policy and governance; trade officials; remanufacturers and manufacturers; research community.
Timescale	Medium-long term.

7.1.4 Improving awareness of and confidence in remanufactured goods

Issue	Awareness of and confidence in remanufactured products amongst public and domestic purchasers is low.
Diagnosis	Although there is a certain recognition of remanufacturing and its benefits amongst corporate (B2B) purchasers, its extent is low and concentrated in certain sectors. The situation is worse amongst public and domestic purchasers. We suggest, therefore, improving 'market pull' by improving the environment for sale into – at least – these latter two purchasing groups. The suggested actions employ on the one hand, the institutional purchasing power of MS through Green Purchasing Policies; and on the other hand, confidence that marketed remanufactured goods have a particular provenance.

Action POL8	<p>Promote remanufacturing through public procurement policy.</p> <p>Increase public sector purchasing for remanufactured products by adopting procurement targets thus pulling through supply from the private sector. It is possible to formulate smart purchasing criteria based on overall life-cycle impact, for example, and the availability of end-of-life options from suppliers which provide a rational basis for comparison with new products.</p> <p>The awareness of the availability of remanufactured products is low amongst purchasers in the public sector. The public sector could save money through buying remanufactured products as well as achieving positive environmental impacts. A wide range of products could fall within immediate scope, including office products, furniture, and fleet maintenance activities.</p>
Target	Institutional (MS) purchasers.
Timescale	Short-medium.

Action POL9	<p>Create a certified mark for remanufacturing and clarify liabilities.</p> <p>Develop a certified mark for remanufacturing and remanufacturers to demonstrate that products have been tested and fully comply with those standards of a new product, and processes verified as fit for purpose. Ensure that the liability over procurement of remanufactured products is resolved to remove the risk of purchase.</p> <p>In an ideal world, remanufacturing would be an embedded and largely invisible activity acceptable to all parties, public, private or consumer. Under those circumstances, a standard would most likely not be necessary. Until that is the case, however, standards and certifications could selectively assist a number of product markets.²</p>
Target	Mainly domestic (retail) purchasers.
Timescale	Medium term.

² This action is unlikely to benefit B2B markets where transactions are conducted on large scales and backed by the reputation and guarantees of established and large corporations, often – but not exclusively – OEMs. However, in less developed consumer-facing remanufacturing markets, and where OEM activity is low, independent remanufacturers commonly attempt to fulfil a market demand. However, not being the OEM means that other guarantees of their capability are demanded. In such cases, a certification or standard would be beneficial.

7.2 Recommendations for educators and researchers

7.2.1 Future business leaders' skills agenda

Issue	Future business leaders, product designers and process operators are not well supplied by conventional training courses.
Diagnosis	Awareness of remanufacturing opportunity and practice is low in industry. A shortage of skills creates a significant barrier to expansion of remanufacturing since this means that potential business opportunities are not recognized, products are not designed to enable remanufacture, and remanufacturing processes are not optimized using structured techniques.
Action EDU1	Boost cross-disciplinary teaching and education in remanufacturing.
Target	Future business leaders, designers and practitioners.
Commentary	<p>Develop cross-disciplinary teaching support and educational materials for remanufacturing both from business viewpoint and technical viewpoint, including design for remanufacturing. A variety of media should be considered</p> <p>In addition, raise the profile of remanufacturing as a discipline by establishing chairs in remanufacturing and coherent teaching and research curricula.</p>
Timescale	Immediate. Not difficult.

7.2.2 Current (re)manufacturing base skills agenda

Issue	Existing remanufacturers and potential new ones lack capacity or knowledge to grow and adapt their business models and practices.
Diagnosis	<p>Demand for remanufacturing and refurbishment is growing, largely in B2B environments, but there is insufficient knowledge and capacity to keep up with demand.</p> <p>New opportunities have been identified – especially in product-services – but challenges are apparent in transforming conventional manufacturing businesses to support a new services model.</p>
Action EDU2	<p>Develop learning materials and tools to assist current, growing remanufacturers and those wishing to diversify into remanufacturing.</p> <p>Two dimensions to this action are apparent:</p> <ul style="list-style-type: none"> • Develop educational programmes and support media to help industries to adapt product-service offering as a business model. • For manufacturers wishing to diversify into remanufacturing, assistance is needed, in the form of diverse educational programmes and support networks, to help businesses change their business models to incorporate remanufacturing.
Target	Remanufacturers and manufacturers.
Timescale	Immediate. Not difficult.

7.2.3 Advancing remanufacturing state of the art

Issue	Lack of an international research agenda is hampering the spread and advancement of remanufacturing state of the art.
Diagnosis	<p>Remanufacturing has been under-recognised as a discipline of study within design, engineering and production fields, as well as within the business community even at a country and regional level. Sharing and exploitation of knowledge related to remanufacturing across borders is needed to stimulate new thinking, technical creativity and process improvements.</p> <p>Design for remanufacturing is necessary when considering new product development or improvement of existing products. Most of these design requirements are set and effected in response to marketing demands for product function. Whilst there is a significant body of work related to 'Design For X' tactics, a coherent framework for evaluating Design for Remanufacture decisions and their life-cycle impact does not exist, for example, choices of materials against design life.</p>

Action EDU3	<p>Increase research and international collaboration to promote remanufacturing.</p> <p>Develop links with other nations to facilitate collaboration and promotion of remanufacturing research. There is a fertile area of research in technologies that can support repair, remediation and other life extension techniques, and their implications for design (see below). In addition, the processes of closing loops effectively, both in the B2B domain but more pressingly in the B2C domain demands further attention. A particular requirement is processes and enabling technologies that can promote core return and assist users to make sensible end-of-life choices (see Action MUL1).</p> <p>Research activity should carry an embedded obligation to disseminate and share best practice and skills for remanufacturing. These initiatives can be delivered through cross-national research objectives, but could also suitably form the subject of framework research programmes under the EC, preferably with a strong industrial, end-user and piloting components.</p>
Target	Remanufacturers and technology providers.
Timescale	Immediate.

Action EDU4	<p>Develop an integrated set of design tools and evaluation techniques that can support business model, product and process design.</p> <p>The fundamental responses to the remanufacturability design challenge are well known. However, there are numerous design choices around the product related to lifetime, upgrades, service options, end-of-life options and, ultimately, how this is linked in a business model, which sit around the core product. Decision support tools are needed in order to integrate these decisions and monitor their material and energy impacts, and to investigate sensitivity to these parameters as well as what information needs to be carried with the product to enable good choices.</p> <p>The availability of these tools can be disseminated via project-related events, sector level events or by consultancies in the (re)manufacturing theme.</p>
Target	Remanufacturers.
Timescale	Medium.

7.3 Recommendations for multi-stakeholders

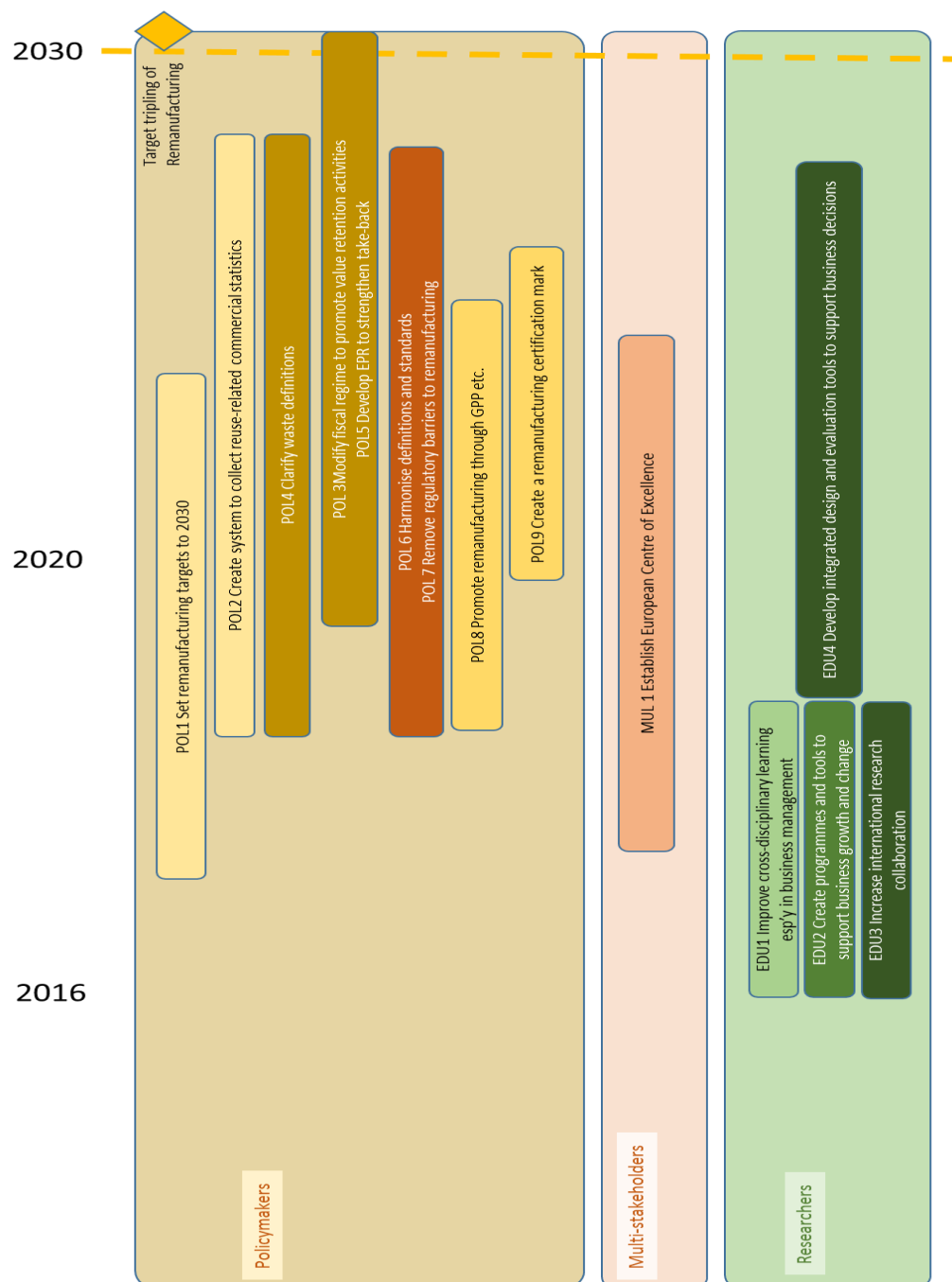
Issue	Provide a technology research platform capable of supporting sector level collaborative research.
Diagnosis	Remanufacturing issues are generally applicable to multiple companies, or are at a system level which requires a critical mass of action in order to gain traction.
Action MUL1	<p>Establish a European Remanufacturing Centre of Excellence.</p> <p>This action is an adjunct to actions identified elsewhere on the education and research agenda. It results in the formalisation of the remanufacturing discipline within a highly applied manufacturing context along the lines of the German Fraunhofer Institutes or the UK's Manufacturing Technology Centres. These centres may obtain a degree of public funding, but are expected to have a high industrial contribution. They will be able to address issues bespoke to a particular company, or to be used as a platform for multi-actor collaboration, perhaps accessing other research funding mechanisms. The advantage of this model is that it provides a degree of 'safe' (cross-)sector collaboration, but more importantly provides access to resources and the ability to tackle issues that could only be addressed by action of a critical mass of companies.</p>
Target	Re(manufacturers) and third party technology providers.
Timescale	Medium term.
Notes	This action is likely to be implemented at an MS level (in the EU), establishing local centres of excellence which can provide a focus for collaborative pan-EU research initiatives (such as through Eurostars), or at a broader, thematic level, H2020.

8 European remanufacturing action-plan

8.1 Introduction

The preceding chapter outlined the core recommended actions distilled from the current work. As previously stated, we have not referenced the European Remanufacturing Council (CER) overtly although its creation is a fundamental outcome of this project. The Council's proposed remit and work is described in Section 8.3. The next section takes the recommendations and creates from them a simplified roadmap to implementation.

8.2 Time line of actions



8.3 Conseil Européen de Remanufacture (CER)

The Council has a distinct remit or value proposition. Its objectives are distinctly focussed at active companies who can articulate issues for their own companies, sectors and the wider policy and legal framework in Europe. These companies wish to progress the agenda with a tight focus on the commercial and environmental benefits that might be enjoyed. Elements of that agenda are expected to align closely with the proposed recommendations but may be directed at particular sector contexts and draw on the support of the ERN partners in addressing new research topics for a remanufacturing evidence base.

8.3.1 Value proposition for CER

The value proposition for the Council is an important tool for setting out the vision and ambition of the organisation:

The aim of the Council

The aim of the Council is to raise policy maker awareness and understanding of:

- the *characteristics* of the European remanufacturing sector,
- the *issues* it currently faces,
- and, its *potential* as an important component of the Circular Economy.

The outputs from the CER will support the lobbying activities of trade associations and remanufacturers, and influence policy through evidence-based research, representing remanufacturers from all sectors.

The role of the Council

The CER will be based in Brussels, and will promote European remanufacturing around the world. It will research and publish papers on remanufacturing topics, to be disseminated to relevant policy makers, such as:

- international organisations (UNEP, Basel Convention Secretariat, OECD, WTO),
- supranational organisations (EU),
- and, within the national and regional administrations of strategic nations (EU-28 countries, US, Canada, Mexico, China, Japan, South Korea, Brazil, South Africa).

The CER will be represented at relevant events by the secretariat provider (Oakdene Hollins), where they will present the evidence-based research and position of CER members (see Work Plan for more details).

The value of the Council

Awareness of remanufacturing remains low amongst global policy makers - membership of the CER will allow companies with an interest in remanufacturing to improve policy maker awareness, and to effect long-term policy change on remanufacturing issues. Participation in research activities may increase the profile of CER members through featured quotations or case studies. CER members will also benefit from networking with other members, discussing shared challenges and opportunities, and from gaining access to the European Remanufacturing Research Network (ER2N) expert group.

"The Commission welcomes the work being done on a Remanufacturing Council. There is a clear need to reap the potential of remanufacturing in support of the circular economy."

Kestutis Sadauskas, Director, DG ENV, European Commission

The work of the Council

Research and drafting of papers will be led by Oakdene Hollins, in close co-operation with members. Workshops may be arranged for members of the CER to input directly into the

research topics, so that all papers best reflect the reality on the ground for remanufacturers. The remanufacturing topics investigated will be agreed upon by CER members.

The ambition of the Council

Our ambition is that the CER will become an internationally recognised resource for policy makers seeking out information and ideas about remanufacturing. The CER will also foster links between the Remanufacturing Industries Council in America and the National Key Lab for Remanufacturing in China to facilitate the transfer of global remanufacturing knowledge.

Annual Membership Fees

Applicable from February 2017 onwards:

Invited Trade Associations	Micro	Small	Medium	Large
Free	€500	€1,000	€2,500	€6,000

8.3.2 Preliminary work programme

The work programme for the Council will be agreed by the members at the first General Assembly of the Council. A draft of the preliminary work programme that will form the basis of the discussion at this meeting is included below.



CONSEIL EUROPÉEN DE REMANUFACTURE

Preliminary work programme

This document contains the preliminary work programme for the Conseil Européen de Remanufacture (CER). The work programme may evolve based upon input from the founding members prior to its launch in January 2017.

Launch event

PURPOSE

A launch event is a key milestone for the Council and will mark the official start of the Council's activities. The European focus of the Council makes a launch in Brussels an appropriate venue to raise the profile of the Council to the appropriate audience. Membership fees will not be due until the 1st February 2017. Organisations joining the Council prior to its launch in January will receive free membership, during which time the cost of the Council's preliminary activities will be covered by the European Remanufacturing Network Horizon2020 project.

DESCRIPTION

A launch event will take place in Brussels to mark the beginning of the Council's operations. The launch event will take place in January 2017. The launch event may involve:

- A networking event for members to get to know each other
- Presentations from invited speakers, including academic partners from the European Remanufacturing Network (ERN)
- A review of the preliminary work programme and selection of research themes for Year 1
- Review of existing membership and identification of target members
- Review of Terms of Reference
- Scheduling of the first General Assembly

PURPOSE

The main role of the Council will be to raise policy maker awareness and understanding of the European remanufacturing sector. This will include disseminating information on: the characteristics of the sector, such as the size of the industry, the types of actors involved in remanufacturing activities and the business models employed; the challenges faced by remanufacturers and suggestions for mitigating these issues for the benefit of remanufacturers from all sectors; and, the potential social, economic and environmental benefits of increased remanufacturing as part of the transition to the Circular Economy, with a focus on the role that remanufacturing can play in job creation, raising industrial productivity, and increasing company profitability.

DESCRIPTION

Long term and emerging issues that are important to remanufacturers will be explored through compilation and publication of position and policy papers.

PRODUCTION OF POSITION PAPERS

Research topics investigated by the Council will be approved by the General Assembly. Evidence will be collected from literature, the ERN expert group and CER members to produce evidence-based research targeted at informing policy makers. Examples of topics that may be investigated include:

- Job creation potential of remanufacturing, per sector (e.g. automotive, aviation, rail, machinery, electronics, etc.).
- How remanufacturing can help improve industrial productivity, per sector (e.g. automotive, aviation, rail, machinery, electronics, etc.).
- EU and Member State legislative barriers to, and drivers of, remanufacturing – an overview.
- EU and Member State policy drivers and barriers to remanufacturing – an overview.
- Public funding for research, development and implementation projects of relevance to remanufacturing – an overview.

SPOTLIGHT ON INTELLECTUAL PROPERTY

This activity will highlight the intellectual property (IP) issues relating to remanufacturing that need to be resolved to remove barriers to remanufacturing growth, e.g. remanufactured items containing the patented components and brand names of OEMs that have been remanufactured by a third party. These will be highlighted in relation to existing and proposed legislation and initiatives, such as the

WEEE Directive, the Circular Economy Action Plan and Green Public Procurement policy at Member State and EU-level.

PRIORITY REMANUFACTURING RESEARCH TASKS

This activity will involve co-ordination with the European Remanufacturing Network (ERN) to identify priority research tasks that would help facilitate remanufacturing in Europe. These tasks would be approved by the CER to disseminate to relevant policy makers with the ambition to inform the construction of more relevant research calls in programmes such as Horizon2020. The CER would also be able to co-ordinate with the ERN to identify potential partners, case studies, data sources etc. to improve the effectiveness of research projects involving ERN members.

HIGH-LEVEL REMANUFACTURING TARGET

This activity will publish and promote a new high-level target of 5% of all EU manufacturing for the proportion of remanufacturing in the EU economy. It is currently estimated to be less than 2% of all EU manufacturing. The CER will identify relevant legislation and initiatives where a target could be incorporated, such as the WEEE directive, the Circular Economy Action Plan and Green Public Procurement policy at Member State and EU-level. The CER will seek to provide evidence to demonstrate the benefits of such a target on the environment, economy and jobs, and evidence of the feasibility of achieving such a target.

PROCUREMENT OF REMANUFACTURED PRODUCTS

This activity will promote EU and Member State public procurement of remanufactured products, through Green Public Procurement policy and any other relevant procurement channels (mainly at the Member State level). The explicit inclusion of remanufacturing in procurement specifications is an important driver for promoting remanufacturing.

PRIORITY REMANUFACTURED PRODUCTS

This activity will publish a list of product categories for which remanufacturing has the greatest potential. This list will be derived through consultation with CER members and the ERN. The CER will identify potential actions to promote remanufacturing of these priority products and opportunities to remove barriers.

PRODUCTION OF POLICY PAPERS

The CER will respond to current events and policy announcements through the publication of policy papers, highlighting the (potential) impacts of these announcements on remanufacturers across all sectors, either positively or negatively.

Raising remanufacturing profile in Europe

PURPOSE

The ambition of the Council is to become an internationally recognized resource for policy makers seeking out information about and insights into remanufacturing. Whilst the focus of the Council will be European, the Council will maintain a global outlook and will cultivate global links befitting of a global practice.

DESCRIPTION

The findings of research conducted to produce the thematic position papers and topical policy papers will be circulated and presented to increase awareness and promote the position of remanufacturers.

DISSEMINATION OF POSITION AND POLICY PAPERS

Written outputs from the work of the Council will be disseminated to relevant policy makers and organisations in Europe and around the world. These policy makers may include: international organisations (UNEP, Basel Convention Secretariat, OECD, WTO); supranational organisations (EU); and the national and regional administrations of strategic nations (EU-28 countries, US, Canada, Mexico, China, Japan, South Korea, Brazil, South Africa).

Dissemination will be targeted using an approach agreed by the General Assembly, e.g.

- UNEP – providing evidence to the UNEP Resource Efficiency Programme on the environmental benefits of remanufacturing and its contribution to the Circular Economy.
- Basel Convention Secretariat – providing evidence on barriers and enablers for remanufacturing related to the movement of core and remanufactured products across transnational boundaries.
- OECD – providing evidence on the benefits of, barriers and enablers for remanufacturing to inform OECD outputs, such as the 2016 Policy Guidance on Resource Efficiency.
- EU – provide information on the role of remanufacturing standards and identify policy instruments (e.g. Ecodesign criteria) that could encourage remanufacturing.

PRESENT RESEARCH AND CER MEMBER POSITION AT EVENTS

The CER Secretariat and/or CER President/Vice-President will present the outputs of evidence-based research and represent the position of the CER members at relevant events to increase the visibility of remanufacturing amongst policy makers.

Examples of the types of events the CER would attend in 2017 include:

- EC-IRP Workshop on Product Lifetime Extension as a contribution to the G7 Alliance on Resource Efficiency (February 2017, Brussels)
- Annual Conference of the European Innovation Partnership on Raw Materials (December 2017, Brussels)
- Horizon 2020 Brokerage Days (Date: TBC, Brussels)
- Presentation to the European Parliament's Environment Committee (ENVI) on Remanufacturing (Date: TBC, Brussels)
- Presentation to the European Parliament's Industry and Research Committee (ITRE) on Remanufacturing (Date: TBC, Brussels)
- Presentation to the German Bundestag's Industry Committee on Remanufacturing (Date TBC, Berlin)
- Presentation to the French Assemblée Nationale's Industry Committee on Remanufacturing (Date: TBC, Berlin)

Facilitating remanufacturing knowledge transfer

In addition to the activities described above, the Council will seek to undertake the following activities:

FOSTER GLOBAL REMANUFACTURING LINKS

The CER will seek to foster and develop links between the CER and relevant remanufacturing organisations around the world, such as the Remanufacturing Industries Council (US) and the National Key Lab for Remanufacturing (China). These links will be beneficial for CER members in identifying potential partners and opportunities with remanufacturers outside of Europe, as well as providing an opportunity for knowledge transfer between these international remanufacturing organisations.

ACCESS TO MEMBERS-ONLY INFORMATION ON COUNCIL WEBSITE

Members will be granted access to a secure section of the Council website (www.remancouncil.eu), which will contain timely, accessible information (e.g. legal advice, best practice, case studies) relating to the work of the Council, its members and the remanufacturing sector.

FACILITATING MEMBER DIALOGUE

CER members will benefit from the opportunity to network with remanufacturers from across Europe and across different remanufacturing sectors at events such as the General Assembly, topic workshops and briefing events. These events will provide opportunities to discuss shared challenges and opportunities, identify potential partners for collaborative projects and to gain access to members of the European academic research network – the team of academics and researchers who ran the European

Remanufacturing Network Horizon2020 project. During such members-only private networking events, particular importance will be placed by the CER on the avoidance of, or even the impression of, any anti-trust activities going on between remanufacturers. This will be essential to guarantee the CER's reputation as an independent promoter of remanufacturing, where members should feel comfortable engaging in private discussions regarding any sector, in a safe environment.

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Annexe A Structured and aggregated list of remanufacturing barriers.

Id	Remanufacturing Barriers
	Business Model
	Need for capital investment
B1.1	<p>Need for capital investment for setting up a remanufacturing business</p> <ul style="list-style-type: none"> - New facilities and technologies (large investments needed for e.g. Aerospace and Rail sectors) - Investment in R&D and labour skills - Storage capacity
B1.2	<p>Need for capital for operating a remanufacturing business and the ability to serve all customers needing specialist and rare components</p> <ul style="list-style-type: none"> - Storing a large variety and volumes of cores - Storing a large variety and volumes of remanufactured components. - Having a less stable turnover can introduce financial challenges
B1.3	Risk with potentially long payback period for investments
	Business Model
	Definition of remanufacturing
B2.1	Exposure of businesses to the global remanufacturing market is hampered by the persistent confusion of terminology. A clear and agreed definition of Remanufacturing is needed. The lack of a clear legal definition of remanufacturing hampers international trade of remanufactured goods.
B2.2	Currently the terminology used to describe remanufacturing is inconsistent across the sector and poorly understood by customers. It is not clear whether organisations reportedly undertaking 'remanufacturing' are performing true remanufacturing, or whether they are undertaking lesser, re-use activities.
B2.3	There is no clear guidance on the use of remanufactured components in new products or whether remanufactured products need to be declared as 'second-hand'.
B2.4	Definition of waste: Ambiguity over whether the activities undertaken during remanufacturing are considered 'waste processing' may affect remanufacturers. The requirement to control and process products that are legally considered waste adds additional administrative and compliance costs to a business.

	Business Model
	Intellectual property and knowledge issues
B3.1	Intellectual property issue around independent remanufacturers working on branded goods, i.e. where the brand is part of the IP of the OEM.
B3.2	Lack of product knowledge and access to data such as technical documentation. The knowledge necessary to remanufacture products effectively is not readily available to non-OEMs. For example, products and components are often difficult to disassemble, particularly where components are glued, riveted, or welded. Where the remanufacturer is not the OEM then lack of availability of technical details about design logic can obstruct efficient disassembly.
B3.3	OEMs wanting to make it harder for others to remanufacture their products. The intentional increase in complexity of products, in some cases, can potentially hinder independent remanufacturers. For example, OEMs can design their ink and toner cartridges to make them difficult to remanufacture by implanting microchips in their products to make them inoperable if 'tampered' with.
B3.4	Dealing with blocking patents. For this independent remanufacturer, the growing number of patents is an issue that makes its business activity increasingly complicated. Remanufacturers must be careful that their use of compatible components does not infringe any of the IP or patents of the OEM.
	Business Model
	Consumer awareness and perception, remanufacturing reputation
B4.1	Awareness of the availability of remanufactured products. Low awareness of remanufacturing amongst purchasers. Buyers of new products sometimes simply do not know the availability of remanufactured products.
B4.2	Negative perceptions of remanufactured products. Customers see remanufacture as second-hand, and therefore inferior or being of lower quality than new products. This perception is particularly problematic for branded manufacturers. Where a product both in function and appearance varies regularly, then the remanufactured product may be seen as outdated. Customers may also assume that the price of the product reflects its quality.
B4.3	Falsely branded remanufactured products malfunction. Competition from low-cost new and used parts: imports of low-cost new products, predominantly from the Far East, are a particular challenge. Companies offering repaired or reconditioned (i.e. not fully remanufactured) parts can offer lower price products which can compete against remanufactured products, but these used products might not perform as expected and may damage the reputation of remanufactured goods.

B4.4	Insurance firms may pay a reduced amount or refuse to pay out for used equipment over a certain age and/or remanufactured equipment - presumably based on the premise that the equipment is not as efficacious as new equipment.
	Business Model
	Institutional barriers
B5.1	Linear technologies are deeply rooted. Financial governance incentives support the linear economy. Remanufacturing may involve a change of culture and/or business model when moving from liner to circular business modes. This requires buy-in from senior managers who will be enacting change throughout the business and the support of shareholders.
B5.2	Some consumers are put off releasing their old computers to remanufacture due to concerns about the safety of their data. Without reliable and perhaps even certified data-wiping processes, users are not willing for their end-of-life products to be used as core for refurbishment and remanufacturing and instead mandate physical destruction of the device. The removal of information and data during the refurbishment process is critical.
B5.3	The safety is of high importance to the end-users. In the construction, industrial, agriculture, HDOR equipment and other industries, end-users face tight regulations in Europe with regard to workplace safety, with corresponding large penalties for employers for non-compliance. This safety-conscious mentality can dissuade potential purchasers from taking the perceived risk associated with remanufactured products.
B5.4	Companies requesting 'new' equipment: Companies' requirement for new equipment (either as an outright purchase or through a leasing system) limits the market for remanufactured products. It is often impractical for large organisations to source large volumes of heterogeneous (remanufactured) equipment.
	Business Model
	Liability, Regulations, Legislation, Standards
B6.1	Re-used components are not permitted in some industries. For example, in the food-related machinery sector, some components need to be food-grade, which may be difficult to achieve through remanufacturing.
B6.2	Continually evolving legislation and approval schemes need to be kept up with in aerospace, rail and marine industries. This requires companies to effectively anticipate legislation to ensure that its remanufactured goods remain compliant.
B6.3	Bureaucracy caused by maintaining documentation. The need to maintain documentation accompanying all equipment (e.g. certification) can lead to higher levels of bureaucracy. Detailed records and testing may be required to convince

	and reassure consumers of the safety of remanufactured, relative to new, equipment.
B6.4	<p>Ambiguity over whether the activities undertaken during remanufacturing are considered waste processing. For example, the requirement to control and process products that are legally considered waste adds additional administrative and compliance costs. There is a business risk where regulatory guidance is not provided.</p> <p>This may present legal issues for the sale of remanufactured products if new legislation has prohibited the sale of chemicals that were used in the original production process.</p>
B6.5	International laws and the Basel Convention proposal could have a significant impact on the amount of trans boarder shipments and impose a large barrier for remanufacturers. International trade barriers / import bans for recycled parts / restrictions on cross-border repatriation of used parts are all barriers. These restrict or prevent the transport of remanufactured products into or out of the country. There are trade barriers that limit the potential for remanufacturing being able to globally move goods because supply and demand may not be in the same country. Many countries outside the EU have either import restrictions for remanufactured products or export restrictions for core.
B6.6	Transboundary shipments of waste and the interpretation of extended producer responsibility (EPR) differ nation by nation.
B6.7	Competition legislation inhibits collaboration between companies (cartels)
B6.8	Legislation on energy efficiency of energy-consuming products. There may be uncertainty over whether legislation only applies to new products or to remanufactured products too.
	Business Model
	Low cost competition
B7.1	Availability of low cost products. Cheaper equivalent products, often produced by overseas OEMs, are cost competitive with remanufactured product.
B7.2	Cheaper copy versions of OEM products, possibly violating IPR issue. Some of these are remanufacturable and some are not. To remanufacture these would be illegal in some countries.
B7.3	Cloned products with inferior quality from the Far East. Remanufactured products also have to compete with the price of these cloned products in the market although the remanufactured products are of a higher quality due to strict remanufacturing and testing processes. Companies offering repaired or reconditioned (i.e. not fully remanufactured) parts can offer lower price products which can compete against remanufactured products, but these used products might not perform as expected and may damage the reputation of

	remanufactured goods. The market needs to understand the difference between the remanufactured products and cloned products in order to promote remanufacturing businesses.
	Business Model
	Remanufacturing costs
B8.1	Relatively high European cost levels can create problems of staying competitive against imports. A challenge for remanufacturing is that the manual work creates high costs which need to be balanced against the actual profit made on each product that enters the remanufacturing facility for being remanufactured, sold as is, and being scrapped for material recycling. There has been a shift in favour of remanufacturing due to economic pressures.
B8.2	Keeping a high enough number of returning cores. The transport of large or bulky items can be a significant cost which may prevent remanufacture of certain goods or prevent the remanufacture of goods in certain sparsely populated areas.
B8.3	The requirement to keep large inventories of remanufactured components to cover all the potential parts that may need replacing is a prohibitive issue.
B8.4	A large number of regulations and extensive testing requirements must be met before a remanufactured product can be sold. While these rules are clearly necessary for the safe operation of this equipment, they place an additional cost burden on potential and existing remanufacturers.
B8.5	The social enterprises that account for a large share of the collection and distribution of used goods historically received grants and funding from charitable donations and governments. Therefore, it makes little economic sense for commercial enterprises to try to compete in this sector where other players are effectively subsidised.
B8.6	There may be high costs associated with the inspection of used products.
	Business Model
	Market size, Marketing, Cannibalising primary markets
B9.1	Where products are complex and heterogeneous, the resulting remanufacturing markets may be small and there may be unstable demand.
B9.2	The sales channel for remanufactured products is often poorly structured and underdeveloped. There is a shortage of distributors for remanufactured products
B9.3	A lack of standards and certification mark makes marketing remanufactured products more challenging.

B9.4	Due to the economic recession, car scrappage schemes were introduced to encourage consumers to purchase new vehicles to generate growth in the sector, to the detriment of repair and remanufacturing.
B9.5	Remanufacturing may cannibalise the primary market, possibly reducing the higher profit margin obtained from new sales. Remanufacturing of equipment and materials can impact on first-time manufacturing jobs. Remanufacturing may therefore be discouraged and obfuscated by OEMs.
	Design for Remanufacturing (DfRem)
	Demand for remanufacturable products
B10.1	Remanufacturability is not often specified or prioritised by OEMs during the initial design phases.
	OEM investment in remanufacturing
B11.1	Limited attention to end-of-life phase in current product design. Remanufacturing can sometimes be inhibited by poor design, for example, related to ease of disassembly.
B11.2	Supporting documentation relating to product design and assembly that could facilitate remanufacturing is often not produced.
B11.3	Supporting documentation relating to product design and assembly that could facilitate remanufacturing is often not shared with independent remanufacturers.
	Knowledge of DfRem principles
B12.1	Little research on Design for Reman.
B12.2	Few standards for Design for Reman at national and EU level
	Integration of End-of-Life learning into product design
B13.1	Lack of information feedback loops to inform new product development to include Design for Reman, particularly where remanufacturing is not embedded within the OEM culture or is undertaken by an independent remanufacturer.
	Process
	Lack of control of core collection, Reverse logistics, Quality of cores
B14.1	Ensuring access to a sufficient quantity of cores. Sustaining availability and optimising level of cores in stock for a large variety and wide range of product models, to match demand for remanufactured products.

B14.2	Poor quality of returning cores. High variety of materials and less durable materials. Obtaining suitable quality of cores at the point where they can still be remanufactured.
B14.3	Core return rate out of control. Uncertain timing and quantity of returned parts. Uneven amount of used products entering the remanufacturing facilities.
B14.4	The key resource is the staff. They need to be skilled enough to be able to buy the right cores to the right quality.
B14.5	Attitude of OEMs towards independent remanufacturers. Ensuring access to new cores, which is controlled by OEMs? Some OEMs offer an exchange service on old parts which are then generally scrapped and recycled.
B14.6	Longer product lifetime reduces core availability.
B14.7	Getting cores for the new model in advance and store these for future service exchange schemes when the demands of the remanufactured units start to hit the market place.
B14.8	User behaviour and lack of perceived incentive to return used products. For example, with mobile phones, convincing users to trade in or reuse their mobile phones is difficult. Many users treat their mobiles as 'spares'.
B14.9	Costly reverse logistics, complicated collection of cores. Reverse logistics infrastructure capacity is low. High cost for the used product individual returns. Transportation of products back to the manufacturing site particularly if the manufacturer is not responsible for direct supply to customers.
B14.10	Competition on returning goods from Circular Economy activities
	Process
	Availability of spare parts
B15.1	Access to new original parts. Hard or even impossible to buy new spare parts for old remanufactured products, if the spare part suppliers have shut down their manufacturing.
B15.2	Attitude of OEMs towards independent remanufacturers. OEMs not willing to sell spare parts to potential competitors.
	Process
	Increasing technological complexity, New technology and innovations, More electronics

B16.1	Products not suitable for remanufacturing. Some products change so fast that new products are significantly different from old products, thereby making it difficult or impossible to remanufacture old products. Materials and equipment may become obsolete during their lifetime as newer designs emerge; efficiencies of equipment may be lowered beyond point of remanufacture.
B16.2	The continued development, computerisation of parts and the increased integration of electrical systems and ICT into systems. Increased complexity of remanufacturing operations, requiring the development of specialist electronics skills. Embedded software in products is hard the update.
B16.3	The increase in complexity of products, potentially driven by OEMs wanting to make it harder for others to copy their products. Limited access to technical information that allows diagnosis and workaround.
B16.4	Coping with new regulations. Response to increasingly stringent emissions and security regulations. For example, the WEEE and Waste Framework Directive
B16.5	Process
	Skills, Infrastructure, Capacity
B17.1	A shortage in skills creates a significant barrier to remanufacturing (e.g. within the automotive sector), as fewer people are developing the technical skills to carry out remanufacturing processes.
B17.2	The capacity for carrying out remanufacturing activities in Europe may be limited by the size and competencies in the surviving manufacturing base, as significant manufacturing base has moved to Asia.
B17.3	Insufficient capacity. Demand for remanufacturing and refurbishment is growing, particularly in the EU as a whole, but there is insufficient capacity to keep up. For example, across Europe there are not enough rolling stock overhaul sites and ship repair yards to facilitate the rising volumes.
B17.4	Difficulty and lack of accuracy of the inspection stage
B17.5	Process
	Process efficiency and flexibility
B18.1	Maintaining and improving the profitability of the business. Improve the efficiency of the remanufacturing process. Ability to utilise the resources well to support fluctuating demands from customers and the market.
B18.2	Short delivery times. Able to respond to customers' increasing standards on delivery times. The remanufacturing process needs to be developed to meet customer service expectations.

B18.3	Planning remanufacturing process better. Foreseeing how long time the reprocessing of parts will take.
B18.4	Response to fragmented market. Flexibility to remanufacture a large variety of cores originating from different manufacturers. Coping with variations and characteristics of the core inputs.
B18.5	Difficulty and lack of accuracy of the inspection stage. Complexity and variability of the cleaning stage. Difficulties in the disassembly stage mainly due to the excess of fixation points in the products

Annexe B Structured and aggregated list of recommendations for remanufacturing.

Id	Remanufacturing Recommendations Short name	Remanufacturing Recommendations Description
	Business Model	
	Need for capital investment	
R1.1	Increase investment and funding in remanufacturing industry	<p>Improve and increase financial investment in the remanufacturing industry.</p> <p>Develop new and alternative funding routes. Developed credit and bond guarantee mechanisms for Green investments</p>
	Business Model	
	Definition of remanufacturing	
R2.1	Definition of Remanufacturing	<p>Agree on International definition of Remanufacturing to enable greater understanding and lessen confusion. Adopt the definition of remanufacturing to provide clarity as to what constitutes remanufacturing versus other aspects of the circular economy.</p>
R2.2	Modify legal definitions of waste vs. products to be remanufactured	<p>Develop guidance on the Legal Definition of Waste to distinguish a product that is due to be remanufactured as being exempt from those products considered as waste. This will ensure that they do not fall within the remit of waste regulations.</p> <p>Or alter waste directive to include a Subsection for Remanufacture</p>
	Business Model	
	Intellectual property and knowledge issues	
	(no recommendations)	
	Business Model	
	Consumer awareness and perception, remanufacturing reputation	

R4.1	Promote remanufacturing advantages	<p>Promote remanufacturing advantages. Produce promotional material aimed at operations managers of facilities and at potential purchasers, clearly describing the benefits of remanufacturing over new and second-hand equipment, e.g. the cost-effectiveness, environmental benefits, product availability and security of supply, etc. Promotion could take the form of case studies or best practice guidelines, supported by evidence of the financial, customer and environmental benefits of remanufacture. Remember the social media.</p> <p>Promote & showcase “cleanliness” & “coolness” in the industry e.g. in city centre.</p>
R4.2	Create a certified mark for remanufacturing	Improve the public understanding quality of remanufactured goods by using a certified mark for remanufacturing.
R4.3	Develop a standardised to assess the environmental footprints.	Develop a standardised methodology to assess the environmental footprints of remanufactured goods so that it can be communicated and compared.
R4.4	Include remanufacturing aspects in CSR reports	Encourage companies, universities and public services to include data on the procurement or production of remanufactured goods and landfill diversion in their Corporate Social Responsibility (CSR) reports
R4.5	Organize campaigns to increase purchasing and leasing of remanufactured products	Organising national campaigns to increase public sector purchasing for remanufactured products and adopting procurement targets to include leasing of remanufactured products.
R4.6	Improve remanufacturing in ICT-sector	Promote “The Transform Compliance Scheme” to disseminate further information about electronics and ICT refurbishment within the electronics sector to responsibly dispose of e-waste and reduce or eliminate any environmental impact.
R4.7	Make a cross-sectoral research about remanufacturing	Make a cross-sectoral research about manufacturer’s and customers’ real perceptions and expectations on remanufacturing.
R4.8	Increase education and awareness of remanufacturing	<p>Increase education and awareness of the environmental benefits of medical device remanufacturing.</p> <p>Increase. Raise awareness of remanufactured products in new markets</p>
WS4	Set target at EU level.	Set targets for remanufacturing at EU level.

	Business Model	
	Institutional barriers	
	(no recommendations)	
	Business Model	
	Liability, Regulations, Legislation, Standards	
R6.1	Develop a certified mark for remanufacturing	Develop a certified mark for remanufacturing to demonstrate that products have been tested and fully comply with those standards of a new product.
R6.2	Remove the regulatory barriers to remanufacturing	Remove and review the regulatory barriers to remanufacturing, address the legal anomalies identified and remove perverse incentives.
R6.3	Rating laws should apply to remanufactured products	Consider changing rating laws such that energy efficiency ratings can also be applied to remanufactured products. Emphasize environmental standards e.g. in cleaning & other steps.
R6.4	Implement selective landfill bans	Implementing selective landfill bans of products to increase recycling and remanufacturing,
R6.5	Make sure that the existing legislation is fair to remanufacturers	Change the existing legislation to make sure it does not unintentionally penalise remanufacturers. For example, current modifications to legal guidelines from the United Nations, with the intention to prevent hazardous electronic waste being shipped to developing countries to be landfilled, should not unintentionally prevent the movement of core, e.g. for automotive electronic remanufacture.
R6.6	Ensure there is no risk of purchasing remanufactured products	Ensure that the liability over procurement of remanufactured products is resolved to remove the risk of purchase.
WS	Creating a Copyright label	Creating a Copyright label, a protecting for OMS products.
	Business Model	
	Low cost competition	
R7.1	Eliminate from the market compatible	Eliminating from the market compatible cartridges that currently infringe the copyright of OEMs would likely increase

	cartridges that currently infringe the copyright of OEMs	the market for remanufactured cartridges, as remanufactured cartridges currently compete with compatible cartridges on price.
	Business Model	
	Remanufacturing costs	
R8.1	Create sustainable solutions in co-operation	Co-operation of designers, manufacturers and EoL stakeholders, to present more sustainable solutions from the entire life cycle perspective.
R8.2	Differentiate the taxes for remanufacturers	Differentiating VAT rates and tax allowances for businesses involved in remanufacturing. Consider implementing a tax break for remanufacturers in order to encourage economic resilience in the remanufacturing industry. Government incentive to change (VAT free remanufacturing)
R8.3	Government grants for energy efficiency remanufactured products	Extend government grants for energy efficiency also for remanufactured products instead of new products only.
R8.4	Develop centralised remanufacturing facilities	Developing centralised remanufacturing facilities to allow remanufacturing equipment to be better used justifying investment in expensive machinery, reducing cost and making remanufactured products more cost-competitive.
	Business Model	
	Market size, Marketing, Cannibalising primary markets	
R9.1	Benefit from integrated product service offerings	Utilize integrated product service offerings for selling remanufactured products. Benefit from the greater profit margins associated with service-based businesses, for example product service systems promote remanufacturing rather than replacement.
R9.2	Market remanufactured products with promoting materials	Market remanufactured products with promoting materials, e.g. as demonstrated case studies showing cost savings both in production and maintenance, product availability and security of supply, and environmental benefits.
R9.3	Promote the growth with public procurement policy	Promote the growth of the remanufacturing industry with public procurement policy.

R9.4	Address present growing market for refurbishment	Address present growing market for refurbishment, an opportune time for new entrants to join the industry and for existing companies to expand or build new facilities.
R9.5	Introduce a Remanufacturability rating system.	Introduce a rating system for new equipment that describes its suitability for remanufacture and upgrade to promote the procurement of equipment which is more suited to remanufacturing as a planned maintenance operation.
R9.6	Examine tyre re-treading possibilities	Examine tyre re-treading possibilities on light commercial vehicles.
R9.7	Benefit of localised operations of remanufactured products	Benefit of localised operations of remanufactured products to create local jobs, minimise transportation costs and also provide rapid turnaround for clients.

	Design for Reman	
	Demand for remanufacturable products	
R10.1	Promote products suitable for remanufacturing	Promote products suitable for remanufacturing. Engage with designers and remanufacturers to develop products suitable for remanufacturing.
WS10	Develop Eco-Design directives for Remanufacturing	Eco-Design directives are need to enable Remanufacturing. Create European government incentives to promote standards for DfRem
	Design for Reman	
	OEM investment in remanufacturing	
R11.1	Integration of Contract remanufacturers in DfRem	Integration of Contract remanufacturers in DfRem. If the OEM is paying a contractor to carry out remanufacture for them, improving efficiency through design could lower this cost and minimize environmental impacts.
	Design for Reman	
	Knowledge of DfRem principles	
R12.1	Publish DfREM success stories	Publish of case studies and examples of DfRem success stories
R12.2	Develop DfRem guidelines	Develop DfRem guidelines based on lifecycle thinking
R12.3	Improve DfRem knowledge	Improve DfRem knowledge of designers
	Design for Reman	
	Integration of End-of-Life learning into product design	
R13.1	Design for disassembly	Develop and promote design for disassembly. This could be achieved through direct company and design-house engagement.
R13.2	DfRem tool	DfRem tool development

	Process	
	Lack of control of core collection, Reverse logistics, Quality of cores	
R14.1	Develop online platforms for core exchange	Development of online platforms with clear standards where businesses can exchange components and cores.
R14.2	Develop extended producer responsibility for returning products	Explore and develop a system of extended producer responsibility on purchased products, e.g. a take-back scheme, that would encourage the return of used products to manufacturers or remanufacturers at the end-of-life stage, and promote shared responsibility throughout the supply chain.
R14.3	Increase international access to used products	Increase international access to used products and spare parts by tackling non-tariff trade barriers
R14.4	Promote policy incentives for growth in renewables	Promote policy incentives for growth in renewables. This will lead to the greater availability of end-of-life products that will be available as core for remanufacturing. The increased demand for renewables may also increase the demand for remanufactured products for smaller-scale installations.
R14.5	Improve and incentivise collecting used items	Improve and incentivise 'core' return rates, develop effective and low cost ways of collecting used items from remote regions of the country.
R14.6	Establish a forum to share best practice	Establish a forum to share best practice on collection techniques of different products.
	Process	
	Availability of spare parts	
R15.1	Improve availability of spare parts for independent remanufacturers	Improve availability of spare parts to enable independent remanufacturers to meet the demand for particular products. Engage with OEMs, manufacturers and brokerage services to do this.
R15.2	Avoid using parts that have to be changed frequently	OEMs should avoid using parts that have to be changed frequently or where there is limited availability of spare parts, as doing so ultimately makes remanufacturing activities more complicated.

WS15	Encourage competitive spare parts pricing	Encourage competitive pricing of spare parts
	Process	
	Increasing technological complexity, New technology and innovations, More electronics	
R16.1	Benefit from advanced technology in electronics	The pace of advancing technology in the electronics and medical equipment field is rapid. Benefit from the increasing numbers of devices available for refurbishment containing technology that is still relatively advanced. Make a link with components which are obsolete but working components
WS16	Engineering manuals platform	Encourage platform with engineering manuals
	Process	
	Skills, Infrastructure, Capacity	
R17.1	Learn from the leaders in the remanufacturing industry	Actively promote remanufacturing and learn from practices in countries which are leaders in this industry.
R17.2	Disseminate and share best practice and skills for remanufacturing	Development of Centre of Excellence for Remanufacturing and online learning and knowledge sharing platform for companies and businesses. Disseminate and share best practice and skills for remanufacturing to new market entrants.
R17.3	Help businesses to incorporate remanufacturing	Create an educational programme and support networks to help businesses change their business models to incorporate remanufacturing.
R17.4	Improve cross disciplinary teaching and education for remanufacturing	Develop cross disciplinary teaching support and education for remanufacturing: <ul style="list-style-type: none"> - Business leadership: understanding how alternative business models could be used to maximise the value for remanufacturing - Technical engineering skills: developing the techniques and technologies to effectively remediate and remanufacture products - Design tools: providing designers with the tools and

		techniques to develop products that are easier to disassemble and remanufacture. Established Remanufacturing Chairs and curricula.
R17.5	Research into advanced materials repair technology	Research into advanced materials repair technology to provide opportunities for MRO (Maintenance, repair, and operations) growth.
R17.6	Highlight key issues within the industry	Identify technical issues through current delivery bodies to highlight key issues within the industry. Many technical issues associated with remanufacturing will only come to light through direct engagement with a company.
WS17	Encourage apprenticeship	Encourage apprenticeship in remanufacturing companies.
	Process	
	Process efficiency and flexibility	
	(no recommendations)	
	Other	
	Critical materials	
R19.1	Stimulate innovation on alternative materials	Stimulate innovation in companies concerning alternative materials to overcome raw materials supply problems.
R19.2	Develop material substitution strategy and standard	Develop an economy-wide material substitution strategy at EU level + Worldwide standard.
R19.3	Research into advanced material repair technology	Research into advanced material repair technology (particularly for aerospace, energy and rail industries) to detect and repair faults in the advanced composites and metals increasingly used in aircraft and other high-value products.
	Other	
	Circular Economy	

	Other		
	Other Recommendations		
R21.1	Collect remanufacturing statistics	Collect data on European remanufacturing annually. Remanufacturing statistics should be collect to enable a clearer picture of the business trends and help identify emerging remanufacturing areas.	Research
R21.2	Foster better knowledge flow to support remanufacturing	Foster better information flow to support remanufacturing: <ul style="list-style-type: none"> • develop standardized data sharing channels, • establish accessible knowledge exchange platforms, • increase the data exchange speed through tied collaboration with stakeholders, • and expand the data ownership in the system of shared values 	ERN, CER
	Other		
	Communication, collaboration		
R22.1	Mobilise supply chain communication	Original Equipment Remanufacturers and third party remanufacturers should work together to mobilise supply chain communication.	Industry
R22.2	Place more policy emphasis for reuse and remanufacture	Government should work with the European Commission (EC) to place more policy emphasis on setting targets for those activities at the top of the waste hierarchy such as reuse and remanufacture.	Policy Makers
R22.3	Establish a Special Interest Group to drive remanufacturing forward	Establish a more formal Special Interest Group to support industry in the development of a comprehensive and inclusive mechanism to drive remanufacturing forward.	Policy Makers
R22.4	Intensify International collaboration in research	Develop links with other nations to facilitate collaboration and promotion of remanufacturing activity and research.	Research

Annexe C : Actions for business and industry

Actions requiring remanufacturers or sector bodies to initiate

Issue	'Conventional' business models and processes are not supportive of remanufacturing for a wide range of products.
Diagnosis	Remanufacturing presents a number of challenges to remanufacturers including: being able to monetise their activities to create a sustainable income stream; to motivate a return of quality core for the remanufacturing process to operate on; and reconfiguring operating processes to cost-effectively cope with the specific demands of remanufacturing.
Action SUP1	<p>Remanufacturers should consider integrated product-service based offerings as an alternative to make/sell models.</p> <p>Examples of this include leasing, selling value and performance instead of physical products. Often, these service-based businesses offer greater profit margins, offering remanufacturing rather than replacement. A mix of conventional sales and servitised product streams can offer the diversity to provide a buffer against changes in the economic climate.</p>
Target	The objective of this action is (re)manufacturers.
Timescale	All timescales.
Notes	This action is not taken as a priority because it is largely an attitude to be adopted by (re)manufacturers themselves. However, we have identified elsewhere that education is required in the possibilities of remanufacturing business models (see Action EDU1). In addition, such changes could be catalysed by the intervention of consultancies and other support agencies which offer business and manufacturing support services. The remanufacturing process needs to be developed to meet customer service expectations.

Issue	Design for Remanufacture is not a standard component of the design process
Diagnosis	Remanufacturability is not often specified or prioritised by OEMs during the initial design phase. Therefore, remanufacturing can be inhibited by poor design, particularly related to ease of disassembly, e.g. due to the joining mechanisms and processes used. Other challenges related to not applying DfRem include: difficulty and lack of accuracy of the inspection stage; and complexity and variability in the cleaning stage. These difficulties cause high costs for remanufacturing.
Action SUP2	<p>Design and promote products suitable for remanufacturing.</p> <p>Engage with designers and remanufacturers to develop products suitable for remanufacturing. Take disassembly into account in design. Create an "open book policy" for remanufactured product. The open book policy aims to gain the confidence of consumers/end-users when buying remanufactured products, by giving details of how (with well-documented records, e.g. test data sheets), they remanufacture the product.</p>
Target	Manufacturers and remanufacturers
Timescale	Short-medium term
Notes	Education may be a factor in addressing this issue.

Issue	OEM and third party remanufacturers may have conflicting business interests
Diagnosis	Collaboration between OEM and third parties is needed, to find a common business solution for remanufacturing. Pertinent knowledge, like the technical documentation necessary to remanufacture products effectively, is not readily available to non-OEMs. Conversely, there is no mechanism for remanufacturers to provide the OEMs with information for the improving the design of products to facilitate remanufacturing.
Action SUP3	<p>Collaborate along the supply chain to create sustainable product solutions.</p> <p>OEM remanufacturers and third party remanufacturers should work together to exchange information and experience, with the ambition of improving the sustainability of products from a life cycle perspective. This could involve developing new business models to collaborate with each other in a mutually beneficial way, or sharing design and remanufacturing information.</p> <p>Where there is resistant to collaboration, remanufacturers could identify the OEMs and specific products that are made difficult or impossible to remanufacture, and so use marketing pressures to encourage change.</p>
Target	Manufacturers and remanufacturers
Timescale	Medium term

Actions requiring multiple parties to collaborate

Issue	Core return for B2C goods is poor, often resulting in unusable, low quality items unfit for remanufacture.
Diagnosis	The B2C market is characterised as being very dispersed with unknown whereabouts of products. This is in distinct contrast to B2B markets where 'fleets' of products may be held, with at least some relationship to the OEM/retailer still in place. Domestic consumers do not recognise the value of their products at end of life, even when broken. Further, they have no structured manner for placing them in recovery, obtaining fair value via reputable agents. Products are generally scrapped, handed on or, occasionally, sold on e.g. ebay. Even worse, products are often not disposed of promptly, meaning they can have suffered more damage or are more obsolete, rendering even lower value.
Action SUP4	<p>Encourage measures which increase the transparency and value of options available to consumers, users etc. at end of life to improve circularity.</p> <p>IT could be utilised to assist users in making proper and valuable end of life choices in what to do with unwanted items. This could range from information on current resale value for working items, to repair agents locally for broken ones, to remanufacturing agents for serviceable items. In the consumer domain, the Stuffstr app plans to log consumer capital purchases through their life and offer such options when the users choose to dispose. The OEM is also contacted to offer a new item, but could form part of the take-back option. This can address the issue of core return for distributed consumer goods.</p>
Target	<p>Retailers, 3rd party technology providers/resellers, logistics companies, (re)manufacturers.</p> <p>Various collaborations of supply chain actors can be envisaged, but requiring some coordination. Prior research into the demands of particular product classes and appropriate customer engagement can be envisaged as per Action EDU3.</p>
Timescale	Short-medium term.
Notes	Disruptive 3 rd party providers may be part of the solution. However, it is likely more productive (initially) to address the EPR issue which provides a stronger motivator for finding solutions to closing product loops.

Issue	Low awareness of remanufacturing as part of the Circular Economy
Diagnosis	<p>There are negative perceptions of remanufactured products. Customers see remanufacture as second-hand, and therefore inferior or being of lower quality than new products. Customers may also assume that the price of the product reflects its quality.</p> <p>This also affects the user behaviour in the return of used products.</p>
Action SUP5	<p>Promote remanufacturing advantages to potential purchasers.</p> <p>To a large extent, this is the responsibility of remanufacturers themselves. It is their own remit to produce promotional material, clearly describing the benefits of remanufacturing over new and second-hand equipment, e.g. the cost-effectiveness, environmental benefits, product availability and security of supply, etc. Promotion could take the form of case studies or best practice guidelines, supported by evidence of the financial, customer and environmental benefits of remanufacture, particularly for institutional purchasers. Social media could form a novel channel.</p> <p>However, many remanufacturers do not have profile or brand reputation that can attract a widespread customer base. A range of approaches could be beneficial, in concert, to boost their legitimacy, but may be assisted by others. For example, independent consumer organisations could produce directories of remanufacturers, subject to consumer reviews, to build visible track record, accompanied by a statement of guarantees and warranties offered.</p>
Target	Potential purchasers.
Timescale	Short-ongoing.
Notes	This action could be undertaken by remanufacturers themselves, by sector trade bodies, consumer organisations oriented to reuse (e.g. ifixit), or the CER.

Actions where the main agent has not been identified yet

Issue	A lack of familiarity with remanufacturing in the finance sector can make it difficult for remanufacturers to access capital
Diagnosis	<p>Remanufacturing can be a capital-intensive business, for example, by needing to store a large variety and volume of core and remanufactured components, and for reverse engineering of products. A lack of knowledge about remanufacturing in the finance sector can make it harder for remanufacturers to obtain access to capital when they need it.</p>
Action SUP6	<p>Promote remanufacturing advantages to financial institutions.</p> <p>By educating financial institutions about the remanufacturing process and products, including why remanufacturing can be capital-intensive, they may be more receptive to remanufacturers seeking investment.</p>
Target	Remanufacturers; financial institutions; lobbying organisations.
Timescale	Medium term.
Notes	This action could be delivered either as part of the educational packages of EDU, but aimed at the finance sector, by sector trade bodies, or by the CER.
Action SUP7	<p>Develop new and alternative funding routes for remanufacturers.</p> <p>Funding routes developed specifically with remanufacturers in mind could help remanufacturers access capital for investing in their business. These routes might include credit and bond guarantee mechanisms for Green Investments.</p>
Target	Financial institutions; research funding organisations

Timescale	Medium-long term
Notes	This action could be delivered by government treasury and business innovation support agencies, financial institutions themselves, and possibly requiring academic support.

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