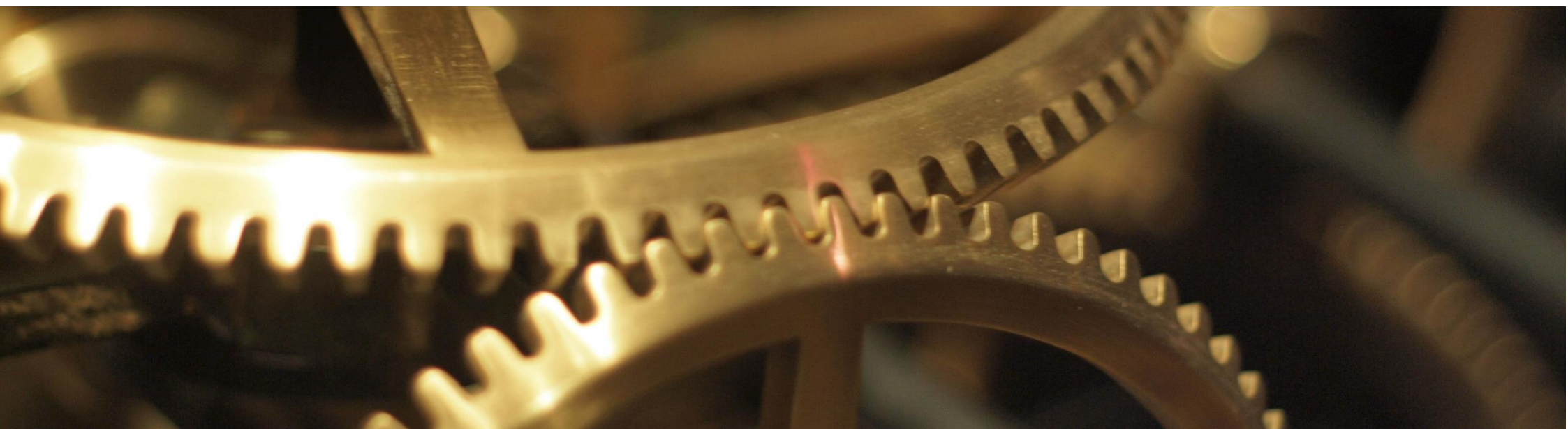


Supporting Excellence in UK Remanufacturing

Stakeholder dialogue on opportunities and challenges



Produced by:



In association with:



Foreword

In early 2014 the All-Party Parliamentary Sustainable Resource Group (APSRG) carried out an Inquiry on remanufacturing, sponsored by the Knowledge Transfer Network.

The Inquiry found that a prosperous remanufacturing industry exists in the UK and that, with appropriate support, there is potential for significant further growth. The Inquiry's findings were published in March under the report titled "Remanufacturing - Towards a Resource Efficient Economy" (APSRG, 2014).

This was then followed up with the publication of a second, more expansive report, entitled: 'Triple Win: The social, economic and environmental case for remanufacturing' (APSRG, 2014). This report provided a more detailed examination of the potential of remanufacturing in the UK and made explicit recommendations, to both government and industry, on how the UK can build remanufacturing to become sustainable, and even revolutionise the manufacturing industry.

The APSRG reports indicate strong support across government to advance remanufacturing in the UK. Furthermore, the launch in January 2015 of the Scottish Institute for Remanufacturing provides a model for creating a coherent UK-wide initiative.

Spurred on by the opportunity and government support, a consortium of organisations began working together to define potential approaches for collaboration across industry, government, and academia.

This consortium brings together the Knowledge Transfer Network (KTN), the High Speed Sustainable Manufacturing Institute (HSSMI), The Carbon Trust, the Centre for Remanufacturing and Reuse (CRR), the Centre for Process Innovation (CPI), Coventry University, the University of Strathclyde, Birmingham University, and University College London.

In order to advance the recommendations of the APSRG reports, the KTN and our partner organisations convened a stakeholder workshop at Coventry University on October 23rd 2014.

Through interactive dialogue between industry, leading academics and supporting organisations, the aim of the workshop was to gain a common understanding of drivers and critical barriers to remanufacturing, and identify potential solutions.

This report provides a synthesis of this stakeholder dialogue. We hope that the outputs of this effort will help inform industry and government efforts to realise the opportunity that remanufacturing represents for the UK.



Chris Warkup
Chief Executive Officer, the Knowledge Transfer Network

Acknowledgements

This report has been co-authored by the **Knowledge Transfer Network (KTN)**, the **High Speed Sustainable Manufacturing Institute (HSSMI)**, **The Carbon Trust**, and the **Centre of Excellence for Remanufacturing (CRR)**.

We would like to thank participants from stakeholder organisations who attended the workshop for their valuable contributions and insights, which are represented within this report.

Our appreciation also goes to the day's presenters: **Susanne Baker of EEF, the manufacturers' organisation**; **Matt Jennings from MCT Reman**; and **Chris Woollett of Bond Group**, for providing expertise and industry insights.

We are grateful to **Coventry University** for hosting the workshop at the university's Advanced Simulation Centre, and to our partners who provided content and support in planning the workshop: the **University of Birmingham**, **University of Strathclyde**, and **University College London**.

Aleyn Smith-Gillespie, Carbon Trust

Ben Peace, Knowledge Transfer Network

Ben Walsh, Centre for Remanufacturing and Reuse

David Stewart, High Speed Sustainable Manufacturing Institute



Stakeholders and Participants

Workshop participants

<i>Adrian Tautscher</i>	<i>Jaguar Land Rover</i>
<i>Anne Wilson</i>	<i>Numill</i>
<i>Anne-Marie Benoy</i>	<i>All-Party Parliamentary Sustainable Resource Group (APSRG)</i>
<i>Carl Perrin</i>	<i>Inst Adv M&E</i>
<i>Chris Smith</i>	<i>Caterpillar</i>
<i>Chris Woollett</i>	<i>Bond Group</i>
<i>Graham Hillier</i>	<i>Centre for Process Innovation / High Value Manufacturing Catapult</i>
<i>Ian Briggs</i>	<i>MCT Reman</i>
<i>Ian Buxcey</i>	<i>Meritor</i>
<i>Ian Collier</i>	<i>High Value Manufacturing Catapult</i>
<i>James Hughes</i>	<i>AMRC</i>
<i>James Marco</i>	<i>WMG / High Value Manufacturing Catapult</i>
<i>Kevin Vincent</i>	<i>Coventry University</i>
<i>Khamis Essa</i>	<i>University of Birmingham</i>
<i>Laura Heywood</i>	<i>Kleenstrike</i>
<i>Matt Beardshaw</i>	<i>Jaguar Land Rover</i>
<i>Matthew Jennings</i>	<i>MCT Reman</i>
<i>Michael Hague-Morgan</i>	<i>Autocraft Drivetrain Solutions</i>
<i>Michael Morris</i>	<i>University College London</i>
<i>Pringle Tegan</i>	<i>Loughborough University</i>
<i>Shahin Rahimifard</i>	<i>Centre for Innovative Manufacturing (CIM) in Industrial Sustainability</i>
<i>Tracey Rawling Church</i>	<i>Kyocera</i>
<i>Will Keeble</i>	<i>MCT Reman</i>
<i>William Ion</i>	<i>AFRC, University of Strathclyde</i>
<i>Malcolm Harold</i>	<i>Knowledge Transfer Network (KTN)</i>

Organisers and facilitators

<i>Aleyn Smith-Gillespie *</i>	<i>Carbon Trust</i>
<i>Ben Peace *</i>	<i>Knowledge Transfer Network (KTN)</i>
<i>Ben Walsh *</i>	<i>Oakdene Hollins / Centre for Reuse and Remanufacturing CRR</i>
<i>David Stewart *</i>	<i>High Speed Sustainable Manufacturing Institute (HSSMI)</i>
<i>Kevin Vincent</i>	<i>Coventry University</i>
<i>Steve Fletcher</i>	<i>Knowledge Transfer Network (KTN)</i>

** Workshop facilitators and report co-authors*

Content contributors

<i>Jonathan Corney</i>	<i>University of Strathclyde</i>
<i>Kevin Vincent</i>	<i>Coventry University</i>
<i>Manish Tiwari</i>	<i>University College</i>
<i>Susanne Baker</i>	<i>EEF, The Manufacturers' Association</i>
<i>Winifred Ijomah</i>	<i>University of Strathclyde</i>

Glossary

APSRG	All-Party Parliamentary Sustainable Resource Group
B2B	Business-to-business
B2C	Business-to-consumer
B2G	Business-to-government
Core	Term used to designate end-of-life product to be remanufactured
OEM	Original Equipment Manufacturer
RFID	Radio frequency identification, used to uniquely identify a component or object
WEEE	Waste Electrical and Electronic Equipment



Executive Summary

Early in 2014 the All-Party Parliamentary Sustainable Resource Group carried out an inquiry on remanufacturing. This concluded that remanufacturing offered huge potential for the UK economy. The current estimate of the economic benefit of UK remanufacturing is £2.4 billion taking account of some good examples of existing remanufacturing activity. However the report suggested that, with appropriate support, this could be increased to £5.6 billion alongside the creation of thousands of skilled jobs. The inquiry culminated with the launch of a report (Remanufacturing - Towards a Resource Efficient Economy) in Westminster in March, which attracted strong support across government departments for exploring what the UK might do to further remanufacturing.

Following this report a small group of organisations, comprising of the Knowledge Transfer Network (KTN), the High Speed Sustainable Manufacturing Institute (HSSMI), the Carbon Trust, and Centre for Reuse and Remanufacturing (CRR), plus a group academic institutions, have developed a programme of activity to build on this report by directly engaging industry and other organisations, notably Innovate UK and BIS. This led to an event held on 23 October 2014 at Coventry University, attended by representatives from industry, academia and the High Value Manufacturing Catapult. The outcomes of that workshop were as follows.

Drivers, Benefits and Enablers for Remanufacturing

These have been well covered and quantified in the APSRG Report but the ones which were emphasised in this workshop were:

- Reduced costs for both remanufacturer and customer
- Closer business relationship between supplier and customer
- Reduced equipment downtime
- Business opportunities for other players in the value chain
- Excellent sources of specialist expertise in academia and the HVM Catapult.

Barriers to Further Uptake of Remanufacturing

These were explored for different types of business sector and company.

OEMs

- The need for new business models to enable OEMs to derive value from remanufacturing
- Availability of skills, particularly in design for remanufacture

Remanufacturers

- Lack of skills & technology for disassembly, diagnosis, automation, reconditioning
- Inadequate information flow and co-operation amongst the value network

Customers

- Awareness and clear understanding of what remanufacturing is

General

- Taxation and legislation, not currently designed to encourage remanufacturing
- More Government support needed to address market failure
- Foreign governments' import and export restrictions.

Potential Solutions

Following discussions within groups of experts representing different organisations and positions in the value chain, the following actions and initiatives were identified, aimed at addressing the above barriers.

Technology and Operations

- Detailed analysis of technology needs and gaps
- Better diagnostics, better prognostics, big data, and "intelligent systems"
- Improved testing methods and techniques
- Map & model the value chains for remanufacturing in different sectors
- Improved data systems for information sharing
- Promote whole life costing approach in procurement

Cross-sectorial information and standards

- A clear, standard definition of remanufacturing (to distinguish from refurbishment, reconditioning etc.)
- Develop "how to" guides & tools on business models (tailored to sectors where appropriate)
- Establish universal "Design for Remanufacture" guidelines
- Revision of ISO 9001 & other standards to include remanufacturing;
- Remanufacturing labels/data kept on products even at end of life
- Education and promotion of remanufacturing to build confidence

Legislation, Taxation and Targets

- Use public procurement when appropriate to stimulate markets
- Re-examine WEEE targets to place more importance on reuse/remanufacture over recycling

- Targets focusing on the value retained in the economy, rather than the volume of waste shredded
- Legislate for access to product specifications
- Lobby foreign governments for policy revision

There was strong support from the delegates for a UK Centre of Excellence in Remanufacturing. This would probably be a virtual centre, operating on the basis of a 'Hub and Spoke' model.

The Centre would be equipped to address an appropriate balance of the above solutions and others which emerge through its networks and ongoing activity. In particular it would:

- Establish and execute technology projects to address industry problems and barriers
- Provide advice to industry
- Advise the government and funding bodies on interventions to promote and encourage remanufacturing where it would add value to the UK economy
- Develop case studies, promote exemplars and share best practice
- Work with other bodies (professional institutions, LEPs etc.) to explore synergies for training and capacity building

An online group hosted by KTN has been set up to provide members with:

- Updates on the latest funding and support opportunities;
- Details of forthcoming events;
- A platform for online discussion, networking and collaboration; and
- Opportunities to engage with our activities to influence policy and future funding.

Membership is free. To join the group, please visit the following link: <http://tinyurl.com/ukreman>

1. Remanufacturing: An Opportunity for the UK

The opportunity

Remanufacturing as an industrial concept has recently been gaining visibility as a better approach to product recovery compared with more traditional recovery/disposal processes such as recycling or landfilling. This is because remanufacturing provides considerable economic, environmental and social benefits.

Remanufacturing already contributes about £2.4 billion to the UK economy, which could be increased to £5.6 billion with appropriate support and coordination (APSRG, 2014). It also provides substantial environmental savings in terms of raw materials, carbon emissions, and energy usage.

The imperative for remanufacturing as a strategy to recover value from used products derives from potential **“win-win-win”** benefits. In opting for remanufacturing over new manufacturing, the customer benefits from getting a quality product at a fraction of the price of a new equivalent, the manufacturer profits from achieving a reduction in manufacturing costs, and the environment gains from a result of reduced emissions and waste generation during production. **The cost to remanufacture a product is generally between 40 and 65% less than the production of a new product, allowing for a market re-sell price that is typically between 30 and 40% lower than that of a newly manufactured product.** The environmental benefits are equally as compelling.

Remanufacturing typically uses 85% less energy than manufacturing and offsets in excess of 800,000 tonnes of carbon dioxide emission per year compared to new manufacture (Steinhilper, 2006).

The application of Remanufacturing within the UK has grown in recent years, with the Automotive, Aerospace, ICT, industrial equipment (pumps, valves, gears, etc.), Rail and Marine sectors proving the most fertile. These High Value Manufacturing sectors have found Remanufacturing to be a

particularly lucrative strategy due to the nature of their products (i.e. they consist of high value components, and can be reworked back to an as good as new condition), however ‘lower value’ sectors too, such as furniture products, refrigeration equipment and power tools have found success through the adoption of remanufacturing. With further Industry engagement, R&D work and dissemination, it is expected that over the next few years, more and more businesses will turn towards the adoption of remanufacturing as part of their business strategy.

A recent report from the All-Party Parliamentary Sustainable Resource Group (APSRG) has organised the Remanufacturing opportunity into 4 key areas:

- The economic opportunity and job creation
- The environmental opportunity
- Competitive advantage for businesses
- Benefits to the end user

The report contends that a sizable opportunity exists for the UK to make more of its remanufacturing potential. In doing so, there is great opportunity to increase economic output and job creation, much in the same way that the United States has done through Remanufacturing in recent years. Between 2009 and 2011, the value of remanufacturing production in the US increased by 15% to £26 billion. This growth has supported 190,000 full time jobs in over 70,000 remanufacturing firms (USITC, 2012).

Part of the reason why the USA has found so much success in encouraging remanufacturing is down to the establishment of centres of excellence. These centres address critical remanufacturing challenges across several industries and provide a focal point from which remanufacturing can be encouraged. **China also has such centres of excellence which have**

enabled them to provide focus for remanufacturing research industry and policy development. In fact, for four consecutive years, China has included remanufacturing in its national strategy for adding value to the manufacturing sector

The UK however does not have such a centre of excellence, or encouragement at a policy level, and currently lacks the skills, knowledge, best practices and cross sector support necessary to propel the remanufacturing industry to become world leading. One of the main recommendations from the APSRG report to enable this, is to set up a ‘Centre of Excellence’ in the UK, which ‘will encourage and stimulate greater knowledge transfer and understanding about the practical application and potential of remanufacturing.’

The challenge

Remanufacturing, although economically and environmentally lucrative, is not without its challenges. **Remanufacturing as a modern industrial concept is still relatively immature, and is plagued by complexity and uncertainty.**

In order for the Remanufacturing industry to grow, it is essential that these challenges are overcome. The majority of Remanufacturers in the UK are SME’s, and as such, lack the capital to leverage the development of best practice systems and tools, and new technologies through increased R&D. Moreover, they lack cohesion to have an influence on policies and legislation that will encourage their business and the wider remanufacturing industry.

Government intervention is required to facilitate engagement with these organisations and assist the co-development of solutions that will overcome these issues.

Jointly developing solutions

In order to address the opportunities and challenges for remanufacturing, we believe it is vital to engage a broad set of stakeholders in the solution-development process.

In October 2014 we organised a first stakeholder workshop with the purpose of better defining the issues that need to be addressed, and to start exploring potential solutions.

This report presents a synthesis of the workshop outputs and signposts next steps for taking these forward.

2. Drivers and benefits for Remanufacturing

Building on the findings of the APSRG report, stakeholders reaffirmed and identified a number of current and potential drivers of remanufacturing in the UK. These include benefits to companies (OEMs and specialist remanufacturing businesses); customers; society and the economy; and the environment.

Supply-side drivers (OEMs and remanufacturers)

Developing new business propositions. Some OEMs are discovering the benefits of integrating remanufacturing into broader service-based propositions. These enable OEMs to have longer-term customer relationships with additional value-added services. By incorporating remanufacturing into their business model, OEMs are able improve product design, minimise working capital costs and continually enhance their proposition.

Penetrating and growing new market segments. Remanufacturing can, in some cases, open up market segments without cannibalising new product sales. Given that lower price points are feasible with remanufactured products, these can be offered to more price-sensitive segments that do not require the latest features (e.g. with longer-life products).

Enabling higher margins. Effective use of remanufacturing allows OEMs to preserve significant value at product end-of-life, enabling whole products or components to be put back on the market at a lower cost than manufacturing new, while being sold and priced 'as new'.

Improving security of material supply. By retaining or reclaiming ownership of products and components at end of life, OEMs rely less on new material inputs. This enables companies to mitigate the impacts of material scarcity and price volatility.

Designing for remanufacturing. As OEMs begin to design products to make them easier and more cost-effective to remanufacture, this will stimulate the market and benefit companies along the value chain. As remanufacturing becomes an integral part of business models and service propositions, it will also drive customer awareness and acceptance.

Demand-side drivers (B2B / end-customers)

Reducing capex and operating costs for business customers. Remanufacturing enables customers to extend the lifetime of equipment for which parts have been discontinued by OEMs, by remanufacturing broken or faulty parts. This avoids the need to invest in new plant or equipment if it isn't otherwise needed, and reduces downtime. In an economic climate where companies are demanding more from their assets and are less able to invest, this can be of significant value.

Making products more affordable. Both for business customers and consumers, remanufactured products can offer lower-cost alternatives without necessarily cannibalising new product revenues. Rather, it can enable OEMs to gain traction in new market segments, creating brand equity and loyalty with new customers.

Technology drivers

Improving efficiency and effectiveness of remanufacturing. Additive manufacturing technologies (3D printing) are improving the cost and quality of remanufacturing, and opening up new opportunities. For example, laser cladding technology is being used to weld metal particles back onto components to address wear and tear, and bring these back to 'as new' specifications and tolerances. Furthermore, improvements in automation, decision-support systems, and other technologies are helping to drastically improve the

efficiency of remanufacturing processes and reduce costs.

Policy and regulatory drivers

Creating incentives to remanufacture. Policy mechanisms can be used to catalyse the market for remanufacturing (as has been done in Japan and China, for instance). In the UK, policy in this area has not yet been established. In fact, current legislation tends to incentivise end-of-life disposal or downcycling, rather than remanufacturing (see next section on barriers).

Socio-economic benefits

Stimulating UK employment. Remanufacturing can enable onshoring of value chains when the cost and convenience of remanufacturing in the UK is better than doing so abroad. So in cases where OEMs and their suppliers manufacture overseas, remanufacturing can create jobs in the UK.

Creating business opportunities for other sectors. Remanufacturing can in itself drive growth in other sectors such as (reverse) logistics; and industries providing the services and technologies required for remanufacturing.

Supporting national economic security and resilience. By reducing dependency on material and product imports, remanufacturing can improve balance of trade and economic resilience.

Environmental benefits

Reducing resource consumption and carbon emissions. By preserving and reclaiming as much value as possible from products at their end of life, remanufacturing minimises the amount of virgin material needed, and associated upstream activities. This means that, from a lifecycle perspective, remanufactured products can demonstrate significantly reduced environmental

impacts compared to manufacturing new. However attention needs to be paid to energy-using/generating products (e.g. engines) to ensure their in-use efficiency doesn't negate the 'embedded' lifecycle benefits.

Reducing waste. The life extension afforded through remanufacturing results in a net reduction in waste generation.

3. Barriers to Remanufacturing

Remanufacturing is a concept that is not without its challenges. The most critical barriers affecting UK organisations were identified by stakeholders during the workshop

Business model viability, lack of a supply of core to remanufacture, an absence of appropriate Education & skills, lack of cooperation, customer awareness, Legislation and lack of funding were among the most commonly identified barriers.

What emerged from the workshop was that these barriers were found to be common amongst remanufacturers from different Industry sectors

Business model viability

There still remains a lack of knowledge and understanding within industry around the business case for Remanufacturing and how to effectively integrate a Remanufacturing business model.

The workshop identified the following key issues within this area:

- It is difficult to accurately quantify the costs involved in the acquisition and recovery of a remanufacturable product. If this cost outweighs the cost to manufacture, then there isn't much of a business case for remanufacturing.
- There is a lack of knowledge of what the breakpoints are for when remanufacturing is profitable and when an OEM should engage in remanufacturing.
- A lack of understanding of how to make the transition to new business models incorporating remanufacturing.
- Understanding about the types of partnerships required in managing a global product returns channel – who do they involve? What do they look like? How do they vary across different sectors?

Lack of core supply

The workshop highlighted the criticality of not having a steady supply of cores to remanufacture with ('core' is the term used to designate end-of-life product to be remanufactured). Supply issues arise from the uncertainty involved in predicting **how many cores** will return to a facility, **when** they will return, and in what **quality**. This issue stems from the fact that, once a product is out in the customers' hands, it is very difficult to control how the product is used, how well it is maintained, or where it will end up at the end of its life.

As a result, it becomes difficult to schedule production, forecast parts procurement and allocate resources within a remanufacturing facility

This then presents further challenges to a remanufacturing facility, such as, the need for flexible production lines and advanced IT systems which improve the traceability of parts in the supply chain.

Education & skills

The remanufacturing industry requires a workforce with a mixture of highly skilled and semi-skilled individuals. What was clear from the workshop was that the reman industry struggles to source employees with the right level of knowledge, expertise and skills to operate effectively in a reman environment.

It was noted that this is largely due to the fact that there is a lack of remanufacturing training available in the UK – Reman is simply not entering enough school and university curriculums. There is also a lack of apprenticeship schemes and professional training for industry.

Another key challenge lies in capturing this expertise from experienced remanufacturing operators – much of it is based on 'tacit knowledge' – i.e. knowledge accrued from a

lifetime of working on a remanufacturing line dismantling products. Being able to capture this knowledge and distil it into a digestible format will facilitate the teaching of reman best practice.

Lack of cooperation/information flow

It was identified at the workshop that there is a lack of cooperation, and subsequent lack of information flow amongst supply chain partners within Remanufacturing models. This lack of cooperation can be attributed to:

- Competition between OEMs and Remanufacturers – fears that a remanufactured product will cannibalise the sales of the new equivalent
- Protection of intellectual property and brand reputation
- Lack of awareness of remanufacturing channels
- Lack of developed IT systems for a remanufacturing context

Customer awareness/perception

It is well documented that remanufactured products suffer from the stigma of being negatively associated with used or second hand products. This perception has led to the notion that a remanufactured product is inferior to that of a brand new equivalent. Contrary to this, quality is in fact intrinsic to remanufacturing. Challenges lie in getting this message out to the wider public and to businesses. In many cases, organisations are unaware that remanufacturing is even an option. This immediately cuts off any channels in a supply chains to link with a remanufacturer.

Legislation

Many of the industrialists present at the workshop viewed legislation as being both a facilitating and limiting factor for remanufacturing. The facilitating factors were covered in section 2 of this report.

The limiting factors are:

- The emphasis of existing legislation such as ELV and WEEE is placed on achieving recycling targets instead of reman or reuse. The targets are also based on the amount of material recovered in weight, rather than the amount of value recovered per product.
- The restriction of the export of 'waste' products under the EU waste shipment regulation. Because end of life products fall into the category of 'waste', it is not possible to get access to cores from overseas for remanufacturing.

Lack of funding

Historically, there has been a lack of funding support from UK institutions to support R&D, industry engagement, business model development and education in Remanufacturing. However, this is changing in light of recent funding competitions such as the Horizon 2020 'Factories of the Future' call; and the upcoming [Innovate UK 'Circular economy: business models' call providing up to £800k of funding for business models incorporating remanufacturing.](#)

4. Solutions and Approaches

Workshop stakeholders proposed a number of solutions to address barriers to remanufacturing. These have been synthesised into six broad areas:

- Establishing effective business models and ensure supply of core
- Educating practitioners
- Customer engagement and demand-side incentives (B2B, B2G, B2C)
- Standards, information and systems to support remanufacturing
- Smart regulation and policy
- Financing

Establishing effective business models and ensure supply of core

Develop viable business models that incorporate remanufacturing.

Establish partnership models between OEMs and remanufacturers. Where OEMs decide to work with third party remanufacturers, several aspects of the business model need to be defined. These may include:

- **Certification schemes for remanufacturers (proprietary or 3rd party)** to ensure core is remanufactured to defined quality standards (this will also improve customer trust and acceptance)
- **Integration of value chains and services** between OEMs and third party remanufacturers to ensure core is effectively reclaimed at end of life. This may also require integration of logistics and other partners as part of a seamless service proposition.
- **Revenue and financial models** between OEMs and third party remanufacturers that incentivise close collaboration and availability of core. These can include elements such as:

- Royalties from reman products sold (as done by some automotive OEMs)
- Warranty schemes for reman products
- Financial incentives for return of core (e.g. discounts, trade-in deals, etc.)

- **Intellectual Property sharing models** that enable OEMs to maintain control over IP while providing remanufacturers with access to critical data (e.g. Bill of Materials, Bill of Processes, disassembly sequences, etc.)

Create knowledge transfer partnerships. For example, working with research councils, EPSRC and Innovate UK to develop relevant programmes.

Educating practitioners

Take a holistic, lifecycle approach to design education. This should include

- Educating young designers on remanufacturing principles and embedding real life examples into their educational and training experience.
- Teaching and training designers to understand and minimise lifecycle impacts when designing products, and incorporate cradle-to-cradle approaches and remanufacturing into design specifications.

Engage decision makers throughout business organisations. It is important to extend education on remanufacturing beyond design and engineering, in particular engaging current and future decision makers who will influence company strategy and business models.

Develop academic and industry partnerships. Encourage academics to work with industry to develop remanufacturing curricula focused on industry challenges and needs

Customer engagement and demand-side incentives (B2B, B2G, B2C)

Support customer understanding and trust in remanufactured products. This could be done in a number of ways, including:

- Developing trusted quality marks for remanufactured products, which may take the form of labelling. This can both reassure customers and enable them to make 'greener choices' by positioning remanufactured products as such.
- Marketing and awareness campaigns for remanufactured products to promote their quality as well as other benefits such as sustainability.
- Engaging businesses down to the local level, such as via Local Enterprise Partnerships (LEPs). These can then turn raise awareness of local businesses.

Use government procurement power and influence to create scale of demand. This could include both influencing private sector, as well as public sector procurement measures. For example:

- Giving a strong signal to OEMs and support remanufacturers by implementing procurement policies that favour remanufactured products (e.g. furniture, vehicles, equipment, etc.).
- Engaging corporates and multinationals in the UK to raise their awareness and encourage them to remanufacture.
- Generally raise the profile of remanufacturing as an important aspect of 'advanced manufacturing' in the UK.

Standards, information and systems to support remanufacturing

Establish quality standards for remanufactured products to meet market expectations. This can in turn support a trusted quality mark or labelling scheme, as discussed above. Standards and labelling will also address the problem of sub-standard remanufactured products which would otherwise tarnish their reputation.

Establish design-for-remanufacturing standards and guidelines. This will improve the efficiency and economics of remanufacturing, and should be part of broader remanufacturing systems (below).

Develop information systems to support efficient and effective remanufacturing processes. End-to-end systems could include the following:

- Product information (e.g. a "product passport") to enable traceability and understanding of what conditions products and parts have been subjected to during their lifetime, and how/whether they can be remanufactured.
- Labelling (e.g. via RFID, product codes etc.) to indicate products that are designed for disassembly. This would enable dismantlers/core brokers to easily determine how to channel products collected at end of life.
- Decision support systems and tools to determine whether products are fit for remanufacturing vs. other options (e.g. refurbishment, downcycling, etc.)

Develop methodologies and tools to quantify environmental benefits of remanufacturing. This will ensure that lifecycle benefits of remanufacturing are effectively assessed and communicated, and can inform the right decisions (both business and policy).

4. Solutions and Approaches *(continued)*

Smart regulation and policy

Supply-side policy incentives to encourage remanufacturing. This could include a number of policy action such as:

- Designing policies to focus on the amount of value retained in the economy, rather than volumes of material recycled. For example:
 - Adjusting WEEE policy to encourage reuse and remanufacture of electronic and electrical equipment rather than recycling
 - Reducing WEEE compliance fees for products designed for remanufacture
- Setting remanufacturing objectives for different sectors and tracking performance against these.
- Requiring OEMs to release product information for products that are obsolete and there is a lack of spare parts, enabling these to be effectively remanufactured to required specifications.

Demand-side policy incentives to encourage uptake of remanufactured products. Government can implement policies to increase awareness and uptake of remanufactured products by the market (both B2B and B2C).

Financing

Provide funding for businesses and supporting institutions to develop business models, technologies, and systems that will enable a step-change increase in remanufacturing supply and demand. This can include:

- **Funding specific innovation projects** through competitions or other means. Positive steps have recently been taken through funding competitions from the EPSRC and Innovate UK, namely:

– Supply chain innovation towards circular economy (EPSRC)

– [Circular economy: business models \(Innovate UK\)](#)

These new calls will be crucial in kick-starting developments in Remanufacturing in the UK.

- **Funding for initiatives and supporting institutions** that have industry-wide applicability and benefit. This funding could go towards addressing many of the solutions proposed above.



5. Conclusions and Next Steps

The response from industry at the workshop shows clear business drivers for remanufacturing. In particular, **financial and market competitiveness** benefits were key reasons to remanufacture and to buy remanufactured products. From a policy perspective, remanufacturing generates local high-skilled jobs and reduces our environmental footprint.

Important barriers were also identified. **Customer perception of remanufacturing** was a significant issue across both public and private sector procurement. **Access to core** is an ever present problem along with **access to skills** for technical staff, designers and business leaders. **Technical barriers** were also highlighted, particularly with remediation, disassembly and monitoring.

Remanufacturing goes hand-in-hand with alternative business models, understanding how to implement these new ways of working and access to appropriate finance is key to gaining market traction.

This workshop was an important step in determining the need for support for remanufacturers in the UK. It follows on from the APSRG's reports in providing evidence for the need for intervention. However, given the complexity of value chains and uncertainty over the viability of business models that incorporate remanufacturing, further research and industry engagement is needed. Nevertheless, **the appetite is clearly there to tackle the challenges and capture the opportunities of remanufacturing.**

We therefore believe that a coordinated, collaborative effort is required involving industry, research and learning institutions, and government, to develop and implement a coherent strategy for the UK.

The consortium intends to further explore the themes highlighted in this report in order to feed into this effort.

We look forward to continue working with our partners and supporting excellence in UK manufacturing.

An online group hosted by KTN has been set up to provide members with:

- Updates on the latest funding and support opportunities;
- Details of forthcoming events;
- A platform for online discussion, networking and collaboration; and
- Opportunities to engage with our activities to influence policy and future funding.

Membership is free. To join the group, please visit the following link: <http://tinyurl.com/ukreman>



Contacts



www.ktn-uk.org

Ben Peace, Sustainability Lead
ben.peace@ktn-uk.org



www.hssmi.org

David Stewart, Research Engineer
david.stewart@hssmi.org



www.carbontrust.com

Aleyn Smith-Gillespie, Associate Director
aleyn.smith-gillespie@carbontrust.com



www.coventry.ac.uk

Kevin Vincent, Business Development Manager
kvincent@cad.coventry.ac.uk



www.remanufacturing.org.uk

Ben Walsh, Manager
ben.walsh@remanufacturing.org.uk

References

- APSRG. (2014). *Remanufacturing - Towards a Resource Efficient Economy*. Retrieved from <http://www.policyconnect.org.uk/apsrg/research/report-remanufacturing-towards-resource-efficient-economy-0>
- APSRG. (2014). *Triple Win - The Social, Economic and Environmental case for Remanufacturing*. Retrieved from <http://www.policyconnect.org.uk/apsrg/research/report-triple-win-social-economic-and-environmental-case-remanufacturing>
- Steinhilper. (2006). *Remanufacturing: The ultimate form of recycling*. Fraunhofer IRB Verlag.
- USITC. (2012). United States International Trade Commission report.