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International Resource Panel

RE-DEFINING VALUE

THE MANUFACTURING REVOLUTION

Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy

KEY INSIGHTS FOR BUSINESS LEADERS

- Remanufacturing and comprehensive refurbishment (Full Service Life VRPs) are intensive, standardized industrial processes that provide an opportunity to add value and utility to a product's service life.
- Repair, refurbishment, and arranging direct reuse (Partial Service Life VRPs) are maintenance processes that typically occur outside of industrial facilities and provide an opportunity to extend the product's useful life.
- Relative to original equipment manufacturer (OEM) New production, value-retention processes (VRPs) require less new material and energy inputs and generate less production waste and emissions per-unit. These reductions can lead to reduced marginal costs for producers who adopt VRPs. Report findings suggest that at the product-level, remanufacturing and comprehensive refurbishment can contribute to GHG emissions reduction by between 79% and 99% in appropriate sectors. Similarly, the opportunity for material savings via VRPs is significant: Compared to traditional OEM New production, remanufacturing can reduce new material requirement by between 80% and 98%; comprehensive refurbishing saved slightly more materials on average, between 82% and 99%. Repair saved between 94% and 99%; and arranging direct reuse largely does not require any inputs of new materials. Cost advantages of VRPs range, conservatively, between 15% and 80% of the cost of an OEM New version of the product
- VRPs rely on high-quality, durable products and components as inputs: there will always be a need for original manufacturing activity alongside VRPs and other circular economy practices.
- Adopting VRPs for appropriate products and product-lines can empower companies to reduce the environmental footprint of their products and their operations. This can enable improved ability to meet climate change commitments and other sustainability goals, as well as achieve compliance with increasing sustainability and circular economy regulations in markets around the world.
- When vertically-integrated into a company's operations, customer-service supported VRPs provide an opportunity to extend and strengthen valuable customer relationships, and tap into new, diverse market segments. Companies can often leverage existing production, logistics, service systems, and distribution infrastructure in the implementation of VRPs.
- Innovative business models, including product-service systems (PSS), product-as-service, sharing economy, and warranty-driven reverse-logistics, can provide cost-effective opportunities for companies to pursue VRPs and enhance the value of their offering.
- An optimized VRP strategy requires that companies adopt new product design processes and priorities. Products must be designed to be durable, upgradable, able to be refurbished or remanufactured and repairable, and these design objectives need to be incorporated early in product planning and business case development stages.
- A strong business case for adopting VRPs is often impaired by the presence of government policies that restrict the import, distribution, and/or sale of VRP products and inputs (e.g. cores [1]), as well as the lack of required technology, product information, and skilled labor.

1 A core is a previously sold, worn or non-functional product or module, intended for the remanufacturing process. During reverse logistics, a core is protected, handled and identified for remanufacturing to avoid damage and to preserve its value. A core is usually not waste or scrap, and it is not intended to be reused for other purposes before comprehensive refurbishment or remanufacturing takes place.

- A significant customer market barrier stems from a common perception that VRP products are of lower-quality than traditional OEM New offerings. To increase customer market demand, there is a need to reconcile any gap between perceived and actual VRP product quality.
- VRPs may not be appropriate for all products or organizations. When considering adoption of VRPs companies should also evaluate: the nature of the product and components (e.g. durability, material composition); the use-phase energy requirement and energy efficiency of the product; the residual value of the product at its end-of-use (EOU); and the marginal cost of the VRP relative to the market value of the VRP product.

SUMMARY OF RECOMMENDATIONS FOR BUSINESS LEADERS

The adoption of value-retention processes (VRPs) is an important strategy for companies interested in taking a leadership position on sustainability and circular economy and interested in the economic and environmental benefits that can be achieved. The following recommendations highlight the key priorities that Business leaders must incorporate as part of their strategy:

1. **Adopt** an expanded systems-perspective that considers the product within the broader system in which it exists, and across its life cycle: production, use, and end-of-use (EOU), or end-of-life (EOL).
2. **Evaluate** existing product lines to identify opportunities to adopt VRPs within the product-system, directly (e.g. offering VRP products) and/or indirectly (e.g. enabling VRPs through third-party arrangements).
3. **Modify** product design priorities to incorporate principles essential to VRPs and circular economy: value creation (e.g. design for quality); value protection and preservation (e.g. design for durability); and cost-effective and easy value recovery (e.g. design for disassembly). Design for VRPs must be incorporated from the beginning of the product development process.
4. **Utilize** – wherever possible – existing production, distribution, and collection infrastructure and networks to facilitate the closing of product and material loops within the supply chain. This can support the implementation of VRPs and enable the transition to circular economy.
5. **Contribute** to the development, ratification, and enforcement of VRP standards that guide industry practice.
6. **Provide** transparent and credible information to customers about VRPs and the quality of VRP products to objectively inform customer perceptions of risk and value relative to the traditional OEM New offering.
7. **Engage** policy-makers in collaborative discussion and initiative focused on communicating and alleviating VRP production-capacity and other technological barriers to VRPs.
8. **Partner** with other industry members to provide active education and awareness initiatives to the customer market about VRPs, VPR products, and the economic and environmental benefits of VRPs.
9. **Collaborate** with other industry members and policy-makers to clearly identify and communicate the key barriers that inhibit the business case for VRPs in all operating jurisdictions.
10. **Coordinate** with internal company stakeholders to facilitate the intra-firm sharing of essential VRP resources across national borders, including necessary technology transfer, resources, product information, and training.
11. **Partner** with research institutes to support and enable enhanced R&D focused on product design, process design, infrastructure design, and other opportunities to adopt and optimize VRPs.

For more information please contact the Secretariat of the International Resource Panel at:
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The full report and Summary for Policymakers can be downloaded at:
http://www.resourcepanel.org/reports/re-defining-value-manufacturing-revolution