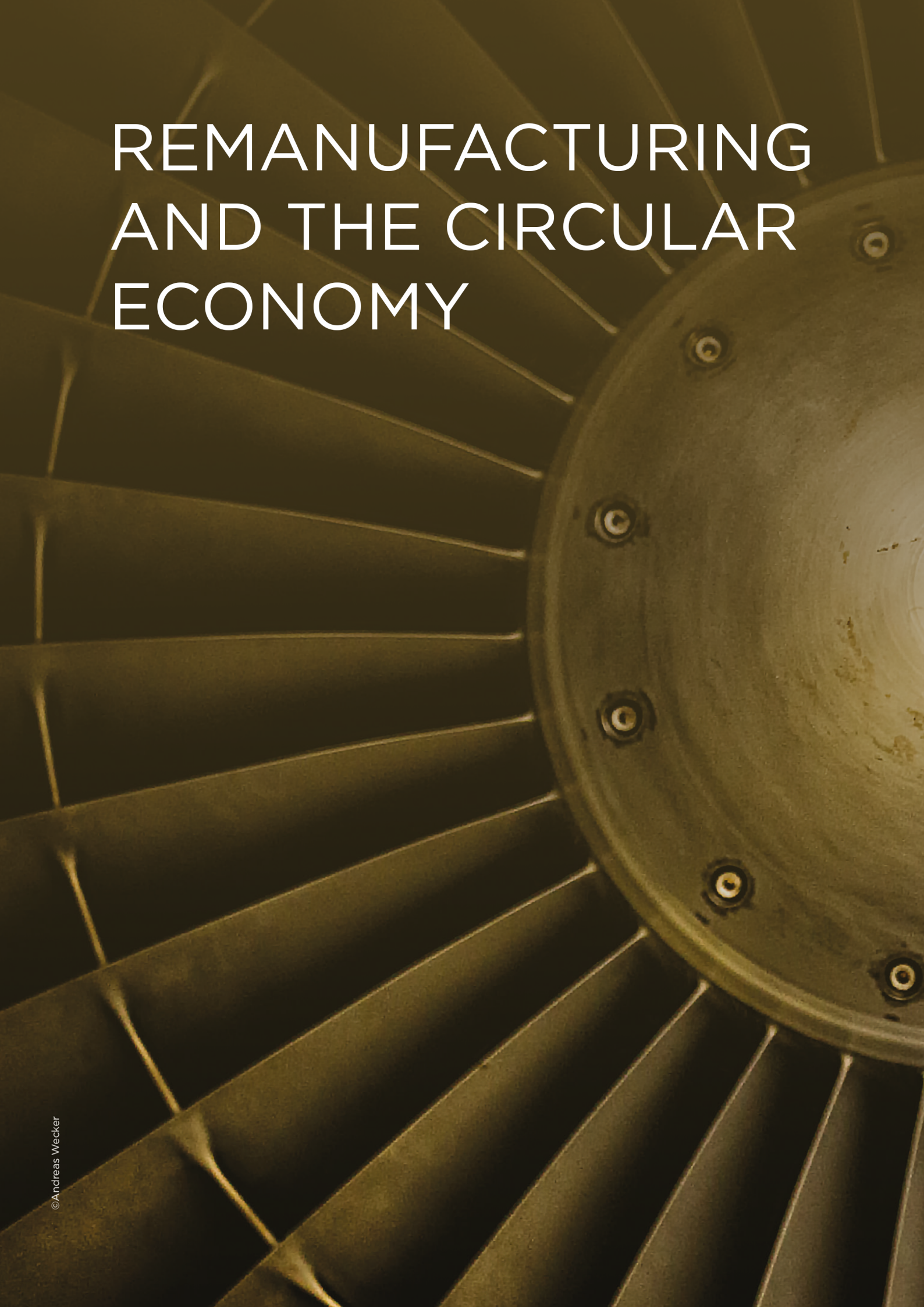
REMANUFACTURING AND THE CIRCULAR ECONOMY



"REMANUFACTURING AND THE CIRCULAR ECONOMY" BY NABIL NASR

Published by the Ellen MacArthur Foundation, *A New Dynamic 2: Effective Systems In a Circular Economy* brings together 18 key thinkers, business leaders and academics who look beyond the boundaries of their respective disciplines and establish the necessary connections to re-think our current development path. This volume helps to further understand and engage in the realisation of the circular economy model.

What is remanufacturing? What are the additional economic or environmental benefits of remanufacturing, and how does this industrial practice differ from reuse or recycling? In a highly instructive chapter *Remanufacturing and the circular economy* Nabil Nasr answers these questions with compelling case studies that illustrate the power of the circular economy model. This study brings an important focus to a topic that holds great promise for contributing to the global adoption of a regenerative economy.

Here is an abridged adaptation of Nabil Nasr's chapter *Remanufacturing and the circular economy*.

Remanufacturing (or 'reman') is a truly closed-loop industrial process that intentionally recaptures the value-added component of a product so that it may lead additional useful lives rather than being landfilled or recycled. The cornerstone of reman is full restoration – a high-quality process through which products are systematically disassembled, cleaned, and inspected for wear and/or degradation. Any substandard or degraded components are replaced, feature upgrades can be incorporated, and the product is reassembled. Quality testing is typically performed to ensure performance meets original specifications. At the end of the process, the remanufactured item emerges functionally equivalent to new production, and often it is supported post-sale with the same kind and length of warranty coverage as a newly manufactured product. (...)

Remanufacturing is often compared with recycling even though the two processes differ significantly. Recycling reduces products into raw material, which can then be used again. In contrast, remanufacturing retains the geometrical shape of the product, and is therefore able to capture both the materials and the value added (the labour, energy, and manufacturing processes) which were embodied in the original product during initial manufacturing. In many cases, the ratio of total energy required for new production compared to that required for remanufacturing is approximately 6:1[1]. Research by Adler[2] found that a typical reman operation (diesel engine

1 N. Nasr, Reman for success (Industrial Engineer, 42, 2010), 26.

2 D.P. Adler, Comparing energy and other measures of environmental performance in the manufacturing and remanufacturing of engine components (MS. Michigan Technological University, 2004)

cylinder head remanufacturing), required less energy and produced fewer greenhouse gas emissions than new production of the same component. Recapturing (and retaining) the value-added component of a product is both environmentally and economically beneficial. (...)

By implementing a remanufacturing strategy, disposal costs (both financial and environmental) can be avoided, the value embodied in the product can be recouped, and resources can be used more efficiently, thus helping advance the circular economy model. (...)

REMAN INDUSTRY PROFILE

The global commercial remanufacturing industry is characterised by predominant emphasis on the automotive sector. However, global remanufacturing activities also encompass aerospace industry; toner cartridges; office furniture and equipment; transportation, construction and electrical equipment; machine tools, compressors, heavy machinery, and others.

The remanufacturing of medical devices is a growing phenomenon within the health-care industry. The types of devices currently remanufactured range from machines such as neonatal monitors and anesthesia vaporisers to devices used in surgery such as forceps, endoscopes, and cytoscopes. (...)

Although it is an enterprise of worldwide scope and significance, remanufacturing is possibly the industry most neglected by researchers. Until recently only two major surveys of US remanufacturing have been conducted ; and both assessed a limited number of broad indicators including number of firms, total annual sales, total direct employment, and number of product areas served. (...)

REMAN AND THE CIRCULAR ECONOMY

Mass production, and high levels of consumption and disposal are forcing society to face constraints on the availability of resources. Closing the loop with regard to the material flows associated with the product life cycle or service delivery to consumers would be an important step toward establishing a circular economy. Product remanufacturing is a key element of an overall product life-cycle strategy that can help achieve this goal. (...)

REVERSE LOGISTICS

In order to realise all the advantages that remanufacturing can offer to the circular economy, several conditions must be met. Chief among them is the

design of the collection system – the supply chain that sources and delivers discarded/worn product 'cores' suitable for remanufacturing to the company performing this work. Organising and maintaining such a collection system is often expensive for the remanufacturer. However, it is in the interest of the remanufacturer – once its collection system is established – to create an incentive for end-users to turn in their discarded/worn-out goods rather than disposing of them in landfills. (...)

DESIGN FOR REMANUFACTURING

Another major challenge for the reman industry is that many potentially profitable products were never designed to be remanufactured. Most products are designed for a single life cycle and are then discarded; however, the discarded product still has significant residual value, and if recovered, could save money and natural resources. The recovered value and environmental benefits can be increased by incorporating the principles of Design for Remanufacturing (DfReman). DfReman can be a viable opportunity to maximise the utility of products and value to businesses and consumers while also maximising the amount of waste that can be diverted from landfills. Products that incorporate DfReman principles from their conception can display greater economic, environmental and social benefits to manufacturers and society than products that incorporate remanufacturing strategies as an afterthought to product design. (...)

PRODUCT SERVICE AND REMAN

Many manufacturing companies are currently making efforts to servitise their businesses. This movement provides opportunities to increase economic profits and develop closed-loop industrial systems including the adoption/ incorporation of remanufacturing. As servitisation leads companies to focus on selling product functions or service rather than products, companies are motivated to take responsibility for the entire life cycle of products and thus to reduce the associated costs by developing closed loops of material flows that, in turn, help enable the circular economy. (...)

DISCUSSION AND CONCLUSION

Remanufacturing is a key enabler to circular economy by giving products multiple life cycles and incorporating incremental upgrades. However, global remanufacturing intensity is still very low due to market and industrial challenges. Those are also referred to as external and internal challenges. Chief among those are market restrictions for trading reman products as well as lack of market awareness of the value of reman products. In addition, at the firm level, there is lack of investment in reman technologies, infrastructure, and supply chain development which limit the potential growth of this industry. Progress in addressing those factors is needed to realize the great promise for

contributing to the growth of the circular economy model.

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