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Remanufactured Products' Advantages and Challenges

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Abstract

Remanufacturing is the process of restoring discarded goods and components to a brand-new, technologically sophisticated state with the least amount of waste and expense. In a rebuilt product that incorporates the technological advancements deemed required to ensure that repairs may be completed promptly and the item is returned to functionality in an efficient manner, non-wearing parts are reused. This review article provides an overview of the remanufacturing process. The significance of it, how it contributes to sustainability, and a list of difficulties with product remanufacturing. When industries adopt new technologies for component restoration, higher material recovery, and even the retention in-house of competencies that could have previously been outsourced, the scope and benefits of remanufacturing expand. However, its drawbacks are also explained.

Keywords: Sustainability, Recycling, Remanufacturing, Reconditioning, Circular economy, Medical Equipment's.

INTRODUCTION

During World War II, the United States and the United Kingdom used remanufacturing in practice. These nations did not produce any automobiles or replacement parts since all production facilities were devoted to the manufacture of military hardware. The only choice left was to remanufacture the old vehicles and keep them on the road. This is the development of the idea. There are 70,000 remanufacturing businesses in the US that bring approximately $53 billion annually [9, 10]. Entrepreneurs are constantly searching for less manufacturing costs, faster manufacturing turnaround times, and higher manufacturing quality in today's cutthroat business environment. In order to meet these needs, technology has been developed. Manufacturing procedures have advanced over the past ten years as a result of the availability of better technical solutions [11, 12]. However, environmental considerations were disregarded throughout the competition. Remanufacturing is a process that offers more affordable and sustainable alternatives. Remanufacturing is included for a number of reasons, including the following: Remanufacturing describes the process of disassembling products, cleaning, repairing, or replacing parts, and then reassembling them in good working order. In other words, it involves reusing discarded materials to create new goods that are functionally and aesthetically equivalent to the originals. Remanufacturing is interchangeable with a variety of other phrases, including rebuilding and refurbishing, although it is now widely recognized as the industry term for this procedure [1–5]. Candidate products are often transported to a production setting and deconstructed there. The component parts are changed, if necessary, after being cleaned, inspected, mended, or reconditioned. The product is then tested to meet its original performance requirements after the parts have been reassembled. Remanufacturing is the process of recovering the value added to the material when

a product was first produced, restoring a used item to like-new condition. Remanufacturing lowers the amount of energy and materials used, as well as the cost of manufacture. The money generated by waste remanufacturing in combination with environmental benefits makes the practice potentially a significant contributor to sustainable development in the context of drivers like the Landfill Directive (SD). Tank remanufacturing during World War I was the first industrial application of the technology; for a brief while following World War II, remanufacturing was profitable for all UK automakers. Remanufacturing is still, in general, a specialized industry today. Caterpillar, Xerox, and Flextronics are three prominent global remanufacturers, but the majority of remanufacturing is done by much smaller businesses. Flextronics remanufactures the majority of Xerox goods in the USA and a minor number in Europe (Cosgrove, 2007b).

The 2004 Oaken Hollins Ltd (OHL) report Remanufacturing in the UK: a Significant Contributor to Sustainable Development offers a thorough assessment of the state of the UK remanufacturing industry and identifies potential future markets for remanufacturing, emphasizing that remanufacturing can reduce carbon emissions. This paper, which expands on the OHL report's findings and adds to some of OHL's analysis, looks into the connections between designs and remanufacture.

The 2006 article Remanufacturing: A Key Enabler to Sustainable Product Systems by Nabil Nasr and Michael Thurston Although the focus of Erik Sundin's work in Product and Process Design for Successful Remanufacturing is on the details, a lot of products can be remanufactured. Automobiles, auto parts, electric motors, single-use cameras, computers, office furniture, industrial equipment, photocopiers, toner cartridges, and many other items fall under this category. The strongest tradition and current level of representation in the automotive industry belong, however, to remanufacturing. Two thirds of all remanufacturing is used to remanufacture products for the automotive industry. Various industry sectors may refer to remanufacturing using different words. Rebuilt is used, for instance, for components and systems in automobiles, while recharged is used for imaging products like laser and toner cartridges. Recycled, repaired, restored, and reconditioned are other phrases that are related yet refer to fundamentally separate processes.

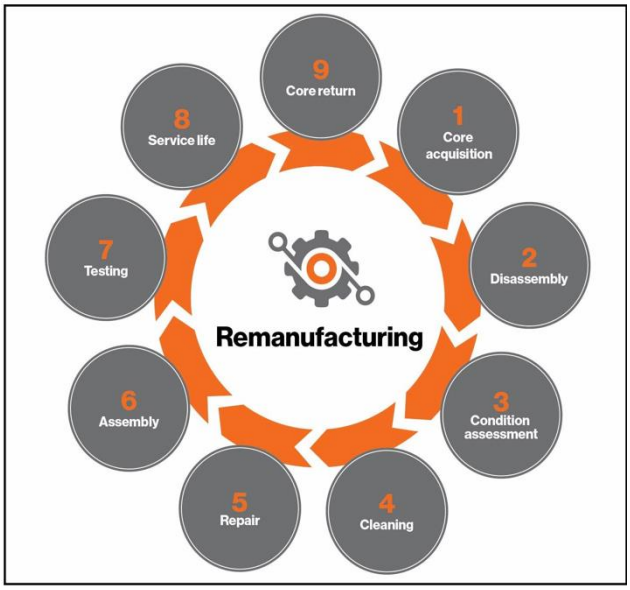

Fig._1: A complete model of the remanufacturing process

THE PREREQUISITES FOR REMANUFACTURING

According to the Remanufacturing Institute (TRI), the procedure used determines whether or not a product has been refurbished. Before a product is deemed to be remanufactured, the following requirements must be satisfied, according to TRI:

- The main parts are repurposed.
- Dismantling is done in order to evaluate the condition, wear, or deterioration of component parts.
- Each component is meticulously cleaned and inspected.
- Any pieces that are damaged, missing, or broken are repaired so they are as good as new, or they are replaced with new components. If their functioning is unaffected, used goods may occasionally be acceptable to include.
- To get everything back to working order, any necessary corrections—such as machining, rewinding, or refinishing—will be made.
- The functionality of a reconditioned item is on par with that of a new one.

Remanufacturing: The process of bringing a used product back to at least the OEM's original performance specifications from the customer's point of view and providing the finished product with a warranty that is at least equal to that of a newly manufactured equivalent.

Reconditioning: is the process of bringing a used product back up to parity with its original specifications while still functioning satisfactorily. The resultant product typically has a shorter warranty than its equivalent newly made goods. All significant worn parts are covered by the warranty.

Repair: Simply put, repairing is the act of correcting a product's identified flaws. There are fewer warranties offered on restored products than on their corresponding newly produced products. Additionally, just the component that has been changed may be covered by the warranty [5], not the entire product.

IT'S NECESSARY TO REMANUFACTURE

Repair, reconditioning, and recycling are further choices in addition to remanufacturing. Damaged parts are restored to a usable state through the process of repair. The reconditioning process is comparable to that of repair, with the exception that parts are not brought to dimensional precision, but rather, through repainting, recoating, and resurfacing operations, their functions are brought to a satisfactory level. Recycling is the process of regenerating material through various methods and reusing parts. It is guaranteed that recycled parts degrade appropriately. The best solution out of all of these is remanufacturing. The several approaches listed below illustrate why remanufacturing is superior to repair, reconditioning, and recycling.

1. Products that have been remanufactured are always higher quality than those that have been repaired, reconditioned, or recycled. Because they require more labor content. The profit margin is lower when products are recycled because of quality issues. Electronics and mechanical components that have been recycled in particular are of lower quality and performance.
2. Warranty: Compared to repaired and reconditioned parts, remanufactured parts have a better warranty. Only the parts that have been repaired receive warranties during repairs. Remanufactured products, however, come with a warranty covering the entire item.
3. Upgrades: Remanufactured products have one or more upgrades, but repaired and reconditioned products do not.
4. Recovery: Only the material is recovered when a product is recycled, while the entire product is recovered when a product is remanufactured.
5. Identity: While some products lose their identity when they are remanufactured, other things keep their original identity.

THE SPECIFICATIONS FOR REMANUFACTURING

Remanufacturing is typically seen as the end-of-life option for a retired product that is the most environmentally benign. If a remanufactured product may be used in place of a new one, a credit is typically claimed for the emissions and resource consumption that would have been avoided had the new product been produced instead. The biggest cost reductions come from not having to produce new materials, although there might be a huge difference between new manufacturing and remanufacturing. At the same time, remanufactured goods often cost between 50% and 80% less than brand-new goods. Remanufacturing is therefore advantageous because it saves the environment and money for consumers. The retired products must have a sizable residual value at the end of their useful lives in order to be remanufactured. The second is that the company that performs the remanufacturing may successfully obtain the retired product. The third is that with only a small expenditure, the product can be brought back to like-new state (in terms of product function). Tires, motors and generators, and automobile parts are the three remanufacturing categories in the United States that have the most remanufacturing facilities. For the original equipment manufacturer, having a product with high residual value at the end of its useful life might be problematic (OEM). For instance, the OEM can find itself in competition with its own products that have been remanufactured by another company if it decides not to remanufacture its own products. An OEM may use a number of tactics to thwart third-party remanufacturing to prevent getting into this predicament. These tactics could entail rendering outdated products useless, implementing a predate system, making quick (small) design adjustments, and purchasing the outdated goods. Diverse printers OEMs have used each of these tactics to defend their ink cartridge business, with variable degrees of success.

PROBLEMS WITH REMANUFACTURING

In addition to the advantages for the environment and society, there are strong indicators that using remanufacturing methods can increase and stabilize profit levels. Despite this, there are still a lot of challenges to be solved before the full potential benefits of remanufacturing can be realized. The majority of these issues are best and most effectively handled by the individual organizations. Below, we've highlighted the key ones.

Design engineering: Because it must be simple to disassemble for refurbishment and, ideally, use subassemblies that can be easily and inexpensively upgraded to incorporate new developments and modifications that have been found

necessary in the light of service experience, product design is a crucial component of profitable remanufacturing. By doing this, obsolescence can be reduced and a company can continue to compete with new items.

Executive commitment: Remanufacturing needs to be incorporated into a corporate plan with the support of the company's leadership team. One of the best instances of a company putting this theory into practice is GE. Through a combination remanufacturing and upgrade service, the goal was to increase the value of GE capital products already in use. As a result of significant resources being devoted to this, it is claimed that 3.5% of the company's revenue in 2001 came from sources other than new goods and service facilities. They demonstrated the value by contributing more than 60% of the profits.

Trade groups: Any company can benefit greatly from membership in a trade group. By offering a single voice or consensus of view that can solve problems or argue for changes that would be beyond the capacity of individuals, trade associations have a considerable impact on industry. Trade organizations have advocated for remanufacturing as a way to conserve energy and important strategic materials by bringing to the attention of the public and government several manufacturing-related issues.

Circular Economy: Future challenges for original equipment manufacturers include diminishing natural resources and rising competition from nations with cheap labor. The requirement to maximize the utilization of the materials already present inside existing end products is increased by this, social pressure, and related factors. A traditional concept for product life cycles was to extract raw materials from the earth, manufacture, supply, and then discard them. The circular economy strategy is increasingly important to many businesses today in terms of resource use and profitability. A successful environmentally friendly and economically viable company strategy relies on efforts to reuse, remanufacture, and recycle [6–8]. In a circular economy, energy and material loops are slowed down, closed, and made smaller in order to reduce resource input and waste, emissions, and energy leakage. Long-lasting design, upkeep, repair, reuse, remanufacturing, refurbishing, and closed loops can accomplish this. In contrast, a linear economy employs a production paradigm known as "take, make, dispose." One of the main arguments in support of the circular economy strategy is that establishing a sustainable world does not necessitate changes in consumer quality of life, as well as income losses or additional expenses for producers and other economic agents. The claim is that circular business models can be just as profitable as linear ones while still enabling customers to take advantage of comparable goods and services. The circular economy prioritizes activities like recycling, product life extension, design thinking, and systems thinking. Every industry sector can benefit from the circular economy, which encompasses goods, facilities, technology, and services. It consists of biological resources as well as technical resources (metals, minerals, and fossil fuels) (food, fibers, timber, etc.). Some of the pertinent theoretical influences are Cradle to Cradle, ecological laws, looping and performance economies, regenerative design, industrial ecology, biomimicry, and blue economies. Early in the 1990s, Jackson started to put the scientific foundation for this novel method of industrial production together in his edited collection, clean production techniques. His later writings on pollution, profit, and quality of life combined these insights into a manifesto for change that would shift industrial production away from an extractive linear system and toward a more circular economy. Moving away from the linear model: take-make-dispose industrial processes drain finite resources to produce goods that end up in landfills or incinerators, and the lives that depend on them. Several scientists and intellectuals were inspired by this revelation, notably Walter R. Stahel, an economist and architect who is regarded as one of the fathers of industrial sustainability. Stahel co-founded the Product Life Institute in Geneva more than 25 years ago and is credited with coining the phrase "Cradle to Cradle" (as opposed to "Cradle to Grave," which illustrates our "Resource to Waste" way of operating). He also worked on developing a "closed loop" approach to production processes in the late 1970s. In 1982, Steve D. Parker conducted research in the UK on the use of waste as a resource in agriculture, creating unique closed-loop production systems that mimicked and merged with the symbiotic biological environments they exploited.

Sustainability: It makes sense that the circular economy would be more environmentally friendly than the existing linear one. Resource depletion and environmental pollution are decreased through reduced resource inputs into the system as well as waste and emission leakage out of it. These straightforward presumptions, however, are insufficient to account for the systemic complexity at play and ignore alternative tradeoffs. In many publications on the circular economy, for instance, the social aspect of sustainability seems to be only tangentially addressed, and there are some situations that call for alternative or extra approaches, such as the purchase of new, more energy-efficient equipment.

ADVANTAGES OF REMANUFACTURED GOODS

Remanufacturing is a profitable and sustainable choice for business owners. It improves the producer's reputation in terms of the environment.

- By using less energy, resources, labor, materials, and disposal costs than traditional manufacturing procedures, remanufacturing breathes fresh life into the product.
- The work atmosphere is monotonous during the actual manufacturing process, especially on the assembly line. However, because each problem is unique and difficult in the case of remanufactured products, work satisfaction is high.

- Additionally, the remanufacturing sector can offer experienced laborers who have retired job possibilities and the chance to apply their prior knowledge of disassembling, cleaning, repairing, and reassembling.
- Entrepreneurs are interested in remanufacturing for a variety of reasons, chief among them high profit margins of roughly 20–30%.
- The remanufacturing process will offer failure data that will be used to develop the actual product.
- Energy savings on greenhouse gas emissions are a direct effect of the ecologically friendly remanufacturing process.
- Remanufacturing allows for the same quality of service to be delivered to clients while using less resource.
- Since remanufactured products have shorter lead times, customers are ultimately satisfied.

Remanufactured products can include

- Industrial Electronics
- Machine Tools
- Electrical Motors And Compressors
- Starter Motors
- Automatic Transmissions
- Medical Equipment's
- Car And Truck Engines
- Office Photocopiers
- Excavation Equipment
- Power Bearings
- Defense Equipment
- Computer And Telecommunications Equipment
- Air-Conditioning Units
- Pumps
- Industrial Food-Processing Equipment
- Aerospace Equipment
- Carpet Tiles
- Rolling Stock

Industrial electronic remanufacturing

Industrial electronics Remanufacturing is one of the common examples of Remanufacturing that is spreading in the industrial sector. This process will serve all Manufacturing facilities, Oil & Gas, Energy, Water & Waste Water Process and commercial buildings. The facility to remanufacture is similar to Fig 1 which is equipped with state-of-the-art testing and assembly equipment. This is an example of a facility in the Middle East that servers many sectors and deliver all the advantages to different sectors.

The facility will receive many different units and some of those units are similar to Fig 2 which is from sectors like Oil & Gas, Water & Energy. This facility will remanufacture more than 1,000 units a year for the Middle East.

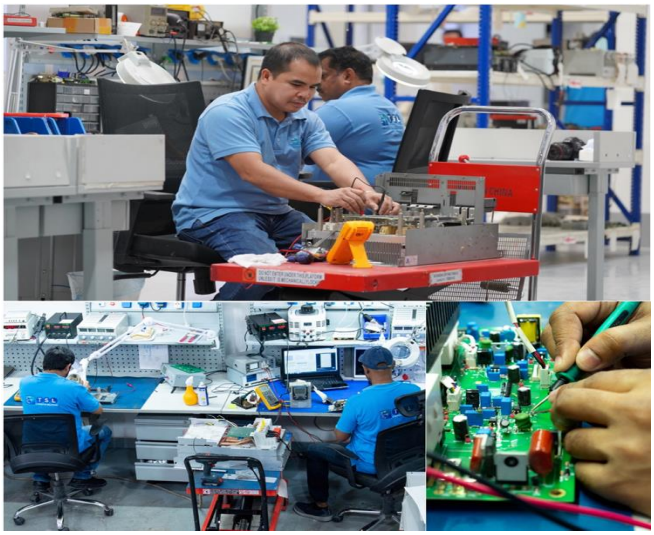

Fig._1: The facility to remanufacture

Fig._2

CONCLUSION

Remanufacturing is becoming more important, and the industry is expanding at a faster rate because of its inherent advantages in terms of utilizing less material and energy and establishing second and third lives after the end of the original life. By creating things from old materials that are just as good as original products in appearance and functionality, remanufacturing promotes sustainable development. In this research paper, we have explained in detail the impacts and drawbacks of remanufactured products and their contributions to Middle Eastern industries.

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