

对组装厂商来说，翻新产品是很有意思的新业务来源。翻新是将使用过的产品恢复到整旧如新的状态，使这些产品具有至少同原产品一样好的性能特点和耐用性。在九十年代末期，美国翻新产品的市场规模超过500亿美元。今天，初始设备制造商在进行翻新，主要是在产品保证、产品回收和产品升级时进行。本研究发现，如果翻新产品以低于新产品价格大约20%的价格出售，消费者就会愿意购买翻新的电子产品。

The Remanufacturing Equation

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Remanufacturing is a \$50-billion market, and assemblers own the skills and knowledge to compete.

Remanufacturing is the restoration of used products to like-new condition, providing them with performance characteristics and durability as least as good as the original product.¹ This important segment of the economy is frequently underestimated; for example, sales of remanufactured goods in the U.S. topped \$50 billion in the late 1990s.²

To date, most remanufacturing in the electronics industry has been conducted by OEMs, primarily in the case of warranty, recall and product upgrades. Third-party manufacturers have also been involved in remanufacturing due to the potential for profit.

An increase in remanufacturing activity is anticipated due to environmental and economic drivers. The European Union Directive³ for take-

back and reprocessing electronics waste as well as other legislation⁴ is encouraging manufacturers to consider ways in which economic value can be found in products that are being disposed of (or, at the very least, ways to inexpensively divert electronics waste away from landfills and incinerators).

In addition, remanufacturing is expected to get more attention as manufacturers find that post-sales opportunities with their product tend to offer greater margin and higher profit than actual product sales.⁵ This discovery has resulted in a greater focus on leasing, financing, training, maintenance agreements and post-user product take-back. The best example of harvesting profit from waste is probably the automobile industry, where over 90% (by weight) of automobiles is diverted from landfills. Electronics products are much more likely to find their way into landfills, but many policy makers perceive that such products have untapped residual value and that their disposal not only forfeits this value, but creates potential hazards due to the presence of heavy metals such as lead, mercury and chromium in some products.

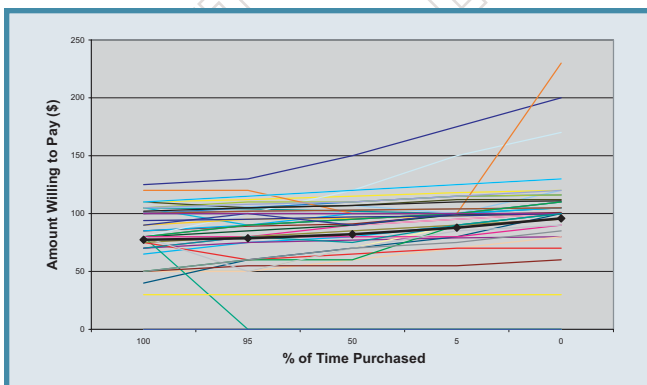


FIGURE 1: At a 23% discount, half the population would purchase a refurbished cellphone ...

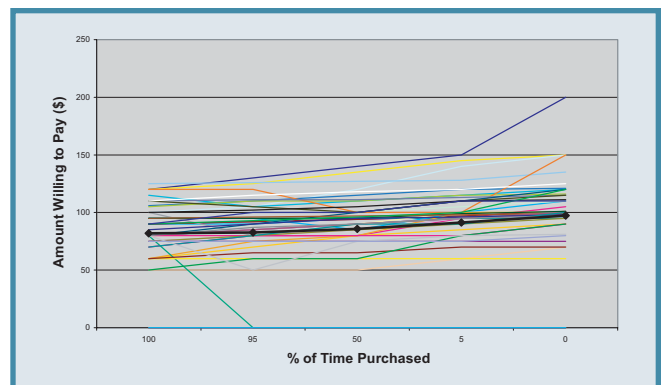


FIGURE 2: While the same population would buy a refurbished printer/photocopier at an 18% discount ...

A reasonable question is: Since both economic and environmental drivers for the reuse and remanufacture of electronics products exist, why is remanufacturing not commonplace? Conversations with executives and academics have identified two issues: 1) a perception that consumers are not interested in remanufactured products because they perceive them to be of low quality, or 2) consumers might buy remanufactured products instead of new products with a resulting overall decline in profit. In other words, remanufactured products may be too unpopular to justify manufacturing or might be so popular that they will damage markets for new products through cannibalization. In some markets, either of these two concerns may be justified.

To obtain a better understanding of how remanufactured products are perceived, we studied the response of graduate students to new electronics products and accessories versus remanufactured ones. More specifically, we considered the preference between new and remanufactured cellphones, printers or photocopiers, and toner or ink cartridges (sidebar). The intent was to gain insights into the degree of price discount that must be offered to make a new product and remanufactured product seem equivalent in value. The relative attractiveness of remanufacturing as a business can then be determined by knowing the cost of remanufacturing a product. Armed with presale knowledge of the expected price differential between new and remanufactured product and the cost of producing a remanufactured product, it can be determined for which products it is: a) unprofitable to remanufacture; b) profitable to remanufacture, but less profitable than producing new product; or c) more profitable to remanufacture product than manufacture new products. The results are of interest since manufacturers of electronics assemblies have the skills, experience, knowledge and equipment to remanufacture products.

A tremendous difference in what respondents are willing to pay for a remanufactured product exists. A thick black line is plotted through the average of Figures 1-3 to indicate what the likely behavior of half the test population is. That is, at these prices half the respondents would be willing to purchase the product at the stated price. In the case of cellphones (**Figure 1**), at a price of \$77 half the population would be expected to purchase cellphones that have been remanufactured. At \$82, about half the

population would buy remanufactured cellphones half the time instead of new cell phones at \$100. Finally, at \$96 or higher no one would be expected to purchase the remanufactured product (opting to instead purchase the \$100 new product).

For printers and photocopiers (**Figure 2**), at a price of \$82 half the population would be expected to purchase remanufactured printers or photocopiers. At \$86, about half would buy remanufactured printers or photocopiers half the time instead of new printers or photocopiers at \$100. Finally, at \$97 or higher no



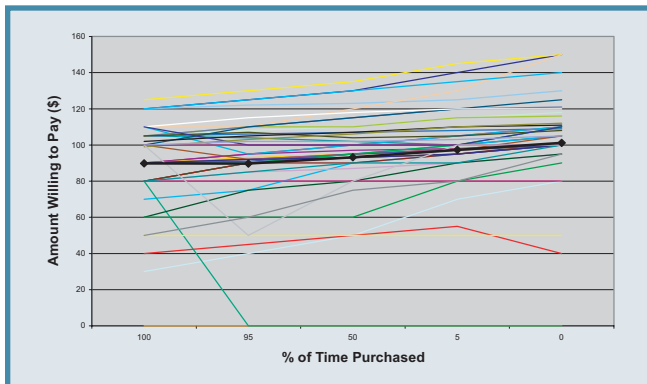


FIGURE 3: And refurbished toner cartridges at a 10% discount.

one would be expected to purchase the remanufactured product (all would purchase the new product).

In the case of toner cartridges (Figure 3), at a price of \$90 half the population would be expected to purchase remanufactured toner cartridges. At \$93, about half would buy remanufactured toner cartridges half the time instead of new toner cartridges at \$100. Finally, at \$101 or higher no one would be expected to purchase the remanufactured product.

These figures show that a discount of about 20% from the price of the new product is required to obtain a substantial market share for the remanufactured product. Whether this would result in cannibalism of new products or open up new markets to remanufactured products is not clear. The effect on overall profitability of firms will of course depend on the cost of remanufacturing.

In summary, remanufacturing products is an interesting source of new business for assemblers. Insights into the likely market price of remanufactured products can be gained by considering consumers' relative willingness to buy. Based on the study of three products considered here, a substantial market for remanufactured products exists, if sold at a 20% discount from the price of new product.⁶

References

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4. State of California, *Electronic Waste Recycling Act of 2003 (SB 20) SHER*, Statutes of 2003, California and State of Minnesota, 2003, Stat 115A.9565.
5. Wise, R. and Baumgartner, P., "Go Downstream: The New Profit Imperative in Manufacturing," *Harvard Business Review*, 77(5), pp. 133-141, 1999.
6. The discount rates shown in this study are based on our study of 49 graduate students in greater Albany, NY, and as such it is an illustrative sample. A company that would like to pursue this or related business opportunities should collect its own data with a sampling method and size that it feels is suitable.

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How Much Will They Pay?

To determine the amount consumers are willing to pay for remanufactured products, we chose a series of products representative of various "greener" products. Three of these products are directly relevant to electronics: cellphones, printers or photocopiers, and toner cartridges. (Although toner cartridges may not appear to be an electronics product, they are necessary for the functioning of printers and photocopiers, which clearly are electronics products. Furthermore, electronics and microsystems devices are critical to the functioning of toner cartridges for laser and inkjet printers.)

Next, we developed a survey to ascertain what price a remanufactured product would have to be, if the cost of a new product was \$100: 1) to ensure that the remanufactured product was always bought instead of the new product, 2) that the remanufactured product was usually bought, 3) that half the time a remanufactured product would be bought and half the time the new product would be bought, 4) that almost all the time the new product would be bought instead of the remanufactured product, and 5) the new product would be bought all the time.

These questions were posed to 49 graduate students studying business or economics at Rensselaer Polytechnic Institute (Troy, NY) and law students at Albany Law School (Albany, NY). The results are shown in Figures 1-3.