



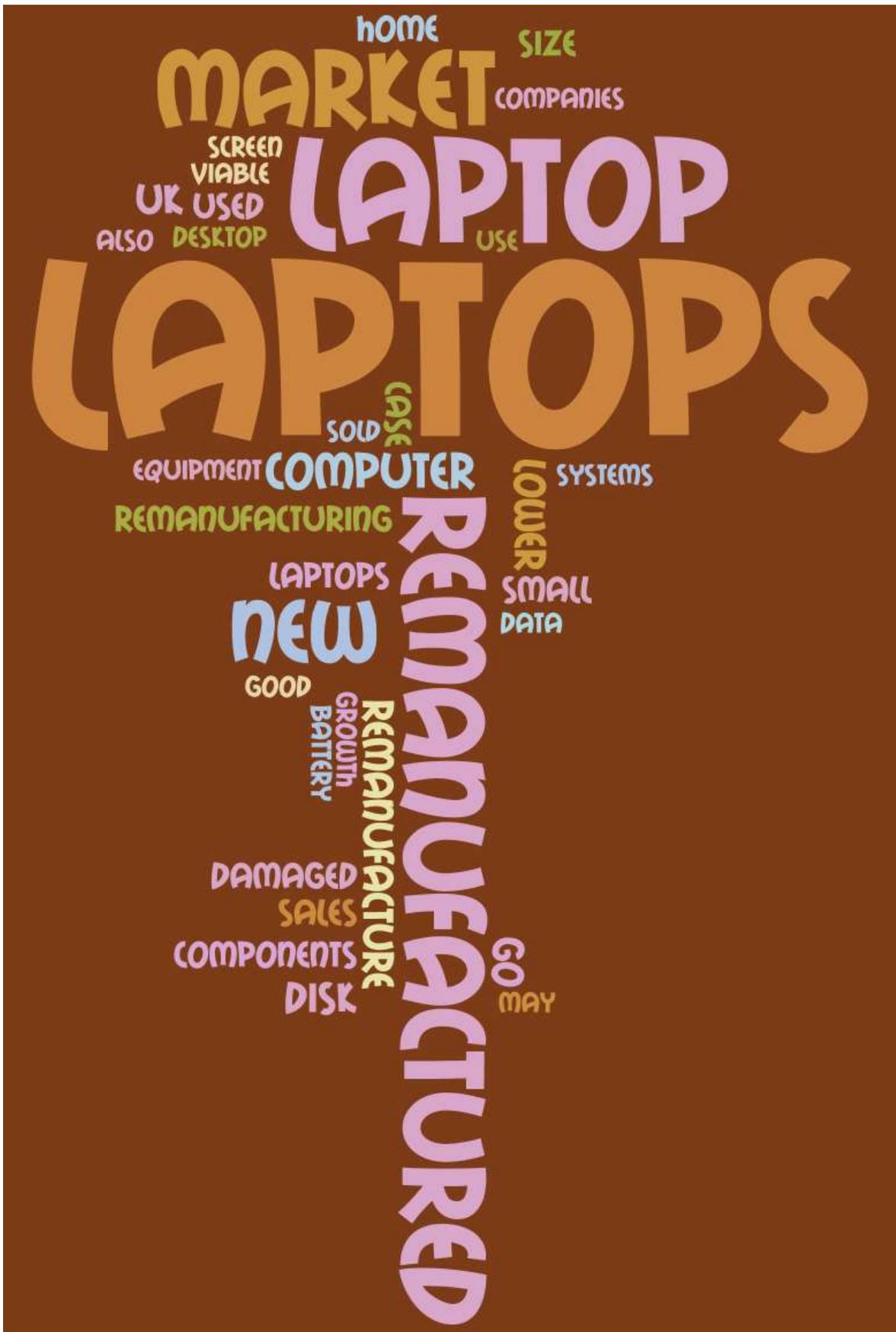
Product Group Report: Laptops

A study of the refurbishment and reuse of
laptops in the UK.

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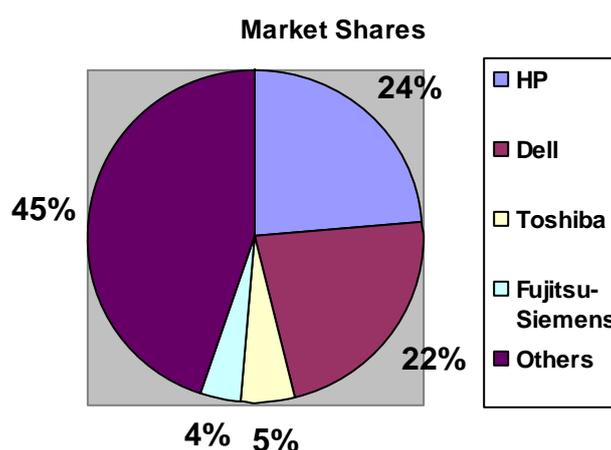
1 Commercial Overview

The first laptop was launched in the early 1980's after several "Portable" or "Lugable" systems had been introduced into the market. These were the size of a small suitcase, extremely heavy, had a small CRT screen, a small hard disk memory and a 5¼ floppy disk that only had a 360k-memory. The cost of these early laptops was between £6,000 and £15,000.

Today, laptops are a mainstream computing product, cost-competitive with desktop units, accessible by business and home users alike. The names laptop and notebook originally denoted their size with the notebook being the smaller version. Recently this has become clouded and both terms are used regardless of size, with the term notebook gaining favour. (This is largely because the use of laptops on the lap has safety implications, and the industry wishes to distance itself from this connotation.) The breakthrough in portability has been driven by two inventions that allowed the laptop to be reduced in size: The LCD screen and improved battery technology.

The leading suppliers of laptops are: Hewlett Packard 24%, Dell 22%, Toshiba 5%, Fujitsu-Siemens 4% leaving 45% between the other smaller manufactures. The majority of the laptops go to the business sector (85%), but with the prices of laptops now being close to that of a desktop the consumer home market is growing, with customers seeing the benefits of having a computer without it taking up too much space. Like TV's, houses are finding it inconvenient to have just one computer and with wireless technology being inexpensive their second computer is a laptop that can be used anywhere in the house or garden.

Figure 1: 2004 market shares



Laptop sales volumes have been growing rapidly with a 69% growth over the five-years up to 2004. Now that laptops are approaching the speed and reliability desktop systems, uptake is accelerating such that laptop sales rose by 17% last year, compared to 22% growth for the whole sector. Financially this is a growth in the UK from £11.2 billion in 2003 to a forecasted market of £13.7 billion in 2008 of laptop sales. The table below shows the sales up to 2004.

Table 1: Sales of Laptops [£k]

| 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|--------|---------|---------|---------|---------|---------|
| £957.5 | £1330.7 | £1419.0 | £1469.0 | £1464.0 | £1620.0 |

With this growth in laptop sales the market for remanufactured laptops should be excellent. There is a market for all types with the lower end cheaper models going to students and the upper end being sold for use in the home and some start up businesses.

The current market for second-hand laptops in the UK is huge with offerings from over 600 commercial websites. To this should be added the many Social Enterprise companies also working with computer and laptop remanufacture, offering an outlet for the discarded equipment of large corporate companies. The equipment is data cleaned and certified to cover the donating company for the data protection act before remanufacture. Such services offer the corporate companies environmental and social aspect to put into their annual returns to satisfy their “Triple Bottom Line” reporting requirements.

2 Technical Overview

Laptops are being replaced constantly so there is a consistent market for remanufactured laptops. Technically they are similar to desktop computers with all the same components with the exception of the power supply being external on most Laptops.

The true power-independence of the laptop has been unleashed by three developments:

- Development of low power components
- Increased battery efficiency
- Better power management systems that turn off unused components when not required.

Laptop batteries wear out causing mains-free work time to reduce. Remanufactured laptops need to have a reasonable battery life and so battery checking needs to be part of the remanufacturing process

With the growing trend for wireless working remote from base the laptops have developed into a multifunctional tool that offers a telephone, internet TV, Radio, MP3 player, diary/address book and computer in one package.

3 Remanufacturing Issues

The remanufacturing process of laptops has to be lean and efficient to make it viable. There is competition from countries like China where the labour rates are 70% lower than the UK, reflected in imports of new goods close to remanufactured prices. Process efficiencies are therefore paramount.

Laptops that are not going to be remanufactured because they are too old, the processor is too small or are badly damaged may not have to go through a data-clean process, as long as the hard disk is physically damaged to a point whereby it cannot be read. In any event removal of data and proprietary software must be conducted, generally to US Government standards.

Key technical criteria are:

- If the laptop has a processor lower than a P3 it is doubtful it would be sellable, although it could be used for spares, recycled or sold overseas. Care has by taken here not to use this route for dumping waste that will contravene the WEEE directive.
- Any screens faults that show as pixel dots or lines would be too expensive to repair. Again, the laptop could also be used for spares or recycling.
- If there is a spare screen from another laptop that has an older processor or was damaged and rejected this can be used to repair laptops with screen faults thus making it viable.
- The outer case will be acceptable if there are small scratches; if it is highly scratched and the laptop is high spec that can be sold for a higher price, respraying or retexturing of the case may be justified.
- Testing laptops has to involve a complete test of all its operations including checking that every key works, drives and memory are integral, and that the CD/CD writer/DVD functions.

- All laptops for resale must be Portable Appliance Tested (PAT) and issued with a test label.
- Once the laptop has been remanufactured is it almost impossible to sell it without an operating programme (e.g. Microsoft Office) installed, which will have to be including in the selling price.
- Set up costs could be kept low, but if the company wants to handle volume it will have to invest in auto disk cleaning systems to allow for several laptops to be processed simultaneously.
- Although laptops are not classified as generally hazardous, the components are covered by the WEEE directive. In addition, sensible precautions must be taken in the handling of e.g. batteries, where product failure and short-circuit fires are not unknown.

The knowledge require for processing laptops is minimal except for the workshop area where laptops with faults are assessed and repaired. This will have to be carried out by a qualified computer hardware engineer.

4 Markets

There is a wide and extensive market for remanufactured laptops in the UK. There is also competition from the many remanufactures, brokers and social enterprise companies. The competition also comes from new reasonably high specification laptops that are being sold on the high street for under £400. This requires remanufactured laptops have to keenly priced or there has to be incentives by government to buy remanufactured over new.

There are three markets:

1. Students – Office applications and internet access are an embedded feature of education. An annual intake of students demands a PC or more likely a laptop. Every year there is a new intake of university students who require a computer to do their studies and the laptop is their preference. As most are on a budget they tend to go for the lower end laptops that may have scratched cases and do not look good.

2. Home market – The next market want the laptop to look good, as it will be in their home and a reasonable spec. The main concern here is the size of the hard disk to ensure they can store photos and download music.
3. Businesses – A few start-up businesses or sole traders are in the market for remanufactured laptops rather than new, although the majority go for new and put it against tax. These have to be the top of the range with higher speed processors and the outer case looking clean.

All three markets require the laptops to have a minimum of a CD reader and several USB sockets. The preference is either a CD read/writer or DVD read/writer, with DVD's being popular at home. The 3½ floppy disk isn't as essential as it has been replaced with the storage sticks that are cheap and have a larger memory.

As there is a good UK market, albeit competitive, the overseas market is for the types of laptop that will not sell here. These are the lower spec, older modals without CD's and or are badly damaged. Countries in Eastern Europe and Africa are keen to have these and will take the laptops in any condition.

5 Environmental

Apart from the benefits of remanufacture in the saving of materials and resources during the manufacturing of new laptops there is added benefit of the saving in transport miles as most of the laptops are manufactured in the far east.

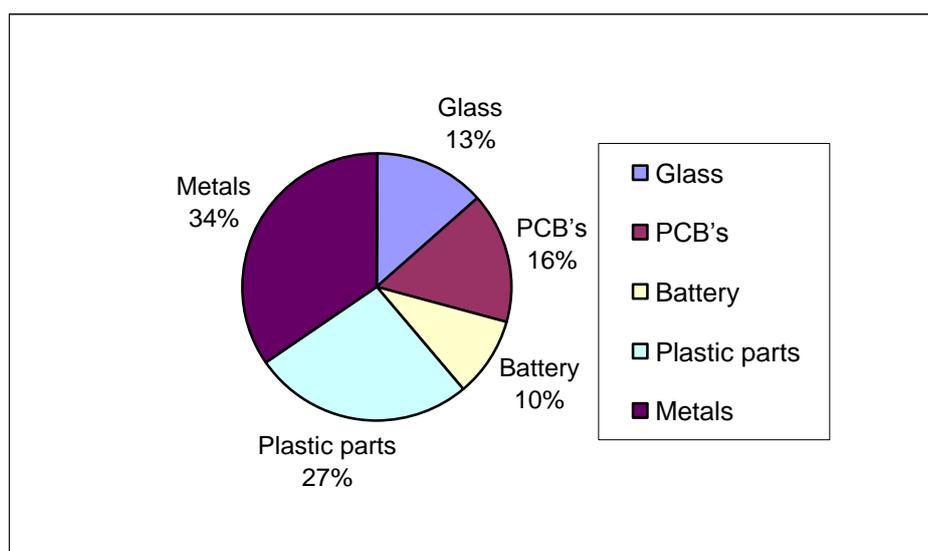
All the laptops remanufactured save the waste being disposed of in the EU especially the batteries having to be disposed of as hazardous waste. The following table indicates the split of mass of materials available for recycling. This is for a laptop weighing just less than 3kg (which is heavy for 2009); if we multiply this by the approximate number replaced or bought new annually, the amount that could go for landfill if not remanufactured or recycled is 40 plus tonnes

Table 2: Composition of laptop:

| Glass (g) | PCB's (g) | Battery Transformer Capacitors (g) | Plastic parts (g) | Metals (g) |
|-----------|-----------|--|----------------------|------------|
| 382 | 450 | 273 | 760 | 983 |

Source: AEA Technology (WEEE & Hazardous Waste: Part 2) for DEFRA

Figure 2: Content figures presented graphically

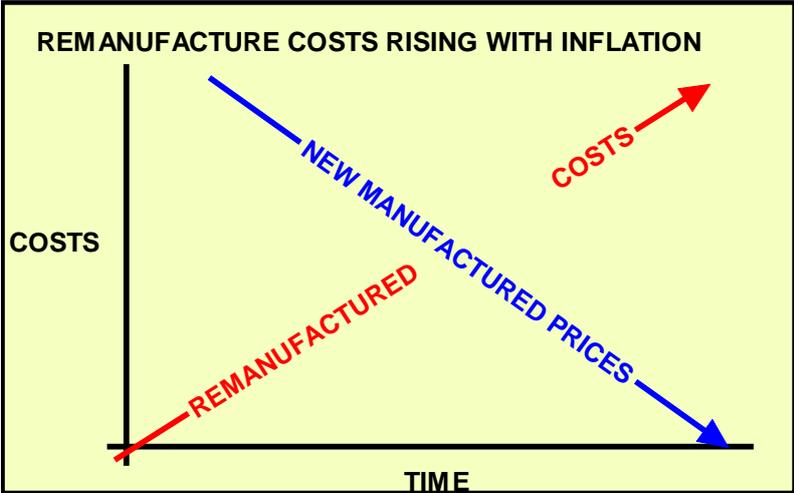


The newer laptops do use their energy better than the early models, but it is negligible and it is not a reason for not remanufacturing them.

6 Conclusions

Currently the remanufactured laptop market is buoyant and viable. The biggest issue has to be the lowering cost of new manufacture meeting the rising costs in Europe of remanufacture and the point where they cross getting lower all the time, see figure. 3. In a "throw-away" society the financial difference might be too low to be viable in the future without incentives. This might arise if disposal costs and landfill charges (translated into input prices) rise to reflect overall environmental burdens.

Fig. 3: Trends in new and remanufactured costs.

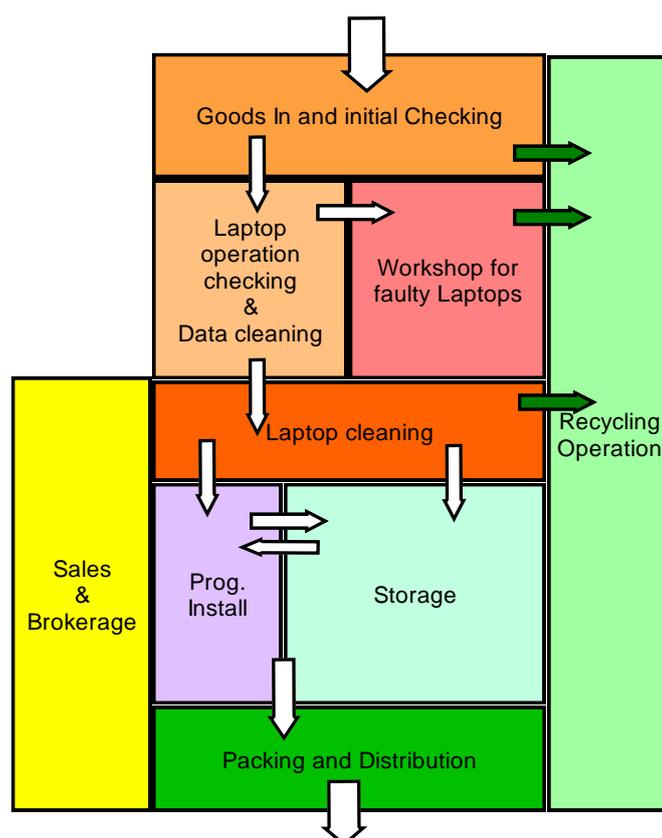


There is a market for most types of remanufactured laptops and they are suitable for remanufacture. With fierce competition from new, any remanufacturing operation will have to be lean and efficient with good marketing to have credibility.

Appendix: Process Flow

Figure 4 shows a block diagram of the departments required to remanufacture a laptop overlain with directions of material flow. For simplicity, batch and unit processes are not differentiated.

Figure 4: Layout of operations for laptop remanufacturing.



Although the workshop is configured for remanufacturing there will be significant sections dedicated to recycle unwanted, damaged or obsolete equipment. These activities incur substantial cost unless well-managed to recoup value through careful dismantling, testing and refurbishment processes. At a materials level, non- or partially functioning components may need to be split down to plastics, PCB's, screens etc.

Figure 5 shows the decision tree associated with the operations, colour-coded with the departments from above. "Hygiene" operations are essential and include front-end activities such as data destruction, as well as electrical safety, RoHS compliance for replacement parts, safe disposal, and statements of performance worthiness to the intended user.

Figure 5: Remanufacturing decision tree.

