Digital Technology, Digital Participation and the Circular Economy

Final Report

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Introduction

In October 2015, Scottish Enterprise commissioned research entitled 'Digital Technology, Digital Participation and the Circular Economy', focussing on the computer re-manufacturing industry in Scotland.

Ross Cockburn (Reusing IT) working with Mike Nicholson (writer and consultant) undertook field work to establish the stakeholders and processes of the computer re-manufacturing industry in Scotland. They also explored the legislation and standards within which the industry works, and the challenges and opportunities it faces.

The work involved meetings and conversations with a range of computer remanufacturers of different scales and types, with the Scottish Environmental Protection Agency (SEPA), and with Valpak regarding quality standards. Desk-based research of relevant strategies, policies and research was also completed. The work drew on Ross Cockburn's experience in the industry in managing the charity Reusing IT, although in the report this has been set in the context of other organisations to give greater depth to the research.

Even for a relatively small industry the issues proved to be wide-reaching and the operational processes complex and varied between different manufacturers. This report begins by setting out some key definition and exploring the wider legislative and quality context within which the industry operates, before setting out the working practices of the industry with examples of companies involved in re-manufacturing, the processes they undertake and the donors and recipients they work with.

It concludes with analysis and opinion and draws conclusions on the connection between the computer re-manufacturing industry and the areas of digital participation and the circular economy, and comments on the industry's current and potential contribution to these areas.

Part 1 Background and context

1a. Digital technology

The development of digital technology whereby digitised information is recorded in binary code, has transformed many areas of society in the 21st century. The ability of digital technology to compress huge amounts of information for easy storage and transportation, enabling fast transmission of data, are key elements of the enormous scale of recent developments. The widespread use and interconnectedness of digital technology means that it has become viewed as standard, and the reach of these technologies in terms of business, healthcare, leisure, media, communication and social networking has been hugely significant. The scale and impact of the changes described have led to the development and use of digital technology being referred to as 'the third industrial revolution'.

In Scotland, the trade body for the digital technology industry (ScotlandIS) states that they *"believe digital technologies are the future and will drive Scotland's long-term economic*

success. We strive to build a thriving community which brings together the ambition, the talent and the experience abundant here to transform the economy, business and lives."

1b. Digital participation

Digital participation is defined by the Scottish Government[1] as *"people's ability to gain access to digital technology, and understand how to use it creatively"*, although there is a further description of the highest level of measurement of digital participation as being 'access to the internet'.

The same Scottish Government review notes the wide reaching impacts of the internet on individuals' wellbeing, education, financial situation and employment opportunities, while the implications of not being online are referred to as 'digital exclusion' or the 'digital divide'. The review concludes that digital exclusion *"reinforces other existing forms of social and economic deprivation and as more and more of daily life moves online, e.g. shopping, banking, government services, there is a risk that this increasing internet penetration will increase rather than reduce inequalities."*

In order to address the areas raised by its review, the Scottish Government launched a digital participation strategy ('A National Framework for Local Action') in 2014. This noted that *"whilst many people in Scotland use digital technology regularly and confidently, others need support to use the internet and efforts should be focused on helping everyone to develop the skills and confidence to become active digital citizens."* The removal of barriers to digital participation was highlighted as an area for action, and the strategy to achieve this was described as requiring *"a national collaborative movement with those organisations and agencies closest to the people who need help to get online."*

The review also defined the barriers to digital participation as being:

- Motivation: the offline population believing that there is nothing of value to be gained by going online, as they access services in other ways or have contacts who can go online for them;
- Confidence: concerns about safety and security, anxiety about "breaking" the technology or confusion with the range of products available;
- Availability of training: people being unaware of where they can access support for computer use / internet access, or finding training intimidating or unsuited to their needs; and
- Affordability: cost can be a significant issue for many people, particularly in low income groups, although those citing affordability as the primary reason for not being on the internet often state that it is not the initial cost of the equipment which is the dominant issue, but the continuing cost of the connection.

On this fourth matter, the same research provides figures from Ofcom looking at people who were unlikely to get internet access in the next 12 months. Of these, 16% stated that it was because a computer was too expensive to buy. Issues relating to motivation and

[1] Digital Participation in Scotland: A review of the evidence 2011

confidence were far more likely to be factors affecting their likelihood of digital participation.

The wider UK picture is set out in the Government Digital Inclusion Strategy (2014) which describes a cross-sector partnership jointly led by the government and digital skills charity Go ON UK to reduce the number of people offline by 25% every two years, thereby leading to everyone being "digitally capable" by 2020. This strategy also highlights the range of factors underlying people's digital exclusion and in relation to equipment highlights that "cost is likely to be less of a barrier in the future" notably with large retail companies offering low-cost tablets.

1bi. Digital participation projects – some experiences

In Scotland, SCVO (Scottish Council of Voluntary Organisations) administers the Digital Participation Challenge Fund which invests in community digital participation projects across Scotland. The experience to date of those managing the fund is of processing around 300 applications for funding totalling £2million. Of these, just under half sought funding for IT equipment and the average request was for £6500 worth of hardware. Most of the applications related to organisations' work in delivering training to service users and not to their staff. The hardware applications included virtually none for desktop computers because the training events and classes which were being run were 'pop-up' shop style formats requiring more portable hardware which was also compatible with what people were using personally, namely tablets. This experience indicates the type of IT equipment which is often in demand, but according to the Digital Participation Officer this may also indicate a lack of awareness of the quality of second hand computer equipment available which could be an alternative.

This lack of awareness is not just in the users of the groups but also can be in those delivering the training from the experience of Reusing IT. In its work with a housing association running 'techie tea parties' they found that many people getting the chance to go online were unaware of the type, quality and high specification of remanufactured computers available and where they could be purchased. The result of this profile raising was that a package of remanufactured laptops was supplied for residents' use.

Our research also gathered information from a pilot project run by a housing association in Knightswood, Glasgow which offered wifi connectivity to 138 flats in a tower block where participating tenants were offered a free tablet for an initial trial period of 12 months. Over the life of the project most tenants made financial savings (on average £147), and there was evidence of increased use of the internet for business and social purposes and some anecdotal evidence of children gaining benefit in terms of schoolwork and homework. The project gained uptake of the free tablets of just under 60%. This project shows some of the benefits of going online for a previously unconnected community. However it also shows

that even when people are offered a package of connectivity and new equipment, there is not universal uptake.

1bii. Digital participation – subsets of people who are digitally excluded

It seems logical to consider that there are two subsets of people within the section of the population who might be termed digitally excluded, and who have particular needs which require different types of IT solution.

The first subset consists of those whose lack of digital skills prevents them from seeking and applying for work, and stops them from being considered for particular employment. These people are likely to need to develop keyboard and mouse skills, use of word processing, or an understanding of spreadsheets. In order to address this, these digitally excluded people need access to PCs or laptops in order to learn how to use the type of equipment and software which might be a job requirement.

The second subset includes people whose exclusion is more personal and home-focused rather than work-focused and relates to the fact that they are unable to access information and financial savings available to those who have internet access. In order to address this, these digitally excluded people need a method of getting online, with a tablet potentially providing a cheap and convenient starting point when only internet access is needed.

Some people might be digitally excluded in both ways, but others distinctly fall into one or other group.

Understanding that these two subsets exists is an important distinction as it shows that digital exclusion does not have a single IT solution. It also shows that the types of computer equipment which are being remanufactured are beyond the specification needed by people in the second subset who simply need access to the internet.

1c. Circular economy

The traditional model of economy is a linear one (make, use, dispose), whereas the circular economy offers an alternative where resources are kept in use for as long as possible, with the maximum value being extracted from them whilst in use, and then products and materials recovered and regenerated at the end of each service life.[2]

The Ellen MacArthur Foundation is a registered charity established in 2010 with the aim of inspiring a generation to re-think, re-design & build a positive future through the framework of a circular economy. It describes the circular economy as being *"restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times".* In a circular economy, waste is designed out of the

[2] www.wrap.org.uk

system, replaced by the notion of by-product – a material no longer useful to its last user but potentially highly valuable to other applications.

The Ellen MacArthur Foundation proposes that there are component elements[3] of the circular economy. These are described as "not mutually exclusive" and often occuring "in combination". One of the six named components is 'Product – reuse, repair and remanufacturing'.

A preliminary examination[4] by the Ellen Macarthur Foundation suggested that the circular economy offers opportunities for Scotland; "*Early adopters of the circular economy approach could gain a significant advantage in the long-term political, market and business response to resource stresses. Scotland, as a small, adaptable economy, has the opportunity to gain early advantage."*

In 2013, Scotland became the first nation to join the Ellen MacArthur Foundation's Circular Economy 100 programme CE100 – a global network of 100 companies, innovators and administrations with a three-year timeframe to accelerate the transition to a circular economy, helping businesses rethink the way they manage resources, whilst stimulating economic growth.

The Scottish Government[5] advocates a *"shift toward a more circular model of resource use and economic growth that ultimately designs waste out of our economy"* and also says that this approach *"isn't simply about using less and recycling more. It's about supporting new forms of manufacturing, redesigning products and packaging, reshaping supply chains and stimulating innovative new ways to transform recyclables into new, higher value materials*."

The Scottish Government's other commitments in this regard include funding Zero Waste Scotland as Scotland's "resource efficiency and circular economy expert" to support the delivery of the Scottish Government's Zero Waste Plan and other low carbon policy priorities.

Other relevant developments include the 2015 launch of the Scottish Institute for Remanufacture, based at the University of Strathclyde in Glasgow, backed by more than £2 million from Scottish Government along with contributions from the Scottish Funding Council, Zero Waste Scotland and private sector businesses. It is the first of its kind in Europe with the mission of helping to grow remanufacturing businesses in Scotland and to develop an international centre of research expertise.

In announcing the development, the Cabinet Secretary for Rural Affairs and the Environment, Richard Lochhead MSP said. *"It is astounding that an estimated £50 million worth of gold will potentially be wasted in Scotland in the next five years through disposal of*

[3] Component elements of the circular economy A. Circular product design & innovation B. Product re-use, repair and remanufacturing C. Innovative business models D. Renewable energy and materials substitution E. Effect supply chain and cross-sectoral collaboration and F. Re-use of waste, heat and energy

[4] Scotland and the circular economy – a preliminary examination of the opportunities for a circular economy in Scotland

[5] Low Carbon Scotland Meeting the Emissions Reduction Targets 2013-2027

electronics like computers and phones. By bringing a more circular approach to the way we manage our resources, we can change that. And by channelling expertise into better remanufacturing, we can ensure that valuable components can be recovered and reused… The Scottish Government is serious about creating a greener, more circular economy, where our valuable products and materials remain in useful circulation for longer, creating and sustaining jobs in the process."

1d. Remanufactured computers

There appears to be no widely shared definition of re-manufactured computers.

"….there's no agreed-upon definition for refurbished, remanufactured, reconditioned, pre-owned, or even used when it comes to computer equipment." (PC Magazine 2010)

The Circular Economy Evidence Building Programme (Zero Waste Scotland, 2015) notes that *"Unlike 'recycling', 'remanufacturing' does not have a universally accepted or recognised definition. This is partly due to its use across a wide number of sectors, where alternative phrases are used that could be interpreted as remanufacturing. Another reason is that there is little European or nationally defined legislation targeting remanufacturing. There have been several attempts to standardise the definition. Probably most relevant to Scottish remanufacturing is the BSI Standard BS 8887-2:2009 that defines a range of end-of-life options for products including remanufacturing.*" It goes on to define remanufacturing as to *"Return a used product to at least its original performance with a warranty that is equivalent or better than that of the newly manufactured product."*

In terms of refurbishment in this research we found that different companies describe their process of refurbishment in similar ways but each with their own emphasis:

"Equipment that has the potential to be reused is identified and passed to our engineers who will carry out an electrical safety test, as well as functional tests using well-known and approved diagnostic software. All hard drives will be erased using software certified to Department of Defence standards) which will permanently erase the drive of all previous user information…..once all tests are completely the equipment is packaged and resold." (Computer Recycling Services, Dundee – website information on refurbished IT)

"Refurbished Desktop PC computers from bargain hardware have been fully cleaned, configured, checked and, tested by our trained IT technicians. …. The majority of the PC's we sell come from large institutions and corporations; they may have some observable cosmetic blemishes, but have been well maintained even before the full overhaul by the bargain hardware team." (bargain hardware.co.uk)

"At HP, a refurbished solution is offered on just about all product lines: printers, notebooks, desktops, and more. They are products that have been returned to HP for a variety of

reasons and then put through a rigorous refurbishment process. Products that are refurbished by HP are restored to their original condition and performance. Each unit is fully tested, any broken or defective parts identified in testing are replaced and the unit is tested again. Units are then cleaned, re-packaged and assigned to new refurbished part number. HP's engineers will validate the Operating System and firmware, and re-image PCs. HP's refurbishment procedures follow the same basic guidelines as HP's testing procedures for new products." (from 'The benefits of refurbished products' www.hp.com)

1e. Relevant legislation on waste

The single most important designation within the computer re-manufacturing industry is WEEE (Waste Electrical and Electronic Equipment) – a wide categorisation within which computers and computer-related products are a subset.

According to the Scottish Environmental Protection Agency (SEPA), the definition of WEEE is *"any electrical or electronic waste, whether whole or broken, that is destined for disposal. The definition includes household appliances such as washing machines and cookers, IT and telecommunications equipment, electrical and electronic tools, toys and leisure equipment and certain medical devices."*

Since 2006, there have been regulations governing the correct disposal of Waste Electrical and Electronic Equipment (WEEE). The current WEEE regulations became law at the start of 2014 and they outline 10 broad categories of WEEE. 'IT and Telecommunications Equipment' is one of these, with others including large household appliances (white goods), medical equipment and lighting equipment.

According to the Health and Safety Executive website[6] and referring to the UK, *"large household appliances (e.g. ovens, fridges, washing machines) currently make up over 40% of WEEE but there are large volumes of other equipment such as IT equipment (mainly computers), TVs (over two million discarded each year), small household appliances (e.g. kettles and hair dryers), electrical tools, digital watches, electronic toys and medical devices."*

A facility which is legally registered to process WEEE is known as an Authorised Treatment Facility (ATF). An ATF can apply to become an Approved Authorised Treatment Facility (AATF) through SEPA in Scotland which then licenses it to issue WEEE evidence notes. Of all of the AATFs registered with Scotland, we estimate that 14 process computers, while the remainder concentrate on other electrical and electronic items such as white goods.

There are certain obligations which any facility processing WEEE has to follow. These are managed by SEPA and introduce a level of administration to the remanufacturing process

[6] www.hse.gov.uk

which some remanufacturers we spoke to in this research described as being onerous and costly in terms of time.

1f. Producer Compliance Schemes

Under the WEEE regulations, businesses that place EEE on the market (either by importing or manufacturing it) must fund its collection and recycling when it becomes waste. The law requires such producers to join approved Producer Compliance Schemes (PCS) who then register members (with SEPA in Scotland or the Environment Agency in other parts of the UK), submit data on the weight of equipment placed on the market, and carry out the collection and recycling of waste electrical and electronic equipment on behalf of members.

This has introduced the fact that computer manufacturers have to have an interest in their products at their end-of-life. This has resulted in some companies choosing to open and operate their own refurbishment plants, for example HP opened a plant in Erskine in 2012 (formed from a former HP manufacturing facility). At the time of opening they predicted they would process 800 units per day.

Producers can make arrangements with a PCS to return the WEEE directly into the system by delivery to an appointed approved authorised treatment facility (AATF) which can issue WEEE evidence notes to show that the producer has taken responsibility for a certain level of WEEE recycling. These can then count towards the producers' recovery and recycling targets. AATF's are certified and treat WEEE in line with best available treatment recovery and recycling techniques (BATTRT) (developed by Department of the Environment and Rural Affairs (DEFRA)).

A further link to standards which is important within the computer recycling and reuse industry is that any company exporting UK-sourced WEEE to countries outside the European Economic Area for recovery, has to supply evidence that the environmental standards at each overseas site are broadly equivalent to those in the UK. Any company exporting waste must also comply with the Waste Shipment Regulations (Authorised Exporters) 4 or 5 in Scotland.

1g. Data destruction

In addition to the correct treatment and disposal of electrical and electronic equipment, the key initial process for the computer remanufacturing industry where high standards have to be ensured, is in the handling and destruction of data. Donors of computers need certainty that the computers which they pass on to the re-manufacturing industry can be traced and the data held on hard drives destroyed in an agreed way, either by data destruction software or by physical destruction e.g. shredding. The consequences of breaches of data protection can be significant and costly in financial penalties. Computer remanufacturing

companies are therefore in a position of trust and responsibility and need to exercise a high level of professional practice in this area.

Some donors choose to destroy their own data. One computer remanufacturer noted that an NHS client removes all of their own hard drives and destroy these on their own premises.

1h. Quality standards

The development of the computer recycling and reuse industry, the regulations for WEEE and the need for donors to be assured of good practice have latterly led to the development of quality standards, which in some cases has become a second tier of service within the sector.

In recent years two developments have introduced a level of formality and standards which though not legislative appear to be influencing some donor behaviour and that of the computer re-manufacturers.

ADISA (Asset Disposal and Information Security Alliance) launched in 2010, has developed the certified IT Asset Disposal Standard. This is a scheme whereby companies which handle the destruction of data on behalf of other clients can have their practice audited and certified (i.e. it focuses on one element of the re-use process). Whilst this is a voluntary scheme (costing £4000 for certification), there was a recent example of a large donor (West Lothian Council) requiring companies bidding for the job of removing and recycling their computers to have achieved this standard.

Launched in 2013, Publicly Available Specification (PAS)141 is a process management specification for the re-use of used and waste electrical and electronic equipment. Developed by industry experts working with the Department for Business, Innovation and Skills (BIS), PAS 141 has been developed to;

• improve the standards for the re-use and refurbishment of electrical and electronic equipment that has reached the end of its first useful life in the UK; and
• address the demand from consumers for assurance that the used electrical products they buy are electrically safe to use and functionally fit for purpose.

There is no formal requirement for any computer remanufacturing company to achieve the PAS141 standard and as yet it appears that there is little expectation or requirement from donors for companies to have this level of certification, and little appetite from those in the industry to have their practice and processes formally audited and recognised in this way. Valpak who administer the scheme in discussion for this research hinted that at the moment there was not sufficiently clear reason for anyone to adopt PAS141 at the moment i.e. there is no significant market driver and not sufficient internal desire across the industry.

1i. Organisations involved in computer remanufacturing in Scotland

In Scotland different types of organisation are involved in the work of re-manufacturing computers. These include:

- Manufacturers – organisations whose core business is to manufacture new computers can also have re-manufacturing facilities and sell refurbished computers (example: HP (Hewlett Packard))
- Commercial organisations – making a profit out of receiving unwanted computers and processing these for resale as refurbished items, and breaking down into components which can be sold on to other agents for recycling and as scrap; (examples: Computer Recycling Services [Dundee], Re-Tek UK Ltd [East Kilbride])
- Social enterprises – following the same processes but re-investing profits to benefit community interests / the client group they work with (examples: LAMH Recycle Ltd [Lanarkshire Association for Mental Health], Haven Recycle [Glasgow based social enterprise with interests in disability and employability])
- Charities – following the same processes but with a focus on the end user of the computer (examples Reusing IT [West Lothian based charity providing refurbished computers to schools, hospitals and NGOs in Africa], Pass IT On [Edinburgh based charity adapting donated computers for people with disabilities (and in receipt of Scottish Government funding as part of their Digital Participation Strategy).

These organisations vary enormously in scale with some being Scottish branches of international companies e.g. TESS-AM (headquartered in Singapore, with branches in China, USA, Brazil, Australia and a UK presence in Irvine), through to the charities listed above with 1-2 staff members.

As well as the different scales of re-manufacturing organisations, they can offer different approaches or specialisations, for example in terms of the balance of refurbishing and recycling that they manage, or if they are specifically equipped to deal in the refurbishment or recycling of particular components.

It is also worth noting that these organisations can be competitors and/or partners at different times, for example competing in the same tendering process to receive donated computers (for example from a local authority tendering process), to selling items to each other dependent on their specialist interest (for example one company selling monitors to another).

Organisations that we understand to be involved in computer remanufacturing in Scotland are listed in Appendix 1.

Part 2 How it all works

2a. Donor types

Donors of computers into the computer remanufacturing sector are very varied but fall into the following main categories:

- private sector companies (mainly small – medium enterprises);
- public sector (local authorities, NHS, schools, colleges, universities);
- third sector organisations (varying sizes) and
- individual donors.

As an example, Glasgow-based social enterprise Haven Recycle lists on its website NHS Greater Glasgow and Clyde, University of the West of Scotland, Scottish Legal Aid Board, Alzheimer Society – Action on Dementia, amongst its clients.

For the purpose of this section we will use the term 'donor' throughout however it is important to note that there are donor types where there are different relationships with the computer remanufacturer. For example, 'customers' (for whom there will be a financial transaction and an audit transaction), 'clients' (who are only concerned about the audit) and 'donors' (who are effectively gifting a computer with 'no strings attached'). From a commercial organisation's perspective, most will fit into the customer category.

It is also worth noting that donors fall into different categories in terms of values, motivations and behaviour.

For example some donors see the importance of not simply recycling computers, but of keeping something whole and of passing on benefit for educational use. They are able to accept a level of managed risk in the process that others may perceive as too high (for example in terms of data handling and destruction) because the end-point of re-use is a strong motivating factor which ties with their value base. In Reusing IT's experience, universities were early adopters of this approach. They were sufficiently trusting of the processes involved to enter into a contract, and indeed were willing to work with Reusing IT to develop the processes being employed, thereby meeting their requirements.

Donor behaviour is also influenced by organisational culture e.g. some local authorities can be more risk-averse and this can lead to simplistic 'broad brush' decisions to destroy all computer equipment (even monitors with no data involved) rather than take perceived risks of these being re-used.

For many donor organisations, it can take a key individual exhibiting sufficient leadership to look at risks and look for solutions to address these in order to ensure that computers might be re-used in other places. The quote from City of Edinburgh Council shows how large organisations can take a more philanthropic approach, and be proactive in playing a role in the circular economy:-

"The City of Edinburgh Council recognises the importance of the circular economy and the role recycled ICT equipment can play in giving access to PCs, laptops and mobile devices to those who would otherwise simply not have the opportunity to learn new skills in ICT and Digital technologies. Through the Council's ICT contract with CGI, Reusing IT are now the supply chain partner for equipment disposal providing a steady stream of former Council ICT equipment into the circular economy, safe in the knowledge that the equipment has been suitably treated in accordance with appropriate legislation. The Council believes that providing ready access to ICT equipment will help to reduce the digital divide, boost skills and allow more people to enjoy the benefits afforded to those who already have ICT and Digital skills"

Donors' behaviour can also change over time, influenced by external factors. For example both Computer Recycling Services and Reusing IT report changes in donor behaviour because of the impact of the financial crash around 2008. This resulted in some donors choosing to retain their computers for longer than normal, for example, for a sixth year after a five year warranty had passed. In addition, companies facing more stringent financial times behaved differently by saving some computer parts for repairs, thereby reducing the quantity, quality and value of goods they donated.

2b. Re-manufacturing steps

2bi. Services offered at the point of contract

Re-manufacturing companies typically offer a collection service for customers who have computers to dispose of. They are effectively offering the connected services of uplift of waste items, safe handling and destruction of data, and a sound environmental approach to re-use where possible, and to appropriate recycling within legislative requirements where that is not an option. Typically all would claim that they would take 0% to landfill.

2bii. Data handling – avoiding contamination

Each collection of computers from a donor would have a unique number and be uniquely stored. This badging and tracking is crucial in providing evidence if required, of appropriate handling and destruction of data, as the remanufacturing company is avoiding risk of any one donor's hard drives and data being mixed up with another, particularly for different uplifts collected on the same day and stored in the same location. The industry refers to this as "avoiding contamination," undertaking batch processing of each uplift and avoiding parallel processing of different donors' computers. Using the asset tags or serial numbers of computers or donated hard drives enables auditing of each item within a uniquely coded batch.

In the ADISA standard referred to earlier, companies are expected to have even higher levels of practice in terms of safe data handling, for example using locked containers to store different uplifts even within the vehicles used for collection, as well as at any processing facility, and to have tracking on the vehicle (ensure traceability if the vehicle is stolen).

2biii. Decisions on re-use and recycling

Typically remanufacturing companies will look at some basic factors at the point of unloading a computer, to assist in the decision about whether it is re-used or recycled. These decisions tend to focus on the type of processor, the presence or condition of a hard drive, and the cosmetic condition of the machine in terms of general wear and tear.

"We'll put the unit on the bench – if it's Core 2 and above, no capacitors blown, if it looks sound, it's refurbishable" (Computer Recycling Services)

However, different types of remanufacturer can make different decisions on the same equipment. There are remanufacturers whose core business is recycling with only a small amount of refurbishing. They will tend to refurbish high value, easy-to-sell-on items.

There are others whose core business is reselling computers and who are willing to invest more time into the refurbishing process, albeit that they are always balancing up the costs of this against the end return to ensure profitability.

Market trends and forces will dictate considerably which machines are refurbished or recycled. Periodic 'milestone' developments in technology are key points where the market can change dramatically. For example remanufacturing companies we spoke to identified that when Core2 (a type of processor) was introduced in 2006, customer demand developed for this to be the standard in computers. Therefore the value of any computer which did not have a Core2 processor was immediately dramatically reduced. As a result a large proportion of computers which would previously have been of a sufficient standard to refurbish, were at that point deemed to be only fit for recycling, and therefore stock was de-valued. These periodic develop mental changes tend to be around innovations relating to the capability of processors (as described) and to hard drive size. For example there is no demand now for a 40gb or 80gb hard drive, whereas these would have been standard 4-5 years ago.

These regular technological developments are a trend which the computer remanufacturing industry can expect to come in cycles, as the next innovation leaves the current standard obsolete.

In some cases the decision on refurbishing or recycling is made at the donor's request (as suggested earlier), notably because of their perception of risk, or by their actions in altering

the computers they are donating. Some may specifically request that everything is destroyed and recycled rather than refurbished, even if it is of sufficient quality. Others may have reduced the quality of the donated computers by removing the hard drives because of data destruction sensitivity (dealing with this aspect in-house). The cost of populating these machines with a new hard drive can mean that it has become too costly to refurbish and the only financially viable route is to recycle.

Organisations such as social enterprises and charities which operate under a different cost basis e.g. because they have a workforce made up of trainees and volunteers, are often able to refurbish computers which others could only economically recycle because they do not have the same labour costs or pressure to process a computer within a particular costed timeframe.

As an example of the key stages and processes involved in computer remanufacturing, the ones undertaken by Reusing IT are shown at Appendix 2. We understand that these processes are similar across the industry. Although this specific process is not PAS141 certified, it is based on the essential elements of PAS141, and indeed there are some elements which are additional.

The processes underlying the stages shown Appendix 2 are complex and are outlined in detail in Appendix 3.

2c. Recipient types

Once the computer remanufacturer has refurbished computers for reuse and broken down computers or parts for recycling, it then sells these to other recipients.

For example, one remanufacturing company described three recipients for their computers:

- one company which took reusable units to sell;
- one which took monitors; and
- one which took scrap (printers, carcasses, base metal, keyboards).

There are different levels to which material will be separated before being sold and companies involved in recycling are always seeking to balance the cost of labour against the improvement in value of the stock they then sell on. For example the simple act of removing plugs from cables involves a labour cost but leads to an increased value for the cables to a recipient who does not have to invest the time in the same activity.

Each company in the chain of reselling will have a minimum specification below which it does not take materials, until the material is purely for recycling at which point it is shredded.

2d. Refurbishing process

There are small scale examples of where it can be cost-effective for computers to be refurbished because the process involves a low labour cost, and because the refurbishment process itself is a positive activity for a labour force otherwise denied opportunities. For example, Reusing IT sends small batches of computers for refurbishment to Support in Mind in Dumfries where trainees with mental health problems are able to spend time refurbishing them as part of an employment skills activity. In such cases the only repair cost is in terms of materials but the refurbishment process becomes of great value to those involved rather than simply a costed activity of labour.

Similarly at Pass IT On Computers, an Edinburgh-based charity which refurbishes and equips computers with specialist features for people with disabilities and a range of additional support needs, volunteers (some of whom have their support needs) are heavily involved in the refurbishment process. Again in this instance the activity involved in refurbishing computers is part of the gain for those involved, as opposed to there being a cost incurred.

2e. Reuse recipients

As far as we understand it from the research done to date, there is a limited amount of resale of remanufactured computers in Scotland.

The larger remanufacturing companies we spoke to described their sales of computers for reuse to be to independent brokers in other parts of the UK (for overseas sales) and directly overseas, with named countries being Morocco, Egypt, Pakistan and India. As one manufacturer said “you can realise better values with the emerging economies.”

According to the HP website, the computers which it refurbishes are “sold back to public and private sector organisations”.

In the case of Reusing IT, their end recipients are other charities, schools, educational establishments, low income families and schools, hospitals and NGOs in African countries. Reusing IT offers a 1 year warranty, believing that this is key to customer confidence in a second hand product.

2f. Recycling recipients

In addition to selling refurbished computers for re-use, computer remanufacturing companies also sell their recycling materials to metal recyclers.

As described earlier, some companies will dismantle computers for recycling into more component parts depending on the labour costs involved. For example, they might separate the memory, cables, PCB (printed circuit board) and screen, leading to less contamination and a higher quality of materials for shredding. Other companies will shred all of the

elements described together, then separate plastics, ferrous metals, copper, aluminium and gold from the shred.

It is our understanding that the majority of recycling of higher value materials, such as gold and copper from memory and network cards, takes place outside of Scotland. There appears to be little commercial extraction of these items in Scotland, for example, CCL North (Irvine) sends materials to a plant in Huddersfield, while East Kilbride-based TESS-AM (an international company) sends materials overseas for processing in Asia.

Therefore in terms of the circular economy in Scotland, there is a relatively early point in the process at which materials of the highest value leave the country. In addition, with a large proportion of refurbished computers being re-introduced to use by being sold to other parts of the UK and internationally, the full cycle of the circular economy of the computer remanufacturing industry in Scotland does not occur within the country.

2g. Description of rough scale of operations in Scotland

There are 14 companies registered with SEPA as AATFs which we understand are actively involved in computer remanufacturing in Scotland (see Appendix 1). We estimate that there are approximately another 12 computer remanufacturers which are involved in the industry which we believe to be classed as ATFs.

Certain companies cover particular parts of the country, for example Computer Recycling Services concentrating activities in Dundee, Tayside and the north east, while other companies cover the central belt or Moray and Highland.

To give a further estimate of the scale of operations in Scotland, we understand that for the larger tenders of work involved in uplift and processing of a donors' computers e.g. a local authority, there might typically be four or five Scottish companies quoting for the work.

2h. Relative outputs of waste, recyclable materials and re-usable goods

As noted already the breakdown of goods received in terms of recycling and refurbishment differs depending on each re-manufacturers' costs, their view on the profitability of the items they have, and on the attitude of the donors they work with towards reuse. We are able to give some examples of the relative outputs of recyclable materials and re-usable goods from the companies we talked to.

Re-Tek identify that of 120,000 computers processed per year, 20,000 will be recycled and the rest will be resold (i.e. refurbishing/reselling 66%). This contrasts with CCL North who identify that of 150,000 units processed per year, ~9000 (6%) are sold for re-use with the remainder broken down for recycling. In this facility, their method of data destruction is

physical destruction of the hard drive which as described previously makes the computers more costly to refurbish as this part needs to be replaced. CCL North also works with customers who are keen that their computers do not come back into reuse, they therefore concentrate more on recycling. At the other end of the scale are smaller organisations like Pass IT On Computers reusing 200 computers and recycling 100 each year.

Appendix 1 gives an indication of the relative outputs from the main remanufacturers. The figures shown indicate both the range of scale of processing, as well as the difference in the relative outputs from the companies involved.

2i. Examples of funding in the system

Costs within the remanufacturing industry are affected by a number of external factors such as competition and the price paid for core materials such as the metals in computer components.

One company noted the change in the market that they have experienced over ten years of operating, whereby they used to charge for uplift with a price attached to each item (apart from keyboards and mice), but with the arrival of competing companies offering cheaper services, and donors having less money to pay for a service, they had to alter their charging structure and offer free collections. It was notable in our discussions with remanufacturing companies that they also provided examples of companies offering donors a rebate i.e. an amount of money coming back to the donor on their donated items depending on their quality for reuse and resale. In such instances, this is costed in an uplift proposal and might help to secure larger bids in tendering processes, because when a large number of units is involved, the rebate figure can be significant.

As noted already the cost of labour influences decisions on refurbishment or recycling, and those organisations with the cheapest labour costs (social enterprises and charities) are able to get refurbishment value out of computers which commercial organisations could only afford to recycle. Companies that can afford to invest labour time can get a greater return e.g. a computer sold for recycling that has been broken down into separated components is worth much more than a unit that is still whole and is sold for recycling.

“I get more if I took the cables out which have copper in them, removed the memory with its gold, the PCB, the heat sinks…I could double the amount I receive for that computer [compared with selling it whole] as long as there is no labour cost in doing this.” (Reusing IT)

In terms of the value of scrap material there were examples of significant price reductions in recent years. One company reported that they would previously have received £160 for a tonne of mixed metals, but that this figure is now £35. Another described the drop in scrap metal value in recent years being £125/tonne to £20/tonne.

Some items within each individual computer have a higher value because of the metal contained in them. For example one company which shreds hard drives identified that it received £750/tonne for this metal because of the copper, silver, aluminium, gold and palladium contained.

Another important area of cost for computer remanufacturers to consider is in travel. Some limit the geographical range within which they will collect computers because of the time and other costs involved in the process.

2j. Non-financial enablers

There are a number of enablers which are not financial, but which support the existence of, and create a positive profile for the remanufacturing industry. Some of these have already been referred to:

- the need for producers to take an interest in their products' end-of-life, and at least gather evidence of correctly disposed WEEE (through Producer Compliance Schemes) or become actively involved in remanufacturing and form a viable business in addition to selling new products;
- the need for any business or organisation which uses electrical and electronic goods to comply with legislation and dispose of their WEEE appropriately;
- the increasing awareness and desire for businesses and organisations to reduce waste, be energy efficient and have all round good environmental practice;
- a broader interest for organisations in playing their part within their respective wider communities (i.e. being aware of their corporate social responsibility), and thereby potentially having a greater interest in their own assets being reused by others;
- the positive influence of schemes like Microsoft Refurbisher Programme / Citizenship Licences enabling low cost good quality software for 'good cause end users' and thus supporting the remanufacturer by reducing overheads and endorsing re-use (an operating system costs £5 as opposed to £80 through this scheme);
- donors' trust – computer remanufacturing companies need to convince donors of safe data handling and destruction processes, allowing donors to consider a reuse rather than recycling option;
- recipients' trust – customers of reused computers need to be able to trust the product (which can be competing with low priced new products which have warranties). Given this fact, Reusing IT offer a 1 year warranty for the computers it resells, although some other suppliers of re-used products offer 3 month warranties.

Part 3 Analysis and opinions

3a. Analysis

This research has highlighted various issues about the computer remanufacturing industry in Scotland, and about its links with digital technology, digital participation and the circular economy. In this section we will highlight a few of the main issues facing the industry and comment on these.

3ai. Digital technology – each significant development in technology influences the type and value of materials available in the remanufacturing market. In addition, the demands of customers who are potential recipients of the refurbished products of the computer remanufacturing industry change according to these developments. Given the most recent and highly popular IT developments such as people being able to access the internet on devices other than computers (for example on tablets, phones, TVs, watches), we can expect the inputs into the computer remanufacturing industry to change significantly over the next few years.

To give an indication of the rapidly changing and to some extent unpredictable context for the industry, news reports in 2013 (The Telegraph) suggested that customers were "abandoning laptops for touchscreen tablets". However in 2015, the BBC reported that tablet sales had "plateaued" as larger screen phones (phablets) had become more popular. It is clear that the technological landscape is changing dramatically although the extent to which such devices transfer to educational and business environments remains to be seen. As further changes occur, the computer remanufacturing industry will change shape and content accordingly.

As one computer remanufacturer said during this research, "There will not be much to remanufacture out of a tablet….it will either work and you can sell it on or it will be scrapped." The suggestion from this is that the remanufacturing industry may process more disposable products in the future and that remanufacturing options may shrink.

Technological advances which impact on demand will also impact on many digital participation projects, where in the view of Reusing IT, "For pop up portability - ipads will win every time" i.e. projects and individuals being supported by them will increasingly want tablets even though other options would work. Reusing IT retains the view that laptops are better for most types of common use but if people's perception is that a different product is what they need, there is a barrier to the sale and use of more commonly available remanufactured equipment.

Some thoughts on the different capabilities, uses and remanufacturing issues of computers, laptops and tablets are shown in Appendix 4.

3aii. Digital participation – this research has found little current connection between the digitally excluded people of Scotland and the country's computer remanufacturing industry.

As noted in the early context of this report there may be issues of people being unaware of the quality of remanufactured equipment available for use, however as noted above there is a further issue of whether the equipment which people want can actually be supplied by remanufacturers as demand moves more towards tablets.

There are wider issues too relating to digital participation. We have noted in the report that research shows that a lack of computer equipment is a relatively limited factor in people's digital exclusion. There is therefore only so much that the industry can be expected to contribute to solve this issue. The digitally excluded are individuals and as far as we have found, the computer remanufacturing industry in Scotland is rarely selling to this group, but rather selling in bulk to larger clients or to brokers outside Scotland for onward overseas sales. Therefore on the whole computer remanufacturers do not have a strong interest in digital participation unless this is key to their organisational objectives (as in the case of Reusing IT or Pass IT On Computers where supporting the end-user to use a computer is a fundamental part of their work). In addition, the market for individual purchasers of computers is a competitive one, where any reused computers lack a significant positive profile and customers have low cost options of new products with longer guarantees providing an attractive way to get online. The ongoing cost of broadband, in addition to any set up costs of equipment is an issue that will continue to be a barrier to digital participation, even if there was a stronger link between the digitally excluded and the reuse market.

Finally on this issue there is the matter that people who are digitally excluded may have different IT requirements depending on their needs; PCs for employment skills, tablets simply to get online. This potentially limits the scale of possible impact on digital participation by computer remanufacturers.

3aiii. Current and future challenges within the system – there are many wide ranging challenges within the system of computer remanufacturing. These include:

Fundamental issues relating to definition whereby WEEE legislation are currently heavily interpreted in terms of waste, compliance and recycling. The message regarding destruction and recycling is stronger than that of re-use, and the remanufacturing industry needs wider support from a positive profile of a reuse message. At the moment the context is of a waste management strategy that has reuse as "nice-to-have" by-product, whereas a *reuse strategy* that has waste as the final rather than the first option, would send out a more powerful message which supports the remanufacturing industry and would be in keeping with a nation aspiring to boost the circular economy.

The administration relating to compliance in the management of WEEE can be significantly time consuming and present an overhead which introduces a burden of cost in an industry where margins are already tight.

The issues around the handling and destruction of data will always be key for remanufacturing companies to address in order to gain the trust of donors for whom risk management is essential. This is integral to increasing the reuse rather than the recycling market. The more that donors' desire for computer hard drives to be destroyed rather than erased, the more the industry will lose the capacity to refurbish because it will become too costly. If there is any stronger move towards remanufacturing companies needing to achieve certain quality standards in relation to data destruction (even though their practice may be in line with these standards) these higher overheads could mean that smaller remanufacturing companies (including charities and social enterprises) could be unable to afford the certification required.

Financial constraints on donors can lead to changes in their behaviour in replacing computers, for example retaining parts for re-use thus reducing the value of goods donated, and changing the balance of these to a higher level of recycling rather than refurbishment.

The industry is also affected by fluctuations in much wider markets. For example, reducing prices for base metals influenced by worldwide markets can make significant differences to the sell-on value of uplifts of used computers in any local area.

There is not a sufficiently strong profile for re-used computers, and with competition from new cheap products, cost is removed as one of the positive factors which could otherwise drive people to the re-use market. In business terms, it is understood that most procurement processes would focus on buying new, which means that there is no large scale purchasing of reused computers.

There are fundamental issues relating to people's attitudes which result in collective behaviour as a 'disposable society'. One remanufacturing company reported that as they collect mixed WEEE from a local authority waste facility they see a large number of nearly new lawnmowers being thrown away at the end of the summer, and a large number of nearly new electric heaters being thrown away in spring. The attitudes underlying this approach to disposing of electrical goods suggest that some people are strongly disconnected from finding a reuse option even for relatively new electrical goods.

Whilst these challenges are testing for the industry the wider context does also offer a potentially strong foundation on which to build a stronger computer remanufacturing industry. The profile and support for the circular economy, the interest in digital participation, the potential interest from donors in having improved environmental and socially responsible actions for their companies and organisations, are all potentially positive influencing factors. However a positive profile in these areas is not sufficient in itself

to support the industry. There needs to be stronger links made between these areas and the computer remanufacturing industry, with a reduction in any burdensome bureaucracy relating to waste management compliance and an increase in incentives to reuse, in order to change affect behaviour on any significant scale. Without such proactive steps the industry is in danger of floating in a sea of positive messages while being left to fend for itself against the many challenges described.

Many of the areas described above match the barriers, drivers and opportunities in remanufacturing outlined in Zero Waste Scotland's Circular Economy Evidence Building Programme – Remanufacturing Study (2015).

3b. Summary and Conclusions

The research has established that there are a relatively small number of players in the computer remanufacturing industry in Scotland, covering a range of commercial and charitable enterprises, and with the involvement of computer manufacturers.

Legislation has created a necessity for businesses to take safe and appropriate actions in relation to the disposal of electrical and electronic waste. This in turn has led to the development of companies which offer a service to assist others in complying with the law. A key area for these businesses to develop is trust with their customers (the donors) to ensure that compliance will take place, as well as in guaranteeing safe data handling and destruction. The need for high standards in the computer remanufacturing industry has more recently led to related developments of good practice standards. There are some limited signs of these influencing donor and remanufacturer behaviour.

Companies involved in computer remanufacturing opt for different levels of computer refurbishment and recycling depending on the donors they deal with, any particular focus or expertise they have, the end user, and the travel and labour costs involved in their own processing.

There appears little link between Scotland's remanufactured computers and those in the country who are digitally excluded. The fact that a lack of equipment is only one factor in people being digitally excluded and that people may want tablets means that the industry does not hold the key to digital participation anyway, although there are surely opportunities for it to support this area more than is currently happening.

The industry faces ongoing challenges in market changes as technology developments lead to waves of obsolescence as new features emerge and are seen as a new preferred standard. It is unclear what the remanufacturing industry will look like in ten years' time, as this will be dependent on the computers which are used as standard, and developments in

design which may have changed the way that parts are replaced and influenced the balance of what can be refurbished and what can be recycled.

The computer remanufacturing industry is clearly an example of the circular economy in action. The scale of refurbishment against recycling is highly dependent on the desires of donors to see reuse (for social and environmental reasons) or to see destruction (because of (sometimes excessive) risk management) and on the business costs of processing. A large part of the processing appears to take place outside of Scotland because there are insufficient markets of end-users for remanufactured computers, and because key stages in the recycling process cannot be handled by facilities here.

Fundamental changes are needed in promoting and incentivising reuse rather than recycling for computer remanufacturing to become a truly accepted and well-recognised industry.

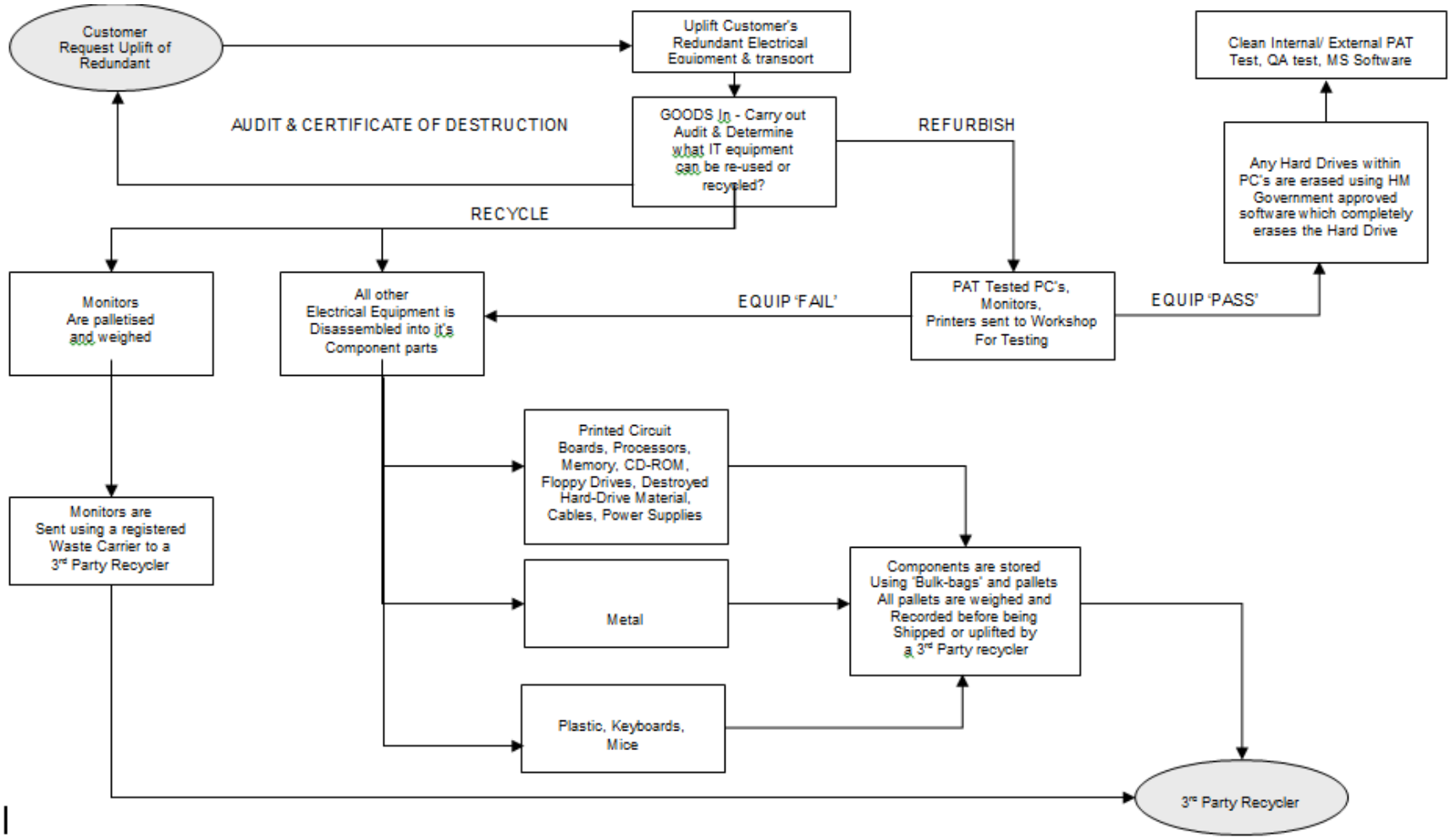
Appendix 1: Organisations with Scottish Presence involved in ICT Remanufacturing, Repair and Recycling

Organisation	Area	Type	SEPA	Notes	Reuse / annum	Repair	Recycling / annum
CCL North	Irvine	Commercial	AATF	Mainly recycling – dismantle to improve shred recovery	10,000	No	120,000
Computers for Africa	Plockton	Charity	Not registe d	Focus South Africa and annual school link	150	Yes	200
Computer Recycling Services	Dundee	Commercial	AATF	Mix – sell on to other brokers	15,000	No	20,000
Datec Technologies	Kilwinning	Large Commercial	AATF	Part of Belmont trading and Sipi Metals - recycling of populated printed circuit boards	Declined	No	Declined
Easdale Environment Developments Limited	Cumbernauld	Commercial	AATF	Also known as MOOK Environmental Solutions	0	No	10,000
Electrical Waste Recycling Group	Glasgow	Large Commercial	AATF	Large plant in Huddersfield	Declined	No	Declined
E Waste Solutions	Glasgow	Commercial	ATF		2,000	Yes	4,000
Glasgow Computer Recycling	Glasgow	Commercial	ATF		10,000	No	5,000
Haven Recycling	Glasgow	Social Enterprise	ATF	Source of employment for disabled people (80% of work force)	30,000	No	5,000
IML Highland	Alness	Charity	AATF	Lack of supply now only processing white goods	0	No	0
Intelligent Storage Solutions	Airdrie	Commercial	AATF	Hard drives of all forms	500,000	No	200,000

Organisation	Area	Type	SEPA	Notes	Reuse / annum	Repair	Recycling / annum
LAMH Recycling	Motherwell	Charity	ATF	Training provider over 400 placements per year	3000	Anything under 20 minutes – refit screens to laptops	3000
MGH Scotland	Cumbernauld	Commercial	AATF		10,000	No	10,000
Pass IT On Computers	Edinburgh	Charity	Not reg-istered	Received and refurbish computers, manage for 50+ house bound clients	200	Yes	100
Pure IT Recycling	Edinburgh	Commercial	ATF		3000	No	5000
Re Boot (Moray Recycling Services	Forres	Charity	ATF	Training and Environment Focus	2000	Yes	3000
Regenersis	Glenrothes	Commercial	N/A	Repair of goods for manufacturers	0	Yes	0
Remade in Edinburgh	Edinburgh	Charity	ATF	Teaching IT and Sewing machine skills	50	Yes	100
Retronix	Coatbridge	Commercial	N/A	Repair of PCB for Aerospace and Defence	0	Yes	0
Restructa	Irvine	Commercial	AATF	Monitor Sister Company of CCL North	10,000	No	120,000
Re Tek (UK) Limite	East Kilbride	Commercial	AATF	Buys Equipment for Reuse from other AATF	84,000	Limited	15,000
Reusing IT	East Calder	Charity	ATF	Refurbish computers for NGO, Schools, Individuals in Scotland and Africa	1,500	Yes – down to PCB componen t level	3,000
SIMS Group	Dumfries	Large Commercial	AATF	Main business is metal recycling – using shred process	50,000	No	200,000
TES-AMM (Europe) Limited	Irvine	Large Commercial	AATF	Metal recycling using chemical	20,000	No	80,000

				extraction process			
Viridor Enviroscot Limited	Perth	Large Commercial	AATF	All types of WEEE	0	No	7000
William Tracey	Glenrothes	Commercial	AATF	All types of WEEE	0	No	10,000

Appendix 2 Generic Computer Reuse / Recycling Process



Appendix 3 Main stages in computer remanufacturing

Computer uplift request

- Customer information captured or updated
- Uplift works order created along with spread sheet for data destruction audit
- SEPA Duty of care documents printed, customer and organisation copy
- All paperwork for uplift day put in folder
- Route planned and uplift times agreed

Material collection and in transit handling and storage

- Equipment is stored on the vehicle by customer, separated using metal roll containers
- Volatile items such as laptops, TFT monitors are storage hard plastic stackable storage bins
- Duty of care documents exchanged a signed
- Data destruction level agreed
- Certain customers insist vehicle is fitted with alarm, immobiliser and tracking device

Goods in receiving, Segregation and storage

- Equipment is unloaded in a goods in area and is given a batch processing number (customer code + uplift date)
- Items with data destruction requirements (laptops, desktops, serves, NAS devices, Specialist Web items) immediately separated from rest of customer's material. Stored by customer uplift batch in data destruction staging area.
- All other items sorted into group types:-
  - Laser printers, Inkjet printers, Scanners, TFT Monitors, CRT Monitors, Projectors
  - Keyboards and Mice, Communications devices, Hubs, Switches and Routers
  - UPS, Power Supply Units
  - PCB's (Printed Circuit Boards), Memory, Cards, Processors
  - Cables and types of cable, Floppy Drives, CD/DVD Drives
  - Other mixed WEEE – TV, VCR, Telecoms
  - Metal, Plastic

Visual inspection of Non Data Items

- Before items are tested for operability they checked for cracks, damage, over all wear and tear, specification and age.
- At this stage the first decision is made whether to Reuse or Recycle, to classify as REEE or WEEE.
- Items marked for Recycling stream are marked with a red dot.

- This first stage visual inspection does not comply to items in data destruction staging area as regardless of condition they will processed within data destruction area. (This process only applies to these items post data destruction.)
- All items deemed in good enough condition for potential reuse are moved to dedicated testing stations (specific to item type). Items with red dots (for recycling) are moved to a staging area for dismantling prior to bulk bagging and transportation to downstream recyclers. All loose items such as memory, DVD, mice, keyboards that look reusable are stored by type.

Preparing for reuse

- Items that pass visual inspection are PAT tested at their specific testing station to ensure safety for further processing. If the PAT test is passed these items are functionally tested. Items which fail marked are for recycling with the exception made for high spec items which are marked for repair. (Blue Dots)

Data destruction

- Prior to processing all units which are incomplete are repopulated where possible with memory, PSU, cables to allow processing.
- Units which cannot be repopulated will have their hard drive removed for external processing. Depending on condition and specification these items will be either stored (hard drive less) for future availability of spares or moved to area for recycling.
- Units are now PAT Tested – those which fail have hard drive removed for external processing and above process is repeated.
- Units which pass PAT testing are processed by batch using Data Destruction software approved by government CSEG (CESG is the Information Security arm of GCHQ, and the National Technical Authority for Information Assurance within the UK. This means that we are the definitive voice on the technical aspects of Information Security in Government).
- InfoSec 5 Higher erasure pattern used, this is the required standard for UK MOD. This pattern performs three passes across the drive and 3 verification checks. The software captures the serial number of every data disk and our process logs this against the client asset tag, serial number of PC. Control totals are kept and reconciled at the start and end of the complete process with verification and audit by an independent operator. The entire processing is then detail recorded for each item collected and reported against a unique clients reference with uplift date and location being used to record a unique batch. Until a batch has been fully completed, verified, audited and signed off – the next batch, customer cannot be started. All hard drives which fail are removed for physical destruction. Machines which fail the hard drive removed for donor machine data destruction. (PC marked for repair) Pass items green doted (laptops, desktops, serves, NAS devices, Specialist Web items)

- All computers and drive passing PAT Testing and completing data destruction are marked with a green dot.
- A decision is now made as to whether or not the item is off sufficiently high enough specification to warrant Reuse

Reporting to customers

- Once data destruction has been completed for an Uplift batch – internal verification and sign off is completed – prior to reporting to the customer.
- The report set includes: Asset Management Report, Certificate of Erasure, Copy of Signed Secure Waste Transfer Form, Data destruction summary report and individual reports per device.
  Summary Report details:-

    - Job Collection Number (unique per collection)
    - Type of Equipment.
    - Manufacturer.
    - Model
    - Serial Number
    - Customer Asset Number.
    - Specification.
    - Drive Serial Number
    - Drive wipe status

Visual inspection, Specification, Non Standard Check of Data Items

Data destroyed PC, Laptop, Servers are now checked for specification and whether or non-standard (this judgement may vary from business to business) Items which fall below spec and are non-standard will be moved to recycling. This may involve prior stripping for spares which are interchangeable. Items are now checked cosmetically. Items not in a good condition will either be moved to Recycling or if possible for cosmetic repair. .

De-tagging, Cleaning and CMOS

Once the customer has signed off the data destruction audit all customer's asset tags, any other forms of identification are removed from all relevant devices. At this stage deep cleaning takes place. Removal of dust internally, specialist cleaning of all plastics, testing and fitting of new CMOS battery. All items are made to look as good as new both internally and externally. Where cases, lids, plastic logo, computer id tags, facia are deemed to be below standard where possible spares are re-fitted.

The above process is conducted on all non-data related IT items at their testing station.

Software imaging

Not all Remanufacturers will install software. If this is the case it will be left to the end user or final retailer.

Remanufacturers who are Microsoft Refurbishers are either Registered Refurbishers or Authorised Refurbishers.

Remanufacturers will purchase software titles – Operating Systems and Applications from MS at agreed rates in line with status.

This adds a level of quality assurance to the remanufacturing process well above simply checking the computer will re-boot/power on and has had all its data destroyed. Each machine will have its genuine MS software license(s) and sticker(s) and the Remanufacturer is assuring the computer will work as intended. A pre-qualifying procedure has to be completed successfully with MS before acceptance into scheme and an audit is conducted on an annual basis before it is renewed for the subsequent year. A Remanufacturer who adds the upfront cost of software to their end product is demonstrating their commitment to the quality of the product to the end user and their confidence in their processes.

Repair

There are 3 types of repair. Cosmetic repair, replacing covers, facial, logo etc. Basic internal repair – refitting of major components (in order of most common faults found). Hard disk, memory, power supply, fans, DVD drive, network cards. PCB component level – blown capacitors, resistors. Most re-manufacturers (unless it is their core business) will only perform basic repairs. Repaired units are tested as fully functioning units prior to storage as unit type.

Final PAT Testing, labelling and inventory recording

After all processing, cleaning, software imaging stages are complete and prior to storing or shipping all units are given a final PAT test and labelled with date of test and signature of tester. Each unit is then uniquely labelled and recorded with inventory system.

Recycling items disassembly

This task is not performed by all Re-manufacturers. Where the 'downstream' partner performs shredding more often than not recycling materials are passed on in whole state. Otherwise all units to be recycled are broken down into component parts and stored in bulk bags for collection which adds value to overall percentage of pure materials during subsequent recovery processes. The bulk bags are weighed as prices are determined as rates per 1000kg of type of recycled material. These rates tend to be in line with the types of metal that ultimately will be recovered and the cost of the recovery (type of process and logistics.)

Product warranty

Varies according to Re-manufacturer. Generally 1 year on hardware only. Most will operate a return to base and straight replacement policy.

Packing for shipping

When orders are received, picking lists are produced and goods are Units are packed carefully for onward shipping to ensure onward arrival in good working order.

Export for reuse

SGS Inspection. Reusing IT uses SGS http://www.sgs.com/en/Service-by-Type-Path/Inspection.aspx to pre inspect all computers for reuse prior to shipping to Africa. This ensures all paper work and equipment meets quality standards for the country they are being sent to.

Appendix 4 Comparison of desktop, laptop and tablets

Comparison	Desktop	Laptop	Tablet
New Cost	Internet ready £200 -£400	Internet ready £160 - £400	New from Amazon for £49.90 Upto £500 for ipads
Refurbished cost	Internet ready £25 - £50	Internet ready £40 - £100	Limited market
Use ability	Easy to use for all age groups	Older people might find keyboard and touch pad slightly harder to use	Some people might find user interface harder to use. Touch-screen, very awkward to type on.
Overall	More options for customization Better than a laptop for creating content, i.e., for productivity. Better for editing videos, managing large music collections, writing long documents, and working on big spreadsheets, etc.	Better than a tablet for creating content, but not as good as a desktop i.e., for productivity. Better for editing videos, managing large music collections, writing long documents, and working on big spreadsheets, etc.	Good for looking at content, e.g., browsing through a magazine, looking at Web sites, watching movies, but not as good for creating content, e.g., blogging or photo editing, or getting work done.
Repair ability, Break fix	If one component breaks, that component can be replaced. Easy to fix	If one component breaks, the whole laptop may need repaired or replaced. Harder to fix	If one component breaks, you may need to repair or replace the whole tablet. Not easily repaired.
Upgrade	Easy to upgrade	Harder to upgrade	Not easy to upgrade
Storage capacity	Hard drive stores more data.	Hard drive stores more data.	Solid-state storage holds less data but lets you access it faster
Local storage and Backup	Always has a hard drive and usually a DVD Reader Writer	Always has a hard drive and usually a DVD Reader Writer	Less likely to be backed up locally
Lost or Stolen	Less likely to be lost or stolen.	More likely to be lost or stolen	Most likely to be lost or stolen
Damage ability	Hard to damage, unlikely to be dropped	Easy to drop and damage	Easy to drop and damage
Parental Supervision	Easy for parental supervision if located in family area	Hard to supervise usage	Hard to supervise usage

Comparison	Desktop	Laptop	Tablet
Comfortable use for longer periods of time	Comfortable to use for long periods of time Perfect seating position. Monitor at correct height, angle and lighting. Keyboard in correct position and angle. Mouse in comfortable location. Least likely to cause RSI	Less comfortable	Not comfortable
Likely to be found in work place	Most likely to be used	Less likely	Not likely
Likely to be found at school or university	Most likely to be used	Used to some extent	Being increasingly used
Clutter	Protruding wires cause clutter or a trip	Few or no protruding wires	No protruding wires
Space required	Need most space and fixed location	Need little space	Need little space
Portability	Not portable	Portable	Portable