REPORT OF THE DIRECTOR OF AUDIT

DISPOSAL OF COMPUTER EQUIPMENT IN THE PUBLIC SECTOR

Ministry of Information and Communication Technology

Performance Audit Report No 4 June 2011

CONTENTS

EXECUTIVE SUMMARY

Before starting the audit, we had discussion with experts in the field of Information Technology (IT) and they even provided valuable inputs. After completion of audit, a discussion forum was held in the presence of stakeholders in the field of information technology which was focused on the draft report submitted in August 2010 by National Audit Office and all the stakeholders in the field of information technology accepted the contents and recommendations made therein.

There is a growing concern about the risks associated with disposal of computer equipment[1] in the public sector[2]. There is concern about the environmental problem associated with electronic waste, the shortage of space to deal with the growth of unserviceable equipment and the very low value obtained when these computer equipment are disposed. The report examines how disposal of computer equipment could be done in a least costly manner and is environment friendly. Significant volumes are involved and these are likely to grow in the future as demand for improved technology increases.

Expenditure incurred in acquisition of computer equipment is growing. An amount of Rs 138 million and Rs 188 million was spent in 2006-07 and 2007-08 respectively. For the period 1 July 2008 to 30 June 2009, Rs 237 million was spent and for the period July 2009 to June 2010 the amount is Rs 224 million. For the year 2006 to 2010 a total of 19,707 printers and personal computers (including notebooks) were commissioned.

The risks associated with computer equipment disposal are related to the environment, data protection and electrical safety. The wider risk associated with data protection is not considered. The consequences for public bodies could be legal action, adverse publicity and loss of public trust if these wider risks are not managed.

The Financial Management Manual (FMM) makes reference to the ways to dispose of all government assets. These are: transfer to other departments, auction sales and landfill. But no reference is made specific to computer equipment. In other countries there are additional options such as refurbishment, recycling and employee purchase agreement. A course of action specific to computer disposal is essential because of the risks associated with the environment.

There is a fact sheet on wiping off of data before disposal. The fact sheet is only a guideline and is not mandatory. In the absence of appropriate tools, data are not being wiped off before disposal; they are simply being deleted. This is not sufficient because data can be retrieved and classified and personal information can be recovered which will adversely affect the reputation of the organization.

[1] Computer equipment includes Personal Computers, Laptops, Printers, Servers, Photocopiers, and Modems.

[2] Public Sector includes Ministries and Departments.

There is not a proper way of managing redundant equipment. Computer equipment was being stored until capacity constraints meant that a disposal is required. Computer equipment rapidly loses value, and failure rates increase when components are stored and are inactive. A formalised organisation wide disposal process is needed.

Recommendations

- Ministries should ensure that unserviceable computer equipments are disposed without delay. They should not be kept too long as computers rapidly lose values and failure rates increase when components are stored and are inactive. This will free some spaces and also better monetary value can be obtained from the computer equipment. Ways to deal with the replaced computer equipment after the survey of the CISD on the 7000 PCs completed could be decided upon. For example the computer equipment can be put to alternative use such as training or testing or re-used in a different environment.

- Environment friendly acquisitions can be made. Suppliers may be required to provide equipment made up of less hazardous materials and also materials that can be recycled. At time of disposal these equipment will not be a threat to the environment. A number of computer suppliers, particularly printer suppliers, e.g. Fuji-Xerox, have done some significant work on improving the recycling compatibility of their printers. A minimum specification requirement may be worked out in respect of Environment friendly acquisitions.

- Additional disposal measure could be considered for example redeployment of old equipment or re-use of spare parts or donation. Employee purchase programme could be developed. Changes in legislation may be required to be able to dispose computer equipment in these ways. The fact sheet of the IT Security Units stated the followings:

  - Redeployment can be highly cost-effective. Often an old computer may remain fully functional and can thus be used for different purposes.

  - Spare parts of computer equipment that are still working can be used for replacing similar faulty parts in equipment. Some spare parts like memory chips can even be used to refurbish computers that can thereafter be redeployed or donated.

  - Old computers can be donated to non-profit organisations, schools and charities and can be put to good use for educational and social benefits.

- Activity such as refurbishment of unserviceable computer equipment could be developed. This would reduce equipment going to landfill and thus protect the environment; landfill is not a sustainable solution because of the risk arising from hazardous substances and loss of valuable resources. The experience of the Ministry of

Education in this field can be sought. The refurbished computer equipment can be redeployed or sold to employees.

- When the computer equipment cannot be refurbished, contracting with private sector organisations to dispose of computer equipment could be adopted. Specialist computer disposal companies would recover all the equipment for recycling purposes and resale. Legislations should provide that these companies dispose the equipment in such a way that protects the environment.

  Some end-of-life equipment has a considerable resale value because of the value of components or precious metals that can be extracted from it. The average PC contains about 42 per cent metals all of which can be melted down and resold. Most contain up to 35 different materials, including copper, nickel, silver, zinc, cadmium, selenium, barium beryllium, manganese, mercury, arsenic and cobalt.

- Whichever disposal method is used, Ministries should ensure that data are completely wiped off before being treated as unserviceable. This responsibility should be clearly defined at the level of each Ministry. Specific equipment is needed to wipe off the data. The fact sheet from the IT Security Unit of the Ministry of ICT mentioned that for computers that will be re-used, there are programs that will erase or wipe information effectively enough to prevent identity theft. Some of the new operating systems may come with the wiping feature. There are several free software programs that can be used for wiping data depending on the operating system.

- A register will have to be set in such a way that all interventions on computer equipment are recorded in it. Intervention history can be queried and used to determine the performance of the computer equipment. Decision can be taken on whether the asset will have to be replaced. Organisations need to monitor how asset values, maintenance costs and disposal costs and revenues change with the age of the equipment. This could be used to refine procurement and disposal to minimise costs.

- There is a need for a central government oversight on computer equipment disposal to exercise control and develop guidance in response to the growing volumes of computer equipment disposals.

CHAPTER ONE

INTRODUCTION

1.1 Introduction of Performance Audit in Mauritius

Performance Auditing is being introduced by Governments worldwide as taxpayers, donors and the public demand more accountability in the use of their resources. Governments are compelled to give information on how resources have been used and whether they have been used economically, efficiently and effectively. As Performance Auditing is a relatively new concept in Mauritius, this chapter aims at briefly orientating the reader about its history, mandate, scope, and methodological approach.

Performance auditing was adopted and incorporated into Government auditing at the Twelfth International Congress of Supreme Audit Institutions (INCOSAI) held in Australia in 1986.

The NAO started to conduct Performance Audit in 2009 following the amendment to the Finance and Audit Act in 2008, giving the Director of Audit the mandate to conduct Performance Audit.

1.2 What is performance auditing?

Most people associate auditing with the checking and verification of accounts to ascertain whether they show a true and fair view. The aim of financial auditing is to ensure compliance with existing regulations and detect errors and fraud. It has a major effect on the information that forms a basis for decision-making, but it provides limited information on the extent to which a Government's programme fulfils its objectives and goals. Financial auditing should therefore be supplemented and complemented by an audit that examines how well public operations have been performed, that is, to what extent they have produced the intended results and effects. This is the function of Performance auditing. As well, it goes without saying that, Performance Auditing, aims at promoting economy, efficiency, and effectiveness in the management of public resources, has a wider scope and goes further than the physical inspections to verify that money spent according to the accounting books is manifested on site in terms of physical, observable investments.

1.3 Benefits of Performance Auditing

- Performance auditing has important functions to fulfill, both in relation to the general public, parliament, the government and the entities that are audited.

- Performance auditing plays an important role in keeping parliament well informed about the government's actions, and the outcome of its own decisions.

- The public needs information on how public resources are spent and how public services perform. By providing objective and reliable information on these issues, performance auditing contributes to transparency and accountability.

- Performance auditing may be of value for Government to get an independent evaluation of the outcome of its decisions and the performance of public services.

- Performance auditing provides incentives for learning and change in the public sector, by providing new information and drawing attention to various challenges. It contributes to improvement and reform in public administration and government. In this way performance auditing adds value far beyond that of a control mechanism.

1.4 Audit Motivation

Government initiated the use of computers in the Civil Service in the 1970's.With the coming up of the third generation of computers, there was a widespread proliferation in the use of computers with the cost of hardwares going down and the lifespan of computer going down. This growth, in the acquisition of computer equipment in the Civil Service, is continuing. A total amount of Rs 138 million was spent in 2006-07 and in 2007-08 it was some Rs 189 million; an increase of 37 per cent. For the year 2008-09, Rs 237 million were spent; an increase of 25 per cent as compared to 2007-08. The growth in use and the reduction in the lifespan of computer equipment have resulted in a growth in replacement of equipment and therefore a growth in the numbers of equipment to be disposed. However, there are no specific guidelines for disposal of computer equipment in the Civil Service yet.

There are environmental risks associated with disposal of ICT equipment as computer equipment is made up of hazardous materials which affect the health. Moreover very low financial return is obtained on disposal of unserviceable computer equipment; an amount of Rs 76,940 was received from sales of 1032 units of computer equipment i.e. an average of Rs 70 per computer equipment. With the accelerating growth in the number of computers requiring to be disposed of, there is an urgent need to formulate specific policy guidelines for the disposal of such items in a least costly manner, enhancing financial return on resale and which would be environmental friendly. It is in this context that the NAO has decided to carry out a performance audit on the disposal of computer equipment in the public sector.

1.5 Scope

This report examines how computer equipment is being disposed at the level of the Civil Service and whether the wider risks associated with disposal is being considered. It concerns the environment, electrical safety and data security .The concerns about whether disposal of computer equipment are done in a least costly manner to increase financial return on resale is also covered.

The audit covered the period 2006-07 up to end of July 2010.

The following data and information have also been looked into:

- List of unserviceable computer equipment at the particular Ministry/Department
- Last disposal date at each Ministry/Department
- Mode of disposal the Ministry/department had recourse to
- Financial returns from auction sales where applicable
- The number of computer equipment purchased /commissioned and the amount spent during the past three years ,and
- Relevant Acts/Legislations

CHAPTER TWO

OBJECTIVES AND METHODOLOGY

2.1 Audit Objective

The objective of the audit is to determine how disposal can be done in a manner that considers the threat it poses to the environment.

2.2 Methodology

To understand the current practices in Ministries, we visited eight Ministries .Judgemental sampling based on budget of the ministries was used. This sample represents 36 per cent of the number of Ministries (22 Ministries).

The NAO conducted this performance audit in accordance with the following methodologies:

- Analyzing the current disposal procedures in place in the public sector
- Site visits, interviews and process familiarization
- Performance and process benchmarking-Comparative analysis of overseas organisations dealing with the disposal of computer equipment
- Documents/file review
- Focus group discussion with computer agencies.

2.2.1 Interviews and process familiarization

We conducted various semi-structured interviews with senior management and staff members who are involved in the process. We also interviewed the IT manager of the Ministry of Education. The Ministry of Education is the only government institution to have a computer laboratory with computer technicians dealing with the 'refurbishment/cannibalization' of computer equipment.

2.2.2 Performance and process benchmarking.

To have hindsight of what private organisations are doing, we contacted some 15 selected companies which use computer intensively but unfortunately there was no response. For international benchmarking, we circularized 10 overseas Supreme Audit Institutions to have their comments/suggestions on this topic but only one responded favourably. We were re-directed to the authority dealing with the disposal of computer equipment and their comments were taken on board. We studied NAO UK performance audit report on the disposal of ICT equipment. We also scrutinised study reports from overseas Universities dealing with disposal of computer equipment.

CHAPTER THREE

BACKGROUND INFORMATION

3.1 Current Disposal Procedures

Each Ministry is responsible for its own disposal. There is no replacement policy and computer equipment are used until the end of their life. Whenever an equipment is not working, a computer support officer (CISD Officer) examines the equipment to determine whether it can be repaired. Repairs are done by the suppliers. If it is beyond economic repairs, the equipment is considered as unserviceable and returned to store. Store section of the ministry is responsible for calling a Board of Survey[3]. The Board of Survey will recommend the ways the assets are to be disposed.

Procedures as laid down in the Financial Management Manual (FMM) are followed for disposal. The FMM makes reference to the ways to dispose of government assets. These are: transfer to other departments, auction sales and landfill.

Before disposing to landfill, as required by the Environment Protection (Standards for hazardous wastes) Regulations 2001, electronic components are separated from casing as electronic components are treated as hazardous waste. This process is done by individual ministry with the help of CISD officer.

3.2 Safe and Secure Disposal of Computer Equipment

The IT Security Unit of the Ministry of ICT issued a fact sheet in 2008 on Safe and Secure Disposal of Computer Equipment. The fact sheet is only a guideline and is not mandatory. It stipulates the followings:

3.2.1 Disposal of Computer Equipment

Computers are decreasing in cost and increasing in speed and storage capacity. It is often easier and less expensive to replace old equipment. This implies that at some point it becomes necessary to dispose of old equipment. There are different options for disposal of computers. Users may not be aware of the dangers associated with improper disposal of computers. Precautionary measures have to be taken prior to equipment disposal.

[3] The Board of Survey as per FMM is responsible to carry out a survey on all unserviceable computer equipment brought to their notice and make recommendations as to their disposal.

3.2.2 Dangers of unsafe computer disposal

Simply throwing a computer out in the trash is a bad idea for at least two reasons:

- A computer usually stores personal and financial information that a person would not want to get into the wrong hands of identity thieves.

- A computer is made up of heavy metals and toxins that are extremely hazardous to the environment.

3.2.3 Disposal Options

There are several options for discarding a computer:

- *Redeployment.* Redeployment can be highly cost- effective. Often an old computer may remain fully functional and can thus be used for different purposes e.g. for training or testing or re-used in a different environment.

- *Donation.* Old computers can be donated to non-profit organisations – schools, charities, etc. and can be put to good use for educational and social benefits. Donating a working computer can make a big difference in someone's life.

- *Re-use of Spare Parts.* Spare parts of equipment that are still working can be used for replacing similar faulty parts in equipment. Some spare parts like memory chips can even be used to refurbish computers that can thereafter be redeployed or donated.

- *Resale.* A set of old ICT equipment can be considered for resale as per established procedures. The Financial Management Manual makes provisions for resale by different methods such as public auctions or competitive tenders.

- *Scrap – Go for Safe Disposal.* If there are no reasonable prospects for old ICT equipment to be re-used/sold as per the previous options, then they may be scrapped. However, due care must be taken for safe environmental disposition. There are lots of recyclable materials and toxic waste to deal with. There are more than 40 elements encased in a computer – many of them being highly toxic even in the trace amounts in which they are used.

The same Fact sheet also stipulates that whether computer equipment is redeployed, donated, re-used, resold or scrapped, it is essential that all personal data and financial information are completely erased from the computer equipment to prevent identity theft and protect the privacy of information. Simply deleting or reformatting the hard drive is not enough. Files deleted by ordinary means (e.g. dragging to the Recycle Bin/Trash Can) can usually be

recovered. Even with default hard drive reformatting, some key information can still be retrieved. It is crucial for security purposes that secure options are used:

- Safe keeping of hard drives
- Data Destruction – Wiping off
- Data Destruction – Demagnetisation (Degaussing)

3.3 Inventory and repairs

The ICT manual from the Ministry of Information Technology makes reference to the followings:

- An 'IT Equipment and Software Register' will be maintained at the level of each Ministry/Department, to keep an inventory of all deployed IT assets. This register will be updated by the officer responsible for inventory at each Ministry/Department. The Register will assist Ministries/Departments to have complete, up-to-date information on deployed hardware, software, network devices and other technology assets. It will also record information about maintenance cover, upgrade and repairs along with corresponding cost and track the movement of the equipment until its disposal.

- The Central Information System Division (CISD) technical support team (which is already providing first-line support on computer equipment) will be reinforced/trained to undertake the repair of computer equipment and operate as a full-fledged support and maintenance unit. Pending the setting up of the unit, Ministries/Departments will continue to have their computer peripherals maintained/repaired on an intervention basis by appropriate firms.

3.4 E-waste Projects

In a report on e-Waste Quantification and Characterisation by the Mauritius Research Council (MRC) the term e-Waste was defined as a generic term embracing all types of waste containing electrically powered components. Electrical and electronic wastes contain both valuable and hazardous materials which require special handling and recycling methods. In 2008, the estimated amount of e-waste was 6571 tonnes and it is estimated to reach 7584 tonnes in 2011 which amounts to an increase of 15 per cent over three years.

The National Audit Office highlighted the issues on disposal of computer equipment in the public service. At the national level, there are projects on e-waste that are being worked on by various public bodies. These are enumerated below.

- The report on e-Waste Quantification and Characterisation in Mauritius prepared by the MRC recommended that e-waste could be recycled. This would involve registration and accreditation of interested recyclers to gain access to the waste. Another possibility of disposing the waste would be exporting it to countries that recycle e-waste.

  The same report stated that e-waste is bound to increase over the coming years. Technology, fashion, and changes in consumption patterns are contributing factors to such increase and one major recommendation of the report is that policies and regulations must be set up to regulate the management of e-waste.

- The National Computer Board (NCB) has set up a Green IT Committee and is currently working with the objective to develop a Green IT Policy for Mauritius. A workshop on Green IT was organised in May 2010 on the occasion of the World Telecommunication and Information Society. A website on Green IT and a brochure on Green IT Guidelines for households were launched during the workshop.

  According to a paper on Green IT, Green computing refers to environmentally sustainable computing and practices of designing, manufacturing, using and disposing of computer equipment efficiently and effectively with minimal impact on the environment.

- The Ministry of Local Government and Outer Islands is currently working on strategies for the sound management of e-waste in Mauritius. In March 2011, a paper was prepared outlining the Ministry's strategies on e-waste. A two–phase approach is being adopted to tackle the e-waste problem in Mauritius. Phase one is intended as an immediate solution to clear the existing backlog of e-waste from public and parastatal bodies. Medium and long term management of e-waste in Mauritius will be undertaken in phase two whereby experience acquired in the management of e-waste in phase one will serve as stepping stone to establish a framework/mechanism for the sound management of e-waste in Mauritius.

  To be able to achieve these two approaches, the followings actions among others are being adopted:

  - Bidding documents for the collection, transportation, dismantling and export of e-waste for recycling which are under preparation.

  - Amendment of the FMM to recognise recycling as a disposal method for e-waste is underway.

  - Development of regulations for the registration of recyclers which is in progress.

  - Investigate the feasibility of introducing environmental policy approaches such as Extended Producer Responsibility (EPR). *The UK Report on Disposal of ICT equipment defines EPR as follows: producers are responsible for meeting the costs of*

collection, treatment, recovery and environmentally sound disposal of electrical and electronic equipment that becomes waste.

- Review existing legislation and recommend appropriate administrative set-up, regulatory and institutional frameworks, policy and financing mechanism and infrastructure requirement.

- Amend legislation to address gaps in existing framework for e-waste for example encourage environmentally friendly electric and electronic equipment and develop a legal framework for a national e-waste recycling scheme.

CHAPTER FOUR

THE GROWING SIGNIFICANCE OF COMPUTER EQUIPMENT DISPOSAL

4.1 Expenditure and Volume

A total amount of Rs 788 million was spent on acquisition of computer equipment from 1 July 2006 to 30 June 2010. A constant growth in acquisition of computer equipment in the public sector is noted. There was an increase of 37 per cent from 2006-07 to 2007-08 and for the period 2007-08 to 2008-09 an increase of 25 per cent was noted.

Table 1: Expenditure on computer equipment

Year	Amount (Rs million)	Percentage Change in expenditure
2006-07	138	-
2007-08	189	37
2008-09	237	25
1July 2009 to 30 June 2010	224	-5
Total	**788**	

Source: Treasury Accounting System

A total of 19,707 units of printers and personal computers (including notebooks) were commissioned in the five years 2006 to 2010 .There was an increase of 103 per cent from 2007 to 2008 although that there was a decrease of 12 per cent from 2006 to 2007 as shown below. From 2009 to 2010 there was an increase of 160 per cent.

Table 2 - Growth in personal computers (including notebooks) and printers commissioned

Year	Quantity Commissioned(Units)	Percentage Change in quantity commissioned
2006	3736	-
2007	3253	-12
2008	6628	103
2009	1687	-74
2010	4403	160
Total	**19707**	

Source: CISD

As at end July 2010 the volume of unserviceable computer equipment awaiting disposal in six Ministries was some 1,107 units. The Microsoft Enterprise Agreement requires that Government Microsoft Licenses be regularized on an estimation of 7,000 personal computers currently in use in the public sector. The optimal configuration for personal computers (PCs) to support Office 2007 and Windows Vista/7 is RAM capacity of 2 GB and Processor of at least 2 cores. Consequently a proportion of the computer will need to be replaced or upgraded. The CISD is currently carrying out a survey to determine the number of computer equipment that needs to be replaced or upgraded.

4.2 Storage

In some Ministries, computer equipment has not been disposed for the past three years. Consequently, this computer equipment is kept in stores. Computer equipment was being stored until capacity constraints meant that a disposal is required. This is not a proper way of managing redundant equipment as computer equipment rapidly loses value, and failure rates increase when components are stored and are inactive. Also computer equipment contains hazardous material which can affect health.

4.3 Data Protection

There is a fact sheet on wiping off of data before disposal. All Ministries accepted the need for wiping off of data from hard drives before disposing of equipment; however, they do not have the appropriate tools. Data is simply being deleted. Also the fact sheet is not mandatory.

4.4 Lessons

Extract from UK NAO issued a report in July 2007 on "Improving the disposal of public sector Information, Communication and Technology Equipment".

The risks with computer equipment disposal are associated with environmental protection, data protection and security, and electrical safety.

The main consequences for public bodies for not managing these risks include:

- Legal action from failure to comply with regulations governing the disposal of hazardous waste.

- Adverse publicity from being seen to breach legislation.

- The loss of public trust through for example, leakages of personal or confidential information because of inadequate data wiping off processes.

4.5 Conclusions

- As at end July 2010 the volume of unserviceable computer equipment awaiting disposal in six Ministries was some 1,107 units. This is not significant, but in the future the volume of computer equipment that will ultimately need to be disposed of will grow as there is a constant growth in acquisition of computer equipment during the past three years and ultimately disposal. The survey being carried by the CISD on the 7000 PCs will also give an indication of the number of computer equipment that needs to be replaced in the future.

- In the absence of a defined life of computer equipment, the volume of computer equipment that would require disposal in the future could not be assessed.

- As far as environmental issues are concerned, as required by the Environment Protection (Standards for hazardous wastes) Regulations 2001, electronic components are separated from casing before landfill is done. However the other wider risks are not always being managed; data are simply being deleted instead of being wiped off. The consequence could be the loss of public trust through for example, leakages of personal or confidential information.

CHAPTER FIVE

POTENTIAL OF GENERATING BETTER VALUE FROM DISPOSAL

5.1 Recording

Computer equipment is recorded in Store Ledger on purchase. When issued by store, the equipment is taken on charge by the Office Supervisor and recorded in an Office Equipment Register. The Office Equipment Register contains details of equipment purchased, e.g. date of purchase, voucher number, serial number, model, make, costs and location. The computer equipment to be disposed of is removed from the Office Equipment register and transferred to an Unserviceable Stores Ledger. This ledger contains details of unserviceable computer equipment together with their received dates at the Ministry.

No 'IT Equipment and Software Register' is yet kept at the level of each Ministry/Department as required in the ICT Manual. Also, the ICT manual is not mandatory. Currently, records such as information about maintenance cover, upgrade and repairs are not recorded as there is no ledger is available to cater for records such as the maintenance, upgrade and repair costs.

The UK report on ICT Disposal mentioned that Fujitsu Services and Hewlett-Packard actively monitor how asset values, maintenance costs and disposal costs and revenues change with the age of the equipment, and routinely use this information to refine their procurement, operational and disposal strategies to minimise costs. The same report also found that the active use of a complete and accurate ICT equipment asset register was an important factor at those organisations achieving net disposal revenues. It enables forward planning of disposals and facilitates the integration of procurement and disposal

5.2 Disposal

In the public sector, computer equipment is used till the end of its life and then is disposed of. The available options as per the FMM are being considered and applied by public bodies. The volume of computer equipment disposed of is some 1,420 units in five Ministries for the past three years. Over 70 per cent (1032 units) were disposed of by auction sales and 380 units were sent to landfill. An amount of Rs 76,940 was received from sales of the 1032 units of computer equipment. The majority of the computer equipment is made up of monitor, CPU and Printer.

There are policies which make reference to the ways to dispose of all government computer equipment. These are: transfer to other departments, auction sales and landfill. But there are no disposal options specific to computer equipment. In other countries there are additional options such as refurbishment, recycling and employee purchase agreement.

5.3 Lessons

Extract from UK NAO issued a report in July 2007 on "Improving the disposal of public sector Information, Communication and Technology Equipment".

In UK for instance, leading commercial organisations dispose of computer equipment typically at around three years of age. Consequently, there is potential to generate better value from computer equipment disposals. The benefits are as follows:

- *Reduced costs of resale and increased resale revenues.* Although there are exceptions, as a general rule, computer equipment at three years of age has residual value and can be resold. It was estimated that if public sector organisations reduce the age at which they dispose of end-of-life computer equipment, from five to three years, this would increase the financial return from resale.

- *Reduced operating costs* .By disposing of their computer equipment, typically at around three years of age, leading commercial organisations are doing so at an age before it starts to incur significantly higher operating costs and reduces business performance. In light of such evidence, departments should look carefully at their disposal cycles to identify whether better value can be obtained from changing refresh cycles. On the one hand procurement costs will increase from moving from a five to a three year refresh cycle. On the other hand there is evidence that by adopting a faster refresh cycle there may be significant countervailing savings from, for example, reduced maintenance costs and increased staff productivity. In particular, the advice of professional advisors and a review of literature indicate that operating cost savings in excess of 40 per cent can be achieved through following best computer equipment management practices which include faster refresh periods.

Fujitsu services and Hewlett-Packard actively monitor how asset values, maintenance costs and disposal costs and revenues change with the age of the equipment, and routinely use this information to refine their procurement, operational and disposal strategies to minimize costs.

The active use of a complete and accurate ICT equipment asset register was an important factor at those organisations achieving net disposal revenues. It enables forward planning of disposals and facilitates the integration of procurement and disposal.

Equipment that is beyond repair or for which there is unlikely to be a viable market can be recycled. The advantages are that the precious metals can be recovered and at the same time the environment is being protected from hazardous waste.

Regulated treatment facilities must exist where components or materials can be recovered for reuse or recycling. Some end-of-life equipment has a considerable resale value because of the value of components or precious metals that can be extracted from it. The average PC contains about 42 per cent metals all of which can be melted down and resold. Most contain

up to 35 different materials, including copper, nickel, silver, zinc, cadmium, selenium, barium beryllium, manganese, mercury, arsenic and cobalt.
There are four broad recycling methods:

- Equipment dismantling – the manual separation of reusable and recyclable components

- Mechanical recycling – the removal of hazardous components followed by granulating and shredding, in order to remove the recyclable raw materials such as plastic and ferrous metal

- Incineration and refining – metal can be recovered after the more combustible material has been incinerated

- Chemical recycling – precious metals such as gold and silver can be removed from printed circuit boards and components via chemical processes.

When computer equipment is no longer required for its original purposes it can be re-deployed. If an organisation chooses not to redeploy the equipment it has a number of disposal options, which are resale, employee purchase programme, refurbishment, environmental recycling and landfill as a last resort.

In UK, Government Departments have a series of targets against which their performance is assessed, such as waste minimisation and recycling levels. These are:

- Departments to reduce their waste arising by five per cent by 2010, relative to 2004-05 levels;

- Departments to reduce their waste arising by 25 per cent by 2020, relative to 2004-05 levels;

- Departments to increase their recycling figures to 40 per cent of their waste arising by 2010;

- Departments to increase their recycling figures to 75 per cent of their waste arising by 2020.

With the large amounts of computer equipment being disposed of by public bodies, responsible re-use and disposal will have an important impact on realising these targets.

Based on a survey carried out by the NAO UK, it was noticed that Public bodies can typically enter into contract with private sector organisations to dispose of computer equipment. Specialist computer equipment disposal companies collect the equipment and dispose of it as instructed. Three-fifths of public bodies disposed of computer equipment in this way as shown by the survey. It is estimated that at least 200 specialist computer equipment disposal

companies operate in the UK ranging in size from national to single-person operations, and covering a range of different activities including:

- Waste management contractors who are paid to take computer equipment as waste;
- 'Dismantlers' or 'shredders' who will either charge to process computer equipment or give a return, depending on the value of the materials and component it contains;
- Asset management companies, that will test and cleanse data, and where necessary refurbish equipment for resale, and share the profits with the disposing organization;
- Charity or community sector 'refurbishers' who refurbish computer equipment for use by, for example, low income households or schools.

In UK, there are different regulations that provide for disposal of computer equipment. For example, the Waste Electrical and Electronic Equipment (WEEE) Regulations impact significantly on how public computer equipment should be managed by creating new obligations for computer equipment producers to finance the disposal of computer equipment and to reduce landfill and increase the reuse and recycling of end-of-life equipment.

A number of computer suppliers, particularly printer suppliers, e.g. Fuji-Xerox, have done some significant work on improving the recycling compatibility of their printers.

Extract from Coventry University UK

The Coventry University in UK follows the procedures below:

- Refurbishing and redeploying equipment to alternative uses, either within the university or external to it, whenever possible.
- Where it is not possible to extend the useful life of the computer equipment, it should be recycled.
- The responsibility of the disposal is well defined. The section that purchases the equipment is responsible for its disposal.
- Information and data are wiped off before disposal of equipment. It is the responsibility of the organisation to remove any personal data stored on the hard drives of computer equipment. Just hitting the delete key is not enough to wipe off data from hard drives. Specialised software must be used.
- Due to limited storage facilities, it is advisable to plan early to identify alternative uses or items which should be disposed of.

Extract from Oxford University UK

At the Oxford University, in the UK, before disposing of computer equipment, ensuring adequate destruction of data is the responsibility of the unit that owns the equipment. It must not be delegated to any person outside the University without adequate contractual obligations being imposed. The Communications and Electronics Security Group (CESG) have established a set of data removed standards geared towards the various different classifications of data across government (that is restricted, confidential, secret, and top secret)

5.4 Conclusions

- The wider risks associated with disposal for example data security is not being managed as data are not being wiped off before disposal. The consequence could be the loss of public trust through for example, leakages of personal or confidential information.

- There is no disposal options specific to computer equipment. Options specific to computer disposal are essential as disposal of computer equipment pose different risks to disposal of other items. The risks are that computer equipment contains hazardous materials which can affect the environment and health. It is essential to reduce the volume of computer equipment going to landfill to reduce the impact on the environment.

- Very low value is obtained on disposal of computer equipment. From the 1032 units of computer equipment sold; the revenue was only Rs 76,940. Computer equipment is used until fully scrapped and hence have very small resale value. In UK for instance, there are asset replacement policies which seek to maximize revenues and to minimize operating costs from disposal; savings up to 40 per cent of the operating costs can be made. An asset replacement policy specific to the disposal of computer equipment in the public sector would help to generate savings in operating costs and retain commercial attractive resale value.

CHAPTER SIX

RECOMMENDATIONS

Ministries should ensure that unserviceable computer equipments are disposed without delay. They should not be kept too long as computers rapidly lose values and failure rates increase when components are stored and are inactive. This will free some spaces and also better monetary value can be obtained from the computer equipment. Ways to deal with the replaced computer equipment after the survey of the CISD on the 7000 PCs completed could be decided upon. For example the computer equipment can be put to alternative use such as training or testing or re-used in a different environment.

Environment Friendly acquisitions can be made. Suppliers may be required to provide equipment made up of less hazardous materials and also materials that can be recycled. At time of disposal these equipment will not be a threat to the environment. A number of computer suppliers, particularly printer suppliers, e.g. Fuji-Xerox, have done some significant work on improving the recycling compatibility of their printers. A minimum specification requirement may be worked out in respect of Environment Friendly acquisitions.

Additional disposal measure could be considered for example redeployment of old equipment or re-use of spare parts or donation. Employee purchase programme could be developed. Changes in legislation may be required to be able to dispose computer equipment in these ways. The fact sheet of the IT Security Units stated the followings:

- Redeployment can be highly cost-effective. Often an old computer may remain fully functional and can thus be used for different purposes.

- Spare parts of equipment that are still working can be used for replacing similar faulty parts in equipment. Some spare parts like memory chips can even be used to refurbish computers that can thereafter be redeployed or donated.

- Old computers can be donated to non-profit organisations, schools and charities and can be put to good use for educational and social benefits.

Activity such as refurbishment of unserviceable computer equipment could be developed. This would reduce equipment going to landfill and thus protect the environment; landfill is not a sustainable solution because of the risk arising from hazardous substances and loss of valuable resources. The experience of the Ministry of Education in this field can be resorted to. The refurbished computer equipment can be redeployed or sold to employees.

When the equipment cannot be refurbished, contracting with private sector organisations to dispose of computer equipment could be adopted. Specialist computer disposal companies would recover all the equipment for recycling purposes and resale. Legislations should provide that these companies dispose the equipment in such a way that protects the environment.

Some end-of-life equipment has a considerable resale value because of the value of components or precious metals that can be extracted from it. The average PC contains about 42 per cent metals all of which can be melted down and resold. Most contain up to 35 different materials, including copper, nickel, silver, zinc, cadmium, selenium, barium beryllium, manganese, mercury, arsenic and cobalt.

The report on E-Waste Quantification and Characterisation in Mauritius prepared by the MRC recommended that e-waste could be recycled or could be exported to countries that recycle E-waste. The same report stated that policies and regulations must be set up to regulate the management of E-waste.

The MOLG is currently preparing bidding documents for the collection, transportation dismantling and export of e-waste for recycling.

Whichever disposal method is used, Ministries should ensure that data are completely wiped off before being treated as unserviceable. This responsibility should be clearly defined at the level of each Ministry. Specific equipment is needed to wipe off the data. The fact sheet the IT Security Unit of the Ministry of ICT mentioned that for computers that will be re-used, there are programs that will erase or wipe information effectively enough to prevent identity theft. Some of the new operating systems may come with the wiping feature. There are several free software programs that can be used for wiping data depending on the operating system.

A register will have to be set in such a way that all interventions on computer equipment are recorded in it. Intervention history can be queried and used to determine the performance of the computer equipment. Decision can be taken on whether the asset will have to be replaced. Organisations need to monitor how asset values, maintenance costs and disposal costs and revenues change with the age of the equipment. This could be used to refine procurement and disposal to minimise costs.

There is a need for a central government oversight on computer equipment disposal to exercise control and develop guidance in response to the growing volumes of computer equipment disposals.

GLOSSARY

CESG	Communications and Electronics Security Group
CISD	Central Informatics System Division
CPU	Central Processing Unit
FMM	Financial Management Manual
GB	Gigabyte
ICT	Information and Communications Technology
IT	Information Technology
NAO	National Audit Office
PC	Personal Computer
RAM	Random Access Memory
UK	United Kingdom
WEEE	Waste Electrical and Electronic Equipment