Computer Disposition at the University of California - Berkeley: What Happens when Computers Outlive their Usefulness?

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Abstract Toxic manufacturing processes, components and large landfill space combined with increasing computer purchases and disposals have focused attention on personal computers. University of California – Berkeley (UCB) computer acquisition and disposal trends for the past 5 fiscal years will determine if UCB is maximizing social use while minimizing impact to the environment. Official UCB inventory records were sorted to acquire acquisition and disposal numbers for the past 5 years and the data used to calculate average age at disposal for each of the disposal options that UCB offers. Computer purchases increased FY95/96 to FY98/99 before dropping sharply in FY99/00. Junking computers was by far the most utilized end-of-life option at consistently over 50% of all disposals while computer re-sales steadily declined over the fiscal years examined. Rate of inventory increase was difficult to determine due to lack of information on computers under $1500 that were tracked but now are not. The average age of junked/cannibalized computers remained fairly constant at 7.9 years. Based on estimates of computer useful life at 5 years and an additional 3 years if reused, UCB is getting close to the entire 8 years of life without utilizing a reuse stage, possibly explaining the small percentage of disposals reused via resale, donation, miscellaneous/donation, and intercampus transfer. The average age at donation experienced a significant decline from 7.0 in FY96/97 to 5.2 in FY99/00 suggesting UCB computers must be at least as new for the University to be giving away computers just barely over their useful life. UC-Berkeley contributes large quantities of computers to the waste stream. Based on the trends in purchases and disposals observed, coupled with increasing software and hardware standards, the number of computers junked/cannibalized shows no signs of decreasing. Public awareness programs, increased visibility of the end-of-life options for University computers and staff education of the proper UCB disposal procedures should aid in increasing accuracy of the Berkeley tracking system, maximizing computer usefulness to the University and reducing computer waste overall.

Introduction

Air pollution, groundwater leaching, hazardous waste disposal, recycling and energy conservation are just a few of the big environmental concerns and issues that make it to the public eye and public conscience. Many treat each issue individually, but in the case of computers concerns arise which encompass a multitude of environmental issues. For the most part, the average person sees computers from a user perspective, an instrument of future progress, and fail to recognize the environmental destruction left in its wake. Few are aware of the highly toxic production processes of silicon wafer fabrication, the use of lead and cadmium in computer circuit boards, or have any perception of the sheer volume of computers entering landfills, potentially contributing to soil and groundwater contamination (Silicon Valley Toxics Coalition, 1997).

Computer production requires 33,000 liters of water, generates 600 pounds of waste, and consumes 5,000 kwh for a single PC (Glosserman, 1996). A 1997 U.S. Census Bureau survey reports that 49% of households purchased a new computer in the past 2 years, and only 18% were using a machine more than 4 years old. The exponentially increasing number of computers shipped domestically within the United States suggests that computers are increasingly treated as a necessity for home, work and school (ITI Information Technology Industry Data Book, 1998). The prevalent mentality that bigger, faster and flashier is a necessity results in a large, currently unregulated electronic waste stream that will not only occupy valuable landfill space (a desktop computer occupies roughly 3 cubic feet and weighs 50 lbs. (Matthews, 1997)) but pose a toxic hazard in the process (computers contain a number of toxic components such as lead).

The computer contribution to the electronic waste stream is a relatively recent phenomenon and while many studies focus on decreasing the waste stream either by recycling and reuse, environmentally-conscious product design (Borland and Wallace, 2000, Banks and Heaton, 1997), or legislation (Struhs, 1998), only a handful of studies have quantified the waste stream or addressed the environmental implications of this growing and still poorly regulated trend. According to the Electronic Product Recovery and Recycling Baseline Report: Recycling of Selected Electronic Products in the United States, approximately 20.6 million personal computers became obsolete in the United States in 1998. Of that number, only 11 percent—about 2.3 million units—were recycled (EPR2). More than a billion pounds of obsolete computers are forecasted to be landfilled by the end of this year (Conley, 2000) and with the

average lifetime of a PC assumed to be 5 years (Matthews, 1997), 55 million computers – about 2.75 billion pounds - are anticipated to enter landfills by 2005.

Using H. Scott Matthews' model for forecasting quantities of electronic waste for the United States comparisons to information from the University of California-Berkeley will determine how adequately his assumptions of computer life and usefulness apply on a smaller scale to actual collected data.

Matthews' 1997 model is an updated version of his 1991 model and reflects the changes that have occurred in the end-of-life options for computers. The 1991 model (Figure 1) did not account for the possibility of interwoven end-of-life options and did not foresee the rapid growth the computer industry would experience, or the increased role and growth of recycling firms (which would expand the end-of-life options and percent distribution between stages). His 1997 model increases the annual growth rate to 15%, and changes the model to a multi-stage model (Figure 2) but still uses estimates and extrapolation of individual recycling firm data to fill gaps.

Matthews' model operates on a national scale for which little data is available regarding

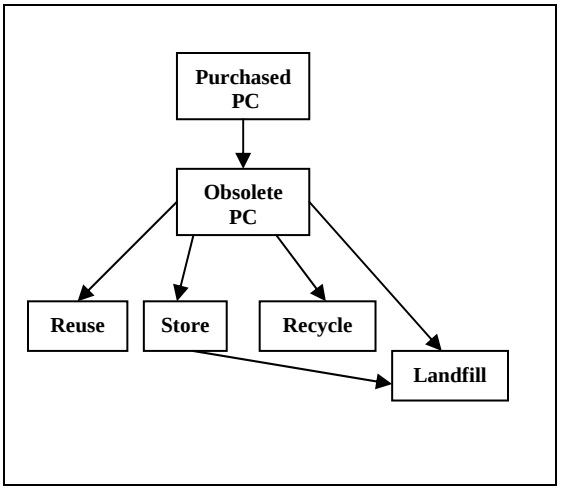

Figure 1: One-Stage Model (Matthews, 1991)

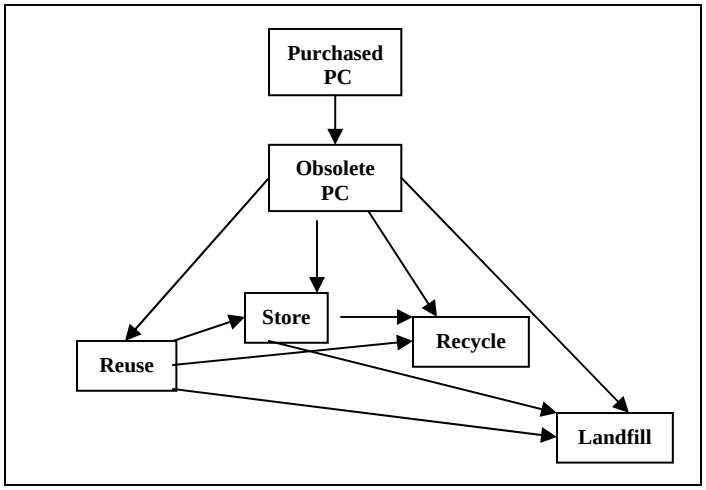

Figure 2: Multi-Stage Model (Matthews, 1997)

computer acquisitions and disposals. Any information gaps were filled by estimates based on observations that may or may not hold true on the national level. The University of California - Berkeley is a state funded institution and must keep precise records of acquisition and disposal of

computers as state property. An evaluation of the University's waste stream will provide several snapshots of current trends in purchases, disposals and average age at disposal. The collected data will provide insight on UCB computer waste potential (current purchases become waste in the future), current contributions to the computer waste stream, and computer usefulness to UCB. Analysis will discuss future implications of this behavior, and suggest means to handle this issue.

Methods

This study will determine how relevant Matthews' estimates are when compared with actual numbers and the smaller scale of a University. In order to do so, it is necessary to track the number of purchases, disposals in each end-of-life option that the University offers, and the average age of disposals in each end-of-life option.

At the University of California – Berkeley evidence of the growing importance of computers in an institution offers a large computer population to study trends in purchases and end-of-life options. Key to this study is that the University is a state institution and as such all equipment purchased becomes state property and must be accounted for as long as the equipment remains in University possession.

UCB uses the Berkeley Electronic Tracking System (BETS) to comply with this policy. Using BETS, UCB keeps strict records of property numbers, equipment codes and descriptions, responsible department, location (building and room number), method of disposal, equipment monetary value, among other things, to track inventoried equipment.

The University is not limited to the buildings contained on the Berkeley campus. For the purposes of this study, the limit of the study site is all those buildings and departments included in BETS. This includes the Berkeley Campus, UC-Extension, Richmond Field Station (RFS), Lawrence Berkeley National Laboratories (LBNL) and the UC Office of the President (UCOP).

Purchases can be directly extracted from BETS by searching for the specific equipment code pertaining to Microcomputers (H0780) using a report that screens University assets at a given point in time. In this way, the number of purchases per fiscal year can be determined.

Disposals are recorded throughout the year and are not kept on the tracking system. Disposals by fiscal year are recorded in an annual report (Annual 30C) which co-mingles computers with all other equipment being disposed of. This 100 to 300 page report required manual sorting for the computer using any of the following criteria:

1. Equipment code = H0780 or Description = “Microcomputer”

   Refers to Microcomputers, the category under which personal computers are classified, the main focus of this study.

2. Equipment code = H0805 and Description = “Word Processor”

   Refers to Typewriters, and includes manual, electric, automatic typewriters, and word processors. From this list, the items of interest are Word Processors, early versions of computers categorized under this equipment code because at the time they functioned as word processing equipment.

3. Equipment code = H0765 and Description = “Server”

   Refers to a more recent category of networking equipment including microcomputers used as servers.

Within these entries the following information is recorded: property number, equipment code, description, department, and disposal code (Table 1). Thus the collected data can be sorted based on this information and number of computers in each end-of-life option counted within the total number of computer disposals by fiscal year.

The above information is used to calculate average age at disposal for each disposal code. Average age at disposal is a means to examine whether the University is maximizing use of a computer, minimizing loss of assets to computer waste, and minimizing contribution to the waste stream.

The age of a computer at disposal is calculated using information contained in the property code. The property code is structured such that the first two numbers indicate the year the

Disposal Code	Description
21	Sold for monetary return
22	Not at designated location at the time of inventory (Lost)
23	Junked/Cannibalized
24	Trade-In toward purchase of newer equipment
25	Theft must be backed by a filed police report.
26	Intercampus Transfer from UCB to other universities within the UC system
29	Miscellaneous
Donation	Subset of Miscellanous regarding donation to non-UC organizations. Considered only when the cost to transport, store, prepare for possible sale exceeds the value of the item.

Table 1: Description of University of California defined disposal codes.

computer was purchased. Since fiscal year is used instead of calendar year the middle of the fiscal year is used to calculate the computer's age. For example, a computer with property number 90-10-01234 in FY95/96 would be 95.5 - 90 = 5.5 years old at the time of disposal.

Given the above data for each fiscal year, trends over time can be observed for purchases as well as each end-of-life option. Regression analysis will be used to determine the strength of these trends. Analysis of the acquired information will provide insight into the magnitude and implications of University computer supply to the waste stream, and the University's ability to manage this waste stream.

Results

Currently, the University of California-Berkeley has 32,992 computers on their tracking system (BETS). Computer purchases for the University of California-Berkeley steadily increased from FY95/96 to FY98/99 before dropping by 1,834 computers to 4,584 in FY99/00 (Figure 3). This number of purchases is based on BETS and only accounts for those computers classified under "Microcomputers" by the UCB Department of Property Management. Computers designated as "Servers," "Word Processors," and "Workstations" were only counted for computer disposals and not for purchases. However, computers under the "Microcomputer" classification consistently account for over 97% of computer disposals and currently account for 98% of computers in use as of 2/3/01. The number of Word Processors or Servers purchases is most likely negligible relative to the Microcomputer purchases.

The University instituted a change in value threshold required for equipment to be tracked. Purchases were broken down into two groups: value over $1500, or under $1500 (Figure 4).

Computer disposals increased overall experiencing a decrease only in FY98/99. Simple linear regression gives an R-squared value of 0.8481 and a P-value of 0.028, increasing at a rate of about 550 computers/fiscal year. When broken down by each end-of-life option the specific number Junked/Cannibalized, Miscellaneous and Donated (a subset of Miscellaneous) appear to increase over time while Re-Sold computers appear to decrease. The other end-of-life options show no obvious trends.

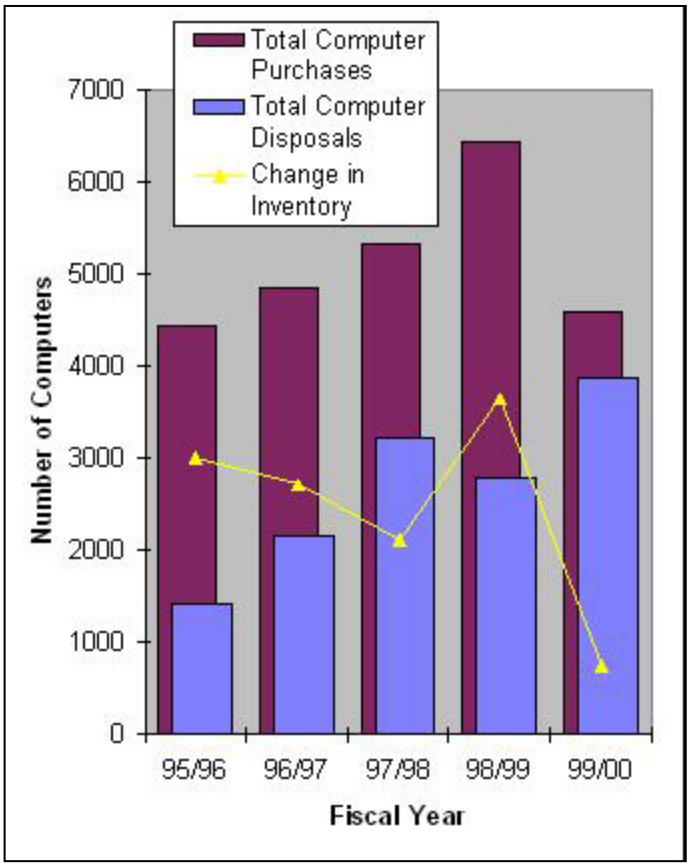

Figure 3: UC-Berkeley purchases, disposals and corresponding changes in inventory per fiscal year (FY95/96 to FY99/00)

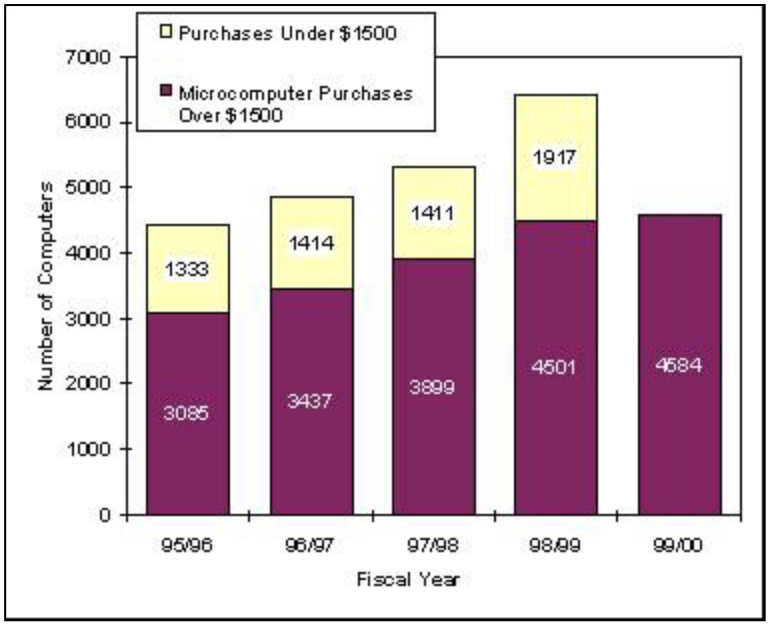

Figure 4: UC-Berkeley microcomputer purchases separated by threshold change of $1500 as the minimum value to be tracked (FY99/00).

The proportions of each end-of-life option remained fairly constant over the years observed with exception of a few anomalies: 1) a spike in Miscellaneous (FY97/98), 2) a spike in Trade-Ins (FY95/96), and 3) a sharp increase in Intercampus Transfers (FY99/00 (Figure 5). Disposals by month were available for FY99/00 to examine annual trends in disposal. Within FY99/00 disposals appear to increase sharply after February and continue towards the end of the fiscal year with respect to the noted sharp increase in Intercampus Transfers in FY99/00. More specifically, there is a sharp anomalous increase in Intercampus Transfers for September 1999 (Figure 6).

Junking computers was by far the most utilized end-of-life option, at consistently over 55% of all disposals. In the years where the three anomalies do not occur, Miscellaneous (donations, transfers to non-UC institutions) and Lost were the second and third most utilized disposal options. Re-Sale was consistently the 4th ranked end-

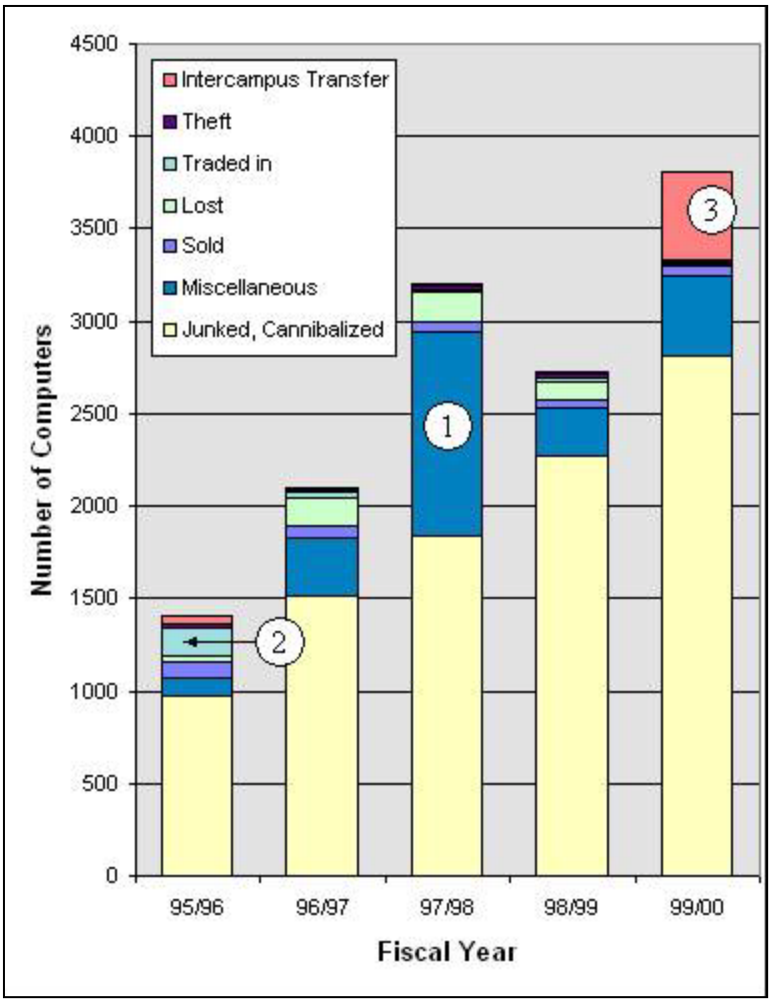

Figure 5: UC-Berkeley end-of-life options as components of total disposal figures by fiscal year.

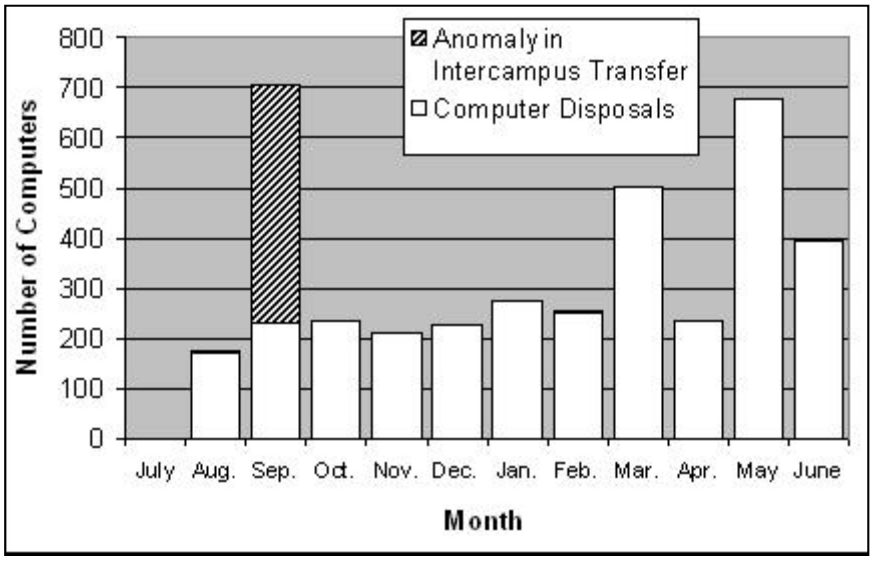

Figure 6: FY99/00 disposals by month accounting for anomalous increase in Intercampus Transfers (Sept.)

of-life option for all years. Donated computers, a subset of Miscellaneous, increased overall experiencing its only decline in FY98/99. For all 5 fiscal years, more computers were lost than were stolen.

Average age at Disposal was calculated for each fiscal year and range of ages over the 5 fiscal years was noted (Figure 7). The average age of all disposals remained fairly consistent over the 5 years at 7.5 ± 0.1.

Average age when Junked/Cannibalized remained fairly constant over the five fiscal years at 7.9 ± 0.4. The average age for Resold computers remained within a range of 4.6 to 5.8 with a noticeable spike in FY98/99 to 7.0. Stolen computers remained constant at around 2.5 to 3.2. Average age for Donated computers steadily declined from 7.04 in FY96/97 to 5.2 in FY99/00. Simple linear regression reveals

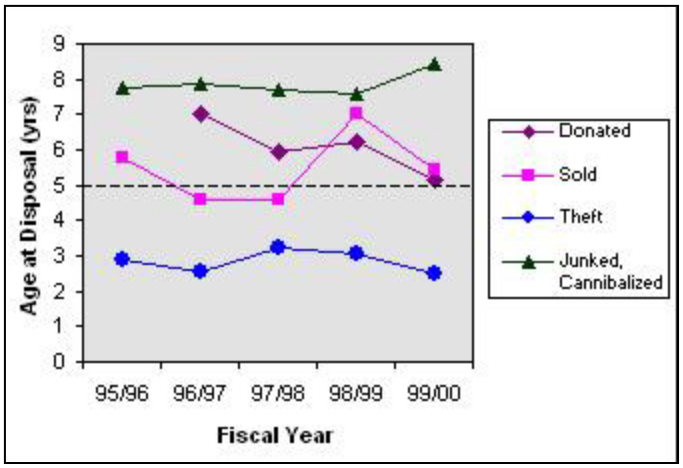

Figure 7: Age at disposal by fiscal year in relation to the 5 year Useful Life expectation.

a strong trend (P-value <0.001) of average age at donation decreasing over time. No donation data was available for FY95/96.

The population of computers at UCB grew during all 5 fiscal years (purchases minus disposals was positive). However, change in inventory declined all 5 years except for a sharp increase in FY98/99 where change in inventory almost tripled that of the previous fiscal year.

Discussion

The BETS counts 32,992 computers currently in use at the UC-Berkeley. Currently there are more computers in use at the University of California-Berkeley than there are students attending it. However, this number does not accurately reflect the total number of computers on campus. The University instituted a threshold change in FY99/00 from $1000 to $1500 as the minimum value for an item to be tracked on BETS. As a result this number is lower than the actual number of computers in use in campus.[1]

Purchases appear to have increased exponentially from FY95/96 to FY98/99 then dropped the following fiscal year. The decrease in computer purchases in FY99/00 can also be attributed to installation of the new Berkeley Financial System (BFS) with specific hardware requirements that many of the currently used computers could not meet suggesting an increase in purchases for FY98/99. Because of this increase in purchases in FY98/99 it is feasible that less money was available for purchases the following fiscal year reflected in the drop in purchases in FY99/00.

However, the decrease can be almost entirely attributed to the change in threshold from $1000 to $1500 as the minimum value for an item to be tracked by BETS. Many purchased computers fall under the $1500 threshold and therefore are not included in the total purchases for FY99/00. When purchases from FY95/96 to FY98/99 are separated by those under $1500 and those over $1500 both categories appear to be increasing. The growth rate of purchases under

$1500 appears to be increasing while the growth rate of purchases under $1500 seems to be slowing down (Figure 4). Increasing purchases of computers under $1500 would continue the trend of exponential growth noticed from FY95/96 to FY98/99. By changing the BETS tracking threshold, the University may be neglecting an important subcategory of their inventory, inventory that may legally need to be tracked in the near future if restructuring of CRT disposal regulations shifts to also include computers[2].

As of June 2000, UCB disposed of 3868 computers and that number is increasing at a rate of about 550 computers per fiscal year. Of this number, 2847 were Junked/Cannibalized increasing at a rate of 450 computers/fiscal year. This is a little more than the incoming freshman class of that same year and is increasing at a faster rate.[3] This is a very large contribution to the waste stream both in number and in volume and shows a very consistent rate of increase.

Excess and Salvage, as the unit of Property Management responsible for disposal of excess equipment and/or supplies, continues to operate under the policy of trying to recoup proceeds for campus departments on items processed through the system[4]. In light of the number of computers Junked/Cannibalized the number of computers Resold are extremely small. And within that small proportion the number of Resold computers are decreasing. In this respect, the University is not taking to heart its own policy and is not getting a potentially large amount of money back on its old computers.

The installation of the new BFS also impacted disposals. Most items are usually deinventoried at the end of a fiscal year and purchased at the start of a fiscal year (Figure 6). The corresponding increase in disposals in FY97/98 (to make room for the incoming computers) then decrease in FY98/99 partially reflects this trend. Further analysis reveals this sharp increase is mostly due to the large quantity of Miscellaneous disposals and the Workstation Support Services (WSS) department as the top contributor. From 1985-1991 the WSS, a campus-wide organization serving campus microcomputer users from all departments,[5] ran a free-of-charge equipment rental program. Over time, equipment, including computers, became obsolete and they stopped maintaining it and left it with the departments who usually disposed of it without notifying Scholar's Workstation or Property Management and thus were never properly deinventoried until FY97/98.[6] Why Property Management was not notified sooner, despite custodial inventory reports required every two years, brings to light a possible lag time between when the department stops using the equipment and when Property Management is notified that

the equipment needs to be deinventoried. The total number of disposals for FY98/99 is artificially inflated with the excess of Miscellaneous disposals in FY98/99 belonging to previous fiscal years. This is the only occurrence of WSS contributing to the Miscellaneous disposals in the 5 fiscal years observed.

With respect to the FY97/98 anomaly, Miscellaneous disposals increased at a rate of approximately 60 computers/fiscal year. This increase is mostly due to Donations which grew from below 25% of the Miscellaneous category in FY96/97 to a little over 60% in FY99/00. Donations are an excellent means to extend the benefits derived from a computer while at the same time reducing the volume of landfilled computers and contributing to the technological advancement of local schools and organizations. From an environmental standpoint, the University should advocate the donation process as an alternative to junking/cannibalizing by making sure schools and other organizations are more aware of this option.

Anomalies 2 and 3 are due to isolated incidents in University tracking history. Anomaly 2 is due to another program offered by WSS. In FY95/96, WSS received a shipment of new Apple computers and offered campus departments a trade-in for their old computers towards one of the new computers. While this action releases the University from disposing of the computers themselves there is no way to know what Apple does with the influx of old computers, whether they are junked, refurbished, or donated, and therefore no way to determine the University's contribution to the waste stream in this manner. However, Trade-Ins account for only a small portion of yearly disposals and therefore hold little bearing on the totals in other end-of-life-options.

The last anomaly to note is the sharp increase in Intercampus Transfers in September of FY99/00 (Figure 2). Following the installation of the BFS in FY98/99 the University of California Office of the President (UCOP) transferred their equipment tracking responsibility from UCB to UCLA. Thus, the UCOP computers were taken off BETS and added to UCLA in FY99/00 under the disposal classification "Intercampus Transfer." That Property Management staff can readily account for the sources of these three anomalies is testament to the accuracy of the BETS to keep accurate records of UCB disposals but only when the proper paperwork and procedures are followed to notify them of such changes.

For the fiscal years without the three anomalies, Miscellaneous and Lost ranked second and third in disposals. Miscellaneous includes donations and transfers to non-UC institutions.

Though the University is not recouping any of the initial costs of the computers, this end-of-life option is a benefit to the community and to the environment since landfilling has been put off for another 3 years (Matthews, 1997). The Donation option is increasing however, Miscellaneous still remains a distant second place to Junking/Cannibalism. Last fiscal year, 3868 computers of all classifications (word processors, servers, microcomputers) were disposed of. Of these, 2811 were junked or cannibalized. At a weighted volume of 2.428 cubic feet (Matthews, 1997) these 2811 computers would line the floor of Wheeler Auditorium 1 foot high. Items Lost peaked in FY97/98 at 171 dropping then to 16 in FY99/00.

Though far behind Miscellaneous and even farther behind Junking/Cannibalism the number of Lost computers is surprising. Lost implies misplaced which is difficult to fathom for a 42 lb., 2.428 $ft.^3$ computer. Lost, in this instance means the computer is not in the place where it was supposed to be at the time of inventory. An item could be listed as Lost but actually be in use somewhere else. This is a "black hole" in the accountability of the BETS. Just because an item is listed on BETS does not mean it is necessarily being kept track of. Equipment tracking policy requires department custodians to retain accountability of computers for entire departments. This number could range from 2 computers to 6162 computers in the Electronics Engineering Research Lab and does not include the multitude of other trackable equipment in their department. It seems then that items are often "lost" because they are moved by staff members who are not aware that the building, and room number of the computer must be recorded and tracked. The sharp decrease in Lost computers in from 100 in FY98/99 to 16 in FY99/00 suggests greater care and more attention is being paid to keeping trackable equipment accounted for.

There are more computers reported as Lost than Stolen. The number stolen is fairly consistent each year suggesting the University will lose more computers to negligence, internal error, than to intent, external forces. It is conceivable that the University could cut down on computer categorized as Lost by educating staff on proper disposal procedures and offering incentives for adhering to policy.

Average age at disposal is a means to determine if the University is getting maximum benefit from their computer purchases. The University has assigned a "useful life" of 5 years to all computers. The average age over all categories is fairly consistent over the 5 years at 7.5 ± 0.1. The average age of a Junked/Cannibalized computer is around 7.8 years. Considering the

average total lifetime of a computer in the United States is estimated to be around 8 years (Matthews, 1997) this is a good indicator that the University is getting just about as much use out of its computers as the rest of the nation, according to Matthew's observations.

Matthew's 8-year average includes an initial life of 5 years followed by an additional 3 years if reused or stockpiled. This suggests the University is getting maximum use of their computers in the initial life though this decreases the probability of secondary use, as reflected by the notably smaller percentages of computers in the reuse categories (Sold, Traded-in, Intercampus Transfer, Miscellaneous) every year.

While Matthews estimated 45% of all computers would be re-used, only about 12-37% of the UCB's computers are. Most computers in the reused categories of disposal (Sold, Traded-in, Intercampus Transfer, Miscellaneous) are over the 5 year useful life and, if Matthews' prediction that reused computers will live an additional 3 years, will exceed the 8 year predicted potential lifetime of a computer. The University is getting full value out of the computers in the form of actual use (initial use) before essentially giving them away (secondary use), a practice consistent with the University's policy of trying to recoup proceeds for campus departments on items processed through the system.

Funneling computers into the Resold category would be the most obvious means to recoup proceeds for campus departments on items processed through the system. Indeed, Resale is the 4^{th} most utilized end-of-life option, but in order to be attractive for resale the computer must be have a relatively new system to still be competitive. Thus, the average age at Resale is 5.4 ± 0.3, just around the 5 year useful life limit. From the average age of Junked/Cannibalized computers and the proportion of computers reused each year, the University would rather extract value from the computers in the form of actual use rather than by decreasing years of use to the University and receiving monetary return in the form of sales.

Intercampus Transfer and Resale fall under this limit in FY96/97 and FY97/98. According to University policy, this behavior is only allowed when items are considered excess equipment of no immediate use.[7] Yet this comes at a time when purchases are consistently increasing indicating a demand for computers exists on campus. Miscellaneous and Intercampus Transfer both fall under the limit in FY99/00 but this comes at a time when the growth rate of tracked items, those over $1500, is decreasing and is thus a more justifiable time of surplus. Average

age at Theft falls entirely under the 5-year useful life limit as expected. Newer computers are more desirable.

Benefits from diverting Junked/Cannibalized computers to these four Reuse categories include monetary return from sales[8] and trade-ins on newer equipment, computer or other, both of which are better than the zero benefit derived from Junking/Cannibalism.

Donated computers are getting younger with time. This is beneficial to the organizations on the receiving end as they get younger computers and therefore potentially extra use out of the computers they acquire. However, this means the University is not getting maximum use out of these computers. Additionally, this indicates that the University is at a state where it can afford to let go of these computers suggesting current University computers are at least, if not better than, the quality of these donated computers.

Computer inventory at the University of California-Berkeley increased for all five years. However, the rate of increase appears to be decreasing with exception to a sharp inventory increase in FY98/99. Computer disposals are increasing over time. Computer purchases also appear to increase with time however it is difficult to tell the actual inventory rate of increase without knowing how many purchases were under $1500 for FY99/00 or separating disposals by the same criteria. To neglect the role of the $1500 threshold would be to neglect the changes occurring within what seems to be two separate populations of computers. Purchases over $1500 exhibit linear growth while purchases under $1500 seem to exhibit exponential growth. Without knowing what the under $1500 purchase numbers are for FY99/00 it is difficult to know if in fact the under $1500 purchases are experiencing exponential growth. Since computer disposals appear to be increasing linearly, especially when adjusted for the previously noted anomaly in Miscellaneous disposals (anomaly 1), knowing the behavior of these two populations (under and over $1500) would aid in analyzing rate of growth or decline of computer inventory on campus.

The two populations of computer purchases exhibit different growth characteristics. Purchases over $1500 increased at a linear rate while purchases under $1500 exhibited almost exponential growth making analysis of inventory trends difficult. Junking/cannibalizing computers was by far the most utilized end-of-life option with an average age close to current estimates of maximum computer life. Average age at disposal is based solely on numbers extracted from BETS and describes years of potential use to the University. Though it is helpful to know how many years a computer will remain University property and the means of disposal

the average age at disposal says little about the efficient use of each computer. Just because an item is being tracked does not mean it is actively being used. In his study, Matthews identified a storage stage in his model and found that after the first 5 years of use the computer is deemed obsolete by the user though it retains some value. Storing the computer is a means to potentially extract future value; however it decreases the likelihood of effectively reusing the equipment as it ages and becomes more obsolete, and increases its chances of entering the waste stream (Matthews, 1997). Further research on maximum use of computers at UCB would be better served by determining the fraction of the age at disposal spent in efficient use, and the factors contributing to deciding when, in the minds of users, a computer is obsolete to them. The University's decision to no longer track the under $1500 population, both in purchases and disposals, may mask the magnitude of UCB's contribution to the waste stream in the future. Not tracking the entire computer inventory may have consequences for the University if legislation is adopted which institutes a waste responsibility program similar to the European Waste Directive, or environmental regulations shift to include computers in the hazardous waste classification.

Acknowledgements

I would like to thank Mary Laverty and the staff at Property Management for accommodating me beyond my expectations and educating me on the extremely complex world of equipment tracking. Above all, I would like to thank Reuben Deumling for his tireless guidance and unconditional support, making me realize I can accomplish great feats of social science research!

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[1] The entire disposal report for July 1999 was specifically dedicated to removing items under $1500 from the tracking system as disposal code 29. All regular disposals were processed in August 1999.

[2] Recently, the California Department of Toxic Substances Control (DTSC) issued a letter regarding "Management of Used Cathode Ray Tubes," in particular, new regulations for waste CRTs. DTSC requires disposals of hazardous waste materials be tracked using a hazardous waste manifest, and while used CRTs do not yet have specific California waste code, the implication is they might soon. It is conceivable, especially with increasing discussion of the European Waste Directive coming to the United States, that the same type of regulatory structure may be implemented for Microcomputers.

[3] Incoming freshman class of UCB in Fall 2000 was 3,735: http://www.chance.berkeley.edu/planning/IC/Campus.Stats/CampStats_F00/CS.F00.Table.F6

[4] http://www-propmgmt.matl.berkeley.edu/excess/intro.htm

[5] http://wss-www.berkeley.edu/about/wssabout.html

[6] "In most cases [departments] disposed of it without notifying us. Proper records were not kept and we have no way of identifying where the equipment is. Regarding other deleted items, we have no idea what happened to those and we do not have them. In some cases, as that equipment became obsolete, it was donated to charities and schools." –Work Station Support Services Representative regarding unaccounted for computer inventory

[7] Disposal policy as stated at Excess, Surplus and Salvage website: http://www-propmgmt.matl.berkeley.edu/excess/metdis.htm

[8] Departments received 80% of proceeds from sales over $75-$2000 and 1-20% on items over $2000