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IT Asset Disposition Services: A Green Solution for the Enterprise

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ABSTRACT

Enterprise IT asset disposition is one important contributing dimension to green IT initiatives adopted by organizations. IT asset disposition services aim to maximize the value of the IT asset investment of enterprises over its entire lifecycle while guaranteeing data security and protecting against environmental liability. The purpose of this paper is to introduce the practice of IT asset disposition services in the United States, and more specifically, the processes used to accomplish the three key objectives in IT asset disposition: 1) data security and protection, 2) environmental responsibility and compliance, and 3) asset value recovery. Regulatory compliance of companies and the role of information systems in IT asset disposition are discussed and a few future directions of research are proposed.

Keywords

IT asset, disposition, recycling, e-waste, green IT, outsourcing, SDLC, IT governance, data privacy, environmental regulations.

INTRODUCTION

The management of information technology (IT) assets has been recognized as one major contributing factor to the sustainability of enterprises while also widely recognized as a challenge to organizations (Chen, Watson, Boudreau and Karahanna 2009). Among the cradle-to-cradle breadth of green IT dimensions, the management of end-of-life IT assets is one important stage of the green IT initiatives adopted by enterprises globally (Molla, Pittayachawan, Corbitt and Deng 2009; Vykoukal, Wolf and Beck 2009).

Enterprise IT asset disposition (ITAD) addresses the recovery (including refurbishment and reuse) and recycling of an enterprise IT asset that is near or at its end of lifecycle to maximize the IT asset value for the enterprise while minimizing the risks associated with retiring active data-bearing equipment from the enterprise environment. Typical enterprise IT assets to be recovered and/or recycled cover a large selection of electronic products and devices such as computers, servers, printers, and their parts and accessories.

Companies and organizations carry both social and environmental responsibilities in the process of producing goods and providing services (Babin and Nicholson, 2009; Molla, Cooper, Corbitt, Deng, Peszynski, Pittayachawan and Teoh 2008). Researchers believe that the driving force of enterprise green IT initiatives come from three sources; the economical forces (pursuit of tangible cost savings), regulative forces (pursuit of legitimacy), and normative forces (pursuit of socially responsible practices) (Chen, Boudreau and Watson 2008; Chen et al. 2009; Molla 2008; Molla et al. 2009a). Among these the regulative forces may be the most immediate and direct to enterprises when referring to ITAD or electronics recycling. The prevalent problem of electronics recycling mainly comes from two aspects. First, the amount of retired electronics generated each year is enormous and keeps rising. In the U.S., the generation of retired electronics is a fast-growing figure. According to the U.S. Environmental Protection Agency (USEPA 2008a, 2008b), in 2007 2.25 million tons of electronics were ready for end-of-life management (i.e., had come out of use during that year), of which only 18% or 414,000 tons was recycled. The balance of 82% primarily went into landfills. Such "e-waste" generation is largely avoidable through responsible recycling.

Second, many organizations are ignorant about the proper processes of ITAD. Corporate and government organizations, a major source of retired IT equipment bear largely the responsibility to address ITAD properly. Recent studies on corporate green IT and sustainability have examined the initiatives of green IT adoption and sustainability (such as Watson, Boudreau and Chen 2010), product design (such as Ijomah, McMahon, Hammond and Newman 2007; Kwak, Hong and Cho 2009), extended producer responsibility (such as Zoeteman, Krikke and Venselaar 2010), etc. However, little is known about the ITAD services that are available to enterprises and how such services are managed and provided as a variable, yet cost-effective solution.

The purpose of this paper is thus to introduce the practice of ITAD services provided to enterprises by IT disposition service companies. This case, therefore, focuses on the description of 1) the processes and management of the ITAD services, 2) the mitigation of risks and recovery of residual value of IT assets, and 3) the recycling of IT assets that reach the end of the lifecycle, thereby describing a green solution of effective ITAD and its value proposition to enterprises. In addition we suggest several research opportunities related to ITAD.

IT ASSET DISPOSITION

Enterprises face a number of risks when considering retirement of IT equipment. These risks include both direct and regulatory risks. For instance, data resident on the equipment could expose proprietary corporate information as well as private consumer data regulated by federal and state laws; asset tags and other identifiable labels on the equipment could negatively impact the company's brand if disposed improperly; recycling, transportation and disposal require a company's compliance to a variety of state and federal environmental regulations; and the residual life and value of many assets could be lost if not effectively recovered through the secondary equipment market. The burden of compliance with these regulations and having expertise to properly mitigate the risks are beyond the capability of most companies. Therefore, specialized solution providers have formed to manage these processes at scale.

The "IT Asset Disposition" (ITAD) solution providers shield organizations from the business, legal, and environmental risks associated with IT asset retirement and recycling. The comprehensive and tightly controlled asset disposition process covers everything from logistics and data security to the de-manufacturing and recycling of materials. The goal is to manage the ITAD process in a smooth, easy, and efficient manner to provide enterprises absolute data security, minimum environmental impact, maximum value recovery, and full assurance.

More specifically, collected enterprise IT equipment will go through a series of steps including triage, data sanitization, repair, testing, and quality check with the goal of eventually being remarketed or resold. Electronic equipment that is at the end of its lifecycle (evaluated on technical specifications or level of wear or damage) will be destroyed and its remains recycled. Figure 1 illustrates the typical ITAD process (explained in detail in the rest of this section) and its relationship with IT asset value recovery and recycling.

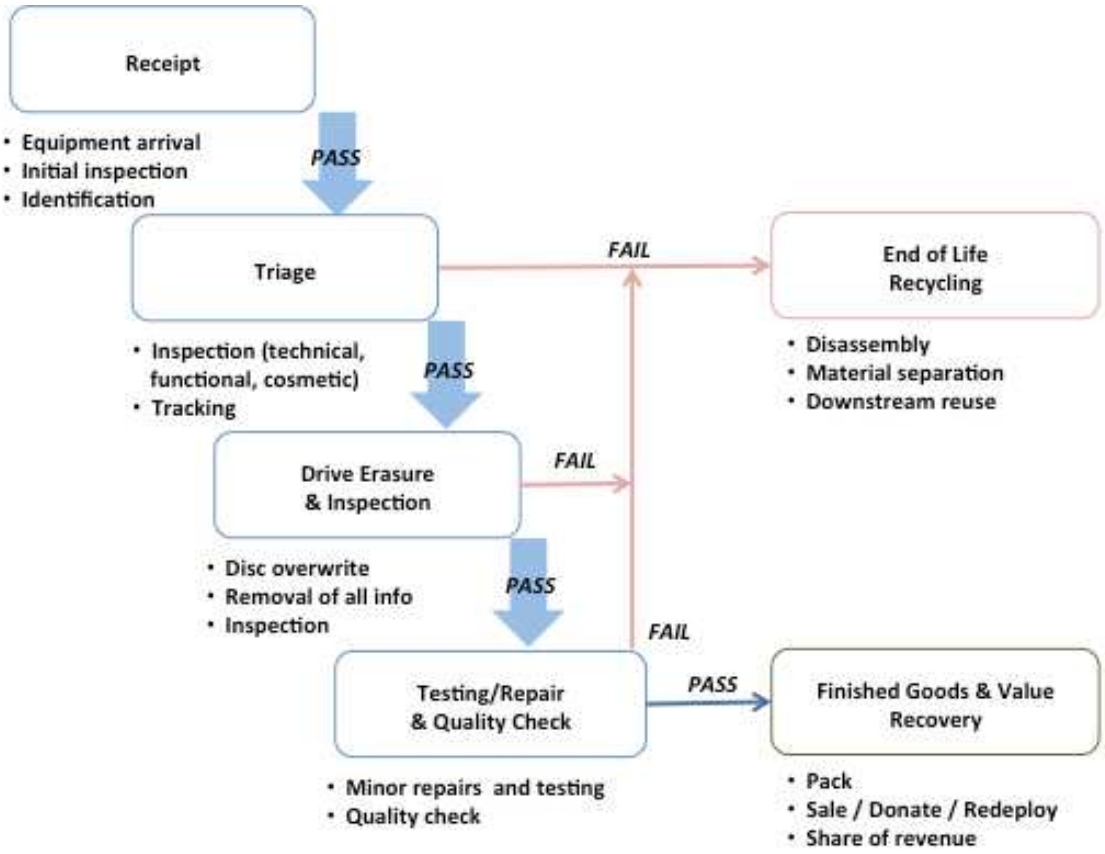

Figure 1. Typical IT Asset Disposition (ITAD) Process

Receipt and Triage

Equipment is received at the ITAD processor's loading dock via common carrier trucks, parcel carriers, or the ITAD processor's own trucks. Arriving products including computers, monitors, printers, etc. often come in shrink-wrapped pallets. Each pallet is assigned a unique lot number, indicating the origin of the content. The items are unpacked and quickly inspected to remove unacceptable or hazardous materials that may be mixed in. Unloaded equipment is uniquely identified to provide tracking back to the originator via a sticker, a barcode, or an RFID tag attached to the equipment.

Once a unit has been identified and loaded in the internal tracking system, it is sorted and inspected to determine if it meets minimum criteria for resale on the secondary market. Those inspection criteria include technical, functional, and cosmetic aspects. Examples of technical criteria are the processor speed, RAM, and equipment age. Functional criteria may include the presence of media drives and power supplies. Cosmetically, the equipment may be graded for different end markets (e.g., retail versus charities). If the product passes the triage step, it is routed for drive erasure and inspection. If it fails triage due to one or more of the criteria, it is routed for destruction and recycling.

Drive Erasure and Inspection

By their nature, organizations' computers are used for managing important enterprise data such as financial transactions, contracts, client information and records, account numbers, and healthcare data. Computers may also hold corporate trade secrets and other confidential corporate information that necessitate special security. When retiring old computers and electronics, organizations face the challenge of addressing the data remaining on their hard drives. As required by federal and state laws and regulations, corporations need to take extra precautions for the data.

Within the ITAD processor's operation, the data sanitization stage is to clean the hard drives and any other equipment that may contain corporate data to maintain confidentiality and the proprietary information of the client. Standards of U.S. Department of Defense and National Institute of Standards and Technology (NIST) are used in the wiping software for data sanitization, requiring a minimum of three overwrite passes to guarantee the elimination of all confidential information. Computer applications for data sanitization can perform the erasure on one drive at a time, or wipe multiple hard discs simultaneously. The software application monitors the progress of each process and the progress of the total cleaning process, which can take up to several hours depending on the capacity of the hard drive. Equipment is also inspected for other media that may contain data (e.g., discs left in the CDROM drives, USB flash memory drives, paper left in printers, etc.). Labels and tags that may be attached to the equipment for inventory purposes are also identified. These items are removed and destroyed to ensure complete confidentiality and security for the originating organization.

Testing, Repairs, and Quality Check

After drive erasure and inspection, the items then undergo thorough testing to determine if technical repairs are needed. Minor repairs may be required, such as replacing the media drive, adding RAM, and general cleaning. Following the repair step, a quality control check is made before the item can be considered ready for sale. Trained employees test each item of the many different types of computer systems, laptops, servers, and communication systems to determine if it passes the quality check.

Pack and Finished Goods

Once refurbished products are cleaned to restore the original look as much as possible (cosmetic clean-up), they are then repackaged with new wrapping material. These items are updated in the internal tracking system as ready for resale (explained in IT asset value recovery in the next section). Before any item leaves the facility, it is rescanned by the system. From the final scan, an inventory control report is generated; this is another measure to maintain security of the assets and also to provide tracking of final disposition back to the originating organization.

IT ASSET VALUE RECOVERY

The value of enterprise IT assets are recovered through a variety of channels. Some of the finished goods may be donated as charitable items to not-for-profit organizations and agencies, with donation credit going back to the originating organization. Other refurbished IT equipment can be returned to enterprises for employee purchase or even internal redeployment to new employees. Many companies find the prices for internal purchase so affordable that they provide such option as employee benefits. The rest of the finished equipment (the majority) is sold for reuse through various global distribution channels, including web sites, auction sites, direct retail, local/regional value-added resellers, and overseas brokers.

Whether it is donated, sold to employees, redeployed back to the enterprise, or sold on the global markets, the originating company gets credit for the value. Effectively the transaction may be done on a consignment basis, with the ITAD service provider retaining a small portion of the proceeds. This recovery of value by the originating enterprise can provide an unexpected revenue stream, which in some cases can fund the entire disposition program.

RECYCLING

Through the process of ITAD, equipment can fail the examination and testing at various stages. Failed items are then routed to the recycling process. The goal of the recycling process is to recover the materials used to manufacture the equipment, such as plastic, steel, aluminum, and copper. Recycling operations typically use manual labor and hand tools to perform initial disassembly and extraction of reusable components. In some cases this is enough to effectively separate the materials into near-pure streams for sale into the commodities markets with the ultimate goal to produce new products. In other cases, further mechanical methods are necessary to efficiently separate the large volume of materials. Recycling operations may also house advanced high-capacity shredders, capable of rapidly destroying large volumes of electronics and automatically separating the various materials using specialized technologies such as screens, magnetic belts, shakers, and electronic separators. The entire system features automatic monitoring to ensure efficiency and safety.

Whether resulting from manual disassembly or mechanical shredding and separation, all the commodity materials are loaded into large containers. These containers of material will eventually be sent to downstream recycling partners who will then further process or refine these materials and convert them into new products. The criteria used to qualify downstream recycling partners are very stringent and require on-site audits and ongoing tracking of material flows to ensure regulatory compliance and transparency of the operations. Scrutiny in downstream recycling is especially important for those toxic and hazardous materials found in some IT equipment (for example, batteries, mercury-containing switches and lamps, lead-based solder, etc.).

One major challenge facing enterprises today is to deal with the large amount of aging and obsolete electronic assets in businesses. The recycling process used by ITAD companies is an environmentally sound system designed to collect and process equipment in the most efficient and cost-effective way possible. The entire process is certified to protect companies from loss of data and liability exposure while complying with all U.S. Environmental Protection Agency (EPA) regulations to protect our environment.

DISCUSSION

Regulatory Compliance

Compliance with regulations is crucial to enterprise IT asset management and disposition services to ensure the proper handling of the proprietary and private data as well as the toxic components contained in retired IT assets. A thorough understanding of every applicable regulation is nearly impossible for a typical organization; therefore, outsourcing this function to an ITAD processor is well justified for the received expertise as well as for legal indemnification. At a high level it is important for enterprises to understand their compliance risks so they can justify the effort and expense of proper handling of retired assets, while still enabling them to leave the details to the ITAD processor. These laws fall into three basic categories: corporate governance, privacy, and environmental protection, although some other legalities may also apply in some cases (e.g., export, copyright, and contract law).

The Sarbanes-Oxley Act of 2002 (SOX) applies to corporate governance in the United States. This and the associated regulations administered by the Securities and Exchange Commission may apply to the financial records associated with appropriate book-keeping for IT equipment as well as the proprietary intellectual property that may be stored on it. Fines associated with violation of SOX can range as high as $5,000,000, in addition to possible criminal penalties.

Privacy laws have increased dramatically in importance in the past several years due to the rising rate of identity theft crimes. In addition to a variety of state laws, applicable federal laws include the Gramm-Leach-Bliley Act of 1999 (GLB) that applies to financial institutions, the Fair and Accurate Credit Transactions Act of 2003 (FACTA) that applies to businesses with credit card transactions, and notably the Health Insurance Portability and Accountability Act of 1996 (HIPAA) that protects personal health information. Enforcement of all of these laws has been active. GLB penalties may be as high as $100,000 per violation. FACTA's maximum fines are $2,500 per violation. With the recent changes to HIPAA signed by President Obama, fines can go as high as $1,500,000 per violation. When one considers the tens of thousands of social security numbers, credit cards, or health records that could be contained on a single hard drive, it is not hard to imagine tremendous penalties on irresponsible companies.

Environmental regulations may be the most complex and challenging for many companies, since they vary greatly depending on the type of material, what ultimately happens to the material (even if outside the control of the originating company), and

the state, federal, and international laws that may apply at any given time. A patchwork of legislation enacted by nearly half the states creates confusion and disparate requirements on companies with far-flung offices. Federal laws such as the Comprehensive Environmental Response, Compensation, and Liabilities Act of 1980 (CERCLA), the Superfund Recycling Equity Act of 1999 (SREA), and the Resource Conservation and Recovery Act of 1976 (RCRA) also apply and can impact a company many years after it disposed of equipment and materials improperly. On a global scale, the Basel Convention applies to trans-boundary movements of materials; Europe subjects companies to the Waste Electrical and Electronic Equipment Directive (WEEE); Canada applies the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (EIHWHRMR); and many other countries have additional regulations. As a producer (generator) of used computers and electronics in each state and country in which it operates, an organization must comply with all relevant environmental regulations.

This combination of international, federal, and state laws regarding governance, privacy, and the environment creates a tremendous burden of compliance with regulations that the organization may not even be aware of. Furthermore, the compliance aspects may be just scratching the surface compared with the brand damage a company may experience when its violations are highlighted by the press. This increases the importance of working with an expert to ensure compliance and to protect the enterprise. Identification of qualified ITAD companies is crucial. To facilitate this, a standard has been developed by the EPA and a variety of stakeholders across the industry to provide independent certification for computer and electronics recyclers: the Responsible Recycling Practices (R2). Additional research into this standard and compliance would provide a clearer understanding of the costs and risks of compliance in the course of ITAD and how these may be mitigated by enterprises.

Information Systems in IT Asset Disposition

Some researchers have labeled IT to be the problem and information systems (IS) to be the solution to green IT adoption in organizations (Chen et al. 2009). Although there is a lack of studies investigating the role of IS in green IT initiatives, some believe that tracking can be the main functionality of IS in the disposal of IT assets (Molla et al. 2009a).

As noted in this paper, tracking plays an important role in the outsourced ITAD process. To ensure compliance and transparency, tracking should begin at the enterprise with an accurate inventory of the IT assets under management. This inventory should include the age and configuration of the assets, as well as the software licenses installed on each machine (for recovery of those seats upon asset retirement). As the IT equipment is shipped to the disposition processor, bills of lading and other tracking methods should be used. And once it arrives at the processor, unique identification of each asset by serial number is critical for tracking it through the process to final disposition, so the enterprise may be paid their share of the value recovered and also demonstrate regulatory compliance through reporting.

ITAD processors may use a variety of proprietary and off-the-shelf software applications to facilitate this tracking and reporting. This is especially important if the processor uses barcodes or RFID tags for tracking of the asset through each step of the process. When integrated with a rules-based system, the tracking can provide checks and balances to ensure security and integrity of each process step. The erasure of hard drives is an important use of software, which could also be integrated into a system to provide positive evidence that an individual drive has been wiped as well as confirm other hardware configuration information. Although much of the process may be managed through implementation of an ERP system, the uniqueness of each IT asset may preclude a simple installation, as such installations typically depend on consistent models or SKUs for application efficiency.

It is easy to see the value of such applications and integration into a tracking and operations management system for ITAD processes. However, additional research into best practice systems and methods could provide opportunity for IS development to drive efficiencies and transparency to assist companies with compliance as well as revenue realization.

CONCLUSION

This purpose of this paper is to introduce the practice of ITAD services to maximize the value of the IT asset investment of enterprises over its entire lifecycle while guaranteeing data security and protecting against environment liability. The ITAD processes, including receipt and triage, drive erasure and inspection, testing/repairs and quality check, pack/finished goods, and recycling, demonstrate a best practice of the efficient and cost-effective ITAD services provided to enterprises. ITAD companies are also obligated to comply with the regulations related to environmental protection.

The above discussion demonstrates a strong example of the way an enterprise IT function can add the Disposal phase into a sustainable SDLC (SSDLC) as outlined by Huang (2009). Planning for disposal is just as important as planning for testing, coding, conversion, maintenance, etc. This case also exemplifies the opportunity for organizations to be a good corporate citizen by embracing the principles of using information systems for environmental sustainability (Melville 2010). Although

the role of IS is primarily focused on the tracking functionality of IT items at this point in time, future studies should explore more broadly and in more detail on the development and use of IS in enterprise ITAD . Additionally, future studies should also investigate the revenue model of ITAD service providers to understand how profit is generated for and shared between both the service provider and the enterprise. Additional research efforts should be able to determine the percentage of organizations that embrace the disposal phase of the SSDLC and also investigate why more organizations don't participate in green IT asset disposal activities. This is especially interesting given the opportunity for IT organizations to contribute to their corporations' environmental sustainability goals and financial objectives in unexpected ways. For example, perhaps the Green IT Readiness model proposed by Molla et al. (2009b) could be used to assess an organization's lack of willingness to be more green.

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