

ATTITUDES TOWARD GREEN COMPUTING IN THE US: CAN THEY CHANGE?

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Abstract

Computers today are an essential part of individuals' lives all around the world; however, these tools are extremely toxic to the environment given the materials used, limited battery life and technological obsolescence. The US and the EU's policies regarding this and other e-waste differ with greater support for the Basel Convention among Europeans. Although computer manufacturers are working to build "green" computers, a large part of limiting such hazardous wastes rests with consumers when purchasing them. Hence, the purpose of the study was to determine if information presented to consumers would influence their attitudes regarding green computing and purchases. A self-administered questionnaire was developed to determine consumers' attitudes toward the environment, attitudes toward green computing, and demographic characteristics. It was hypothesized that there would be no differences in consumers' attitudes before or after reading the information on computer toxicity. A convenience sample of students enrolled in marketing courses at a southwestern university, were surveyed. Results of Paired T-tests revealed significant differences for 13 of the 15 statements at the $p < .05$ level. Respondents mean scores increased significantly suggesting stronger agreement with the statements after reading the information. Implications were then discussed.

Keywords: green computers, environment, consumers' attitudes

JEL classification: M14; M15

1. INTRODUCTION

Computers have become an essential part of our lives for business, home, and entertainment. Given the state of technology, newer and faster computers in a multitude of forms are introduced annually as companies rush to gain market share and improve profit margins. However, with the ease the computer has given our lives it has also become a burden. Elec-

tronic waste or e-waste is now a major problem worldwide and is growing daily. According to Widmer et al (2005) e-waste not only contributes to disposal of toxins that are hazardous to the environment but also dangerous to humans that are exposed to them. Some of the toxins include mercury, lead, cadmium, arsenic, and selenium, that when burned create toxic emissions that harm human health (Widmer et al., 2005). The problem becomes an international fiasco when developed countries export their hazardous e-waste to undeveloped countries ("The Basel Convention. . ."2009). The Basel Convention on the Control of Trans boundary Movements of Wastes and their Disposal was signed in 1989 with the EU and the United States providing leadership in the implementation of it (Dreher and Pulver, 2008). However, although the EU ratified the Convention in 1993, the US along with Afghanistan and Haiti have yet to ratify it (Dreher and Pulver, 2008). Why the difference? According to Dreher and Pulver (2008) one reason is the strong tie that the US has with economic viability both domestically and in developing nations. According to the US position, allowing developing countries that have the capabilities to deal with e-waste, handle it as "equals" in trade, fosters economic growth (Dreher and Pulver, 2008).

This divergence from the EU and Eastern Asia regarding environmental policies is also demonstrated by the number of companies in the US that have adopted ISO 14001. ISO 14001 is the international standard for an environmental management system that firms can adopt to reduce their negative impact on the environment while improving management control (Nishtani, 2009). Today there are over 15,000 firms that have adopted ISO 14001 with the largest number of adoptees in the EU and East Asia. Although the US is ranked 7th in ISO 14001 adoptions (Neumayer and Perkins, 2004), Neumayer and Perkins (2004) found that countries that exported more to the EU and Japan and less to the US were more likely to be certified. The researchers concluded that Japan, EU and the US had different priorities regarding adoption of ISO 14001 by suppliers (Neumayer and Perkins, 2004).

Nishtani (2009) suggests that the pressure exerted by stakeholders is often a starting point for adoption of ISO 14001 for companies and the adoption of sustainable operations. For the US, those primary stakeholders are consumers. McDougall (1993) states that consumer environmental knowledge is the key to driving the green movement. However, according to Cooper (2004), McCollough (2009) American consumers have created a "throwaway society." Research (McCollough, 2009; Lucsko, 2008) has shown that repair shops are giving way to a disposable society with over 300 million computers and over 100 million cell phones thrown away in 2005 alone. Manufacturers' technological upgrades and desire for profit have driven down the price of these electronics making way for purchases of new over repair of the old.

However, American consumers are improving their attitudes and practices when it comes to the environment. Even with the global recession Cone ("Consumer interest . . ."2009) reported that approximately one-third of consumers are more likely to purchase environmentally sustainable products. Further, the study found that about one-third of Americans have greater expectations for companies to also be environmental stewards. However, this is only one third.

According to Laroche et al. (2001) knowledge is the key to forming environmentally proactive attitudes, with attitudes being the underlying predictors of ecological purchases. The researchers found that importance and inconvenience to be paramount when it came to green attitudes among consumers, importance referring to the severity of the problem and inconvenience regarding recycling behavior (Laroche et al., 2001). Moreover, they found

that some consumers that were not willing to pay more for green products perceived that companies operated in a sustainable manner (Laroche et al. 2001).

Given that two-thirds of Americans are not practicing sustainable behaviors, the amount of e-waste in the form of computers and cell phones will continue to increase. Hence, the purpose of this study was to determine if information presented to consumers would influence their attitudes when purchasing computers. Specifically, the objectives of the study were to:

1. Determine consumers' attitudes towards the environment,
2. Determine consumers' attitudes towards green computing habits,
3. Determine consumers' demographic characteristics, and
4. Determine changes in consumers' attitudes regarding green computing habits when presented with information.

The researchers hypothesized that once presented with information regarding the toxicity of computers and e-waste that consumers attitudes would significantly change to be more environmentally conscious regarding use and purchase of them.

2. METHODOLOGY

Sample: As a pilot study, data for this study were gathered from a sample of students enrolled in an undergraduate business program at two southwestern universities. A total of 37 students participated in the sample.

Instrument: A self-administered questionnaire was developed to ascertain the following information: (1) attitudes towards the environment, (2) attitudes regarding green computing habits and purchases, (3) attitudes toward e-waste disposal, and (4) demographic characteristics. To determine the impact of information on attitude change the researchers developed informational brief regarding the toxicity of computers and technological obsolescence titled "Your Computer. . . Did You Know." This was inserted into the instrument followed by the same series of statements regarding attitudes regarding green computing habits and purchases.

To measure attitudes towards the environment the scale developed by Shetzer, Stackman and Moore (1990) was modified and incorporated into the instrument. Shetzer's et al (1990) scale consisted of 26 statements regarding the role of business leaders, government regulation, environmental issues and jobs, the balance of nature, the role of humans to the natural environment, the state of industrialized growth, and the role of environmental issues in a firm's bottom line. The number of statements was reduced to 17 and were measured using a five point Likert scale ranging from strongly agree (5) to strongly disagree (1).

To measure attitudes towards green computing habits and purchases the scale developed by Schwepker and Cornwell (1991) was modified and used in the final instrument. The original scale consisted of a total of 14 statements regarding litter, solid waste disposal, and solid waste reduction in packaging. Some statements were adapted to reflect the nature of computer waste and green computing habits. Further, statements were developed based on the literature regarding computer toxicity. Statements included "I put my computer into sleep mode to save energy when it's not in use," "computers should be made with recycled parts," "computers are toxic to the environment," "organizations need to have a policy to dispose computers properly," "I look for the Energy Star symbol when look to purchase a new computer," "a company should provide free e-waste disposal and recycle programs," "power saving features are important to me when looking for a computer," and "when shop-

ping for a new computer, its carbon footprint is important to me.” The final scale consisted of 16 statements that was measured using a five point Likert scale ranging from strongly agree (5) to strongly disagree (1). This final scale was replicated and used after the informational brief on computer toxicity.

To measure e-waste disposal three closed-ended questions were developed. The first question was regarding the best option for e-waste disposal. Five responses were developed from the literature and included “ship back to manufacturer,” “take to a local charity for reuse,” “take to a computer retailer,” “take to a recycling center,” and “take to a collection event.” The second question asked respondents what they thought happened to their computers after they disposed of it. Again, five responses were given and included “sent to a landfill,” “valuable metals are extracted,” “equipment is sold,” “recycled in the United States,” and “recycled in another country.” The third close-ended question asked respondents why it was important to keep e-waste out of landfills. Five responses were given and included “fills up landfills too fast,” “hazardous substances leach into waterways,” “dangerous to humans and animal health,” “wastes precious metals such as copper and gold,” and “it’s not important to keep e-waste out of landfills.” Finally, based on the literature reviewed demographic characteristics were sought and included age, gender, ethnicity, annual income, and marital status.

3. RESULTS

Thirty-seven students completed the survey. Regarding gender the majority were female (56.8%), single (94.6%), with an annual income of less than \$20,000. Regarding ethnicity approximately a third (32.4%) were Hispanic, followed by White (27%) and Asian (16.2%).

Regarding attitudes toward the environment, most responses reflected a pro-environmental attitude among respondents. Specifically, the majority of respondents agreed with the statements “we are approaching the limit of the number of people the earth can support (51.3%),” “humans are severely abusing the environment (62.1%),” “the earth has plenty of natural resources if we just learn how to develop them (56.8%),” and “despite our special abilities humans are still subject to the laws of nature (51.4%).” The majority of respondents were neutral regarding the following statements: “my computer is considered e-waste,” “humans have the right to modify the natural environment to suit their needs,” “when humans interfere with nature it often produces disastrous consequences,” “federal, state and local governments should enact stricter environmental regulations on computer manufacturers,” “the balance of nature is very delicate and easily upset,” and “human ingenuity will insure that we do not make the earth unlivable.” Regarding the statement “plants and animals have as much right as humans to exist” over 70 percent of respondents agreed or strongly agreed to it. For the statement “humans were meant to rule over the rest of nature” responses varied with 21 percent of respondents disagreeing, 35 percent neutral and 28 percent in agreement. Cronbach’s alpha reliability testing resulted in a coefficient of .50 for the scale.

Regarding attitudes toward green computing and purchases most respondents disagreed or were neutral about the importance of carbon footprint when shopping for a new computer (75.6%), looking for eco-friendly batteries (62.1%), upgrading their current computer to become greener (59.4%), looking for computers that use less energy when shopping for a new one (59.4%), or using eco-friendly batteries for their laptop (54.8%). Interesting to

note, over half (54.1%) of the respondents were neutral regarding the statement “computers are toxic to the environment.” However, the majority of respondents agreed or strongly agreed with the statements “I put my computer in sleep mode to save energy when it’s not in use (67.5%),” “I turn my computer off when it’s not in use (59.4%),” “computer should be made with recyclable parts (70.2%),” “organizations need to have a policy to dispose computers properly (67.6%),” “power saving features are important to me when looking for a computer (54%),” “a company should provide free e-waste disposal and recycle programs (64.9%),” and “companies should provide details on the greenhouse emissions, energy efficiency, restricted substances, and material efficiency for its packaging (62.1%).” Reliability testing resulted in a Cronbach Alpha coefficient of .89.

Regarding attitudes towards disposing of e-waste most respondents felt the best option was to take the item to a recycling center (45.9%). Most respondents (40.5%) thought that computers end up in landfills once discarded but thought it was important to keep e-waste out of landfills because it’s dangerous to human and animal health (40.5%) and that hazardous substances leach into waterways (35.1%).

*Table no. 1 Results of Paired T-tests before and after reading the Informational Brief
N = 37*

Statement	Mean Before	Mean After	2 tailed t	df	significance p value
When shopping for a new computer, its carbon Footprint is important to me.	2.76	3.42	-3.87	32	.00
I wish my computer was recyclable.	3.62	4.03	-3.04	31	.01
I put my computer into sleep mode to save energy When it’s not in use.	3.55	3.88	-2.97	32	.01
I turn off my computer off when it’s not in use.	3.62	3.75	-1.00	31	.33
Computers should be made with recyclable Parts.	3.88	4.03	-0.90	32	.38
Upgrading my current computer is important To me in becoming greener.	3.18	3.48	-1.67	32	.11
I look for computers that use less energy when Shopping for a new computer.	3.06	3.48	-3.24	32	.00
Computers are toxic to the environment.	3.18	3.82	-4.25	32	.00
Organizations need to have a policy to dispose Of Computers properly.	3.70	4.21	-3.40	32	.00
It is important to me that companies reduce Packaging for their computers.	3.24	3.58	-2.07	32	.05
I look for the Energy Star symbol when looking To purchase a new computer.	3.00	3.36	-2.67	32	.01
Power saving features are important to me when Looking for a computer.	3.39	3.70	-2.39	32	.02
A company should provide free e-waste disposal And recycle programs.	3.58	3.88	-2.15	32	.04
Companies should provide details on the greenhouse Emissions, energy efficiency, restricted substances, and Material efficiency for its packaging.	3.41	3.75	-3.23	31	.00
I look for eco-friendly batteries for my laptop.	2.94	3.18	-2.48	32	.02
I use eco-friendly batteries for my laptop.	2.82	3.15	-4.00	32	.00

Hypothesis Testing: To test the hypothesis, paired T-tests were conducted on each of the statements on the scale regarding attitudes toward green computing before and after reading the informational brief on computer toxicity. Results showed significant differences at the $p < .05$ level for 13 of the 16 statements (Table no. 1). In all, respondents were more in agreement with the statements after reading the informational brief. Means increased for

all the statements following the informational brief with the majority increasing significantly. Hence, the hypothesis was supported in the research.

4. DISCUSSION AND IMPLICATIONS

The research sought to determine if information regarding computer toxicity would influence consumers' attitudes regarding green computing habits and purchases. Findings supported the hypothesis with the majority of statements found to be significant at the $p < .05$. Respondents mean scores increased significantly after reading the brief suggesting that an informed consumer is an environmentally conscious consumer regarding green computing habits and purchasing attitudes. Seitz and Razzouk (2001) found that, unlike previous findings, attitudinal factors are better predictors of intention to purchase environmentally packaged products than demographic characteristics.

Interestingly, results showed that respondents prefer organizations to shoulder the burden of environmental responsibility with recycle programs for electronics. Without information regarding computers toxicity most respondents were only concerned with energy consumption of such electronics and were not actively seeking recyclable batteries or using them. Most importantly, most respondents did not perceive computers to be toxic to the environment or were neutral about it.

The non-profit Green Electronics Council uses the EPEAT system to identify environmentally friendly electronics (Environmental benefits. . . 2007). This system evaluates electronics based on several criteria including reduction of harmful materials, recyclability, energy conservation, corporate performance, end-of-life (EOL) management, and product longevity. EPEAT registered computers have reduced levels of toxic metals, are energy efficient and are easy to upgrade and recycle. Twelve manufacturers subscribed to EPEAT and provide sales data to the Council. In their 2007 report the Council noted that extending the life of electronics through upgrades and refurbishing would be the best solution for the state of electronic waste. Although many manufacturers subscribe to the EPEAT system, getting the message to consumers is lacking. Findings show that consumers are proactive regarding energy savings and look for the "Energy Star" label; however, regarding other components of computers, such as batteries and materials, consumers lack the knowledge to make informed choices. Further, findings showed that when informed that respondents were more inclined to make greener computing choices.

Implications of the findings are several. First and foremost, consumers need to be educated regarding the toxicity of computers and the problems of e-waste. This education would best be carried out by public policy holders, educational institutions and various non-profit agencies such as the Green Electronics Council. Additionally, manufacturers that subscribe to EPEAT should develop labeling and symbols that are incorporated into packaging and product design to further communicate their support of green computing initiatives. Further, these manufacturers should communicate this distinction as a point of brand differentiation when developing advertising messages. To this point, differentiation among computer manufacturers has been based on after-sale service, brand reputation, speed, and new technological capabilities. Additionally, product strategies should include educational seminars provided to resellers in the form of employee training so that they are better able to communicate features and benefits of "green" computer brands and models to consumers.

Manufacturers and resellers should develop a network of repair facilities to make it easy for the consumers to repair their computers, much like companies that manufacture ma-

major appliances. Information should be provided by manufacturers of recommended repair facilities in computer product packaging materials. According to *Consumer Reports* ("Repair or replace it," 2005), it is advised that when computers are between two to four years old that repairs should be made when something goes wrong; however, at five years, they suggest replacing it. Manufacturers should work to extending the life of computers by allowing upgrades so that a five year old computer can still be repaired rather than replaced.

Unlike Europe and Japan, the US is a market driven economy with focus on satisfying the needs and desires of consumers and making a profit. Given this, the government has not imposed regulations on computer manufacturers so as not to impede market growth. However, in Europe regulation is currently under way making manufacturers responsible for computers' End-of-life (EOL). Such regulations make manufacturers responsible for taking back their old merchandise and either recycling it or disposing of it in an environmentally safe manner (Toffel et al., 2008). However, in the US, it is consumers that drive manufacturers and subsequently government policy. By informing consumers regarding computer toxicity, EPEAT subscribed manufacturers would be differentiating their brands and driving sales toward their "greener" computers. Subsequently, other manufacturers would follow suit to grab a portion of this market share resulting in greener computers in the marketplace and a reduction of hazardous e-waste.

4. LIMITATIONS

Given the nature of the research as a pilot study, the generalizations are limited to the sample of students in the two southwestern universities. Further, the findings are limited to the product category of computers. However, the findings do provide a window as to the impact of information on consumers' attitudes toward green computing.

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