Waste Intensity Improvements in Operations

Proposed to
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ENVIRONMENT

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All recommendations are based on Lenovo employees' voluntary participation in the sustainability survey along with observations recorded from three separate waste audits. Two of the waste audits were performed at Lenovo's North American Research & Development Headquarters in Morrisville, North Carolina on September 27, 2019 and January 24, 2020. The third waste audit was performed at Lenovo's Manufacturing and Distribution Center in Whitsett, North Carolina on September 30, 2019.

CONFIDENTIALITY

All Lenovo employee survey responses were recorded anonymously and were only viewed by the authors of this study. Responses to the survey can in no way be traced back to any individual employee. Additionally, any of Lenovo's environmental data presented in this report that has not been made publicly available has been generalized to maintain confidentiality. However, all recommendations are based on original data obtained from Lenovo. Lastly, secondary research was conducted using publicly available information and is cited throughout this report where appropriate.

DISCLAIMERS

This report was prepared by the authors in their personal capacity. The authors' conclusions and recommendations are based solely on secondary research and data collected and do not reflect the views of Lenovo. This report does not reflect the actions of Lenovo moving forward, nor does indicate that Lenovo has or will implement any of the author's recommendations in the future.

EXECUTIVE SUMMARY

The Global Waste Problem

In 2016, cities around the world generated over two billion tons of solid waste, and this amount is only expected to increase.[1] This waste fills landfills and infiltrates the environment, which only further exacerbates the global climate crisis. In the United States alone, the Environmental Protection Agency (EPA) reported that solid waste alone generated a total of 105.6 million metric tons of carbon dioxide-equivalent emissions.[2] These emissions, mainly from municipal landfills, are caused by the release of methane into the atmosphere as organic matter breaks down. Recently, more businesses and governments have created initiatives and policies to address the growing waste issue and curb the production of waste. As a result, there has been increasing interest in a circular economy model to prevent the initial generation of waste in operations.

The Client: Lenovo

Founded in 1984 in Beijing, China, Lenovo has quickly become the world's largest personal computer (PC) manufacturer with three main business sectors: Intelligent Devices, Data Centers, and Mobile Devices. For its Intelligent Devices Group, it competes against HP Inc., Dell, and Apple to sell PCs. Within its Data Center Business Group, it competes against Huawei, IBM, HP Enterprise, and Cisco to produce Servers. Lastly, in its Mobile Business Group, Lenovo competes against Samsung, Huawei, and Apple to manufacture mobile phones. As of December 2019, Lenovo generated US$51 billion in revenue. This success has allowed the company to maintain its position as the world's dominant leader in the PC market with a 24.6% market share globally.[3]

Project Description

A recent in-house study concluded that Lenovo lags behind its peers, such as Dell and HP, in regards to its waste management performance, specifically its waste intensity. This internal report compared Lenovo to Dell and HP between 2014 and 2016 with regards to their absolute non-hazardous waste generation (measured in metric tons), and found that Lenovo produced four times the amount of waste of Dell, with HP ranking in between Lenovo and Dell. This study also considered non-hazardous waste intensity (i.e. metric tons of waste produced per employee), and concluded that Lenovo's waste intensity was seven times worse than that of Dell's, with HP's waste intensity again ranking in the middle of the two companies. Lastly, the report concluded that Lenovo's absolute volume of non-hazardous waste increased 10% year over year between 2014 and 2016. Therefore, Lenovo would like to better understand its relative waste performance position in the industry and evaluate the ways in which it can improve its waste management performance.

This final report has been prepared to provide Lenovo with a better understanding of the industry landscape in regards to waste intensity, as well as a strategy that the company can use to improve its current waste management policies. A combination of insights gathered through competitor benchmarking, researching industry best waste practices, performing three separate waste audits, and creating and distributing employee engagement surveys at its U.S. offices have been used to develop a long-term sustainability strategy for Lenovo.

The recommendations in this report have been formulated based on observations made at Lenovo's North American Research & Development Headquarters in Morrisville, North Carolina and Lenovo's Manufacturing and Distribution Center in Whitsett, North Carolina. For Lenovo to truly become a leader in sustainable waste management, it will have to apply our recommendations throughout its global operations, where appropriate.

Employee Engagement Survey, Waste Audits, and Findings

One employee engagement survey was developed to understand Lenovo employees' perceptions of sustainability, specifically waste management. In total, the five question, two-minute survey reached 714 Lenovo employees at its North American Research & Development Headquarters in Morrisville, North Carolina and its Manufacturing and Distribution Center in Whitsett, North Carolina. The average response rate for the survey was 20.30%. Three of the most significant insights from the employee engagement survey include: 1) Most of Lenovo's non-hazardous waste is generated in the breakrooms and cafeteria; 2) Receptacle options and labeling are not consistent throughout the Morrisville campus; and 3) More waste education and engagement is required across all stakeholders to improve the company's overall waste performance.

In addition to the employee engagement survey, three separate waste audits – two at Lenovo's Morrisville location and one at the Whitsett location revealed that: 1) Morrisville must better align the goals of all stakeholders to achieve better waste performance; and 2) Whitsett is more efficient than Morrisville in waste sorting and tracking.

Recommendations

After gathering insights through competitor benchmarking, researching industry best waste practices, performing three separate waste audits, and creating and distributing employee engagement surveys, three primary recommendations were developed for Lenovo:

1. Communication: Lenovo must clearly communicate its waste goals to employees and provide all stakeholders with the necessary tools and information to help the company reach these goals.
2. Consistency: Lenovo must be consistent in the availability of the three receptacles (trash, recycling, compost), as well as the labeling of each receptacle throughout its Morrisville campus.
3. Culture: Lenovo must work to receive top-down recognition of sustainability, and be more proactive in instilling a sustainability mindset in its employees.

We also made recommendations related to disclosure of waste intensity metrics.

INTRODUCTION

Introduction to Corporate Sustainability

Over the past few years, the private sector has become increasingly proactive in addressing environmental, social, and governance issues. This has given rise to "corporate social responsibility" (CSR), a comprehensive management approach of companies that focuses on creating and maximizing long-term economic, social, and environmental value.[4]

Formally, the United Nations Industrial Development Organization (UNIDO) defines Corporate Social Responsibility (CSR) as "a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders."[5] CSR drives a company's strategy through the Triple Bottom Line approach which includes economic, environmental, and social goals and initiatives. That is, while corporate sustainability recognizes the importance of corporate growth and profitability, it also requires companies to pursue societal goals, specifically those relating to sustainable development, like environmental protection, social justice and equity, and economic development.[6]

Aside from being "trendy," incorporating the principles of corporate sustainability into their management practices has several business benefits for companies. These include: reduced operating costs due to more effective use of natural resources; more effective economic, social, and environmental risk management; stronger relationships with stakeholders; identification of hidden areas that can create long-term value for the organization; and building a more loyalty trustworthy customer base.[7]

In order to communicate their sustainability performance, a majority of companies now publish annual or bi-annual sustainability reports to disclose their progress. Particularly for impact investors, these annual reports have become increasingly important. Investors analyze and compare the performance of companies. Today, one in every four US dollars invested is done so using Environmental, Social and Governance (ESG) criteria.[8]

Waste and Circular Economy

In the CSR space, waste management has become a center of focus among companies. Not only is the amount of global waste increasing, but there is also the question of what to do with it. In 2017, the U.S alone generated 267.8 million tons of municipal solid waste, and 52% or 139 million tons of was directly landfilled.[9] This statistic alone demonstrates that there is a huge opportunity for waste reduction, and companies have been racing to find solutions.

Waste reduction can be done in several ways. They include volume reduction by using less material, increasing recycling and compost rates, and by redesigning products to support a circular economy.[10] The most interesting method is this last one, moving society towards a circular economy. A circular economy is one that minimizes waste production by utilizing resources more efficiently. As the Ellen MacArthur Foundation defines it, a circular economy is "an intentioned economy that is restorative and regenerative by intention and design."[11] This concept encourages a closed loop system, which minimizes resource input and waste output through recycling, reusing, and reducing.[12] Today, we rely heavily on the traditional linear

economy model, causing us to send large amounts of waste to landfills at even larger costs (e.g. 95% of plastic packaging material is lost to the economy after its short lifecycle and is valued at $80-120 billion.)[13] Therefore, transitioning to a more circular economy has the potential to reduce waste and cost for companies. By establishing effective waste management practices, businesses are discovering that they can drive high productivity, efficiency, and innovation, while also minimizing operational costs and reducing their environmental impact.

Recently, the goal of incorporating the principles of a circular economy into business operations has gained traction among companies.[14] Many countries, like Germany, China, and Japan, have even begun to integrate the concept into national laws, especially targeted at improving waste management.[15] Moreover, one McKinsey & Company study found that if a subset of European Union manufacturing companies adopted the circular model immediately, it could result in cost savings of up to $630 billion annually by 2025.[16]

As a result of the push for a more circular economy, new waste management companies have emerged. For example, TerraCycle is an innovative recycling company that has become a global leader in recycling hard-to-recycle materials. That is, TerraCycle has already adopted the circular economy model and works to turn waste into usable products. From its creation in 2001 until 2010, TerraCycle has grown by more than 100% year over year, demonstrating that there is high market potential for this type of resource recovery.[17]

Nevertheless, fully transitioning from a linear to circular economy will not be an easy task. One challenge that remains is the sheer volume of waste that is generated at every stage throughout the life cycle of a product. Waste streams are becoming more complex as they are composed of a variety of materials, and only a fraction of these materials are valuable at current recycling facilities. This means that there are severe technological difficulties to sorting this waste, even beyond the question of economic viability.[18] Another difficult challenge that remains is shifting consumer behavior to reduce consumption and properly dispose of items. Waste reduction requires system-wide thinking to make significant improvements, and more education and collaboration will be necessary to fully adopt a circular economy. Without alignment between product development teams, packaging manufacturers, consumers, and recycling and composting entities, a true circular economy may not be feasible.

Waste Intensity

According to the United Nations, waste intensity is “the amount of waste generated in a country per year – in total, by economic sectors and households, per unit of GDP, per capita, etc.”[19] For the purpose of this project, waste intensity can be defined as the total amount of nonhazardous waste generated by a company in its operations in a given fiscal year per unit. It can be measured in weight of waste per unit of revenue, sales, product, or even employee.

Unlike other measurable environmental impacts, such as Carbon Dioxide (CO_2) emissions, there is currently no uniform measurement for waste intensity. This is due to the variation in company sizes, as well as the large range of products and services that they each provide. To measure how well companies are reducing their greenhouse gas emissions, carbon intensity is simply the

amount of carbon by weight emitted per unit of energy consumed, usually measured in British thermal unit (Btu).[20] However, this methodology does not translate for measuring how well companies are reducing their waste streams. There are no standardized units for waste intensity, and reaching an industry-wide consensus on how to measure waste intensity has produced some conflicting results. Waste intensity can become easily subjective based on the unit a company decides to use, and, therefore, finding an objective metric that is suitable for every company seems nearly impossible.

Employee Engagement

The most sustainable businesses realize that engaged employees are key to achieving long-term environmental goals. Meaning, while there are several key performance indicators (KPIs) of high performing sustainability companies, all these companies seem to have one thing in common – they have tapped into empowering employees as their secret weapon.[21]

According to Isos Group, an innovative corporate responsibility and sustainability consulting firm, there are three main categories of employee engagement. First, the pledge-based approach encourages volunteerism among employees. Focusing on promoting individual behavioral changes, the pledge-based approach often uses the "gamification" model to foster competition among employees.[22] The second type of engagement is a volunteer-based approach. Engagement initiatives that fall into this category of engagement include neighborhood clean-ups, annual Earth Day celebrations, and other events that produce a net positive impact on the surrounding community.[23] Lastly, the third type of engagement is a workplace-based approach. This approach focuses on offering employees environmental education opportunities, office recycling programs, and establishing a green team.

The 3M Company was a pioneer in utilizing its employees to create environmental impact. 3M's Pollution Prevention Pays, or "3P" Program, was established in 1975 and is a workplace-based approach. 3P seeks to eliminate pollution before it occurs, focusing on sustainable product development and lean production.[24] In the first year of the program alone, 3M prevented the generation of 1.7 billion pounds of pollution and reduced costs by $850 million.[25] 3P has been so successfully because it encourages employees to use their subject matter expertise and thenrecognizes their efforts, creating a feel of self-fulfillment and accomplishment.

Therefore, dedicating the time and resources to carefully craft effective employee engagement programs can advance a company's environmental performance. Survey data from a 2015 study performed by Suzanne Benn et al. showed that employee participation in environmental initiatives is directly linked with higher levels of employee engagement, higher rating of their organization's environmental performance, and lower intention to quit. Therefore, engaging employees around environmental issues may also provide wider benefits for organizations in terms of overall job satisfaction and employee retention.[26]

The Importance of Employee Engagement

Recently, companies have started to leverage employee engagement to advance their sustainability goals. There have even been studies performed that suggest companies with higher levels of employee engagement experience a competitive advantage when attracting and retaining employees. This is why a large portion of Samsung's waste program emphasizes the importance of reducing disposable products from its offices, restaurants, and stores at its worksites. For example, in its employee restaurants and cafés, plastic containers have been replaced with paper ones to improve resource efficiency. Similarly, in company stores, plastic cups and straws have been replaced with paper ones, and these stores offer discounts to customers on beverages when they bring their own mugs. As a result of these initiatives that began in 2018, Samsung reduced their disposable product usage by 80 metric tons in the first three months.

Samsung also offers Environmental, Health and Safety (EHS) courses to all of its employees, regardless of their role, function, or seniority. The courses range from basic introductory courses to professional licensing courses. For its non-EHS employees, a total of 5,311,635 hours of training were conducted, completed by 524,790 employees. Offering these courses works to create a more environmentally-conscious workplace by teaching employees the importance of environmental stewardship. A more educated and engaged workforce provides Samsung with a greater chance of achieving its ambitious sustainability goals.

[27,28]

LENOVO AND SUSTAINABILITY

Background on Lenovo and Waste

As the world's largest PC manufacturer, Lenovo has always been committed to environmental stewardship in all three of its business sectors. Lenovo's corporate Sustainability Policy explicitly states that it incorporates the triple bottom line methodology— people, planet, profit— into all of their core business operations.

One of Lenovo's primary environmental objectives for its operational facilities involves minimizing solid waste and maximizing recycling and reuse. During FY2018/2019, Lenovo's North American Research & Development Headquarters achieved a reuse/recycling rate for nonhazardous solid waste of 87.6%.[29] While this data indicates that Lenovo is successfully managing its waste, internal sources suggest that Lenovo has room for improvement. The circular economy model has become particularly popular in the technology manufacturing space, and Lenovo is interested in outcompeting others in its industry to reduce waste.

PROJECT OBJECTIVE

The objective of this project was to assist Lenovo in improving its waste intensity in its operations. Our team focused on non-hazardous waste management in Lenovo's operations, particularly at its Research & Development Headquarters in Morrisville, North Carolina campus and its Manufacturing and Distribution Center in Whitsett, North Carolina. Our evaluation of waste management includes both the current practices and reporting methods Lenovo currently uses. Our team developed potential improvements to waste handling and employee engagement, and also assessed the most effective waste intensity metrics to use.

For this project, our team focused on improving Lenovo's waste intensity for non-hazardous waste only. Lenovo defines nonhazardous waste as waste coming from its research & development locations, offices, and manufacturing sites. This includes waste that is related to product manufacturing (i.e. any packaging materials that enter factories), as well as the day-to-day operational waste, such as the waste generated by employees in breakrooms and cafeterias. It does not include waste that is recycled through its product end–of-life management programs. Currently, Lenovo reports its waste intensity per unit of product produced.

Lastly, our team researched the industry's practices surrounding operational waste intensity. Our goal was to understand how Lenovo can improve its own waste intensity metrics, and provide suggestions on what changes, if any, the company should make in measuring and reporting their waste intensity. To accomplish this, we used publicly available reports, as well as Lenovo's internal database for operational waste data. The specific steps in our process included:

1. Surveying best industry practices for waste management, and benchmark Lenovo's current practices against its peers in the PC, Server, phone, and cloud industries.

2. Collecting data on Lenovo's current waste management practices and employee engagement initiatives.

3. Recommending methods to improve Lenovo's waste management reporting and disclosure.

4. Identifying opportunities for Lenovo to improve its overall waste management and reduce the gross amount of non-hazardous waste that is generated through its operations.

5. Providing educational materials to engage employees and other critical stakeholders to promote proper waste management.

METHODOLOGY

Our team researched waste management best practices and recommended strategic improvements to Lenovo's GEA&S Team. Our recommendations focus specifically on Lenovo's North American large operations, including the headquarter office in Morrisville, North Carolina and the Manufacturing and Distribution Center in Whitsett, North Carolina. The potential improvements are applicable to Lenovo's international operations as well. Our methods are summarized below:

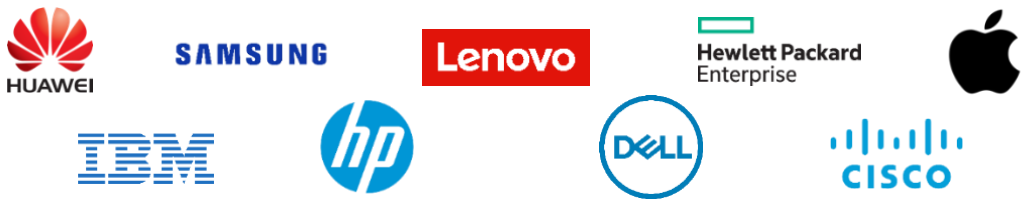
1. Competitor Benchmarking
2. Background Research on Waste Intensity Metrics and KPIs for Waste Management
3. Analysis of Lenovo's Internal Waste Data
4. Waste Audits
5. Employee Survey

Competitor Benchmarking:

We first performed a competitor benchmarking analysis to survey best industry practices regarding waste management. Lenovo provided us with a list of peers to evaluate, including HP, HPE, Apple, Dell, Huawei, Cisco, IBM, and Samsung. Surveying these eight companies allowed us to identify Lenovo's relative waste management position in the PC, server, phone and cloud sectors. This also enabled us to determine how similar companies are approaching waste management and reporting waste intensity. Unlike most of their peers, Lenovo manufactures their own products. Therefore, we studied the electronic manufacturing industry to make our comparisons more accurate and recommendations more realistic.

For each of the eight companies Lenovo provided, our team reviewed the most recent sustainability report and recorded the following:

- General waste info, focusing on waste initiatives
- The definition of non-hazardous waste for that company
- Any quantitative waste goals
- The progress against these goals
- The waste metric used to measure progress – either absolute waste or waste intensity
- Any mention of partnerships to achieve its waste goals
- If the company mentioned zero waste or zero landfill and in what context
- If they perform waste audits, and, if so, with whom
- Employee engagement programs, both waste and non-waste related



Background Research:

After conducting a preliminary competitor benchmarking analysis, our team expanded our research to other industries to collect data points on other potential waste intensity metrics for Lenovo. We worked with the Global Fortune 100 (2019) list, which allowed us to examine how companies in different industries and geographies are reporting on waste management. This research helped us understand the use of waste intensity as a metric.

We also performed other background research over the course of our project which focused on emerging waste management certifications and KPIs. More specifically, we preformed research on Green Business Certification Inc. (GBCI) and Underwriters Laboratories' (UL) zero waste certifications, as well as Klynveld Peat Marwick Goerdeler's (KPMG) True Cost Analysis.

Analysis of Lenovo's Internal Data:

Our team analyzed Lenovo's internal waste data to develop potential metrics to use for waste intensity. This analysis included quantitative data on non-hazardous waste streams, such as waste generated in cafeteria, breakrooms, and office work spaces. Lenovo provided our team with an excel spreadsheet containing data about these waste streams from the last five years, for both their Morrisville and Whitsett sites. Lenovo also provided us with the data necessary to experiment with waste intensity metric options, including revenue, number of employees, occupied building floor area, units of production, and total scope 1 and 2 energy consumption.

Due to our confidentiality agreement with Lenovo, raw data from this step in our methodology will not be included in this report.

Waste Audits:

Three on-site visits and waste audits to Lenovo's North Carolina sites allowed our team to collect qualitative data on current waste management practices. Due to the size of Lenovo's campuses, we discovered that amount of waste in each receptacle varied greatly. Therefore, we performed our waste audit using random sampling and conducted only qualitative analysis. We randomly sampled receptacle bins, including trash, recycling, and compost, for each building and floor. We also randomly collected items that were placed in the wrong bins to document at the end of each site visit. At the end of each visit, we recorded these incorrectly placed items in each sample.

It is important to note that at Lenovo's North American Research & Development Headquarters in Morrisville, North Carolina, we performed one waste audit before and after the company implemented the use of shadow boxes. This was intentional to determine if the shadow boxes were effective in promoting proper waste sorting by employees.

Employee Survey:

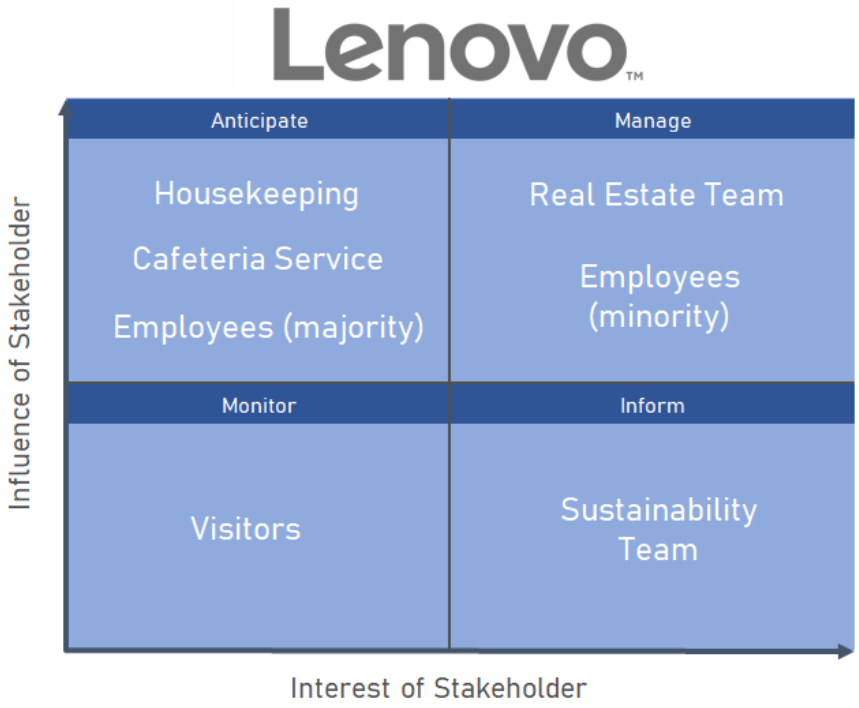
Lastly, our team crafted and distributed an employee survey. It was sent out to 3,223 employees at Lenovo's North American Research & Development Headquarters and 300 employees at its Manufacturing and Distribution Center, for a total of 3,523 employees who received the survey.

To successfully circulate our survey, we worked with Lenovo's Communications Team to finalize the survey questions, and also coordinated with Duke University's campus Institutional Review Board (IRB) office to receive approval. IRB's approval is required by Duke for all research performed on human beings, including studies designed to collect data through surveys. We created our survey through Qualtrics, and Lenovo's Communications Team emailed it out to all targeted employees (Appendix: Exhibit D). After receiving a sufficient number of responses, our team analyzed all the data, both qualitative responses and quantitative reports.

This step was a crucial part of our methodology. We gathered invaluable insights about Lenovo's employees' current perspectives on sustainability, as well as suggestions on how the company could improve its waste management specifically. One component of our final deliverable to Lenovo will be a master PowerPoint slide deck, which will be used to educate the GEA&S Team about employee engagement opportunities to implement at its North Carolina sites to improve its waste performance.

DATA ANALYSIS

As our team gathered data and analyzed our results, we recognized that there were numerous stakeholders involved in Lenovo's waste management. Each of these players must be managed according to their influence and interest. Through our site visits, we learned who contributed to the company's waste management, specifically who had a larger stake in the issue. Our version of Lenovo's stakeholder map can be seen below. This shows which stakeholders are the most interested and most influential in contributing to Lenovo's waste management performance. Most employees are not concerned about their waste, but it is important for Lenovo to develop content that specifically addresses their habits. Additionally, because the housekeeping team and cafeteria service can significantly impact waste management practices, Lenovo must ensure that they align with Lenovo's sustainability goals. Lastly, the real estate team must work to oversee these initiatives and work with the sustainability team to promote awareness and engagement.



Competitor Benchmarking:

While performing a competitor benchmarking analysis, our team found that companies generally report absolute waste, rather than reporting a metric for waste intensity. Moreover, companies typically reported their absolute waste in metric tons. Therefore, we focused on comparing Lenovo's competitors' general waste information and any waste reduction goals that they have set. Most notably, HP, HPE and Cisco have achieved landfill diversion rates of over 80%. Additionally, Apple and Cisco, have goals to achieve zero waste. The comprehensive analysis, as well as the links to each of Lenovo's competitors' sustainability report, can be viewed in Appendix: Exhibit B.

Company	General Waste Information	Goals on Waste
Lenovo	• Nonhazardous Waste: 44,377.44 metric tons	Maintain a global nonhazardous waste recycling rate > 90% (+/- 5%)
hp	• 32,000 metric tons of nonhazardous waste in 2018 • 90.9% landfill diversion rate globally	N/A
Hewlett Packard Enterprise	• In 2018, 13,208 metric tons of nonhazardous waste produced in operations • In 2018, 90% of nonhazardous waste was diverted from landfill	Annual target of 83% diversion rate for nonhazardous waste, but seeking to increase it to 87% as the company re-evaluates the overall waste strategy
	•In fiscal year 2018, generated 74,000 metric tons of waste and diverted about 74% from landfill through recycling and composting	Currently pursuing an ambitious goal of Zero Waste to Landfill at more than 450 corporate facilities, more than 500 retail stores, and five data centers

DELL	• Expanded composting programs so that multiple Dell locations worldwide have cafeterias with waste stations where waste can be separated for compost, recycling, and landfill	Ensure 90% of waste generated in Dell-operated buildings is diverted from landfills
HUAWEI	• In 2018, disposed of 11,332 metric tons of e-waste globally, among which 190 metric tons (only 1.68%) were landfilled	N/A
CISCO	• In 2018:Total operational waste/trash: 10,559 MT • HQ in San Jose diverted 86% of all waste streams from landfill in FY18, • Boxborough campus diverted 100% of all waste from landfill in FY18	Zero waste by FY20 for Research Triangle Park site. They will explore adding campus composting, waste sorting, and single-use items replacements
IBM	• Source reduction and waste prevention initiatives implemented by IBM worldwide estimated to have prevented the generation of about 185 metric tons of nonhazardous waste in 2017, with estimated annual handling, treatment and disposal cost savings and revenue returns totaling $2.2 million	Send an average of 75% (by weight, annually) of the nonhazardous waste generated at locations managed by IBM to be recycled
SAMSUNG	• Waste Strategy mostly focused on Recycling with overarching goals to: Separate and reuse waste by waste material type; Establish Closed-Loop recycling system for waste resources • Waste Management Plan (Hazardous Waste): 1. Product Development 2. Waste Discharge 3. Waste Transport 4. Waste Treatment	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse 1. From 2009 to 2030, accumulate 7.5 million metric tons of collected e-waste 2. By 2030, expand the accumulated amount of recycled plastics use to 500,000 metric tons 3. Maintain > 95% recycling rate

Lenovo[30]; HP[31]; HPE[32]; Apple[33]; Dell[34]; Huawei[35]; Cisco[36] ; IBM[37]; Samsung[38]

RESEARCH TRIANGLE PARK:
Lenovo has competition when it comes to waste management in Research Triangle Park (RTP), North Carolina. One of its main competitors, Cisco, also has a main campus in RTP, and Cisco has announced its goal to become zero waste, along with 100% renewable energy and water neutrality, by FY2020. To accomplish this, Cisco has switched to biodegradable to-go boxes and reusable cups, saving 3 tons of plastic from landfill and diverting 68% of waste during the last year.

Cisco highlights its focus on circularity in the sustainability report, citing design changes, use of recycled content plastic in products, and integration of reusable pallet wraps rather than disposable ones made from plastic shrink-wrap. All of Cisco's efforts are underlined by concrete FY25 goals for reducing waste; 70% of suppliers by spend will achieve a zero waste diversion rate for at least one site, foam packaging will be reduced by 75%, and product packaging efficiency will be increased by 50%.

To include employees in the discussion around the circular economy, Cisco also offers a newsletter and learning series to show them about Cisco's contributions to circularity and videos to learn more. For example, at the San Jose headquarters, Cisco also hosts "SustainX" for employees, an annual forum to showcase how Cisco implements sustainability principles; employees learn from speakers and through hands-on activities, such as a game where employees sorted waste into the appropriate categories and learned about waste that is difficult to recycle. There are also environment aspect teams that concentrate on waste reduction and recycling in each region.

In its sustainability report, Cisco includes a very detailed breakdown for its San Jose headquarters to show every waste stream, from kitchen oil, foam, and batteries, to cans, cardboard, compost, and trash. Cisco continues to improve its waste management system and transparently showcase progress over time.

EMPLOYEE ENGAGEMENT:
Cisco seeks to provide several educational opportunities for employees to learn about sustainability. Beyond the training on environmental policies, there is ad hoc training for proper waste sorting. A Green Team Network offers chances for employees to connect and learn, with activities ranging from discussions about plant-based diets to tours of recycling facilities. The Green Team has also worked to eliminate paper cups in various Cisco buildings and have created shadow boxes to show proper sorting methods in U.S. cafeterias. Furthermore, on its internal website, there is a hub with information specifically on Cisco's environmental sustainability, as well as a platform where employees can connect and share actions to become more sustainable. Other employee activities include annual shutdowns with incentives for employees to avoid emissions, Recycle IT Day for collecting old electronics, and a two-month-long Earth Aware campaign to encourage employees to perform sustainable practices.

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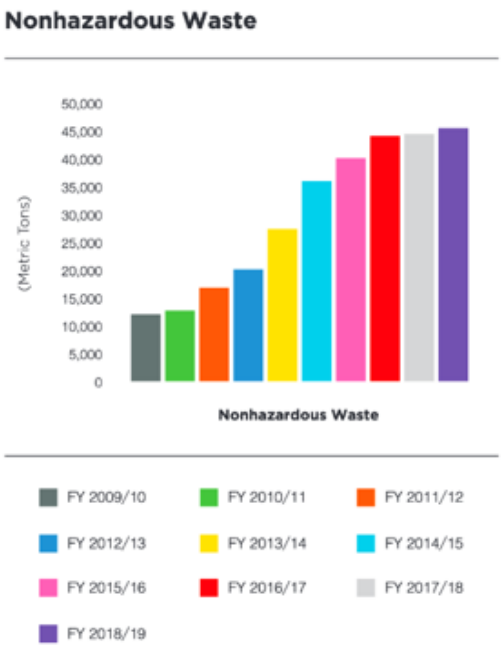
Global Fortune 100 Benchmarking:

Using waste intensity metrics to report on waste management performance is a new phenomenon, but it is becoming increasingly popular among companies. Currently, Lenovo chooses not to discuss waste intensity in its Sustainability Report and focuses on reporting absolute waste generation (in metric tons) instead (seen to the right). For Lenovo's industry, this is not uncommon. None of Lenovo's top eight competitors, HP, HPE, Apple, Dell, Huawei, Cisco, IBM, and Samsung, currently include waste intensity metrics in their respective sustainability reports.



In order to fully understand the current trends in the private sector surrounding waste intensity metrics, our team surveyed the Global Fortune 100 List of Companies from 2019. Out of these 100 companies, only 24 reported their waste performance using waste intensity metrics over traditional absolute measurements. Those companies that did use waste intensity metrics, such as BMW, Nissan, and Peugeots were ones producing one product type (ie. cars), and therefore, easily measure their waste in weight per product produced. A summary of our findings is summarized below.

Waste Intensity Metric	Number of Companies	Examples of Companies
Waste/Unit of Product Produced	10	Toyota, Daimler, Ford Motors, General Motors, Honda Motors, BMW Group, Nissan Motors, Nestle, Rosneft Oil, Peugeot
Waste/Employee	5	Volkswagen, China Construction Bank, Bank of China, Banco Santander, Allianz
Waste/$	5	Samsung Electrics, China State Construction Engineering, Dongfeng Motors, AT&T, Bosch Group
Waste/CO_2e	4	China State Construction Engineering, China Mobile Communications, Siemens, SK Holdings
Waste/Energy Produced	1	China Resources

[40]

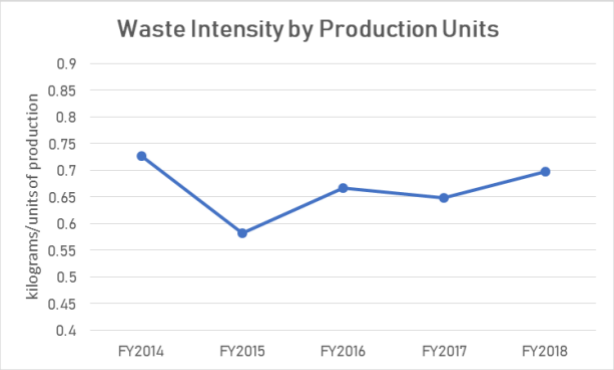
Analysis of Lenovo's Internal Data:

Lenovo provided our team with internal data on the breakdown of solid waste streams from both its Morrisville and Whitsett sites, as well as its global operations. For our analysis, we chose a baseline year (FY2015) and evaluated this data to identify nonhazardous waste percent changes,

since choosing a baseline for reporting progress seemed to be common practice in the industry. However, some of the individual site data had large variations in data throughout the past few years because of changing parameters (i.e. employee headcount). Therefore, we chose a relatively recent year for the data to be as consistent as possible. Our team focused on the global operations data in our analysis. The global operations data are also the data Lenovo would most likely include in its sustainability report.

In testing the different waste intensity metrics for Lenovo to use, we divided the total non-hazardous solid waste (originally measured in metric tons, and then converted to kilograms for intensity purposes) by different factors, such as revenue (USD), employee headcount, occupied building floor area (square meters), total production volume (units), and Scope 1 and 2 energy consumption (kWh).

For Lenovo's waste intensity metrics to be meaningful to stakeholders, the data must be consistently measured over time to show real evidence of trends. Most notably, employee headcount decreased significantly, while waste increased, which made this particular waste intensity increase. Occupied building floor area has not been very stable, causing this metric to be unstable. There was an increase in production as well, which forced this intensity metric to vary. The graphs below demonstrate trends from two of the waste intensity metrics that are most commonly seen in the industry, waste intensity based on number of employees and based on number of units produced.



Furthermore, we used FY2015 as a baseline to calculate percentage change for FY2018 since FY2015. Most companies who use waste intensity will set a goal that reduces waste by a certain percentage from a baseline year. Most metrics tended to increase over time (as seen on the table to the right). The intensity based on square meters and kWh did decrease since the baseline, so these could be metrics for Lenovo to consider.

Waste Intensity Metric	Percent Change from FY2015 to FY2018
kilograms/$	26.19%
kilograms/# of employees	50.30%
kilograms/square meters	-9.22%
kilograms/units	19.71%
kilograms/kWh	-7.68%

Waste Audits:

Our team performed three total waste audits two at Lenovo's Morrisville site and one at Lenovo's Whitsett site. At Morrisville, we performed one waste audit before and one after the implementation of shadow boxes. This was done intentionally to observe any changes in waste sorting behavior which could be attributed to employees gaining information from the shadow boxes. We also sampled the same receptacle bins on both Morrisville audits. Due to the varying schedules that the waste receptacles are emptied and collected, as well as the size of the Lenovo campus at Morrisville, all three waste audits were mainly qualitative. Our data consisted of observations about the signs on receptacles and common items that were misplaced in receptacles.

The waste audit data presented below data are meant to be a representation of employee behavior. We sampled waste at random collection sites throughout the Morrisville campus and noted which items were misplaced in the wrong bins. The comprehensive data collection can be found in Appendix: Exhibit D. A visual representation of commonly misplaced items, as well as relevant photos from the waste audits, are seen below.

1st Waste Audit in Morrisville – Before the Installation of Shadowboxes:

The items below were considered to be the most confusing items for correct disposal. They were placed incorrectly in multiple bins.

Icons made by Freepik and iconixar from www.flaticon.com

2nd Waste Audit in Morrisville – After the Installation of Shadowboxes:

During our second waste audit, we looked specifically for items that were wrongly sorted in order to see if Lenovo's shadowboxes were helpful. We chose to highlight the items below because we either noticed that they were incorrectly sorted in bins multiple times, or we believed that they required clarity due to their ambiguous nature. For example, employees seemed to be confused about napkins. There is confusion about which receptacle it belongs in because it is inherently a paper product. However, napkins are supposed to be composted, not recycled. Coffee cups are also a source of confusion, because some are compostable but others are not. These kinds of items should be particularly clarified.

Icons made by Freepik and Nikita Golubev from www.flaticon.com

Photos from Waste Collection Sites:

Shadowboxes and Stickers:

Signage:

Mingled Waste:

Waste Receptacles:

Employee Survey:

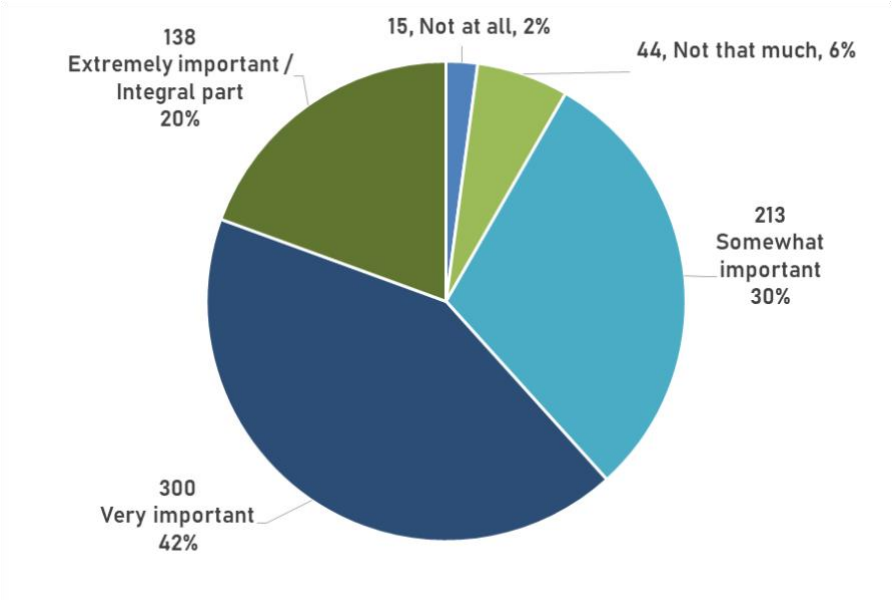
The results from the employee survey were collected through Qualtrics and analyzed through Qualtrics and Excel. The full version of the recruitment email is in Appendix: Exhibit E, and all

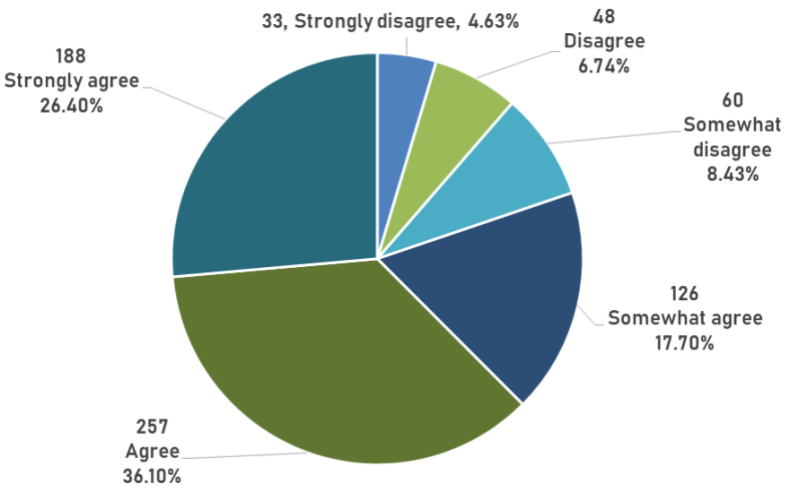
survey questions can be found in Appendix: Exhibit F. The most relevant questions are described below.

Lenovo's Communications Team sent our survey out to a total of 3,523 employees, 3,223 employees at Morrisville and 300 at Whitsett. The 3,523 also included a small number of employees that work remotely but are associated with the Morrisville campus. After two weeks, we received a total of 714 responses, with a 20.27% response rate. Employees were not required to answer all questions, and the results show the actual number of employees that responded to each individual question.

Question 1: *Sustainability refers to the concept of using resources efficiently to simultaneously support the economy, the environment, and people. How important, if at all, is sustainability to your day-to-day activities?*

There were 710 responses for this question. A majority of participants reported that sustainability was very important or extremely important to their day-to-day activities. However, we do recognize that there could be bias due to the participant population that was willing to fill out a survey on waste as part of this project, which also follows for the rest of the questions.



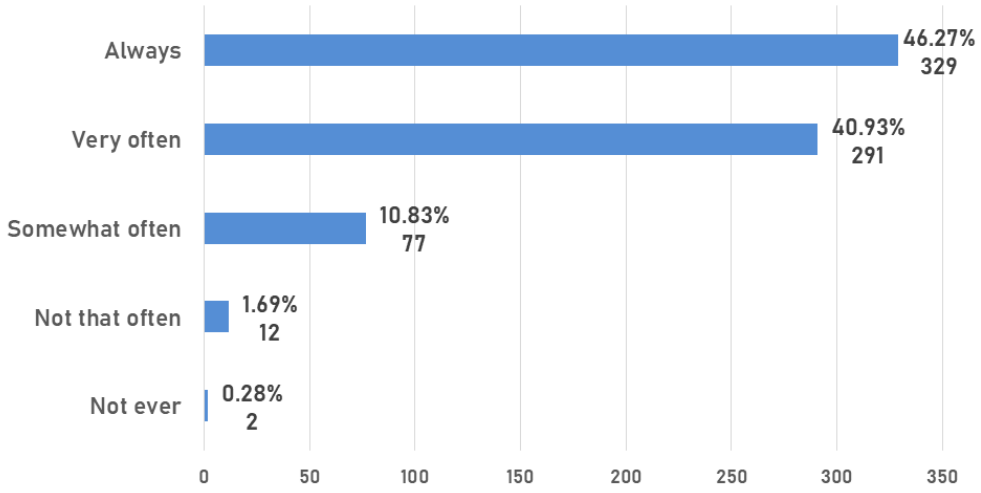


Question 2: *How strongly do you agree or disagree that there are enough options at Lenovo for you to dispose of trash, compostable, recycling, etc. properly?*

There were 712 responses to this question, and the majority of participants at least somewhat agreed that there are enough options.

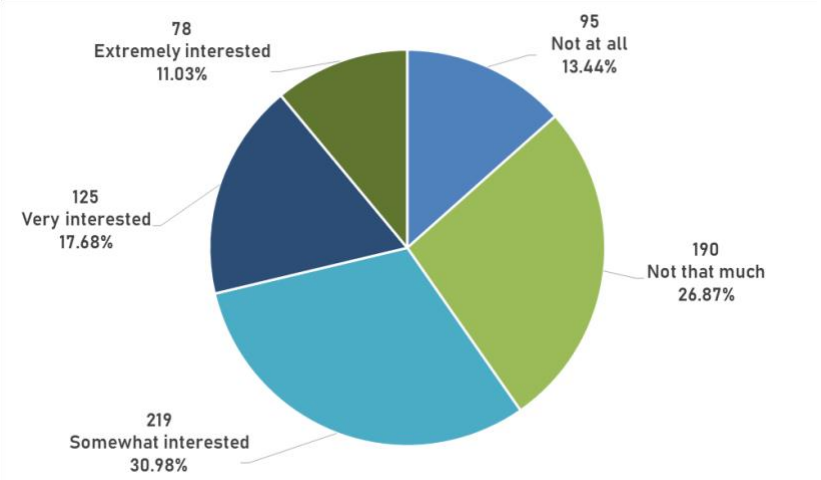
Question 3: *As you may know, at Lenovo, we have designated bins for either recycling, trash, or composting. How often, if ever, would you say you dispose your trash/recycling/compost properly?*

There were 711 responses to this question, and most participants generally thought that they tended to properly dispose of their waste.

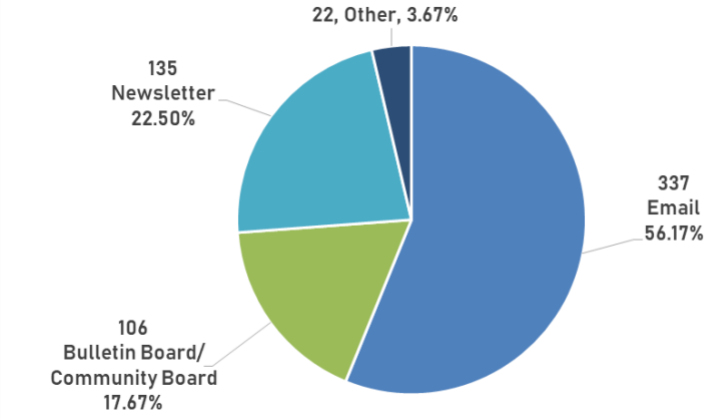


Question 4: *Are you interested in participating in company initiatives to improve overall waste management (i.e.. Waste reduction competitions between departments, buildings, or floors)?*

There were 707 responses to this question. Only about 28% of participants were very or extremely interested in these initiatives. The largest group was somewhat interested, and the second largest group was not very interested.



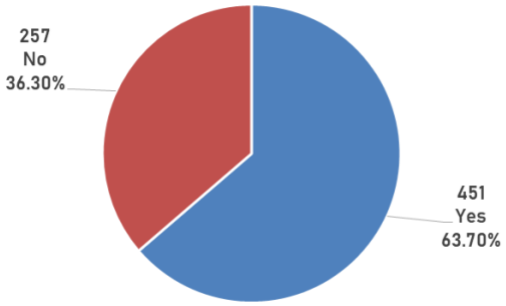
Question 5: *If you are interested in learning more about waste management, how would you like to receive this information?*



There were 600 responses to this question, and the majority of participants were interested in communication by email. For the write-in option, some participants mentioned all of the above, none of the above, and the news flyer that is used in the bathrooms.

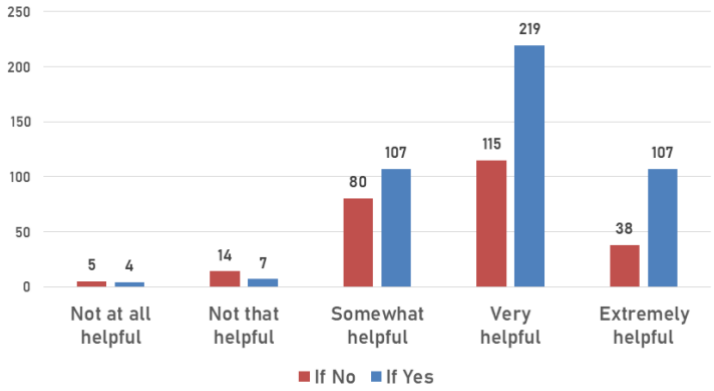
Question 6: *Have you noticed the shadowboxes and/or their print replica posters? (Pictures that were presented in the survey are shown in Appendix: Exhibit F)*

There were 708 responses for this question. The following questions were presented to the participant if they answered no or yes, respectively.



Question 7/8: *If you answered No/Yes, do you think the shadowboxes with the waste samples would be/are helpful for understanding which bin to place waste in?*

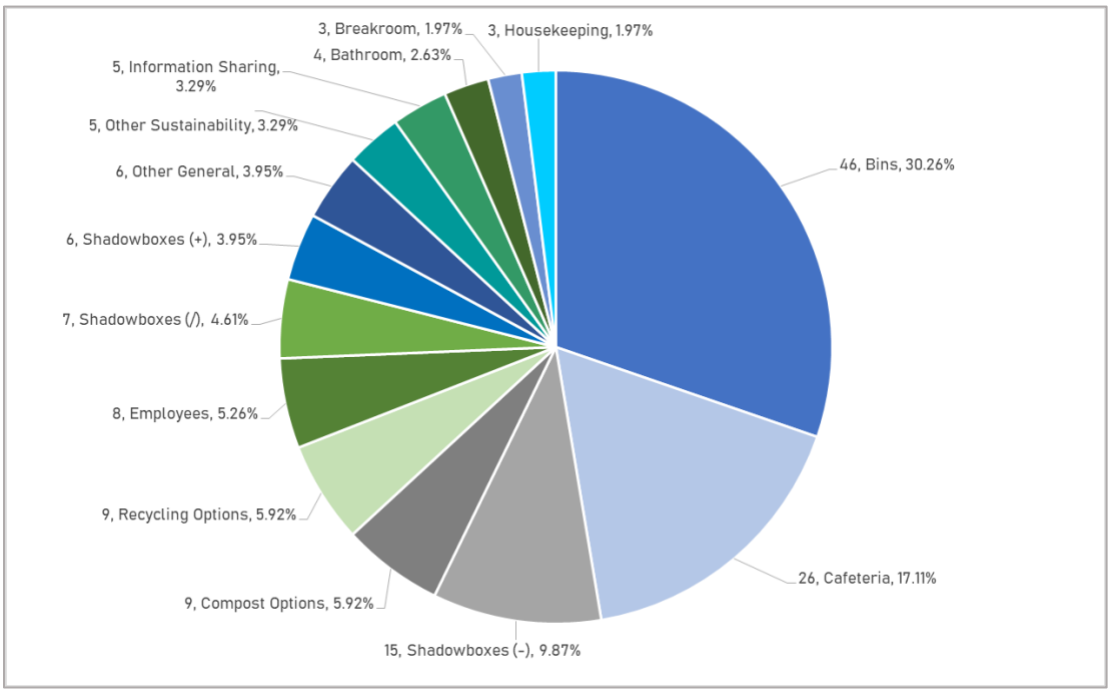
There were 252 responses from those who answered "No," and there were 444 responses from those who answered "Yes." Whether participants had seen the shadowboxes in person or not, the majority found them at least somewhat helpful, and many found them very helpful.



Question 10: *Thank you for taking this survey. If there is anything else you would like to share about sustainability or Lenovo's waste management program, please use the space below to do so.*

There were 152 responses for this question, which is 21% of the total survey participants. The top concern among respondents was the consistency among receptacle bins throughout the Morrisville campus buildings. While there are all three waste options (waste, recycling, compost) at the campus, they are only available at certain locations.

Descriptions and examples of categories can be found in Appendix: Exhibit G. The full list of all responses from this question can be found in Appendix: Exhibit H.



Exemplary Waste Management at Whitsett

Lenovo's Manufacturing and Distribution Center in Whitsett, North Carolina serves as a microcosm for how Lenovo's global waste operations should operate in the future.

Whitsett has three main waste streams, including: 1) Trash, 2) Recycling (multiple types separated), and 3) Corrugated Cardboard. However, what makes Whitsett unique is how these three waste streams are sorted. On the warehouse floor, there is one designated member of the "Cleaning Team" that collects trash in one large container, known as the "Green Elephant." Once the Green Elephant is full, the designated employee sorts the materials into their respective bins. This method of sorting is highly effective for one main reason – having one highly-trained individual sort the waste results in an extremely low contamination rate. This is critical for Whitsett because the site is refunded by weight for all the corrugated cardboard it properly recycles (meaning, no contamination!).

In the breakroom, Whitsett only offers trash and recycling. Because there are only 300 employees, there is no catered cafeteria, and there is not enough demand to provide composting. Nevertheless, Whitsett makes up for its lack of compost with its other various environmental initiatives. For example, in the breakroom, Whitsett displays a rolling presentation on the monitor that communicates the site's waste performance. The presentation not only tracks waste intensity over time, but it also converts the site's progress into relatable terms (ie. "This month we saved 80 trees through recycling."). Moreover, Whitsett separates aluminum cans from the rest of its recyclables to donate to the community. Periodically, Boy Scouts will come collect the cans and cash them into cash with their troop. Lastly, Whitsett puts a large emphasis on the traditional "Earth Day" celebration. Every year, the site provides employees with plant and tree seeds to plant in their backyards, offers employees the opportunity to make an individual "Recycling Pledge," and even created a wall in the office with recycled wood pallets.

From all this, it is clear that Whitsett contributes to Lenovo's successful waste performance. Their secret weapon? Facilities Manager, Tony Belline. Tony is passionate about environmental stewardship and is a member of Lenovo's "Green Team," an environmental task force comprised of other Facility Managers from the U.S. Tony also tracks Whitsett's waste performance in his own system, in addition to Lenovo's official data, credit360. Doing this allows Tony to more accurately monitor his site's waste intensity since he tracks it per pieces sold, whereas credit360 tracks it per headcount. Tony takes pride in his dedication to ensuring proper waste management, and makes sure every one of his employees – floor workers or cleaning crew members – have the necessary information to create a positive contribution at the site. While Whitsett has some clear advantages when it comes to its waste operations, such as its relatively small size, the rest of Lenovo should turn to Tony and his team for advice on how to implement some of his solutions to improve Lenovo's overall waste performance.

RECOMMENDATIONS

Data and insights gathered from: 1) competitor benchmarking; 2) performing waste audits at Lenovo's Morrisville and Whitsett sites; 3) creating, distributing, and analyzing an employee engagement survey; 4) dissecting Lenovo's internal environmental data; and 4) conducting additional industry background research have led to the development of three primary recommendations for waste management and an overall recommendation for reporting waste intensity.

Waste Intensity

We do not currently recommend using waste intensity metrics based on revenue, number of employees, square meters, or scope 1 and 2 energy consumption. The variations in trends could be due to changes in how Lenovo measured its data, so consistency over time could affect the viability of these metrics. However, waste divided by revenue and Scope 1 and 2 energy consumption are not greatly recognized in the industry due to changing economic conditions and different manufacturing capabilities.

While there was a continued drop in number of employee headcount, waste continued to increase over the years, which made this particular waste intensity metric trend upward. If Lenovo were able to decrease the amount of waste per employee and stabilized the number of employees over the year, this would be a possible metric to highlight in its sustainability report.

Next, we recommend that Lenovo continue to monitor the viability of occupied building floor area as a metric. This waste intensity metric has not been stable long enough over the past few years for it to be meaningful. But, after Lenovo's occupied building floor area stabilizes, it might serve as a valuable metric to track. The waste intensity technically decreased in FY2018 compared to the baseline FY2015, but establishing consistent measurements and deciding which spaces are counted are crucial for future consideration.

Therefore, finally, solid waste divided by units of production volume is the most realistic metric for Lenovo use. This metric is the most common one used by other industries. However, it is crucial for Lenovo to measure production volume consistently year over year. Moreover, this metric does not currently show significant improvement since the baseline year, due to an increase in waste along with a general increase in production, and therefore, it may not be worth publicly emphasizing yet.

Overall, waste intensity is a newer KPI companies include in sustainability reports, and can be highly subjective due to data manipulation to show positive results. As waste intensity as a KPI is still developing, it remains most important for Lenovo to showcase progress. To do this, it must first establish a baseline year to each metric, and ensure each metric has been fully established.

Waste Management

Each of the three waste management recommendations includes a feasible, ideal, and aspirational sustainability strategy for Lenovo to implement. They are outlined below. In the following section, each of the three recommendations will be explained in detail.

1. Communication: Lenovo must clearly communicate its waste goals to employees and provide all stakeholders with the necessary tools and information to help the company reach these goals.
2. Consistency: Lenovo must be consistent in the availability of the three receptacles (trash, recycling, compost), as well as the labeling of each receptacle throughout its Morrisville campus.
3. Culture: Lenovo must work to receive top-down recognition of sustainability, and be more proactive in instilling a sustainability mindset in its employees.

Lenovo	Communication	Consistency	Culture
Feasible (easiest)	Leveraging REWS News Lunch and Learns Targeted Information for Stakeholders Clarity on Cafeteria Operations Battery Recycling	Removal of Single Trash Cans Color-coded Descriptions and Labels for Identifying Receptacles	Bring Your Own Mug Discount Green Task Force Earth Day Games Plastic Bag Reduction Volunteering
Ideal (possible)	Display of Company Progress on Waste	Composting Options in Buildings 6 and 7 Improvement of Regular Housekeeping Practices	Reusable To-Go Containers Employee Training Sustainability Excellence Awards
Aspirational (hardest)	Update for Internal Reporting Systems Employee Tracking System	Campus-wide Branding and Same Waste Containers throughout All Buildings	C-Suite Involvement Negotiation for a Stricter Cafeteria Contract

Communication

The analysis of the Lenovo employee engagement survey revealed that there is an educational barrier between Lenovo and various stakeholders (ie. employees, housekeeping). This barrier is preventing the company from achieving higher levels of waste performance. Therefore, Lenovo should work to create clearer, more transparent information to provide each stakeholder group. This will ensure proper waste sorting by empowering individuals to change their behaviors in ways that can contribute to increasing Lenovo's overall waste performance.

Feasible

- Leveraging REWS News: As a strategy newly implementing during the time of this study, the use of "Real Estate Workplace Solutions" Newsletter ("REWS News") in bathroom stalls to distribute waste-related information has proven highly effective. It offers a convenient and effective way to educate employees about Lenovo's waste procedures. Lenovo should not only continue this initiative, but also expand upon this it by placing digital copies of the newsletters on tv monitors throughout workspaces and breakrooms, and even send an electronic copy via email. This will continually reinforce the importance of proper waste management to its employees.

- Lunch and Learns: Lenovo currently utilizes third parties, such as *CompostNow* and *Waste Industries,* to handle their different waste streams. Lenovo should leverage the knowledge of these third parties by hosting the various vendors and holding educational "Lunch and Learns." This would spur employee engagement in Lenovo's sustainability efforts and equip individuals with the necessary information to contribute to improving the company's overall waste performance. Lenovo should consider making these training opportunities mandatory, especially for new hires, to highlight the importance of sustainable waste practices at the company.

- Targeted Information for Stakeholders: There are two main stakeholder groups that contribute to Lenovo's waste performance: employees and housekeeping. Lenovo should develop and communicate more targeted waste management information for these two groups, including basic instructions on how they can each contribute to improving the company's performance. For example, explicitly instructing housekeeping to place the correct color bags for each waste stream in the corresponding receptacle bins (clear – trash, blue – recycling, green – compost) will create consistent branding across the office spaces and will allow employees to accurately dispose of waste. More information on that recommendation can be found in the Consistency section. Furthermore, there should be communication to employees, whether through newsletters, training, or tv monitors, to remind them of the importance of sorting waste correctly in order to prevent contamination.

- Clarity on Cafeteria Operations: One of the largest complaints made through the employee engagement survey was the lack of waste receptacle options in the cafeteria at the Morrisville headquarters. Many employees were outraged that there were no available recycling or compost bins available in the seating areas. As the Real Estate team explained, this is because all waste is discarded onto a conveyor belt and sorted by Lenovo's third-party caterer – *Southern Comfort* – staff. To overcome this informational gap, Lenovo should work with *Southern Comfort* to clearly explain this process to employees to avoid any confusion.

  Second, although the cutlery dispensers indicate that they are recyclable, the Real Estate team has indicated in their shadow boxes (Appendix: Exhibit F) that all cutlery should be treated as "trash." While *Southern Comfort*'s cutlery is technically recyclable, it requires very specific recycling facilities that Durham simply does not have. Therefore, in Durham, *Southern Comfort*'s cutlery is not recyclable. To address *Southern Comfort*'s misleading labeling of its cutlery, Lenovo should ask *Southern Comfort* to replace the labeling on its cutlery, or collaborate with *Southern Comfort* to create an informational sign to place near the cutlery explaining the situation.

"There is an incredible amount of waste generated in our cafeterias, despite efforts to be sustainable... There should be much more awareness in the cafeteria..."

"It would be great if there was a compost bin in the building 7 cafeteria area. I currently work on that floor but have to go to floor 3 to compost my waste."

"It would be nice to have visable recycle bins in the Main Dining Room / Cafe of Building 8."

"I am frustrated that there is so much non-recycleable waste generated in the cafeteria every day. I believe that the cafeteria should ONLY use compostable containers and forks/spoons/knives for takeout."

"I see a large lapse in Lenovo and the food service company we hire. When we talk about our sustainability it needs to cover all aspects otherwise, we are hypocritical in our efforts."

"Lenovo needs to invest in all recyclable containers for the cafeteria & kitchens."

- Battery Recycling: In analyzing the survey, one question that continually surfaced was where the battery recycling collection receptacle bins were located. At the same time, as seen on the Morrisville waste audits, these bins exist, but are just not conspicuous. Therefore, Lenovo should work to better communicate where battery collection stations are located to eliminate any confusion. These instructions can be communicated through additional signage above the traditional recycling bins or through REWS News.

"After recent renovation in Bld. 7, Battery recycle bins are not in places like it used to be. Having more battery recycle bins could sure help."

Ideal

- Display of Company Progress on Waste: Many employees indicated on the survey that they would be interested in learning more about the company's waste progress overtime. To do this, Lenovo should display the data it obtains from third-parties, such as *CompostNow* and *Waste Industries,* in a digestible way to report on the company's overall waste performance each month. These "mini-reports" will increase Lenovo's transparency with employees, and make them more engaged with contributing to the company's sustainability efforts. They can be showcased on tv monitors in the cafeterias or breakrooms.

> *"I'd like to see static displays of our campus' waste amounts. Maybe a sculpture of all the disposable coffee cups used in a week, quarter, year, and a sculpture that represents all the re-usable coffee mugs, thermoses, etc used in the same timeframes?"*

Aspirational

- Update for Internal Reporting Systems: Currently, Lenovo's internal environmental database does not acknowledge "compost" as a viable waste category to report. Because of this, Lenovo is forced to input the data received from *CompostNow* under "recycling," within an "other" category. Additionally, Morrisville and Whitsett use very different categories to internally track their waste streams. In order to be better equipped to report on its waste progress in the future, Lenovo should devote the time and resources into developing a more rigorous, state of the art internal tracking system. For example, if its industry competitors begin including "compost" in the waste section of their respective sustainability reports, Lenovo would not easily be able to replicate this since their compost is currently tracked under "trash." Therefore, investing in a more modern and accurate environmental reporting system will give Lenovo a competitive edge to communicate their sustainability efforts in the future.

- Employee Tracking System: A handful of employees indicated on the survey that they would be interested in setting personal waste goals that they could track over time. Lenovo should consider building a platform where individuals, or even teams can set their own waste-related goals and track their progress over time. This will provide employees with an opportunity to become more engaged with Lenovo's sustainability strategy, and it will create accountability for individuals (or teams) in helping the company achieve its goals. This platform can serve as an interactive way for Lenovo to communicate the importance of incorporating sustainability into its operations.

Consistency

The second theme of our recommendations is Consistency, which requires Lenovo to maintain similarity throughout its buildings on its Morrisville campus to ensure effective waste management. The most feasible actions for this theme focus on small changes, such as removing excess receptacle bins that are unlabeled and used for miscellaneous waste in common areas.

Other most feasible actions include a creation of a consistent color scheme for labels across all buildings, and longer-term actions build on this consistent organization.

Feasible

- Removal of Single Trash Bins: There are currently "trash" bins that are sporadically placed in areas near the cafeterias or breakrooms, and they are neither labeled nor easily identified. Because these extra trash bins allow employees to deposit trash without the context of recycling or composting bins, they often hold waste that may have been otherwise diverted from landfill (ie. soda cans and water bottles). Lenovo should remove these unlabeled bins and instead focus on bringing attention to waste sorting.

- Color-coded Descriptions and Labels for Identifying Receptacles: Based on the current color scheme for waste bags developed by the Real Estate team, Lenovo should develop the color scheme for any branding or labels regarding the receptacle bins. Currently, there are signs with information on proper waste sorting, which were pictured in the Data Analysis section.

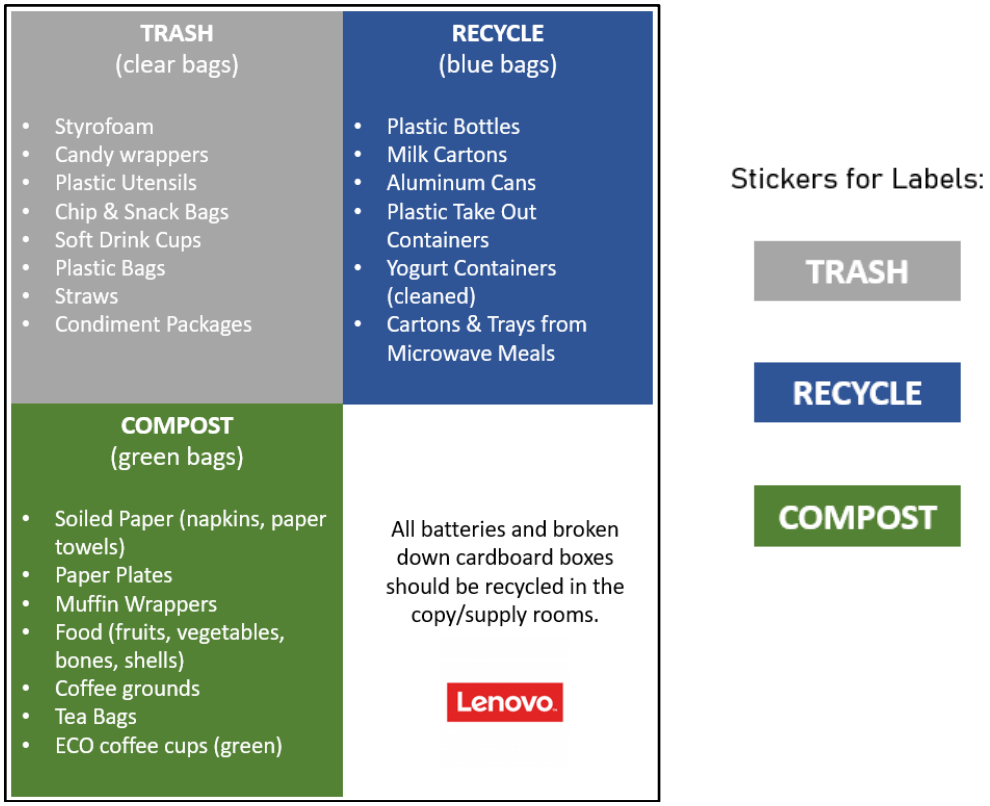
  It is crucial to have these informational signs in all buildings because it provides a longer list of compostable and recyclable items than the shadowboxes. We based this recommendation on specific feedback from the employee survey; employees were still unclear on the sorting.

> *"Need posters or shadow boxes near waste recepticles in office space -- is a paper coffee cup from the cafeteria recyclable or compostable? No clue..."*
>
> *"I'm just so tired of there not being compost bins in Blg 7 (2nd floor), and horrible sign-age. I'm constantly having to pull starbucks cups (straws and all) from the recycle bin. No one gives a damn. How hard is it for Lenovo to put up signs?"*

Due to various renovations across Lenovo's Morrisville campus, signage options are inconsistent across the three office buildings. At the same time, research has shown that color can actually improve readability and clarity, so that employees are more likely to comprehend the information and recognize it.[1] Using color also enhances individuals' attention level, which makes them more likely to memorize information.[2] These studies illustrate how important it is to maintain a consistent color scheme across the waste labels and bags. Without one, employees may subconsciously be confused and not bother to actively learn proper waste sorting.

Therefore, we recommend establishing a distinct color scheme for the labels and signs based on the current color code for plastic bags in each waste receptacle. The current practice is meant to provide clear bags for trash, blue bags for recycling, and green bags for compost, which allows housekeeping to recognize where bags should be placed after collection. These same colors should be used for each waste type's labels and signage.

We have drafted examples of possible labels and advertising that can be seen below:



Stickers for Labels:

Ideal

- <u>Composting Options in Buildings 6 and 7:</u> Our ideal proposal for Lenovo, which we believe is ultimately possible, expands further on the feasible ideas by targeting actual waste receptacles beyond the labels. For example, on Lenovo's Morrisville campus, in Buildings 6 and 7, existing receptacles do not always include composting even though the receptacle bins are organized in multiples of three. Therefore, it would be useful for each set of bins to include one bin designated for each waste stream – compost, recyclables, and trash. This system would also require the new labels that were part of our feasible recommendation. The current and proposed options are seen below:

Before:

After:

- Improvement of Regular Housekeeping Practices: Another ideal proposal for Lenovo focuses specifically on housekeeping and the regular removal of trash, which was cited as a problem throughout both the employee survey and discussions with the real estate team during the waste audits.

"Also the bins in the common kitchen areas fill up and are often overflowing, so people just toss stuff in any bin that has space. They need to be emptied more frequently, especially around lunch."

"We used to have waste can's and recycle bins at our desk, but this is gone, so it is easier now to just through out everything is the same trash bin, also, the trash bins are full most of the time so again, just dump trash is whichever bin is available."

"People are most likely aware of what goes into each bin (trash, compost, recyclables) but when the trash is full and there's no where else to put it, I often see the recyclables full with trash. I believe it's just a lack of concern, or apathy."

"I often work late and see housekeeping just dump everything in trash."

Housekeeping is responsible for emptying receptacle bins regularly throughout the day. In the survey, employees cited unnecessary full bins as reasons for just throwing waste in any available receptacle. This is something that can be fixed with a different schedule for housekeeping. Although Lenovo currently has an online reporting system where employees can report overflowing bins to the facilities team, employees may not be interested in exercising this option regularly. Therefore, we recommend that bins be emptied right before and after the main lunch time, so that all bins are empty for waste during this time of day.

Additionally, throughout the waste audits, our team noticed that many of the available compost bins did not have a green plastic bag inside. As the real estate team explained, this indicates that housekeeping treats compost like trash, rather than compost. Ensuring that housekeeping has access to these green bags and understand the system is crucial to

maintaining the validity of the compost system. We recommend that this system be reiterated to employees regularly to maintain awareness. Moreover, the online reporting system, mentioned above, can be used by employees to keep housekeeping accountable for these bags. There must be direct information provided to housekeepers to help them practice proper waste management. Information to help remind and guide housekeeping can be seen below:

Aspirational

- Campus-wide Branding and Same Waste Containers Throughout All Buildings: Our final recommendation regarding consistency is aspirational, which means that it should be considered in the future as the waste management at Lenovo evolves over time. Waste management at Lenovo should be be instilled through using exact same waste containers in all buildings. This would create a waste "brand" for the company and employees would always have access to compost, recycling, and trash at every waste station.

  Since the renovation process on Lenovo's Morrisville campus is ongoing, this is something for the company to consider in the future. The most modern option would be from Building 8, which is shown to the right.

Culture

The third set of recommendations is aimed at fostering a more sustainable company culture at Lenovo. Integrating sustainability into a company's culture is a critical component in any successful corporate sustainability strategy. If Lenovo employees become more empowered to create waste changes in their everyday lives, it would result in overall improvements in Lenovo's waste management.

Feasible

- Bring Your Own Mug Discount: Lenovo's Morrisville cafeterias serve coffee and other beverages in compostable coffee cups. However, instead of focusing on just diverted waste, Lenovo should also focus on reducing consumption in general. Therefore, our team recommends that Lenovo provide discounts to employees who bring their own reusable coffee mug to work. This program is often implemented on college campuses and should be relatively simple to implement and publicize. Lenovo might also be able to turn this into a marketing platform by offering Lenovo-branded reusable coffee cups that employees can purchase, personalize, and reuse. Discounts on daily beverages and other similar discounts would incentivize employees to bring their own container, change consumer behavior, and reduce waste generation at Lenovo.

- Green Task Force: Lenovo should create a green task force for each campus, which would include employees that are interested in furthering Lenovo's sustainability strategy. This practice of organizing such teams of employees is common throughout the industry, as seen

through the Cisco case study earlier. These teams help the sustainability departments by promoting initiatives among other employees, brainstorming new ideas, and volunteering at green events. For example, LinkedIn has over 1,000 employees in their Go Green groups (shown below).[41]

Engaged employees

At LinkedIn, talent is our number one priority, and our employees play a critical role in our sustainability program. More than one thousand employees representing every LinkedIn office around the globe have joined our Go Green employee groups for environmental sustainability action. These groups host events and drive awareness across our global offices.

Employees also contribute through our commuting initiatives. Currently 70% of our global employees choose an alternative form of transportation to get to the office, including walking, biking, carpooling, public transit, and shuttles. Our Bay Area locations have been recognized as a Best Workplace for Commuters.

Best Workplace for Commuters page

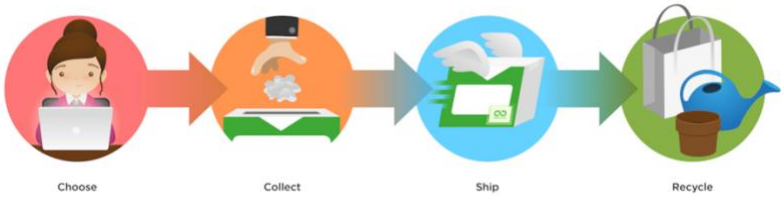
Source: LinkedIn Environmental Sustainability

Our survey results showed that about 60% of the survey respondents were at least somewhat interested in participating in company initiatives to improve waste management. Therefore, Lenovo should leverage this interest and should send out another survey to gather feedback on the potential of forming green task force teams.

- Earth Day Games: As part of its annual Earth Day Campaign, Lenovo should engage employees to participate in various waste sorting games and activities. This would be an interactive way for them gain knowledge about how to correctly sort waste. Earth Day could serve as the launching point for these types of games, but if successful, Lenovo could begin hosting additional events throughout the year.

- Plastic Bag Reduction: During our visit to Lenovo's Morrisville campus, we observed plastic bags that were available on the counter in the cafeterias. By having them so accessible makes it more likely for employees to take them without actually needing them. Lenovo can limit the access by placing them behind the counter and only providing them to employees when they ask for it. This "opt in" mentality would encourage employees to either bring their own bag or refrain from using a bag at all.

Lenovo could also hold plastic bag drives sponsored by the GEA&S Team as part of the company's annual Earth Day celebration, , where employees can bring any extra plastic bags from home in exchange for a reusable bag. As for recycling the bags, third-parties, such as Terracycle, offers a zero waste box that can be purchased, filled with plastic bags, and returned for recycling.[42]



Source: Terracycle Grocery and Shopping Bags Zero Waste Box

- Volunteering: Lenovo should organize additional volunteering events that focus on environmental stewardship, such as cleaning the banks of Eno River. While Lenovo already has existing volunteering initiatives, but they do not concentrate on the environment, let alone waste management. These volunteering efforts can be arranged around the holiday season, when employees are feeling more generous, in order to gather a larger group. However, Employees may also be more willing to participate during slower seasons. Regardless, these events will demonstrate to employees how waste infiltrates the natural environment and will result in more consciousness and awareness of their own waste.

Ideal

- Reusable To-Go Containers: Lenovo can replace disposable clam shell containers with a reusable to-go container system in their Morrisville cafeterias. During our team's visit to campus, we observed many disposable clam shell containers each of the receptacle bins, including both plastic and Styrofoam containers. At the same time, many companies, such as Green to Go[43] and Go Box[44], have created these reusables to go container programs and are helping reduce waste from take-out.

  Moreover, recently many college campuses have implemented reusable to-go box systems to reduce the amount of trash that is generated. For example, in December 2019, Duke University has introduced a reusable to go system at its main campus eatery, Brodhead Center.[45] Students sign up online for the program and is added to their

Duke student ID. Then, all they have to do is ask for a reusable to go container at Broadhead Center, and return the container when finished. For this particular system, when a student checks out a container, $5 is held on the card and only reimbursed when the container is returned. Although Duke's program is in the piloting stage nearly 800 students have signed up!

Source: Sun Sugar Farms

Programs at other campuses allow varying flexibility depending on the needs of the campus. Some systems allow multiple containers to be taken out at once (Duke's program only allows one at a time), and some offer their own collection box that the supplier can collect and clean in their own operations. Lenovo can adopt one of these programs and encourage employees to use the system. We considered other options, such as the idea of employees bringing in their own containers. However, we believed that there would be health code issues that would prevent this type of program from being successful.

Currently, *Southern Comfort* offers compostable boxes for an additional $0.25 charge. This system does not seem to be well-noticed by the employees, due a lack of awareness within the survey responses. However, implementing a novel system to offer reusable containers and cleaning them would be very convenient for all of those involved. Any associated costs would be partially offset by the reduction in costs for composting and trash collection, and part of the cost would be passed onto the consumer and built into the cost of eating at the cafeteria.

- Employee Training: New employee onboarding and orientation presents Lenovo with a great opportunity to educate new employees about proper sorting and the importance of waste management. This online training could be configured as a short program, just like regular onboarding trainings that teach employees about proper behavior. These trainings would demonstrate to new employees how important sustainability is to the company, and instill in them proper waste management behaviors from the beginning.
- Sustainability Excellence Awards: Lenovo can recognize individuals, teams, or departments at the company who have proven themselves as leaders in sustainability topics, such as waste management. For example, the GEA&S Team can periodically recognize the department, team, or employee that use their reusable coffee mugs every day for a whole month.

Competitions are another way to promote a sustainable company culture into the company. However, for these types of programs to be successful, Lenovo must have enough employee interest and offer valuable incentives.

Aspirational

- C-Suite Involvement: Receiving top down support of sustainability initiatives is pertinent for a company's success in achieving its goals. Many large companies such as Kaiser Permanente, Ikea, Apple and Salesforce are leaders in this area.[46] To gain support, the GEA&S Team must solidify its waste management strategy, and make the business case to Lenovo's C-to win support. The business case could analyze the cost savings from generating less waste and reallocate the savings to employee engagement and sustainability initiatives. Additionally, as younger generations desire more sustainable companies, Lenovo could attract high-quality talent and achieve higher retention. Over time, with C-suite support, Lenovo can advance its sustainable company culture. Because C-suite buy-in can be difficult to achieve, this initiative could be spearheaded with first targeting departmental or regional managers.

- Negotiation for a Stricter Cafeteria Contract: Southern Foods manages all of Lenovo's waste collection and sorting in the cafeteria. Therefore, Lenovo should work to negotiate a stricter contract with them to eliminate plastic bags, plastic utensils, and single-use drink/food containers altogether. Many companies have already made such changes in their employee cafeterias to reduce waste. For example, 3M plans to eliminate all plastic bottles from the cafeteria at their headquarters. In their other locations, they include initiatives to reduce waste in other ways, such as offering reusable coffee mugs at their Germany office.[47]

FURTHER CONSIDERATIONS

In addition to the series of recommendations made above, our team has also developed a further set of recommendations for Lenovo to advance its waste management strategy. While the following recommendations will take a larger amount of time and resources, they will ultimately provide the company with a large competitive advantage as corporate sustainability becomes

more ubiquitous. While they may not be feasible anytime soon, they are additional initiatives for Lenovo to keep on its radar.

Zero Waste Certifications

In 1973, Dr. Paul Palmer first used the term "zero waste" to describe the resource recovery process from chemicals. Today, "zero waste" is referred to as the concept of completely eliminating the generation of materials that have no viable or economic option for end-of-use management. The goal is to have no waste created throughout a certain process. When a material reaches its end-of-life phase, it must be reused and re-incorporated into a circular system.

Recently, the concept of zero waste is gaining traction as more and more governments and companies, such as Coca Cola, Toyota, Fuji Xerox,[48] are beginning to implement it in their operations. Due to this market shift, various companies have gone the extra mile to become officially zero waste diversion certified. This is done through GBCI's TRUE zero waste, as well as UL Environment's various certifications. They are outlined below:

GBCI's TRUE Zero Waste: GBCI is leading independent organization that works to recognize excellence in green business industry performance and practice globally. Its TRUE Zero Waste certification enables organizations achieve their zero waste goals without large financial investments. The certification process works by a points system and is tiered by the following scale.

Certified: 31-37 points
Silver: 38-45 points
Gold: 46-63 points
Platinum: 64-81 points

The one major requirement of TRUE is that the company must have obtained a minimum of 90% annual diversion of solid, nonhazardous wastes from landfill, incineration (waste-to-energy), and the environment for one year.[49] Moreover, companies must keep their contamination level for any materials leaving the site below 10%.To learn more about the certification process and requirements, click here.

UL Environment's Certifications: UL Environment is a business unit of UL, a global safety certification company. One of UL Environment's offerings is Landfill Waste Diversion Validation. In order to achieve Zero Waste to Landfill, UL requires at least 90% diversion through methods other than waste-to-energy. Moreover, the certification process is tiered, and UL utilizes a ranking system to differentiate between diversion rates:

Silver Status: 90-94% diversion
Gold Status: 95-99% diversion
Platinum Status: 100% diversion

To request more information about UL's rigorous certification process, click here.

- - -

As Lenovo works towards increasing their waste diversion rate, they should consider obtaining either a TRUE or UL zero waste certification. Its competitors, such as Apple and Cisco, are already working towards achieving these certifications, and HP's headquarters in Palo Alto has already achieved GOLD TRUE Certification status in 2017.[50] Pursuing a zero waste certification would reduce costs associated with waste disposal, reduce reliance on limited landfill space, and provide Lenovo with a competitive advantage by proving itself to be an environmentally responsible corporate citizen (UL).[51]

Apple's Zero Waste Journey

Apple has successfully incorporated the concept of zero waste into their sustainability strategy with two main programs – one directed towards their own operations and facilities, and one for their suppliers.

At Apple's Facilities:

Apple has >450 corporate facilities, >500 retail stores, and five data centers. The company's strategy to reduce waste generation at these sites is to reevaluate their entire operations. The amount of waste generated at these sites was diverted from the landfill at a rate of 74% in FY 2018, an increase of 4% since 2017.

Apple has diverted waste when renovating their buildings, with 85% of the furniture discarded from any of the 450 corporate facilities being recovered, repaired, and reused. The company has also set up new rigorous packaging standards to reduce the need for packaging altogether at their data centers. They are also looking for methods to reuse packaging from its shipping. Lastly, Apple has installed remote, real-time monitoring systems that help the company prioritize action at sites with higher waste generation.

For their Suppliers:

In 2015, Apple launched a Zero Waste Program for their suppliers to help them reach their goal to divert 100% waste from the landfill. This program consists of 90 suppliers, and it is an onsite support initiative that helps the suppliers recycle and reuse materials. Targeting their final assembly facilities who generate the most waste in their supply chain, Apple provides these suppliers with the necessary tools to reduce their waste generation.

As a result of this program, in 2018, Apple achieved UL's Zero Waste to Landfill certification for all final assembly facilities for nearly all of their products. Moreover, they diverted a total 1 million metric tons of waste through their supplier Zero Waste program by having 90 suppliers on board. Now, the company is looking into up-cycling methods for ways to reuse their products.

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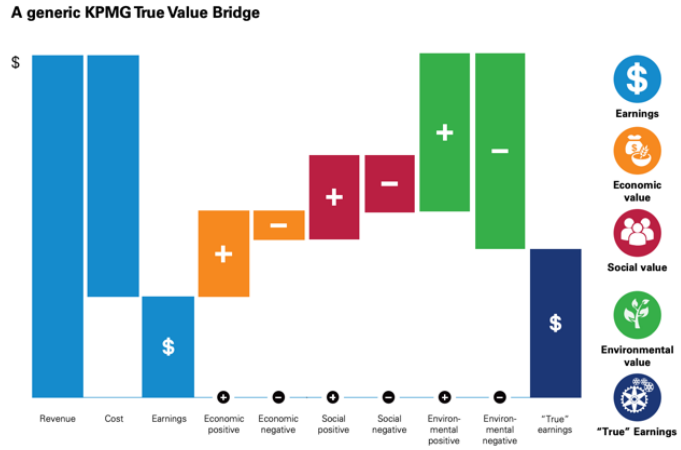
KPMG's True Value Analysis

In order to provide stakeholders with more accurate sustainability metrics, there has been a growing trend among companies to express all of their economic, social and environmental impacts in a common financial metric (i.e. dollar amount). Converting all of their impacts – both positive and negative – into financial metrics can help companies make stronger business cases for sustainability.

KPMG is one of the big four accounting firms and has been at the forefront of this movement to quantify a company's impact. In 2014, KPMG launched its True Value Methodology service to assess organizations' most material economic, social, and environmental impacts. Since its launch six years ago, dozens of global companies have adopted the True Value analysis to better measure their sustainability progress.[53]



One unique feature about True Value is its scalability. This means that the analysis can be applied to a company's single product or service, or the entire value chain.[54]

The final deliverable of the KPMG True Value analysis to companies is known as the "KPMG True Value Bridge" (see above). This infographic allows sustainability managers to quantify and then analyze the company's impacts using a financial metric. Moreover, the Value Bridge also allows C-suite executives to compare the company's "true" earnings to the traditional financial earnings.[55]

Overall, KPMG True Value has been shown to 1) Improve Decision Making, 2) Enhance Reporting and Strengthen Stakeholder Relationships, and 3) Build the Business Case for Innovation.[56]

SAMSUNG

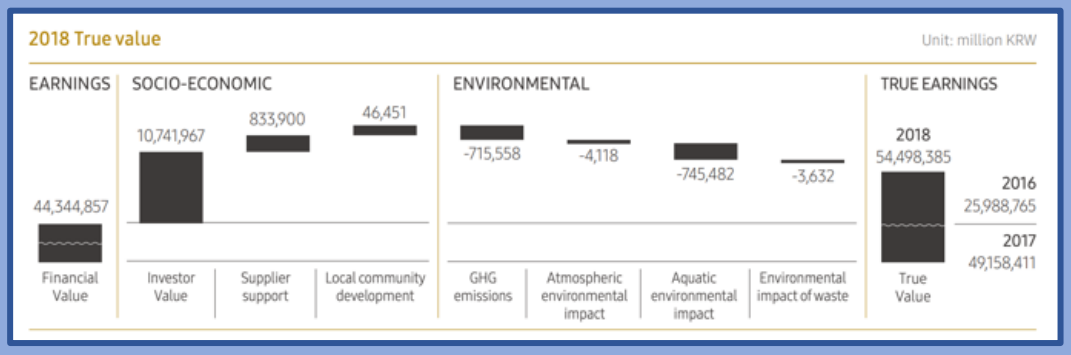
Samsung Assigns Financial Value to Its Impacts

Samsung strives to create simultaneous economic, social, and environmental values. Since it can be difficult for companies to numerically quantify environmental, social, and governance values, in 2016, Samsung began using KPMG's "True Value" methodology.

Value measurement methodology

Category		Type	Measurement methodology[1]
Socio-economic Value	Investor Value	Benefits	Dividends and interest payments to investors and creditors
	Supplier Support	Benefits	Investments made in the Win-Win Cooperation Fund
	Local Community	Benefits	Return on investment made in educational projects (118%)[2] Return on investment made in infrastructure development projects (250%)[3] Return on investment made in sanitary facility development projects (550%)[4]
Environmental Value	GHG emissions in workplace	Costs	Social costs that incur due to GHG emissions[5]
	Atmospheric Environmental Impact	Costs	Social costs that incur due to the emission of air pollutants (NOx, SOx, PM) [6]
	Aquatic Environmental Impact	Costs	Social costs that incur due to water consumption based on severe water shortages in the area where our worksites are located [7]
	Environmental Impact of Waste	Costs	Social costs that incur due to waste landfilling, incineration, and recycling respectively[8]

As shown below, in 2018, Samsung's financial value was approximately KRW 44.3 Trillion. During the same year, according to KPMG's True Value methodology, the company's "true" value was approximately KRW 54.5 Trillion. By using the True Value Analysis, Samsung discovered that its "true" value was approximately 23% higher than its financial value and 11% higher than its 2017 "true value." This proves that Samsung's sustainability strategy has been successful as its positive impacts on society outweigh its negative impacts.



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CONCLUSION

Beginning in June 2019, our team of three graduate students from Duke University's Nicholas School of the Environment has both qualitatively and quantitatively analyzed Lenovo's industry position in regards to its non-hazardous waste performance, specifically its waste intensity metrics. Throughout the process, two separate waste audits were performed at Lenovo's North American Research & Development Headquarters in Morrisville, North Carolina (and one at its Global Distribution Center in Whitsett, North Carolina), one employee engagement survey was sent out across Lenovo's U.S. employees to understand how they perceive sustainability at the company, and Lenovo's internal historic environmental data was analyzed. The results of these efforts highlighted key recommendations for Lenovo to revise their current non-hazardous waste strategy:

1. Communication: Lenovo must clearly communicate its waste goals to employees and provide all stakeholders with the necessary tools and information to help the company reach these goals.
2. Consistency: Lenovo must be consistent in the availability of the three receptacles (trash, recycling, compost), as well as the labeling of each receptacle throughout its Morrisville campus.
3. Culture: Lenovo must work to receive top-down recognition of sustainability, and be more proactive in instilling a sustainability mindset in its employees.

These three recommendations were developed solely on data collected from Lenovo's North American Research & Development Headquarters in Morrisville, North Carolina, as well as its Lenovo's Manufacturing and Distribution Center in Whitsett, North Carolina. For Lenovo to achieve both its waste and larger sustainability goals, it will require implementing these recommendations on an international scale, where appropriate. Relevant tools and resources from industry peers, non-profits, and industry organizations have been included in this report to assist Lenovo to incorporate these recommendations into their global operations. The team is grateful for the opportunity to work with Lenovo in helping them improve their sustainability efforts and performance.

APPENDIX

Exhibit A: Glossary

Circular Economy: Looking beyond the current take-make-waste extractive industrial model, the Ellen MacArthur Foundation defines a circular economy as a model that redefines growth, focusing on positive society-wide benefits. That is, it entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system.[58]

Sustainability: According to the UN World Commission on Environment and Development, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[59]

Corporate Social Responsibility: The United Nations Industrial Development Organization (UNIDO) defines Corporate Social Responsibility (CSR) as "a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders"[60]

Environmental Social Governance: ESG means using Environmental, Social and Governance factors to evaluate companies and countries on their sustainability performance. Once enough data has been acquired on these three metrics, they can be analyzed and integrated into the investment process.[61]

Sustainability/Annual Reports: A sustainability report is a report published by an organization about the economic, environmental and social impacts caused by its everyday activities. These reports present the organization's values and governance model, and demonstrate the link between its strategy and its commitment to a sustainable global economy. Publishing a sustainability report allows the organization to be more transparent about the risks and opportunities they face.[62]

Comingle Recycling: Comingle Recycling, also referred to as single stream recycling is simply a mixed recycling collection. Commingle recycling allows for a single dumpster to contain all recycling materials available in your area, including paper, cardboard, cans, and glass. The individual materials are then sorted by the recycling provider.[63]

Compost: Compost is organic material that can be added to soil to help plants grow. Food scraps and yard waste together currently make up more than 28% of what Americans throw away, and should be composted instead. Compost keeps these materials out of landfills where they take up space and release methane, a potent greenhouse gas.[64]

Hazardous Waste: Hazardous waste that is improperly managed poses a serious threat to human health and the environment.[65]

Non-Hazardous Waste: Sometimes referred to as Solid Waste, Non-hazardous waste is any type of industrial waste which, according to regulations, cannot be added to a dumpster or sewage line. Non-hazardous waste materials won't negatively affect the health of humans, they must be collected and disposed of properly for a variety of reasons.[66]

Waste Intensity: Waste intensity is a variation of resource intensity, which is a measure of a particular resource (i.e. waste, energy and water) required for the provision of a unit of a good or service. Resource intensity is usually expressed as a ratio of materials used per value (ie. 10 metric tons of waste per product sold).[67]

Scope Emissions: The GHG Protocol Corporate Standard classifies a company's GHG emissions into three 'scopes'. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are indirect emissions produced either upstream or downstream along the value chain.[68]

Waste Audit: A waste audit is a survey of a facility's regular waste stream. Waste auditors go through bags of waste, sort items, record and analyze the data. In doing this, they identify what is being thrown away, what is being recycled or diverted through other means, and the amounts of each type by weight or volume.[69]

Shadow Box: A shadow box is an enclosed glass-front display case containing an object or objects presented in a thematic grouping with artistic or personal significance. As it pertains to waste, it can be used to educate individuals sort their waste by visualizing each separate category (trash, recycling, or compost).

GBCI: Green Business Certification Inc. is a certification and credentialing body that administer sustainability project certifications and professional credentials.[70]

UL Environment (UL): UL Environment is a business unit of UL (Underwriters Laboratories), a global safety certification company headquartered in Northbrook, Illinois.[71]

Diversion Rate:

$$\text{Diversion Rate} = \frac{\text{Materials diverted from landfill, incineration (WTE), and the environment}}{\text{Total Generation}}$$

Exhibit B: Competitor Benchmarking

Company	Product Category	Reporting Year (2017, 2018, 2019)	Link to Report	Waste Metric Used (Absolute or Intensity)	Definition of Non-Hazardous Waste	Mention of Zero-Waste or Zero Landfill?	General Waste Info (Initiatives mainly concerned with non-hazardous waste, etc)	Goals on Waste
Lenovo	*PCs, Servers, Phones*	FY2017/18 (April 1, 2017 - March 31, 2018)	2018/2019 Sustainability Report	Absolute: Metric Tons (MT) Intensity: Total nonhazardous waste generated per unit of produced during the fiscal year	• Track nonhazardous waste coming from manufacturing, research and development sites and some large office locations (https://www.lenovo.com/us/en/social_responsibility/waste_water/)	No	• Nonhazardous Waste: 44,377.44 metric tons	• Maintain a global nonhazardous waste recycling rate > 90%
HP	*Printers, PCs*	FY2018 (ended October 31, 2018)	2018 Sustainable Impact Report	Absolute: Metric Tons Intensity: N/A	• No available definition, but graphic breakdown of HP's nonhazardous waste is on the HP tab, includes paper, pellets, electronic equipment, metals, packaging equipment, and others, beyond what was landfilled	• Pursuing TRUE Zero Waste certification at campuses globally; Palo Alto headquarters has already achieved Gold TRUE certification • Launched pilot project for a supplier in China to pursue zero waste certification; program will be expanded to more suppliers in China, and there was already a successful zero waste to landfill project in Brazil for a supplier	• 32,000 metric tons of nonhazardous waste in 2018 (up 8% from 2017 due to increased manufacturing). Of the 32,000 metric tons, 28,100 metric tons were recycled, 2,900 metric tons were landfilled, and 1,000 metric tons were incinerated. • 90.9% landfill diversion rate globally • Works with suppliers to improve waste management of suppliers and increase landfill diversion	N/A

Company	Progress	Partnership References in Report (Waste Only)	Do they Perform Audits (if yes, with whom)?	Employee Engagement Initiatives (Waste and Non-Waste)	Important Links
Lenovo	• Global nonhazardous waste generation by year: - 2013/14: 27,316.95 metric tons - 2014/15: 35,944.75 metric tons - 2015/16: 40,041.55 metric tons - 2016/17: 44,032.69 metric tons - 2017/18: 44,377.44 metric tons • Global nonhazardous waste recycling rate = 88% - Some large office locations worldwide achieved a reuse/recycling rate of 91.4 percent during FY 2017/18.	• Lenovo partnered with the China Reach Academy of Environmental Sciences on the "Cleaning Production Program" that took place in all locations in Beijing during 2016 and focused on identifying energy savings opportunities and eliminating waste generated in our manufacturing/assembling operations.	• EMS （Lenovo's Environmental Management System） is ISO 14001 certified by our third-party certification body • ISO 9001:2015 (Quality Management) is also third-party certified • ISO 27001 third-party certified • Bureau Veritas Certification (BVC), our global registrar, regularly evaluates Lenovo against OHSAS 18001:2007 requirements through on-site audits • Self-assessment	• Safety Suggestions Program/ Safety Awareness Month . • "Lenovo Listens" Employee Engagement Survey • Internal/External Traning on sustainability, environmental impact • Ensure employees receive health and safety training and detailed, site-specific safety information. All manufacturing personnel engage in an annual safety awareness training that is compliant with local governmental regulations. • Activities in Lenovo Foundation • OHS Recognition and Awards	https://www.lenovo.com/us/en/lenovo/compliance/
HP	Global nonhazardous waste generation by year: -2015: 28,100 metric tons -2016: 27,800 metric tons -2017: 29,500 metric tons -2018: 32,000 metric tons	• Endorsed the European Strategy for Plastics and the French Circular Economy Roadmap • Joined the Platform for Accelerating the Circular Economy (PACE) • Is a member of the Ellen MacCarthur's commitment to end plastic waste	• Audits performed to focus on corruption risks and human rights violations • Audits performed on suppliers to ensure compliance with the HP Code of Conduct and other metrics • Participates in the Responsible Business Alliance Validated Audit Program, which uses external auditors to Audit suppliers • Limited assurance provided by Ernst & Young on selector indicators in Appendix A (they do not include Waste)	• Goal to double factory participation in sustainability programs by 2025 • Year-round employee engagement encourages healthy behaviors in day-to-day life. Employees can set their own goals, track progress, and challenge peers and spouses/domestic partners. Depending on location, U.S. employees and spouses/domestic partners can each receive incentives of up to $550 a year for finishing activities, such as completing a wellness assessment or making a tobacco-free pledge. • Employee engagement survey	

Company	Product Category	Reporting Year (2017, 2018, 2019)	Link to Report	Waste Metric Used (Absolute or Intensity)	Definition of Non-Hazardous Waste	Mention of Zero-Waste or Zero Landfill?	General Waste Info (Initiatives mainly concerned with non-hazardous waste, etc)	Goals on Waste
HPE	*Enterprise Products& Services*	FY2018 (November 1, 2017–October 31, 2018)	2018 Living Progress Report	Absolute: Metric Tons Intensity: N/A	• In a footnote, mentions nonhazardous waste is defined under the Basel Convention (only refers to it to note that its e-waste does not include nonhazardous waste)	No	• In 2018, 13,208 metric tons of nonhazardous waste produced in operations • In 2018, 90% of nonhazardous waste was diverted from landfill • In the UK, employees led an initiative to remove single-use plastics from offices by replacing plastic cups with reusable cups, engaging vendors in offering incentives to encourage people to bring their own reusable cup, and changing logistics products • Incentives for suppliers to report on waste	• Annual target of 83% diversion rate for nonhazardous waste, but seeking to increase it to 87% as the company re-evaluates the overall waste strategy
Apple	*PCs; Phones*	FY2018	Apple 2019 Environmental Responsibility Report	Absolute: Metric Tons and US Pounds (lbs) Intensity: N/A	N/A	• Facility in Cork, Ireland, was the first outside North America to receive UL's Zero Waste to Landfill certification • Zero Waste Program for suppliers in 2015 (mostly for assembly sites in China) - In 2017, 22 supplier facilities were certified as Zero Waste,including all iPhone final assembly sites • Pursuing a zero waste effort at over 500 retail stores and at our headquarters in Santa Clara Valley, which includes more than 200 buildings (To achieve a Zero Waste to Landfill validation against the UL 2799 standard, a factory must divert 100 percent of its waste from landfills, with a maximum of 10 percent sent to a waste-to-energy facility)	•In 2018 (unit in US lbs): -Landfilled: 36,553,900 -Recycled: 108,515,200 -Composted: 10,397,400 -Hazardous waste: 6,277,800 -Waste to energy 1,105,100 -Diversion rate 74% •Eliminate waste sent to landfill at manufacturing facilities as well as corporate offices, data centers, and retail stores •Apple Trade In: Trade in program for used devices. Customers receive credit toward a new device, or recycle it responsibly for free •First aim is to reduce the waste generated in areas from building renovations to food service •In fiscal year 2018, generated 74,000 metric tons of waste and diverted about 74 % from landfill through recycling and composting	•A zero-waste program for Apple facilities. Currently pursuing an ambitious goal of Zero Waste to Landfill at more than 450 corporate facilities, more than 500 retail stores, and five data centers

Company	Goals on Waste	Progress	Partnership References in Report (Waste Only)	Do they Perform Audits (if yes, with whom)?	Employee Engagement Initiatives (Waste and Non-Waste)	Important Links
HPE	• Annual target of 83% diversion rate for nonhazardous waste, but seeking to increase it to 87% as the company re-evaluates the overall waste strategy	• Surpassed goal by reaching a 90% diversion rate • Nonhazardous global waste by year: -2016: 42,900 metric tons and 84.2% landfill diversion rate -2017: 13,200 metric tons and 83% landfill diversion rate -2018: 13,208 metric tons and 90% landfill diversion rate	N/A	• Audits suppliers regarding social and environmental metrics • Limited assurance provided by Ernst & Young on select indicators (they do not include waste)	• Channels for employee engagement include Connect Now, HPE Inside, and Living Progress Champions • HPE Spirit Week allows HPE to connect with employees many topics, including Living Progress • Annual employee survey to gather feedback and monitor engagement	
Apple	•A zero-waste program for Apple facilities. Currently pursuing an ambitious goal of Zero Waste to Landfill at more than 450 corporate facilities, more than 500 retail stores, and five data centers	•Landfill diversion rate: -2012: 70% -2013: 73% -2014: 68% -2015: 63% -2016: 66% -2017: 71% -2018: 74% •Cutting down on plastic: In three years, reduced plastic use in U.S. product packaging by 48% •100% fiber retail bags in all retail stores •In fiscal year 2018 used an average of 58% recycled paper for packaging	•World Economic Forum's Platform for Accelerating Circular Economy •Ellen MacArthur Foundation •Chinese Association of Circular Economy	•Bureau Veritas (BV) provides "reasonable assurance" — one of the highest levels of verification in the industry •Fraunhofer IZM reviewed Apple's corporate packaging plastic footprint data	•Hardware Reuse Program for employees – collecting and refurbishing used devices	

Company	Progress	Partnership References in Report (Waste Only)	Do they Perform Audits (if yes, with whom)?	Employee Engagement Initiatives (Waste and Non-Waste)	Important Links
Dell	• Manufacturing facilities, which account for the largest source of waste, diverted 98% of their total nonhazardous waste from landfills. It is estimated that the global diversion rate in other Dell-operated buildings remains in the 50–60% range. In FY2017 and FY2018 the diversion rates were 99%. • Nonhazardous waste generated by year: -FY17: 13,239 MT -FY18: 12,602 MT -FY19: 13,802 MT • Of 13,802 MT generated in FY18: -12,410 MT was recycled/reused, -996 MT was waste to energy, -0 incincerated, -94 MT composted, -302 MT landfilled	• No apparent partnerships on waste- however, working with Lonely Whale to collect ocean plastic that can be used in Dell's packaging	• Audits for suppliers	• Goal to have 100% of Dell buildings have at least 1 active sustainability initiative; there are 4 options, one of them being employee engagement • Local team members and business leaders have developed certain sustainability initiatives, such as removing disposable coffee cups and improving recycling. One of the large sites in Bangalore set a goal to reduce single-use plastics in the office by 90% by 2020 and are progressing towards that goal	https://blog.dell.com/en-us/dell-pledges-eliminate-plastic-straws-world-oceans-day/
Huawei	• Building recycling-system (not directly related): By the end of 2018, we had more than 1,300 recycling stations in 48 countries and regions around the world	• Strategic partnerships: Huawei establishes strategic partnerships with core suppliers to ensure stable supply (increase efficiency, minimize waste)	• Management system internal/third-party - ISO 14001 certification Environmental protection, waste management and energy efficiency program - ISO 9001 certification Quality management system - ISO 26000 and SA 8000 • In 2018, Huawei carried out sustainability audits on 93 potential suppliers. 16 of them were denied certification as a Huawei supplier because they did not meet the company's high standards	•Form CSD sub-committees: ensure the effective execution of the sustainability strategy, make the CSD Committee work more efficiently, better manage sustainability risks, and continue to meet the requirements of stakeholders, like customers and governments • Meetings with employee representatives (routine) • Employee surveys, such as organizational climate surveys (annual) • Manager Feedback Program (MFP) (annual) • Non-monetary incentives for sustainability (annual)	https://www.huawei.com/ch-en/press-events/news/ch/2015/huawei-builds-greener-supply-chain

Company	Product Category	Reporting Year (2017, 2018, 2019)	Link to Report	Waste Metric Used (Absolute or Intensity)	Definition of Non-Hazardous Waste	Mention of Zero-Waste or Zero Landfill?	General Waste Info (Initiatives mainly concerned with non-hazardous waste, etc)	Goals on Waste
Cisco	*Servers*	FY2018 (July 2017-July, 2018)	Cisco 2018 CSR Report	Absolute: Metric Tons (MT) Intensity: N/A	N/A	• Recently developed a comprehensive green strategy for RTP site, with goals to achieve 100 percent renewable energy, water neutrality, and zero waste by FY20 EX: reduced consumption of paper cups by offering reusable cups for employee	•In 2018: - Total operational waste/trash: 10,559 MT - % real estate portfolio covered by waste reporting: 100% - Total operational waste recycled: 7,717 or 73% •Product return services for customers and employees •Donating surplus used office supplies to local schools •Cisco's Waste Reduction and Recycling Program uses the principles of reduce, reuse, and recycle for their operations •In FY18, recycled approximately 73% of the waste generated at our facilities. Per the GHG Protocol Corporate Value Chain (Scope 3) Standard, they report emissions generated from operational waste sent to landfill only (1,096 tCO2e) •Methodology is to extrapolate measured waste to 100% of their facilities in order to report total waste generated and recycled, rather than only reporting measured waste. This methodology is industry best practice and the recommended by auditors •HQ in San Jose diverted 86% of all waste streams from landfill in FY18, including a compost program that diverted approximately 890 metric tonne of waste from local landfills to be turned into compost •Boxborough campus diverted 100% of all waste from landfill in FY18 through a comprehensive composting, recycling, and waste-to-energy program •In FY18, 127 facilities, making up a quarter of their office square footage, were paper cup-free. A main area of focus for the upcoming year is single-use plastic items	•Zero waste by FY20 for Research Triangle Park site. They will explore adding campus composting, waste sorting, and single-use items replacements

Company	Progress	Partnership			Important Links
Cisco	•Percent operational waste recycled: -FY14: 79% -FY15: 76% -FY16: 75% -FY17: 68% -FY18: 73% •129 metric tonne of used electronics collected at Recycle IT Day 2018 •Successful elimination of paper cups from select Cisco buildings in India, Europe, and the U.S •In FY18, 127 facilities, making up a quarter of office square footage, were paper cup-free •Headquarters in San Jose diverted 86% •Boxborough campus diverted 100%	• Ellen MacArthur Foundation- Cisco identified them as an ideal partner to work on circular economy. Part of Circular Economy100 Program	• To date, Cisco has achieved ISO 14001 certification at 30 sites through independent, third-party auditors.Cisco's Waste Reduction and Recycling: key component of ISO 14001 certification	•Recycle IT Day: Around Earth Day in April every year, employees are encouraged to bring in their electronics for proper recycling •Earth Aware: Every April they host a monthlong employee volunteerism and awareness campaign encouraging employees to be environmentally responsible •SustainX: Cisco SustainX event, a thought leadership forum hosted on Cisco's campuses. Employees come together to learn about Cisco's sustainability practices and how they can contribute •Product teardown events: Teardown events increase awareness of the complexity and variety of materials used to make Cisco products and employees give ideas for reusability •Cisco Green: This is a hub on their internal social media site that enables employees to learn about Cisco's environmental sustainability activities and provides links to programs, information, and other tools • Cisco GreenHouse: In 2016, launched an interactive sustainability web platform for employees. Cisco GreenHouse connects passionate employees with like-minded peers all over the world •Our People Deal: Guiding Principles for employees •Team Space: communication platform for employees. Can also be used as a tool for expressing any concerns or improvements to leadership. Also includes an 8 question survey about working with leadership at Cisco •Real Deal: 16-question survey helps them uncover Cisco employees' perspective on strategy, culture, and leadership •Other: Monthly TV talk-show-style, all-hands meeting, The Cisco Beat. At the Beat, every employee hears company news and can voice questions	https://blogs.cisco.com/csr/cisco-announces-new-goal-to-reduce-its-use-of-virgin-plastic-by-20 https://www.cisco.com/c/en/us/about/approach-quality/iso-14001.html
	• In 2017, recovered and sent 87.8% of nonhazardous waste to be recycled		• Self-Assessments + Other Internal Processes		

Company	Product Category	Reporting Year (2017, 2018, 2019)	Link to Report	Waste Metric Used (Absolute or Intensity)	Definition of Non-Hazardous Waste	Mention of Zero-Waste or Zero Landfill?	General Waste Info (Initiatives mainly concerned with non-hazardous waste, etc)	Goals on Waste
IBM	*Servers*	FY2017	IBM 2017 Corporate Responsibility Report	Absolute: Metric Tons Intensity: N/A	• Nonhazardous waste includes paper, wood, metals, glass, plastics and other nonhazardous chemical substances • Materials recovered from nonhazardous waste and sent to be recycled included: paper and cardboard, metals, plastics, wood, construction debris, cafeteria waste and end-of-life IT equipment (https://www.ibm.com/ibm/environment/pollution/)	No	• IBM Pollution Prevention Program founded in 1971 • In 1988, established first voluntary environmental goal to recycle nonhazardous waste streams - Goals have since expanded to: 1. Traditional dry waste streams to include nonhazardous chemical waste and end-of-life IT equipment from company operations, as well as IBM-owned equipment that is returned by external clients at the end of a lease 2. Include nonhazardous waste generated by IBM at leased locations meeting designated criteria • Treatment methods that are credited toward the waste recycling target included: reuse, recycle, energy recovery, composting, reclamation and land farming • Treatment methods that result in a non-beneficial use and that are not credited toward recycling target included incineration, landfilling, and treatments such as aqueous treatment, biodegradation of organics, filtration, neutralization and stabilization • Source reduction and waste prevention initiatives implemented by IBM worldwide estimated to have prevented the generation of about 185 metric tons of nonhazardous waste in 2017, with estimated annual handling, treatment and disposal cost savings and revenue returns totaling $2.2 million	• Send an average of 75% (by weight, annually) of the nonhazardous waste generated at locations managed by IBM to be recycled
Samsung	*Phones*	FY2019	Sustainability Report 2019	Metric Tons - Goal to Reach 50 tons/KRW 100 million in intensity based use of water resources by 2020 -- water only! **Have begin using KPMG's "True Value" methodology, which provides a proven approach in the quantification of social and environmental indicators (ie. Places an interal value on waste; p.105)	• Classify waste according to the standards in each nation -Generated waste is then further classified as either 'General waste' or 'Designated waste' and disposed according to the prescribed methods such as reuse, incineration, and landfill -Generally separate waste into general and designated waste, and dispose of or recycle it in accordance with prescribed laws and best practices -For sites who fail to meet 95% recycling rate, develop separate management plans, in order to ensure that the waste is properly treated and to improve the recycling rate	No	• Waste Strategy mostly focused on Recycling with overarching goals to: -Operate national e-waste recycling program -Separate and reuse waste by waste material type -Establish Closed-Loop recycling system for waste resources • Perform Life Cycle Assessment (LCA) to identify the potential environmental impact of our products throughout their life cycle in order to detect their potential environmental footprints -ie. LCA for Galaxy A6 performed in 2018 • Waste Management Plan Steps (more for Hazardous Waste): 1. Product Development 2. Waste Discharge 3. Waste Transport 4. Waste Treatment	• By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse 1. Between 2009-2030, accumulate 7.5 million metric tons of collected e-waste 2. By 2030, expand the accumulated amount of recycled plastics use to 500,000 metric tons 3. Maintain > 95% recycling rate

Company	Progress	Partnership References in Report (Waste Only)	Do they Perform Audits (if yes, with whom)?	Employee Engagement Initiatives (Waste and Non-Waste)	Important Links
IBM	• In 2017, recovered and sent 87.8% of nonhazardous waste to be recycled -2013 – 86.0% -2014 – 85.9% -2015 – 85.2% -2016 – 86.3% -2017 – 87.8% • In 2017, worldwide operations generated approximately 36,900 metric tons of nonhazardous waste (decrease of about 7,600 metric tons from 2016) • In 2017, total generated nonhazardous waste worldwide by treatment method (% by weight of 36,900 metric tons processed) - 87.8% Recycle - 10.8% Landfill - 1.4% Other treatments	• Plastic Bank • IBM Cognition Foundry: - Mobilizing entrepreneurs from the world's poorest communities to recycle plastic waste in return for life-changing goods - To date, Plastic Bank has collected over 8 million pounds of plastic waste — the equivalent of 144 million plastic bottles — from its first recycling centers in Haiti - Accomplished by more than 1,850 full-time collectors working across 40 collection locations	• Self-Assessments • Other Internal Processes • Use of Electronic Industry Citizenship Coalition (EICC) Code • Validated Audit Process (VAP) for IBM Facilities and Suppliers • Audited suppliers create and submit a Corrective Action Plan (CAP) for all nonconformances discovered in an assessment • Waste Audits fall into "Wastewater and solid waste (Env)" category • IBM's 2018 audit plan includes full-scope audits aligned with the Responsible Business Alliance (RBA) Code of Conduct version 6 (effective Jan. 1, 2018) • Responsible Minerals Assurance Process (RMAP) audits --> To remove the cost barrier of RMAP audits, IBM donated to the Responsible Business Alliance (RBA) Foundation and Initial Audit Fund, which offers smelters or refiners (SORs) an incentive for participating in the RMAP by fully paying for the cost of their initial audit • "IBM did not employ an external agency or organization to audit the 2017 Corporate Responsibility Report"	• Topics discussed under "Employee Engagement" section: - Parental Leave -IBM Business Resource Groups (BRGs) are volunteer, cross-department, employee-led groups that focus on a common interest or a certain constituency -Leadership Development • Professional Growth • Brief mention of employee volunteering, but not solely for waste-related activities	https://www.ibm.com/downloads/cas/41Q1DYQ6
Samsung	1. From 2009 - 2018, collected 3.3 million metric tons of e-waste 2. In 2018, used around 40 thousand metric tons of PCM (Post Consumer Materials), which is recycled material from wastewater bottles and consumer plastics 3. General Waste Environmental Data (% of all waste recycled): -2016: 728, 905 metric tons (95%) -2017: 760, 463 metric tons (95%) -2018: 813, 831 metric tons (96%)	• Various Governments -ie. In Korea, collaborate with Korea Urban Mining Association to urge Korean smelters/refiners to seek Responsible Minerals Assurance Process (RMAP) certification • Eco-Partner Certifications • Member of Responsible Business Association (RBA) • Supporter of: -RMI (Responsible Mineral Initiative) -GeSI (Global e-Sustainability Initiative) - EPRM (European Partnership for Responsible Minerals • "uBreakiFix" to assist with repairs and recycling • Basel Action Network (BAN) • Electronics Recyclers International (ERI) • Use e-Stewards Standards • R&D Institutes • Universities (Korea, India, Moscow)	• Whole Report assured by "Samil PricewaterhouseCoopers" the Korean member firm of PwC • Audit Topics - combination of internal/third-party -Suppliers (most important) -Labor/Human Rights third party audits -EHS -Ethics -Management Systems • All audits conducted by independent Responsible Business Association (RBA) Auditors who have completed 'RBA Labor & Ethics Lead Auditor Training' and other global labor and human rights experts • For all operations: Tightened waste management standards to ensure that waste containing minerals are transferred only to Responsible Minerals Assurance Process (RMAP)-certified smelters/refiners while processing waste generated by manufacturing sites in Korea as well as collected e-waste	• Encourage the use of personal cups at work to reduce the use of disposable products • Enhanced the separate collection of waste at worksites in Korea • In employee restaurants and canteens, plastic containers are being replaced with paper to improve resource efficiency • In stores at worksites, paper cups and straws are used instead of plastics; stores also provide drinks in mugs and offer discounts when customers use their own tumblers • Internal E-Waste Recycling Campaign • EHA Staff Training (ie. in-house examiner courses, professional licensing courses, refresher and extension courses - Total 62,360 hours of training were offered, completed by 11,537 employees • In 2018, reduced office-generated disposable product usage by 80 tons in 3 months • Since 2018, have helped the community by reusing waste milk packs generated from their worksites. Waste milk packs are recycled into toilet paper, which they donate to the disadvantaged in local communities.	

Exhibit C: Global Fortune 100 (2019) Benchmarking

Rank	Company	Waste Intensity Metric
1	Walmart	Achieve zero waste to landfill from our own operations in key markets, including the U.S., U.K., Japan and Canada by 2025 in accordance with the Zero Waste International Alliance guidelines.
2	Sinopec Group	N/A
3	Royal Dutch Shell	N/A
4	China National Petroleum	N/A
5	State Grid	N/A
6	Saudi Aramco	N/A
7	BP	N/A
8	Exxon Mobil	N/A
9	Volkswagen	N/A
10	Toyota Motor	Achieve Zero Landfill Waste by Composting Bio-sludge with Worms (India), zero waste facilities throughout US and Japan
11	Apple	• Zero Waste Program for suppliers in 2015 (mostly for assembly sites in China) - In 2017, 22 supplier facilities were certified as Zero Waste ,including all iPhone final assembly sites • Pursuing a zero waste effort at over 500 retail stores and at our headquarters in Santa Clara Valley, which includes more than 200 buildings (To achieve a Zero Waste to Landfill validation against the UL 2799 standard, a factory must divert 100 percent of its waste from landfills, with a maximum of 10 percent sent to a waste-to-energy facility)"
12	Berkshire Hathaway	N/A
13	Amazon.com	N/A
14	UnitedHealth Group	N/A
15	Samsung Electronics	N/A
16	Glencore	N/A
17	Mckesson	N/A
18	Daimler	N/A
19	CVS Health	N/A
20	Total	N/A
21	China State Construction Engineering	N/A
22	Trafigura Group	N/A
23	Hon Hai Precision Industry	Adopted “zero waste” program in China, ensuring 100% waste conversion rate that limits waste incineration rate to 10%. As part of the program, are also working towards

		reducing waste at source and achieving a higher recycling rate of packaging material, reclaiming internal and external packaging materials, to improve the overall recycling rate of waste materials.
24	EXOR Group	N/A
25	AT&T	Working to help divert waste from landfills with a goal of achieving zero waste at 100 AT&T facilities – including our corporate headquarters – by the end of 2020
26	Industrial & Commercial Bank of China	N/A
27	AmerisourceBergen	N/A
28	Chevron	N/A
29	Ping An Insurance	N/A
30	Ford Motor	88 true zero waste to landfill sites. Will achieve true zero waste to landfill across our operations in next 20 years
31	China Construction Bank	N/A
32	General Motors	N/A
33	Mitsubishi	At production plants, convert industrial waste materials generated from production processes into reusable resources, reduce the volume of waste discharged, and maintain landfill waste disposal rate of zero* at every plant

Exhibit D: Data from Waste Audits – Morrisville

Items that we noticed in the waste receptacles before the shadowboxes were installed:

COMPOST	
Correct	**Incorrect**
coffee filters	cups
food	food wrappers
napkins	straws
plates	styrofoam
	utensils

RECYCLING	
Correct	**Incorrect**
cardboard	chip bag
food holders	cups (soft drinks)
milk bottle	ECO coffee cups
paper	napkins
paper towel tube	paper towel
plastic bottle	plastic bag
plates	food wrappers
soda can	Starbucks
water bottle	straws
	Styrofoam
	utensils
	yogurt

TRASH	
Correct	**Incorrect**
candy	aluminum can
Chick-fil-a	cans
chip bags	ECO coffee cups
K cups	food
plastic bags	napkins
sandwich wrapper	paper plate
soda cup	plastic bottles
Starbucks	plastic cups
straws	plastic food containers
Styrofoam	soup holder container
take out	water bottle
utensils	yogurt container
wipes	
Ziploc plastic bags	
When there is no compost:	
food	
napkins	

The following are items that we noticed in the waste receptacles after the shadowboxes were installed. During this follow-up waste audit, we mainly concentrated on what items were in the receptacles that were not supposed to be there.

COMPOST	
Correct	**Incorrect**
paper towel	plastic-wrapped apple
napkins	McDonald's cups
green coffee cups (ECO)	food wrappers

RECYCLING	
Correct	**Incorrect**
plastics	paper towel
bottles	utensils
	straws
	tea bags
	napkins
	white coffee cups
	sandwiches in plastic boxes
	to-go bags
	Styrofoam

TRASH	
Correct	**Incorrect**
food wrappers	napkins
	water bottle
	food
	aluminum cans
	plastic bottles
	paper
When there is no compost:	
napkins	
green coffee cups	

Exhibit E: Recruitment Email

Dear Morrisville and Whitsett,

Master of Environmental Management students from Duke University have collaborated with Lenovo's Global Environmental Affairs and Sustainability Department to help Lenovo improve its overall environmental performance. With Lenovo's support, the students have developed a survey to understand Lenovo employees' perceptions of sustainability, specifically proper waste management. This partnership and the data collection are essential to the students' Master's Project, which is one of the requirements for graduation. Therefore, some of the results of this survey may be included in the team's report for their Master's Project. Duke researchers will never have access to your emails or know the identities of any survey respondents.

This survey will take approximately 1-2 minutes to answer. Participation is completely voluntary, and submitted information will remain confidential. You may quit the survey at any time by closing your internet browser, and you may also refuse to answer any questions you do not wish to answer. By clicking the survey link below, you are acknowledging that you have read the above and agree to participate in the survey.

If you have any questions, please feel free to reach out to the students who developed this survey at Anna Chang or Sona Stenclova, Advisory Engineer. Additionally, if you have concerns about your rights as a participant, you may contact the Duke Institutional Review Board.

Take the survey

Thank you,

Lenovo Comms

Exhibit F: Employee Survey

Sustainability refers to the concept of using resources efficiently to simultaneously support the economy, the environment, and people.

How important, if at all, is sustainability to your day-to-day activities?

- ○ Not at all
- ○ Not that much
- ○ Somewhat important
- ○ Very important
- ○ Extremely important/Integral part

How strongly do you agree or disagree that there are enough options at Lenovo for you to dispose of trash, compostable, recycling, etc. properly?

- ○ Strongly disagree
- ○ Disagree
- ○ Somewhat disagree
- ○ Somewhat agree
- ○ Agree
- ○ Strongly agree

As you may know, at Lenovo, we have designated bins for either recycling, trash, or composting.

How often, if ever, would you say you dispose your trash/recycling/compost properly?

- ○ Not ever
- ○ Not that often
- ○ Somewhat often
- ○ Very often
- ○ Always

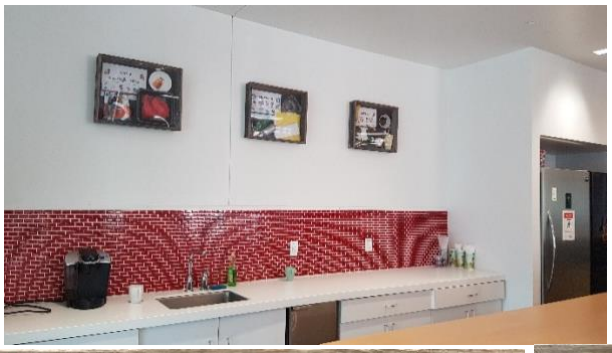
Are you interested in participating in company initiatives to improve overall waste management (i.e. Waste reduction competitions between departments, buildings, or floors)?

- ○ Not at all
- ○ Not that much
- ○ Somewhat interested
- ○ Very interested
- ○ Extremely interested

If you are interested in learning more about waste management, how would you like to receive this information?

- ○ Email
- ○ Bulletin Board/Community Board
- ○ Newsletter
- ○ Other: _____

Lenovo recently added these shadowboxes to help employees understand which bins are meant to hold each type of waste.



Have you noticed the shadowboxes and/or their print replica posters?

- ○ Yes
- ○ No

If you answered No, do you think the shadowboxes with the waste samples would be helpful for understanding which bin to place waste in?

- ○ Not at all helpful
- ○ Not that helpful
- ○ Somewhat helpful
- ○ Very helpful
- ○ Extremely helpful

If you answered Yes, do you think the shadowboxes with the waste samples are helpful for understanding which bin to place waste in?

- ○ Not at all helpful
- ○ Not that helpful
- ○ Somewhat helpful
- ○ Very helpful
- ○ Extremely helpful

Please select which building you work in.

- ○ Morrisville – Building #6
- ○ Morrisville – Building #7
- ○ Morrisville – Building #8
- ○ USFC
- ○ Other _____

Thank you for taking this survey. If there is anything else you would like to share about sustainability or Lenovo's waste management program, please use the space below to do so.

_____

Exhibit G: Categories for Survey Question Requesting Feedback

Category	Number	Feedback
Need Bigger and Better Bins with Clearer Labeling	46	“Lenovo provides options to dispose of waste properly, but only in limited locations. The areas around desks have too few waste disposal areas.” - Employee, Building 8
Waste in Cafeteria	26	"I am frustrated that there is so much non-recycleable waste generated in the cafeteria every day." - Employee, Building 8
Negative Shadow Box Feedback	15	“The new stickers are much more helpful than the shadowboxes where were not very close to the bins themselves." - Employee, Building 8
Inconsistent Compost Options	9	"I am frustrated that there is so much non-recycleable waste generated in the cafeteria every day." - Employee, Building 8
More Recycling Options	9	“I'm not sure if there is something already in place or not, but is there a recycling station for past life electronics in the building? ...[If] there was an option to recycle them I would be happy to do so!” - Employee, Building 8
Employees Do Not Care	8	“Any program is only as good as the people using it and I would guess we have 50% or less of the employees paying any attention to where their waste is going. Any receptacle is open for any trash to them.” - Employee, Building 7
Neutral Shadow Box Feedback	7	"I work remotely and do not know what shadow boxes are." - Remote Employee
Positive Shadow Box Feedback	6	“The posters are great! I know to recycle/compost more trash.” - Employee, Building 8
Other General Comments	6	“I appreciate Lenovo's decision to make this a priority and something they take seriously.” - Employee, Building 6
Other Sustainability Comments	5	"On a scale from 0 - 10 for sustainably minded as defined at the beginning of the survey, I'd say Lenovo overall gets an 8.5." - Other Employee
Need Better Information Sharing	5	“Lenovo should start tracking waste it generates - Total weight of waste and how the weight is distributed in three different types of waste disposals (trash, recycle, compost). A monthly or quarterly update on how the distribution is across the three disposals to show progress of people using the correct bins.” - Employee, Building 8
Waste in Bathroom	4	"Waste containers in the bathrooms are not labeled." - Employee, Building 7
Waste in Breakroom	3	"Most people seem to ignore different bins in breakroom, lots of to go containers everywhere." - Employee, Building 8
Housekeeping	3	"I often work late and see housekeeping just dump everything in trash." - Employee, Building 7
Total	**152**	

Exhibit H: Sample Quotes from Employee Survey

Comments on More Waste Receptacles

"Not enough bins on the floor. Would be good to have them by the elevators and stairwells as people can drop it on their way out."

"We need more trash cans - its a waste of time - pun intended - to have to walk 100 yards to get to one. As for participation, no, some infantile competition between floors would be just dumb - of course sustainability has business value - discuss it like adults."

"We used to have waste can's and recycle bins at our desk, but this is gone, so it is easier now to just through out everything is the same trash bin, also, the trash bins are full most of the time so again, just dump trash is whichever bin is available."

Inconsistent Waste Receptacles

"I'm just so tired of there not being compost bins in Blg 7 (2nd floor), and horrible sign-age. I'm constantly having to pull starbucks cups (straws and all) from the recycle bin. No one gives a damn. How hard is it for Lenovo to put up signs?"

Cafeteria and Breakrooms

"The bins and signage is very useful, however many people simply ignore them. Also the cafeteria/cafe's around the campus use way too much styrofoam and plastic take out containers. Perhaps a compostable container/utensils would be more beneficial (even charge customer a small premium for takeout to cover costs)."

"There is an incredible amount of waste generated in our cafeterias, despite efforts to be sustainable. Some examples: fruit is wrapped in plastic; food is automatically given to you in single use plastics instead of using plates/silverware. There should be much more awareness in the cafeteria, encouraging people to take a moment to sit and eat lunch, using the reusable plates and cutlery. Remove the unnecessary wrappers and stickers. Charge people who take plastic containers a nominal fee to draw awareness to usage. Reduce the accessibility of the plastic containers (often they are easier to spot at eye level, while plates are hidden under the counter)."

"Most waste I produce is from purchasing lunch or a snack from our sundry shops and cafeteria. My observation is that most waste is from these sources. To best manage what waste goes where and gets disposed of properly, I recommend we assert specific packaging they use for "carry out" and utensils which are compostable or at a min, clearly marked with how to dispose."

"I would like to see reuseable to-go containers for the cafeteria. Maybe a rewards program for those that use the reusable containers."

"I am frustrated that there is so much non-recycleable waste generated in the cafeteria every day. I believe that the cafeteria should ONLY use compostable containers and forks/spoons/knives for takeout. I think there should also be more encouragement for reuse instead of recycling. There is no reason that employees should not be able to use reusable cups for hot/cold drinks instead of paper."

"We need to get rid of single use plastic and styrofoam in the cafeteria. There are many sustainable options around this area."

"I see a large lapse in Lenovo and the food service company we hire. When we talk about our sustainability it needs to cover all aspects otherwise, we are hypocritical in our efforts. The food cafeteria uses Styrofoam to go containers and far more plastics than needed. I suggest we look to partner more closely with this group to find a better way to make greener choices at our cafe. Lastly, when employees get to go containers for their food and then sit in the cafe and eat from them that is also not the right message."

"Lenovo needs to invest in all recyclable containers for the cafeteria & kitchens. There is no reason so much waste should be created with non-recyclable materials for to go containers or plastic utensils/straws, etc. Get rid of the plastic.....do better."

"The posters are great! I know to recycle/compost more trash."

Shadow Boxes and Labels

"Shadow boxes are well designed, but the placement of posters on the counter was not thoughtful and is unattractive, which detracts from the message."

"The shadow boxes were poorly placed, too high on the wall. The stickers on the counters over the trash bins are easier to recognize."

"The new stickers are much more helpful than the shadowboxes where were not very close to the bins themselves. It would be good if we had bins in more visible areas so people could see the stickers. Also the bins in the common kitchen areas fill up and are often overflowing, so people just toss stuff in any bin that has space. They need to be emptied more frequently, especially around lunch."

"Please ensure the photos are in all buildings. I work in B7 but noticed them in B8. I try to dispose of my items properly, but I am not convinced that everyone does."

"Even with the new shadowboxes, I have had difficulty understanding what container to put stuff in - ex. where do clear plastic cups go?"

"Need posters or shadow boxes near waste recepticles in office space -- is a paper coffee cup from the cafeteria recyclable or compostable? No clue..."

"I have seen the poster images confuse people on which bin to use. There are more things that can be recycled and some people think only the items in the picture can go in."

Employees Still Do Not Care

"I love recycling and composting but I don't think many people know that we actually do it since the physical bins aren't labeled that well/trash is not taken out enough leaving people little to no choice but to contaminate the recycling and composting. It would be beneficial to have a flyer above that states that we are actually composting."

"The shadowboxes are clear but people still place trash in the recycling bins or do not use the proper bins at all."

"It is discouraging to see people constantly throw obvious recycleable things like bottles and cans in trash. Not sure what can be done about it."

"People are most likely aware of what goes into each bin (trash, compost, recyclables) but when the trash is full and there's no where else to put it, I often see the recyclables full with trash. I believe it's just a lack of concern, or apathy."

"Despite the shadow boxes and posters all over the place, people still seem oblivious to what bun they throw trash, recycling, and compost in. I think there needs to be communications from the senior leadership team bringing this to folks attention, and possibly mandatory formal training."

Other Comments

"I'd like to see static displays of our campus' waste amounts. Maybe a sculpture of all the disposable coffee cups used in a week, quarter, year, and a sculpture that represents all the re-usable coffee mugs, thermoses, etc used in the same timeframes?"

“I appreciate that Lenovo is taking this program seriously and am happy to help in any way.”

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