



Are There Benefits to Integrating Corporate Health and Environmental Strategies? An Exploration of the Food/Agriculture and Textile Sectors

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Review

Terry Huang, City University of New York
Dan Vermeer, Duke University

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SUMMARY

Businesses impact environmental determinants of health and can play an important role in creating integrated approaches for promoting a healthy environment. This report describes the ways in which the food/agriculture and textile sectors affect environmental conditions that are associated with health risks and assesses how companies are tracking and addressing these interconnected issues. We define environmental and health strategy integration as having corporate goals, policies, metrics, initiatives, and products that strive to improve human health through reducing associated environmental impacts. We used company communication through sustainability reports as a proxy of whether or not companies are implementing environmental and health strategy integration. We followed up with company and industry group interviews to determine the advantages and disadvantages of health and environmental strategy integration. We found that 58% of companies recognized the connection between their environmental impacts and their associated health outcomes. Furthermore, we found that 46% of companies have products, operations, or programs that explicitly connect health and environmental issues within their strategy. This shows that some companies have integrated or are taking steps toward integrating their health and environmental strategies. Our company interviews indicated that integrating health and environment strategies can lead to internal efficiencies, clearer understanding of corporate social responsibility¹ (CSR) purpose by stakeholders, and reduced cost of project implementations. On the other hand, companies pointed out potential challenges of integrating health and environmental strategies, including greater complexity and confusion, and higher costs of larger programs. Our report reveals that integrated health and environmental action is not standard practice within companies but is recognized and acted upon by many companies. Our research found that there are potential advantages to integrating health and environmental action, suggesting that companies may benefit from moving environment and health integration toward standard practice. Further research is necessary to develop the business case for company integration of health and environmental strategies. We hope that this report will engender greater discussion of this topic within the business and sustainability communities.

¹ Carrol (1979) defines Corporate Social Responsibility (CSR) as: “The social responsibility of businesses encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time.” Corporate Social Responsibility includes environmental and health considerations within the economic, legal, ethical, and discretionary societal demands. Carrol, A.B. 1979. “A Three-Dimensional Concept Model of Corporate Performance.” *Academy of Management Review* 4(4): 497–505.

INTRODUCTION

Health and the Environment

In order to live healthy lives, we need to have a healthy environment. Therefore, in order to tackle many of the most pressing health concerns of our time we must address the environmental conditions that beget them. Prüs-Üstün and Corvalán (2006) determined that 24% of global disease burden and 23% of all deaths are attributed to environmental conditions. For example, water pollution caused 1.8 million deaths in 2005 and urban air pollution causes 1.2 million mortalities per year.² Furthermore, recent studies of the effects of climate change on health add a new layer to the environment and health nexus, showing that greater carbon dioxide emissions can have detrimental impacts on human health. The 2015 Lancet Commission on Climate and Health states that “tackling climate change could be the greatest health opportunity of the 21st century.”³

This inherent link between health and the environment shows that efforts to improve human health and efforts to reduce environmental degradation cannot be effectively pursued in isolation. They must be approached holistically. Guidance for such a holistic approach has been outlined by the United Nations Sustainable Development Goals (SDGs). The goals compel the need for interdisciplinary problem solving by outlining the direct connection between issues such as poverty, governance, the environment, and health. In our case, the SDGs outline the dependence of human health on the environment in target 3.9:

By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

The efficacy of the holistic approach outlined by SDG target 3.9 necessitates a wide group of stakeholders. Many groups have formed to address the overlap between health and the environment, including WHO entities such as The Health and Environment Linkages Initiative,⁴ research organizations such as *The Lancet*,⁵ and cross-NGO and academic collaborations such as the Planetary Health Alliance⁶ and the Bridge Collaborative.⁷ However, the work of these groups may be insufficient without greater collaboration with the private sector.

Companies are essential to improving environmental determinants of health, because they have a disproportionate impact on the environment. This is exemplified by 224 companies contributing 72% of global greenhouse gas emissions.⁸ Therefore, corporations have the opportunity to create linked health and environmental solutions at many junctures in their value chains as shown by Figure 1 below. In house, companies can improve the environment in which their employees work in order to reduce health risks. In the greater community in which they work, companies can reduce the release of water pollutants and air pollutants to protect vulnerable populations. Companies can also promote stronger environmental protection through their sourcing practices. Lastly, companies can protect their customers by providing products that are safe for the end user and whose waste will not endanger the environment.

² GDB 2015 Risk Factors Collaborators. 2015. “Global, Regional, and National Comparative Risk Assessment of 79 Behavioral, Environmental, and Occupational, and Metabolic Risks of Clusters of Risks (1990–2015): A Systematic Analysis for the Global Burden of Disease Study 2015.” *Lancet* 388: 1659–1724; WHO. 2010. “Urbanization and Health.” *Bulletin of the World Health Organization* 88: 241–320.

³ Watts, N., W.N. Adger, P. Agnolucci, J. Blackstock, P. Byass, W. Cai, S. Chaytor, et al. 2015. Health and Climate Change: Policy Responses to Protect Climate Change. *Lancet* 386: 1861–1914.

⁴ The Health and Environment Linkages Initiative. Who.org. Accessed on November 24th, 2018. Retrieved from: <https://www.who.int/heli/en/>.

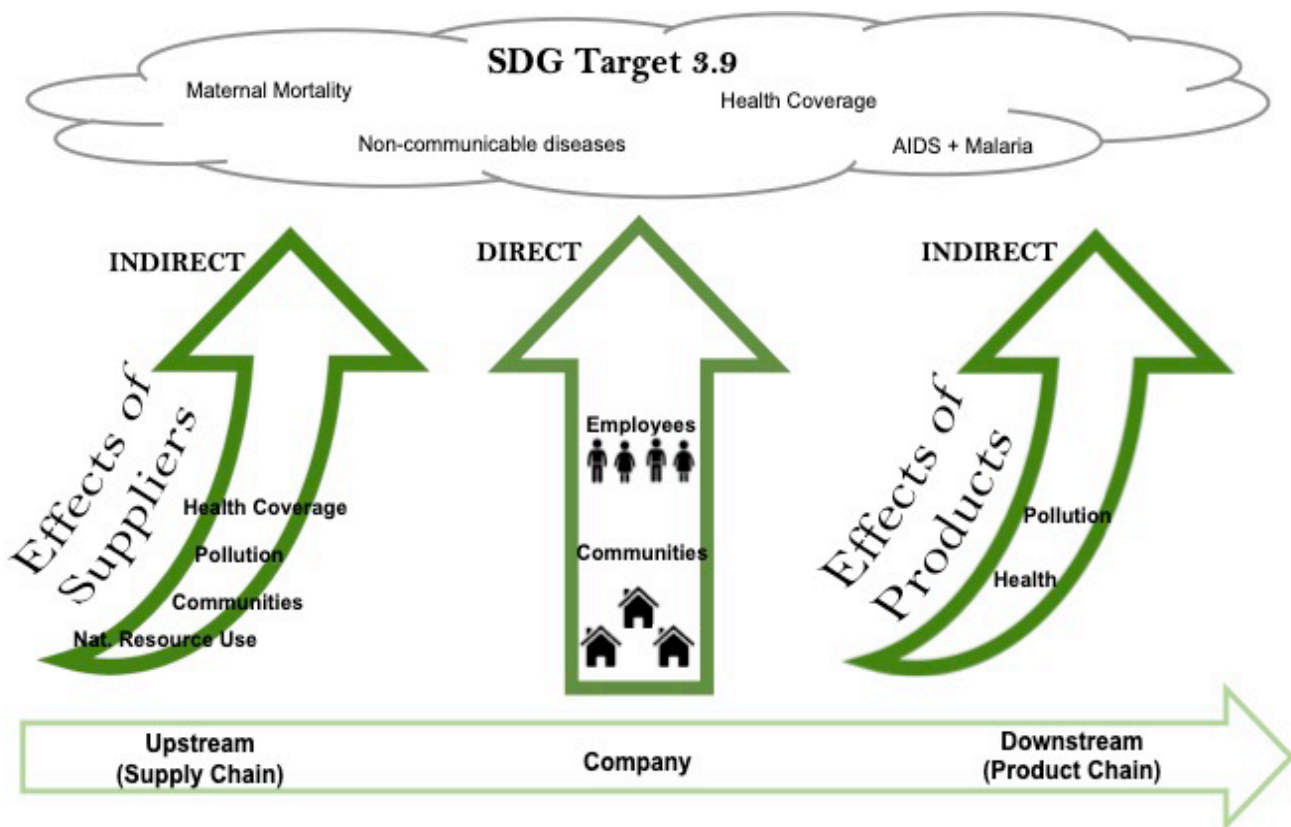
⁵ *The Lancet*. thelancet.com. Accessed on November 24, 2018. Retrieved from: <https://www.thelancet.com/>.

⁶ Planetary Health Alliance. Planetaryhealthalliance.org. Accessed on November 24, 2018. Retrieved from: <https://planetaryhealthalliance.org/>.

⁷ The Bridge Collaborative. Bridgecollaborativeglobal.org. Accessed on November 24, 2018. Retrieved from: <http://bridgecollaborativeglobal.org/>.

⁸ Griffin, P. 2017. The Carbon Majors Database: CDP Carbon Majors Report 2017. The Carbon Disclosure Project. Accessed on March 9, 2019. Retrieved from: <https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/002/327/original/Carbon-Majors-Report-2017.pdf>.

Figure 1: Linked health and environmental impacts across company supply chains.



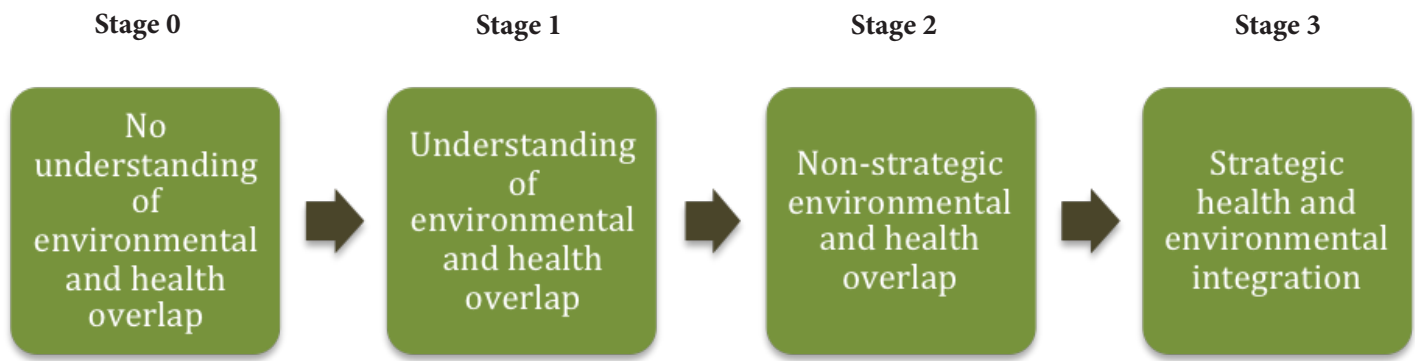
The diagram represents the direct impacts companies have on the health of their employees and communities. Companies also have indirect effects on health through environmental degradation upstream and downstream in their supply chain through natural resource use and pollution.

Environmental and Health Strategic Integration Framework

The effectiveness of company actions addressing health risks associated with environmental conditions is dependent on companies integrating health and environmental strategies. In this paper we define environmental and health strategy integration as having corporate goals, policies, metrics, initiatives, and products that strive to improve human health through reducing associated environmental impacts. For example, a company may have a health strategy that focuses on employee health in their factories and an environmental strategy for reducing water effluent emissions, but without integrating these strategies, the company may not identify and remediate the health risks associated with employees drinking contaminated water at home. Therefore, companies may be able to harness cobenefits by working on environmental and health issues in an integrated way.

The Environmental and Health Strategic Integration Framework presented in Figure 2 below demonstrates that there are four distinct stages of health and environmental integration. First (Stage 0), a company can have no understanding of environmental and health overlaps. Second (Stage 1), a company can understand and communicate the overlaps without acting on them. Third (Stage 2), a company can act upon the overlapping health and environmental issues without a strategic framework for doing so. And fourth (Stage 3), a company can strategically integrate health and environmental actions across their supply chains. This can be accomplished when companies have strategic plans that target health and environmental cobenefits and C-suite leadership promoting planetary health. A company reaches our definition of environmental and health strategy integration upon arriving at Stage 3.

Figure 2: Stages of environmental and health strategy integration



Objectives and Approach

The objectives of our study are twofold. Our first objective is to explore what stages companies have reached along the Environmental and Health Strategic Integration Framework described in Figure 2. Our second objective is to identify the advantages and disadvantages of integrating health and environmental strategies.

We begin by outlining the most important links between environmental degradation and human health directly affected by companies in the food and agriculture and textile sectors. We then use research on company CSR reports to identify what stages companies have reached in the Environmental and Health Strategic Integration Framework and which issues are being bridged between environmental conditions and health outcomes. Lastly, we use company and stakeholder interviews to identify the advantages and disadvantages of moving towards Stage 3 of the framework and complete integration.

Sectors Chosen

Although a variety of business sectors such as mining, energy, and pharmaceuticals create significant environmental and health impacts, we chose the food and agriculture sector as well as the textile sector for this study, because these sectors most clearly demonstrate environmentally related health risks at all stages of the value chain. With the objective of presenting examples of environmental and health risks at the upstream, company, and downstream levels shown in Figure 1, these sectors provide the most comprehensive outlook. For example, the food and agriculture sector affects air quality and respiratory impacts at the sourcing level, water quality impacts at the company level, and the waste-nutrition interplay at the consumer level. In addition, the food/agriculture and textile sectors most prominently demonstrate the breadth of connections between environmental issues and health outcomes. The purpose of using these two sectors is to draw useful insight that can be used across other sectors.

FOOD AND AGRICULTURE

Sector Overview

Food and Agriculture is one of the biggest economic sectors in the world, employing 29% of all workers in 2017.⁹ Humans are highly dependent on agricultural production, an industry that produced approximately \$3 trillion (2010) value added in 2016.¹⁰ The food industry is a complex chain of inputs, production stages, products, and waste. In its most basic nature, the food sector has six subcomponents: agricultural input production, farming, food manufacturing, food retail, consumption, and disposal. The production and processing stages vary widely across food types, and the final food products vary even further. The food system ranges across the world from highly technological in developed countries to rudimentary in developing countries. Food and agriculture deplete natural resources such as soil and water, which can have indirect effects on health outcomes (e.g., water sanitation and childhood stunting). They can also have direct impact on

⁹ World Bank Development Indicators. Employment in Agriculture (% of total employment) (modeled ISO estimate). Retrieved from: <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS>.

¹⁰ World Bank Development Indicators. Agriculture, value added (constant 2010 US\$). Retrieved from: <https://data.worldbank.org/indicator/NV.AGR.TOTL.KD>.

consumer health through contaminants, antibiotic resistance, and food safety. Table 1 below shows the direct connections between environmental impacts and associated health outcomes of the food and agriculture sector.

Table 1: Environment and health issues in the food and agriculture sector

| Environmental Issue | Contributing Practices | Health Outcomes | People Affected |
|------------------------------|-----------------------------|---------------------------|-----------------|
| Water Pollution | Fertilizer application | Childhood diarrhea | Communities |
| High nutrient loads | Animal Waste | Neurological issues | |
| Suspended solids | Food processing plant waste | Respiratory issues | |
| Bacteria | | Blue baby syndrome | |
| Nitrates | | | |
| Chemical Pollution | Fertilizer application | Respiratory issues | Workers |
| Volatile organic compounds | Pesticide application | Kidney and liver damage | Communities |
| Particulate matter | Manure pools | Nausea | |
| | | Dizziness | |
| Air Pollution | Chemical application | Respiratory issues | Workers |
| GHGs | Manure | Kidney and liver damage | Communities |
| Volatile organic compounds | Vehicle/machinery | Lung disease | |
| Particulate matter | Land use | Dizziness | |
| Nitrogen Oxides | | | |
| Antibiotic Resistance | Antibiotic use in livestock | Inefficacy of antibiotics | Workers |
| | | | Communities |
| | | | Consumers |

Environmental Impacts on Health in the Food and Agriculture Sector

The agricultural sector impacts many environmental determinants of health including water quality, air quality, and chemical exposure. This sector also faces the environmental and health interplay of food waste and undernutrition. Lastly, the agricultural sector is one of the largest emitters of greenhouse gas emissions (GHG), producing 9% of all GHGs in 2015.¹¹ The following section explains the health outcomes of environmental degradation occurring in the food and agricultural sector.

Water Pollution

Agriculture significantly contributes to water pollution around the world. Water that is transported across agricultural fields gathers excess field inputs such as fertilizer, pesticide, herbicide, manure, and mineral additives. These agricultural inputs can contaminate lakes and streams with nitrogen, phosphorous, and other pollutants. Excessive nutrient loading of nitrogen and phosphorous can lead to algal blooms that can kill fish and sometimes release toxins (toxic algal blooms)

¹¹ U.S. Environmental Protection Agency. Greenhouse Gas Emissions: Sources of Greenhouse Gas Emissions. Retrieved from: <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>.

BOX 1: CLIMATE CHANGE AND HEALTH

Climate change is projected to have numerous impacts on human health. It has been shown that warmer temperatures lead to increased levels of mortality linked to cardiovascular diseases and respiratory illness. Populations including children, the elderly, people with pre-existing heart conditions, and people with low economic means are most vulnerable to temperature-related mortality.^a Furthermore, climate change affects environmental pathogens. Changes in the climate can change the life cycle of pathogens and the range of disease vectors.^b These changes can have widespread effects on the prevalence of certain diseases and the people affected by those diseases. Climate change also increases malnutrition due to lower food production in some areas of the world. Foodborne, waterborne, and vector-transmitted diseases are also likely to increase due to changes in the climate. The Intergovernmental Panel on Climate Change (IPCC) delineates three types of health impacts caused by climate change. The first are direct impacts due to weather events such as floods, fires, and droughts. Second, there are effects that interact with natural systems such as vector-transmitted diseases and air pollution. Lastly, there are effects that occur through human systems such as undernutrition, occupational hazards, and more.^c

^a Song, X., S. Wong, Y. Hu, M. Yue, T. Zhang, Y. Liu, J. Tian, and K. Shang. 2017. "Impact of Ambient Temperature on Morbidity and Mortality: An Overview of Reviews." *Science of the Total Environment*. 586: 241–254.

^b Wu, X., Y. Lu, S. Zhou, L. Chen, and B. Xu. 2016. "Impact of Climate Change on Human Infectious Diseases: Empirical Evidence and Human Adaptation." *Environmental International*. 86(14): 23.

^c IPCC. (2004). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.

that contaminate shellfish and can cause neurologic or other human health impacts.¹² The field runoff of fertilizers in high enough concentrations can also cause methemoglobinemia in newborns.¹³ Water discharge from food processing plants can contain suspended solids, excessive nutrient loads, and pathogens.¹⁴ In developing countries where proper water sanitation practices are not present, agricultural inputs and bacteria associated with animal waste are found in drinking water. These contaminants can lead to childhood diarrhea, one of the greatest causes of childhood death in the developing world.¹⁵ In some agricultural areas high levels of nitrates can be found in drinking water that make children ill, leading to shortness of breath and cause blue baby syndrome.¹⁶

Exposure to Agrichemicals

Agricultural jobs can be dangerous. Conventional agriculture uses many chemical inputs that are harmful to the environment and to the workers applying them. Agricultural inputs such as nitrogen fertilizer, pesticides, and herbicides evaporate into the air at very high rates, posing danger to the environment and to farm workers. Farm workers are exposed to many dangerous sources of volatile organic compounds (VOCs) such as pesticides and manure. VOCs can cause dizziness, headaches, nausea, and damage to the liver and the kidney. There are also links between VOC exposure and cancer in animals.¹⁷ VOCs also play an important role in the formation of ozone, a dangerous air pollutant. Furthermore, fertilizer releases particulate matter through wind or machinery disturbance.¹⁸ Particulate matter has been attributed to increased likelihood of respiratory infections, asthma, and bronchitis.¹⁹

¹² Watkins, S. M., A. Reich, L.E. Fleming, and R. Hammond. (2008). Neurotoxic Shellfish Poisoning. *Marine Drugs* 6: 431–455.

¹³ Fewtrell, L. 2004. Drinking-Water Nitrate, Methemoglobinemia, and Global Burden of Disease: A Discussion. *Environmental Health Perspectives* 112(14): 1371.

¹⁴ United Nations Industrial Development Organization. "Pollution from Food Processing Factories and Environmental Protection." Retrieved from: http://www.unido.org/fileadmin/import/32129_25PollutionfromFoodProcessing.7.pdf.

¹⁵ World Health Organization. "Causes of Child Mortality." Who.int. Accessed on March 7, 2018. Retrieved from: http://www.who.int/gho/child_health/mortality/causes/en/.

¹⁶ World Health Organization. "Water Related Diseases." Who.int. Accessed on April 21, 2018. Retrieved from: http://www.who.int/water_sanitation_health/diseases-risks/diseases/methaemoglob/en/.

¹⁷ EPA. "Volatile Organic Compounds' Impact on Indoor Air Quality." Retrieved from: <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality>.

¹⁸ Verner, M-A., D. Sonneborn, K. Lancz, G. Muckle, P. Ayotte, E. Dewailly, A. Kocan, et al. 2013. "Toxicokinetic Modeling of Persistent Organic Pollutant Levels in Blood from Birth to 45 Months of Age in Longitudinal Birth Cohort Studies." *Environmental Health Perspectives* 121(1): 131

¹⁹ Kermani, M. et al. 2016. "Health Risks Attributed to Particulate Matter of 2.5 Microns or Less in Tehran Air 2005–2015." *Journal of Kermanshah*

Air Pollution

In addition to contributing significantly to the release of greenhouse gases, which have a number of related health impacts explained above, the food and agriculture sector emits nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter through production processes as well as agrichemical use as mentioned above. Farm vehicles are significant contributors of NOx, a group of air pollutants that can increase the likelihood of bronchitis and emphysema, and can exacerbate conditions for people with heart disease.²⁰ Lastly, agricultural practices release particulate matter that can be dangerous to surrounding communities. Some practices that release particulate matter include animal waste, animal feed, fungal spores in animal feeding operations, land preparation, crop harvest, fertilizer and chemical application, and grain handling.²¹ Particulate matter poses health risks by increasing the likelihood of lung diseases for individuals living near farms. Some of the health risks increased by exposure to particulate matter include respiratory infections, asthma, and bronchitis.²²

Antibiotic Resistance

Antibiotic resistance is one of the greatest threats to human health in the near future. Antibiotics are medicines that are used to fight bacterial infections. These antibiotics can become ineffective if bacteria mutate in ways that make them resistant to the antibiotics. Antibiotic resistance is growing very quickly, and many infections are becoming harder to combat due to the inefficacy of antibiotics.²³ The food and agriculture sector plays an important role in the formation of antibiotic-resistant bacteria due to the use of antibiotics in livestock operations. A number of different antibiotics are used to boost growth and prevent disease in feedlot animals.²⁴ The large amounts of antibiotics used in feedlots create a medium for antibiotic-resistant bacteria strains to develop. The variety of antibiotics leads to bacterial strains resistant to multiple antibiotics, which means that basic infections that have been easily treated since the invention of penicillin can now be difficult or impossible to treat. These resistant bacteria strains can be transferred to humans through contact with the livestock, ingestion of infected livestock, or ingestion of water contaminated with antibiotic-resistant genes.²⁵

Food Loss and Waste

Food that is lost or wasted in the food supply chain causes unnecessary stress on natural resources and lost opportunities to feed the undernourished. In 2011, the FAO estimated that one third, or 1.3 billion tons, of food did not attain consumption every year.²⁶ In the United States, the food lost or wasted is associated with 21% of water use, 19% of fertilizer use, 18% of cropland, and 21% or 52.4 million tons of landfill waste.²⁷ These inefficiently used natural resources and agricultural inputs contribute to the health outcomes described in this section without any economic value associated with the use of the final product. Most importantly, however, is that the food loss and waste in the supply chain contributes to global hunger. The FAO estimated that one in every nine people, or 821 million people globally, faced hunger in 2017.²⁸ The scale of food waste is large enough to have consequential effects on hunger, with affluent countries wasting as much food as the net food

University of Medical Sciences 20(3): 99–105.

²⁰ IPCC. 1996. Revised 1996 Guidelines for National Greenhouse Gas Inventories: Reference Manual. Chapter 4.3. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0269749198800328?_rdoc=1&_fmt=high&_origin=gateway&docanchor=&md5=b8429449ccfc9c30159a5f9aeea92ffb; Boningari, T., and P.G. Smirniotis. 2016. Impact of nitrogen oxides on the environment and human health: Mn-based materials for NOx abatement. *Current Opinion of Chemical Engineering* 13: 133–144.

²¹ Pattey, E., and G. Qiu. 2012. "Trends in Primary Particulate Matter Emissions from Canadian Agriculture." *Journal of Air and Waste Management Association* 62(7) 727–747. Retrieved from: <http://www.tandfonline.com/doi/full/10.1080/10962247.2012.672058?scroll=top&needAccess=true>

²² Kermani, "Health Risks...", 99–105.

²³ World Health Organization. 2017. "Antibiotic Resistance." Who.org. Retrieved from: <http://www.who.int/mediacentre/factsheets/antibiotic-resistance/en/>.

²⁴ Alliance for Prudent Use of Antibiotics. "Science of Resistance: Antibiotics in Agriculture." Emerald-tufts.edu. Retrieved from: http://emerald.tufts.edu/med/apua/about_issue/antibiotic_agri.shtml.

²⁵ Chang, Q., W. Wang, G. Regev-Yochay, M. Lipsitch, and W.P. Hanage. 2014. "Antibiotics in Agriculture and the Risk of Human Health: How Worried Should We Be?" *Evolutionary Applications* 240–247.

²⁶ FAO. 2011. Global Food Loss and Waste—Extent, Causes and Prevention. Rome: FAO. Accessed on March 10th, 2019. Retrieved from: <http://www.fao.org/3/a-i2697e.pdf>.

²⁷ ReFED. 2018. "2018 U.S. Food Waste Investment Report—Trends in private, public and philanthropic capital." Refed.com. Accessed on March 10, 2019. Retrieved from: <https://www.refed.com/downloads/ReFED-2018-US-Food-Waste-Investment-Report.pdf>.

²⁸ FAO, IFAD, UNICEF, WFP, and WHO. 2018. The State of Food Security and Nutrition in the World 2018. Building Climate Resilience for Food Security and Nutrition. Rome: FAO.

production of Sub-Saharan Africa.²⁹ These trends demonstrate the inextricable link between food waste, environmental degradation, and health.

TEXTILES

Sector Overview

The textile industry is a large global industry that employs over 60 million people across the globe.³⁰ The sector reached \$667.5 billion in global textile mill value and \$842.6 billion in apparel market value in 2015.³¹ Although it is a global industry, textile production is highly concentrated in developing countries such as India, Cambodia, Bangladesh, and Sri Lanka. In some of these countries, the textile industry makes up over 50% of the manufacturing value added to the economy.³² The industry faces human rights issues such as child labor and worker safety. The textile industry's supply chain spans many sectors, including chemicals manufacturing, agriculture, and fashion. The supply chain includes agriculture and petroleum extraction, the production of fiber from natural or synthetic inputs, the creation of yarn and other materials, fabric manufacturing, and dyeing, printing, and finishing. The production outputs of the sector vary widely from fiber to household products and clothing.

Table 2: Environment and health issues in the textile sector

| Environmental Issue | Contributing Practices | Health Outcomes | People Affected |
|----------------------------|------------------------|---------------------------|-----------------|
| Water Pollution | Washing and rinsing | Skin irritation | Workers |
| Heavy metals | Wastewater | Reproductive issues | Communities |
| Quinolones | Dyeing | Development issues | |
| Dioxins | Bleaching | DNA damage | |
| | | Neurological damage | |
| Chemical Pollution | Dyeing | Nasal, lung, brain cancer | Workers |
| Hazardous chemicals | Washing | Respiratory issues | Communities |
| Particulate matter | Fiber handling | Q fever | Consumers |
| Bioagents | | | |
| Air Pollution | Fabric coating | Nervous system issues | Workers |
| GHGs | Holding tanks/drums | Birth defects | Communities |
| Volatile organic compounds | Generators | Respiratory issues | |
| Nitrogen Oxides | Boilers | Kidney and lung damage | |
| Sulfur dioxide | Dyeing | | |

²⁹ FAO. 2011. Global Food Loss and Waste—Extent, Causes and Prevention. Rome. Accessed on March 10, 2019. Retrieved from: <http://www.fao.org/3/a-i2697e.pdf>.

³⁰ International Labor Association. "Textiles, Clothing, Leather and Footwear Sector." Accessed on December 12, 2018. Retrieved from: <https://www.ilo.org/global/industries-and-sectors/textiles-clothing-leather-footwear/lang--ja/index.htm>.

³¹ Lu, S. 2017. "Market Size of the Global Textile and Apparel Industry: 2015–2020" (Data source: Marketline). Accessed on December 12th, 2018. Retrieved from: <https://shenglufashion.com/2017/06/06/market-size-of-the-global-textile-and-apparel-industry-2015-to-2020/>.

³² World Bank Development Indicators. "Textiles and Clothing (% of Value Added in Manufacturing)." Accessed on March 23, 2017. Retrieved from: <https://data.worldbank.org/indicator/NV.MNF.TXTL.ZS.UN?locations=AF-AL-KH>.

Environmental Impacts on Health in the Textile Sector

Textile production is concentrated in developing countries with low environmental and employee safety standards. The textile industry contributes to high levels of water pollution and air pollution that create health and environmental harms in these countries. These environmental issues are pervasive across the supply chain, from pesticide use in cotton farming to dangerous air pollutants used in fabric coating. The following section explains the health outcomes of environmental degradation occurring in the textile sector.

Water Pollution

The textile production process is very water intensive. Most of the water used in textiles is released as wastewater, often containing many chemical inputs including dissolved solids, quinolines, and metals such as chromium and arsenic.³³ These effluents harm ecosystems by absorbing dissolved oxygen and by blocking sun exposure, which kills plants and animals in the water.³⁴ The contents of textile effluent can also cause health risks for humans through exposure to chemicals and heavy metals. For example, effluent containing quinolines can cause skin irritation issues in communities that use water polluted by the effluent.³⁵ Dioxins are another group of persistent environmental pollutants used in bleaching that can cause reproductive and development problems in humans.³⁶ Finally, the process of dyeing fabrics is one of the greatest contributors to water polluting in textile production. The dyeing process releases heavy metals including lead, mercury, cadmium, nickel, cobalt, and copper. These heavy metals can cause DNA damages, neurological disorders in newborns and liver problems in adults.³⁷

Chemical Pollution

Chemicals used in the process of producing fibers, dyeing products and finishing garments can raise health risks for textile workers as well as consumers. These chemicals include dyes, solvents, washing agents, and synthetic fibers. One of the most dangerous chemicals in the textile industry is formaldehyde, a chemical used in crease-resistant clothing. Textile workers can be exposed to formaldehyde, a chemical associated with lung and nasal cancer, as well as brain cancer and leukemia.³⁸ Lastly, certain processes in the textile sector can put workers at risk of exposure to dangerous biological agents such as anthrax, clostridium tetani, and coxiella burnetti. These agents can lead to sickness such as tetanus and Q fever.

Chemical exposure also poses risks for consumers. Many textile products including clothing and couch fabrics contain added chemicals such as flame-retardants that can cause thyroid issues that are detrimental to pregnancy.³⁹ Some studies have shown a relationship between flame retardant blood levels in pregnant mothers and baby birth weight.⁴⁰ Other chemicals such as phthalates found in upholstery have been correlated with semen quality, reproductive hormone, and birth measurement issues.⁴¹

³³ Vineta, S., Z. Silvana, R. Sanja, and S. Golomeova. 2014. Methods for Waste Water Treatment in Textile Industry. *Unitech 2014* 3: 248–252.

³⁴ Al-Rufaie, M. 2016. "Measuring the Extent of the Environmental Pollution in the Waters Of The Al-Diwani River by Certain Trace Elements Resulting from Al-Diwani Textile Factory Using Spectroscopic Methods." *Transylvanian Review of Systematical and Ecological Research* 18(1): 69–84.

³⁵ Luongo, G., G. Thorsén, and C. Östman. 2014. Quinolines in Clothing Textiles—a Source of Human eExposure and Wastewater Pollution. *Analytical and Bionalytical Chemistry* 406: 2747–2756.

³⁶ World Health Organization. 2016. Dioxins and Their Effects on Human Health Fact Sheet. Retrieved from: <http://www.who.int/mediacentre/factsheets/fs225/en/>; Dadi, D., T. Stellmacher, and F. Senbeta. (2017). Environmental and Health Impacts of Effluent from Textile Industries in Ethiopia: The Case of Galen and Dukem, Oromia Regional State. *Environmental Monitoring and Assessment* 189: 11.

³⁷ Akhtar, M.F., M. Ashraf, A. Javeed, A.A. Anjum, A. Sharif, M. Saleem, G. Mustafa, M. Ashraf, A., A. Saleem, and B. Akhtar. 2018. "Association of Textile Industry Effluent with Mutagenicity And Its Toxic Health Implications upon Acute and Sub-Chronic Exposure." *Environmental Monitoring and Assessment* 190: 179; Jaishankar, M., T. Tseten, N. Anbalagan, B.B. Mathew, and K.N. Beeregowda. 2014. "Toxicity, Mechanism and Health Effects of Some Heavy Metals." *Interdisciplinary Toxicology* 7(2): 60–72; Kant, R. 2012. "Textile Dyeing Industry an Environmental Hazard." *Natural Science* 4(1): 2–26.

³⁸ Fibre2Fashion. "Safety and Health Issues in the Textile Industry." Retrieved from: <http://www.fibre2fashion.com/industry-article/2554/safety-and-health-issues-in-the-textile-industry?page=1>.

³⁹ Chevier, J., K.G. Harley, A. Bradman, M. Gharbi, A. Sjödin, and B. Eskenazi. 2010. "Polybrominated Diphenyl Ether (PBDE) Flame Retardants and Thyroid Hormone during Pregnancy." *Environmental Health Perspectives* 118(10): 1444–1449.

⁴⁰ Harley, K.M., J. Chevrier, R. Aguilar Shall, A. Sjödin, A. Bradman, and B. Eskenazi. 2011. "Association of Prenatal Exposure to Polybrominated Diphenyl Ethers and Infant Birth Weight." *American Journal of Epidemiology* 174(8): 885–892.

⁴¹ Wolff, M.S., S.M. Engel, G.S. Berkowitz, X. Ye, M.J. Silva, and C. Zhu. 2008. "Prenatal Phenol and Phthalate Exposures and Birth Outcomes." *Environmental Health Perspectives* 116(8): 92; Main, K.M., G.K. Mortensen, J.M. Kaleva, K.A. Boisen, I.N. Damgaard, and M. Chellakooty. 2006. "Human Breast Milk Contamination with Phthalates and Alterations of Endogenous Reproductive Hormones in Infants Three Months of Age." *Environmental Health Perspectives* 114(2): 270; Swan, S.H., K.M., Main, F. Liu, S.L. Stewart, R.L. Kruse, A.M. Calafat, C.S. Mao, J.B. Redmon, C.L. Ternand, S. Sullivan, and G.L. Teague. 2005. "Decrease in Anogenital Distance among Male Infants with Prenatal Phthalate Exposure."

Air Pollution

The textile industry is one of the greatest contributors of air pollution. This is especially true in low-income countries where textile plants are located. The fabric coating process is one of the largest contributors to air pollution from textile production. Fabric coating releases methyl ethyl ketone, methyl isobutyl ketone, toluene, xylene, and dimethylformamide. These chemicals are emitted from many sources within the coating process including bulk tanks, holding drums, and oversprays. These chemicals are attributed to nervous system issues and certain birth defects.⁴² Other sources including generators and boilers release nitrogen oxides and sulfur dioxides. Nitrogen oxide particles can exacerbate conditions for people with heart disease and sulfur oxides can put children and people with respiratory issues at risk of lung, nose and throat irritation.⁴³ In addition, textile manufacturing processes release substantial amounts of VOCs. These practices include singeing, heat setting, and dyeing.⁴⁴ Volatile organic compounds can cause dizziness, headaches, nausea, and damage to the liver and the kidney. Some links have been made between VOC exposure and cancer in animals.⁴⁵ Textile workers can also be exposed to many types of air particulates through working with fibers such as cotton, wool, and hemp. Working with these fibers can create a high level of dust in processing plants. Exposure to dust in the textile sector can cause higher risk of respiratory diseases. One common respiratory disease in the textile sector is brown lung (bysinosis), caused by high exposure to cotton dust.⁴⁶

COMPANY REPORTING ON ENVIRONMENTAL DETERMINANTS OF HEALTH

Purpose

We reviewed sustainability reports of 50 companies in order to demonstrate the current state of play regarding health and environmental strategy integration and the manner in which it is occurring.

Methods

The 10 largest companies from each subsector of the textile sector (apparel/accessories, apparel/shoe retail), and food and agriculture sector (beverage, food processing, and food retail) were selected from the 2018 Forbes Global 2000. We analyzed 50 companies in total. We used public communication by companies as a proxy for their understanding and implementation of health and environmental linkages. Although this does not perfectly demonstrate whether or not companies are integrating health and environmental strategies internally, it does provide a strong indication of whether companies understand the connection between these issues and have strategies to address them.

We selected the most recent sustainability report for each company for the analysis explained below. If the company did not have a sustainability report, we selected the most recent annual report. We deleted companies from the list that did not have reports that were in English. The next largest company within their sector replaced companies without English sustainability reports.

We used a keyword search to find if companies mentioned topics related to health and the environment. Our list of search words included words related to the environment, climate change, water quality, waste, air pollution, health, wellness, disease and more. Appendix 2 has a full list of our keyword search.

Environmental Health Perspectives 113(8): 1056–1061.

⁴² EPA. 2016. Methyl Isobutyl Ketone (Hexone). Retrieved from: <https://www.epa.gov/sites/production/files/2016-09/documents/methyl-isobutyl-ketone.pdf>; New Jersey Department of Health. Hazardous Substance Fact Sheet: Dimethylformamide. Retrieved from: <http://nj.gov/health/eoh/rtkweb/documents/fs/0759.pdf>

⁴³ Boningari, T., and P.G. Smirniotis. 2016. "Impact of Nitrogen Oxides on the Environment And Human Health: Mn-Based Materials for NOx Abatement." *Current Opinion of Chemical Engineering* 13:133–144.

⁴⁴ Shishoo, R. 2005. "Textiles in Sports." Woodhead Publishing Limited and the Textile Institute. Cambridge, U.K.; AEE INTEC. Singeing in Textile Industry. Retrieved from: http://wiki.zero-emissions.at/index.php?title=Singeing_in_textile_industry

⁴⁵ EPA. Volatile Organic Compounds' Impact on Indoor Air Quality. Retrieved from: <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality>

⁴⁶ OSHA. Occupational Safety and Health in the Textiles Sector. Retrieved from: http://www.osha-mddsz.gov.si/resources/files/pdf/E-fact_30_-_Occupational_safety_and_health_in_the_textiles_sector.pdf; Nirmala, A. 2013. A Study of Workplace Hazards Faced by Workers in the Textile Industry as a Part of Occupational Health and Safety. *Paripex – Indian Journal of Research* 2(4): 333–334.

We collected the following data from the company sustainability reports through the keyword search method:

- (1) Whether or not a company discusses environment and health jointly;
- (2) Whether or not the discussion of company actions considers environmental conditions and their associated health outcomes

Each paragraph in which a keyword appeared was read in order to determine whether or not the company discussed connections between health and the environment and whether the connections were implemented through changes in the supply chains, new products, or company policies.

Data were also collected regarding each company's country headquarters, region, and 2017 sales. We also gathered information on each company's environmental reporting progress using data from the Climate Disclosure Project.⁴⁷ Lastly, we collected nutrition score ratings for food companies from the Access to Nutrition Index (ATNI).⁴⁸ These data points were used to determine whether there were relationships between company characteristics and environmental reporting and the likelihood of reporting links between health and environmental issues.

Chi-Squared tests and ANOVA were used on STATA to determine whether company characteristics and environmental reporting were related to the likelihood of reporting links between health and environmental issues.

RESULTS

Descriptive Statistics

The companies in our survey were evenly split into the following five subsectors: apparel/accessories, apparel/shoes, beverage, food retail, and food processing. Each of these subsectors was represented by ten companies. The companies studied spanned four regions including North America, Europe, Asia, and Australia. The research included 22 companies from North America, 17 companies from Europe, 9 companies from Asia, and 2 companies from Australia. The mean sales of the companies researched was \$33.4 billion \pm 26.8. The food retail sector had the highest mean sales of \$69.29 billion \pm 24. Excluding Australia (which was only represented by two companies), Europe had the highest mean sales out of all regions at \$37.7 billion \pm 29.1. More information on the sectors, regions, and sales of the companies studied can be found in Appendix 1.

Reaching Stage 1: Linking environmental issues with health outcomes

Our Environmental and Health Strategic Integration Framework shown in Figure 2 above outlines understanding health and environmental linkages as a precursor to health and environmental strategy integration. In order to reach strategy integration, companies must first understand the environmental impacts of their value chains that impact human health. This subsection demonstrates whether or not companies have reached Stage 1, through the overlap of health and environmental issues in their value chains.

We found that 58% of companies link environmental impacts to health outcomes. An example of linking health and environmental impacts would be a company describing their water pollution and the impacts those pollutants have on sanitation and hygiene of local communities. The food processing subsector had the highest frequency of companies linking environmental and health impacts within their sustainability reports at a rate of 70%. The beverage and food retail subsectors had the lowest frequency of companies linking environmental and health impacts at a rate of 50%. Europe was the region with the highest rate of companies linking environmental and health impacts with 65% of companies making the connection. On the opposite side of the spectrum, Asia only had 44.4% of companies linking health and environmental impacts within their sustainability reports. We did not find any statistically significant difference between likelihood of linking health and environmental impacts of different sectors or different regions. We also did not find a statistically significant relationship between sales and likelihood of linking environmental and health impacts.

⁴⁷ Nirmala, A. 2013. A Study of Workplace Hazards Faced by Workers in the Textile Industry as a Part of Occupational Health and Safety. *Paripex – Indian Journal of Research* 2(4): 333–334.

⁴⁸ Nutrition Indexes. Accessed on November 18, 2018. Retrieved from: <https://www.accesstonutrition.org/>.

BOX 2: CASE STUDY: KELLOGG AND MORNINGSTAR FARMS: “JUST WHAT THE WORLD ORDERED” CAMPAIGN

In 1999 Kellogg purchased Worthington Foods, Inc. Through this acquisition, Kellogg acquired Morningstar Farms, a product line that sells plant-based proteins such as veggie burgers and veggie nuggets. The company states: “Making better-for-you, better-for-the-world versions of the foods you love is our business.”^a

The production and consumption of red meat has a dual effect on consumer health and environmental degradation. The FAO estimates that livestock emit 7.1 Gt of CO₂ equivalent per year, which equates to 14.5% of total greenhouse gas emissions.^b Furthermore, the consumption of red meat at the end of the supply chain has been attributed to higher risk of chronic diseases.^c Given this link between environmental and health benefits of plant-based diets, Morningstar Farms launched a campaign in 2016 to strengthen the public’s understanding of health and environmental benefits of vegetarian diets. The brand called its new marketing campaign “Just What the World Ordered.” The goal of the campaign was not only to demonstrate the impacts of switching to a vegetarian diet, but also to show customers how easy the transition can be.

Morningstar Farms has since helped demonstrate to its customers the joint environmental and health benefits of its products by performing a lifecycle analysis (LCA) that incorporates both environmental and health impacts of its products.^d From this, the company created a “VegEffect Calculator” that demonstrates to consumers the environmental impacts of switching from meals including different types of meat to vegetarian meals. The calculator shows the impact of diet changes on water use, greenhouse gas emissions, and land preservation.^e The “Just What the World Ordered Campaign” also included a city-to-city summer tour for the company’s food truck to help educate people on how they can replace meat with plant-based proteins. The tour was meant to help strengthen the public understanding of the impacts of meat consumption on health and the environment as well as demonstrate to consumers how they can change their diets.

^a Morningstar Farms. “Plant Protein for All.” Accessed on November 11, 2018. Retrieved from: https://www.morningstarfarms.com/just_what_the_world_ordered/what-we-do.html.

^b FAO. “Major Cuts of Greenhouse Gas Emissions from Livestock within Reach: Key Findings.” Accessed on November 11, 2018. Retrieved from: <http://www.fao.org/news/story/en/item/197623/icode/>.

^c Pan, A., Q. Sun, A.M. Bernstein, M.B. Schulze, J.E. Manson, M.J. Stampfer, W.C. Willett, and F.B. Hu, F. B. 2012. Red Consumption and Mortality: Results from Two Prospective Cohort Studies. *Archives of Internal Medicine*. 172(7): 555–563.

^d Morningstar Farms. “LCA Background.” Accessed on November 11, 2018. Retrieved from: <https://www.morningstarfarms.com/executive-summary.html>.

^e Morningstar Farms. “Calculator + Comparison Facts.” Accessed on November 11, 2018. Retrieved from: <https://www.morningstarfarms.com/comparisonfacts.html>.

Most of the connections made by companies linking environmental impacts on health outcomes described general associations between environmental issues and health impacts. Many companies stated that healthy communities necessitate a healthy environment. Another common general connection made by companies was the statement that in order to have healthy and productive workers they need to work in healthy environments. Even so, many of the connections made between environmental issues and health impacts were superficial in nature. Some commonly mentioned links between the environment and human health that were more concrete, including the connection between air pollution and respiratory issues, the connection between climate change and nutrition, the connection between food waste and nutrition, and the connection between water quality and sanitation.

As we mentioned earlier in the food/agriculture and textile sector overviews, air pollution in these sectors can have detrimental health effects on respiratory issues and lung disease. Some of the companies in our research clearly described this connection in the context of their value chains. Associated British Foods, a food processing company in the U.K., clearly described the impacts of volatile organic compound releases from their production sites on their employees. The company’s site in the Netherlands is working with the Lung Disease Center to reduce the amount of airborne enzyme particles in their workplace.⁴⁹ Similarly, Adidas, the German apparel company, emphasizes the impacts of air pollutants in

⁴⁹ Associated British Foods. “Doing Good Every Day.” Accessed on November 10, 2018. Retrieved from: <https://www.abf.co.uk/responsibility>.

their value chain on their employees. They state that volatile organic compounds found in their solvents are attributed to respiratory issues that put factory workers at risk.⁵⁰

Another important health and environmental connection made by companies is the impact of climate change and healthy ecosystems on human nutrition. Danone, the French food processing company, states the following in their sustainability report: “We believe a healthy body needs healthy food. And healthy food needs a healthy planet. All with healthy ecosystems and strong, resilient social structures. We believe in a food and water ecosystem that works in harmony with people, communities and the environment.”⁵¹ More specifically addressing climate change, Wesfarmers, the Australian food retailer, states that stronger and more frequent heat waves can lead to food spoilage and local food shortages, which are dangerous to public health.⁵²

Ahold Delhaize, the Dutch food retailer, states in their sustainability report that food is one of the largest sources of climate change—impacting greenhouse gases and additionally impacts the health of communities that miss out on valuable nutrients.⁵³ Other companies emphasized the connection of food waste on natural resource use and nutrition. Kroger, the U.S. food retailer, connects the importance of reducing the environmental impacts of food waste on health issues of hunger and malnutrition. Box 2 below explains that the company identified that the issues of food waste and malnutrition go hand in hand, providing otherwise wasted food to those facing hunger and poverty.⁵⁴ Similarly to Kroger’s position, Kellogg states that solving food waste can reduce excess pressure put on natural resources as well as meet public health needs.⁵⁵

The last commonly discussed environmental and health connection made by companies in these sectors is the impact of water pollution on hygiene and sanitation. As discussed earlier, water pollution from agriculture and textile plants can lead to childhood diarrhea (which can lead to childhood stunting), skin irritations, and neurological disorders. Many of the connections between water quality, hygiene, and sanitation made by companies emphasize developing countries where these issues are most prevalent. For example, Aeon, the Japanese food retail company, works with the UNICEF Safe Water Campaign to focus on the impacts of deteriorated water quality on hygienic water use in countries such as Cambodia, Laos, and Myanmar.⁵⁶ Sysco and Heineken describe the impacts of polluted water on hygiene, stunted growth, and lost school days.⁵⁷ Lastly, General Mills states that clean water sources are essential to proper sanitation and hygiene.⁵⁸

Reaching Stage 2: Action on Linked Environmental and Health Company Impacts

In addition to determining which companies describe environmental and health links within their sustainability reports, we gathered data on whether companies explicitly addressed health and environmental issues through supply chain changes, company policies, or new products. This takes us to Stage 2 in our Environmental and Health Strategic Integration Framework shown in Figure 2. In order to determine which companies reached the nonstrategic integration of health and environmental overlap, we searched which companies communicated actions they were taking on environmental conditions impacting health. The companies identified as having reached the nonstrategic integration of health and environmental overlap may have reached the complete strategy integration of Stage 3 without us being able to identify this through their sustainability reports. Therefore, the findings in this section demonstrate that some companies are beginning to integrate health and environmental actions and may potentially be doing so with strategic internal integration. The next section will further explore the merits of reaching Stage 3.

⁵⁰ Adidas. “2017 Annual Report.” Accessed on November 10, 2018. Retrieved from: <https://www.adidas-group.com/en/sustainability/reporting/sustainability-reports/>.

⁵¹ Danone. “Integrated Annual Report 2017.” Accessed on November 10, 2018. Retrieved from: <http://iar2017.danone.com/>.

⁵² Wesfarmers. “Sustainability Report 2017.” Accessed on November 10, 2018. Retrieved from: <https://sustainability.wesfarmers.com.au/media/2464/2017-wesfarmers-sustainability-full-report.pdf>.

⁵³ Ahold Delhaize. “Better Together: Annual Report 2017” Accessed on November 10, 2018. Retrieved from: <https://www.aholddelhaize.com/en/investors/financial-information/annual-reports/>.

⁵⁴ Kroger. “Setting the Table for a Sustainable Future.” Accessed on November 10, 2018, Retrieved from: <http://sustainability.kroger.com/>.

⁵⁵ Kellogg. “Nourishing Families so They Can Flourish and Thrive.” Accessed on November 10, 2018. Retrieved from: <http://crreport.kelloggcompany.com/cr-report>.

⁵⁶ Aeon. “Aeon Report 2017.” Accessed on November 10, 2018. Retrieved from: <https://www.aeon.info/en/environment/>.

⁵⁷ Sysco. “2016 Corporate Social Responsibility.” Accessed on November 10, 2018. Retrieved from: <http://sustainability.sysco.com/>; Heineken. “Message in a Bottle 2017.” Accessed on November 10, 2018. Retrieved from: <https://www.theheinekencompany.com/sustainability/reporting?Skip=0&Take=10>.

⁵⁸ General Mills. “2018 Corporate Responsibility Report.” Accessed on November 10, 2018. Retrieved from: <https://globalresponsibility.generalmills.com/HTML1/tiles.htm>.

BOX 3: CASE STUDY: DIAGEO'S INTEGRATED SOCIAL IMPACT STRATEGY

Diageo is a beverage company that sells well-known brands including Johnny Walker, Smirnoff, and Guinness. Diageo outlines its sustainability projects and partnerships with an integrated approach for health and environmental actions. The company's social programs are focused on three main goals: reducing alcohol-related harm, building thriving communities, and safeguarding and preserving natural resources.

For example, one of the company's flagship programs is called Water of Life and aims to improve sanitation and hygiene in communities in which Diageo works or from which they source. The company tries to integrate this program with its sustainable agriculture program, and its sustainable sourcing program. The company explains that it tries to combine water sanitation and hygiene initiatives within its sustainable agriculture program in India and Africa, in order to leverage the combinatorial effectiveness of working on these issues jointly within communities. In this way, improving agricultural practices reduces water pollution to reinforce the water sanitation and hygiene practices.

Diageo has been able to identify these areas of overlap between its programs through the process of creating and analyzing its social impact framework that outlines the connections between strategic focus areas, social impacts, commercial impacts, and partner impacts.^a

A great example of Diageo's integrated programs is the efforts it has taken to improve water quality, hygiene and sanitation in and around its bottling plants in India. Diageo's bottling plants in India are mostly in suburban areas where there is a lack of robust infrastructure, low amounts of water, and poor water quality. The company's strategy for tackling these issues integrates reducing its environmental impacts through improving its water use efficiency and reducing effluent releases, with health projects to improve the communities' access to clean water. Diageo works with local villages to create Water, Sanitation and Health (WASH) committees that are led by members of the community. The company also improves the local water infrastructure by putting in rainwater harvesting structures and other water management practices.^b

Through its integrated approach, Diageo is able to create long-lasting environmental and health solutions. By using a multiprocess strategy that includes improving its own environmental impacts, improving health infrastructure within the community, and involving members of the community, Diageo demonstrates integrated social impact in areas in which they work.

^a Diageo. "Materiality." Accessed on November 11, 2018. Retrieved from: <https://www.diageo.com/en/in-society/our-role-in-society/materiality/>.

^b Diageo. "Empowering communities through an integrated approach." Accessed on November 11, 2018. Retrieved from: <https://www.diageo.com/en/in-society/case-studies/empowering-communities-through-an-integrated-approach/>.

We found that 46% of companies have reached Stage 2 of the Environmental and Health Strategic Integration Framework by outlining specific actions whose objectives are to solve environmental and health impacts in an integrated manner. An example of explicitly addressing health and environmental issues in an integrated manner would be a company implementing water treatment plants alongside hygiene education programs within neighboring communities. The apparel/accessories, apparel/shoes, and food processing subsectors had the highest frequency of integrated health and environmental action at a frequency of 60%. The beverage sector had the lowest level of integrated environmental and health action with a frequency of 20%. The food retail sector also lagged behind with a health and environment integration frequency of 30%. From a regional perspective, European countries had the highest level of linked environmental and health action at a frequency of 65%. Asia had the lowest number of companies linking health and environmental action at a frequency of 33%. We did not find any statistical differences between integrated health and environmental action between different regions and different sectors. Furthermore, we did not find a statistically significant relationship between sales and health and environmentally integrated action.

The most common company actions integrating environmental improvements and their associated health outcomes included the use of chemicals and their impact on employee health, water quality and the impacts on community sanitation and hygiene, and the connection between food waste and undernutrition.

One of the most commonly discussed actions taken by companies integrating health and environmental considerations is improved use of chemicals to protect the water quality and employee health. For example, Gap has integrated a newly designed washing technique called Washwell, which uses techniques that reduce water use. The technique also uses plant-based fabric softeners that are better for the environment. The Washwell technique saved 17.9 million liters of water in 2016 and protected workers from chemicals that cause health risks.⁵⁹ Wilmar International is another example of protecting water quality and employee health through better chemical management. Wilmar International, a food processing company based in Singapore, has completely eliminated the use of paraquat herbicide in oil palm plantations and has limited its use in sugarcane farming. In its sugarcane operations, Wilmar International only permits the use of paraquat if it is applied by a machine with very direct application. The company has reduced the use of paraquat in order to protect the health of its workers and the soil and water health of the areas in which they work.⁶⁰

A second commonly linked environmental and health action is the connection between water pollution, sanitation, and hygiene. As we discussed in the sector overviews, the food/agriculture and textile sectors have substantial impacts on water quality. The degradation of water quality promotes waterborne diseases and poor sanitation and hygiene. In order to tackle these challenges, some companies have made concerted efforts to improve sanitation and health near their operations. As mentioned earlier, Aeon has partnered with UNICEF to launch the Safe Water Campaign to educate communities in Cambodia, Laos, and Myanmar on proper hygiene practices. The campaign combines water quality infrastructure and sanitation education.⁶¹ As described in the case study below, Diageo, a U.K.-based beverage company is working in communities near its processing plants to reduce their processing impacts on water quality and provide infrastructure and education for better hygiene within the community. The company overlaps the Water of Life program described below with environmental programs such as its sustainable agriculture program (See Box 3 below).⁶² Nestle has also worked on a Water Sanitation and Hygiene (WASH) program near its operations by providing infrastructure, education, and best practices in cocoa farming communities in Ghana.⁶³

The last commonly linked category of environmental and health action is the interaction between food waste and undernutrition. Approximately one third of food goes to waste every year and yet many communities face persistent hunger.⁶⁴ Food waste is also an environmental problem. The production of the wasted food releases 3.3 billion tons of GHGs, increases the land footprint used, and requires significant water, fertilizer and pesticide use, all of which contribute to other health impacts, beyond undernutrition.⁶⁵ Companies can work on these issues by lowering their food waste and sending the unused produce to organizations that provide hunger relief in communities of need. As described in the case study below, Kroger works simultaneously to tackle food waste and hunger. Kroger's Zero Hunger Zero Waste Program works to lower food waste throughout the company by partnering with WWF Food Waste Program to identify the areas of waste reductions within Kroger's supply chain. In addition, the company works with ReFED, an organization working on hunger issues, to efficiently transfer unused food in the Kroger supply chain to impoverished communities.⁶⁶

COMPANY INTERVIEWS: ADVANTAGES AND DISADVANTAGES OF HEALTH AND ENVIRONMENT INTEGRATION

Purpose

The CSR report research findings determined that some companies understand the connection between environmental conditions and health and some companies even create solutions that tackle both issues simultaneously. However, these findings did not determine whether companies have reached strategic integration in Stage 3 of our Environmental and Health Strategic Integration Framework. We interviewed companies and industry stakeholders in order to determine

⁵⁹ Gap. "Good Business Can Change the World." Accessed on November 11, 2018. Retrieved from: <http://www.gapincustainability.com/>.

⁶⁰ Wilmar International. "Sustainability Reports." Accessed on November 11, 2018. Retrieved from: <http://ir-media.wilmar-international.com/phoenix.zhtml?c=164878&p=irol-reportsSustainability>.

⁶¹ Aeon. "Environment and Social Reports." Accessed on November 12, 2018. Retrieved from: <https://www.aeon.info/en/environment/>.

⁶² Diageo. "Sustainability and Responsibility Performance Addendum to the Annual Report." Accessed on November 12, 2018. Retrieved from: https://www.diageo.com/PR1346/aws/media/6111/diageo_sustainability-responsibility_perfaddendum_2018_final.pdf.

⁶³ Nestle. "Nestle in Society: Creating Shared Value." Accessed on November 12, 2018. Retrieved from: https://www.nestle.com/asset-library/documents/library/documents/corporate_social_responsibility/nestle-csv-full-report-2017-en.pdf.

⁶⁴ World Food Programme. "Zero Hunger." Wfp.org. Accessed on November 12, 2018. Retrieved from: <http://www1.wfp.org/zero-hunger>.

⁶⁵ FAO. 2013. Food Wastage Footprint: Impacts on Natural Resources (Summary Report). Accessed on December 12, 2018. Retrieved from: <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>.

⁶⁶ Kroger. "Setting the Table for a Sustainable Future." Accessed on November 12, 2018. Retrieved from: <http://sustainability.kroger.com/>.

BOX 4: CASE STUDY: KROGER ZERO HUNGER ZERO WASTE PROGRAM

In September 2017, Kroger launched its new social responsibility initiative and coined it the Zero Hunger Zero Waste Program. The company launched this program to face the following problem: 40% of food produced in the U.S. goes to waste and yet 1 out of 8 people go hungry. Kroger believes that it can tackle this challenge due to its scale and its connection to the community.

In 2016 Kroger committed to reach or surpass the EPA's challenge of meeting a 90% diversion rate away from landfills by 2020. The company followed its 2016 commitment within the new Zero Hunger Zero Waste Program by committing to end hunger in communities and eliminate waste across the company by 2025. The company has committed to donate 1 billion meals by 2020 and 3 billion meals by 2025. Kroger's commitment to ending hunger and waste takes an interdisciplinary approach to tackle integrated Sustainable Development Goals including SDG 2: ending hunger, SDG 12: responsible consumption and production, and SDG 3: health and well-being. The actions taken by Kroger to meet its program commitments are two-pronged. First, the company rescues food wasted at different levels of the supply chain including at the farm, at the processing plant, or in grocery stores, and secure it as part of meals for the community. Second, the company provides funding for organizations that work on lower hunger prevalence. In their sustainability report, the company states: "Recovering edible food that is lost through the value chain (farms, food manufacturers, consumer-facing businesses and homes) represents an opportunity to support Americans who experience hunger and food insecurity, build efficiency in the supply chain, and shift consumption in a way that reduces environmental impacts."

The Zero Hunger Zero Waste Program has demonstrated considerable success during its first year of action. The program rescued 91.2 million pounds of food within the company, 74.3 million of which was rescued from Kroger retail stores. The company reached a 77% waste diversion rate as well. In the near term, the program is hoping to expand the products available for donation.

the merits of creating integration of health and environmental strategies. The goal of this exercise was to understand the advantages and disadvantages of integrating health and environmental action within corporate strategies.

Methods

We performed interviews with companies and industry groups. We contacted seven companies within the food/agriculture and textile sectors as well as two industry groups. Three companies and two industry groups agreed to speak to us. We spoke with Helen Medina, the Senior Public Affairs Manager of Government and Multilateral Relations at Nestlé as well as her colleague Marian Fernando Moss, a Public Affair Specialist. We also had the privilege of receiving information from Kim Elena Ionescu, the Chief Sustainability Officer at the Specialty Coffee Association, and Christina Iskov, a Business Manager at the Global Fashion Agenda. We also spoke to chief sustainability officers at a large food processing company and a large apparel company. Both of these individuals and their companies did not wish to be identified in this paper.

During our interviews, we asked the interviewees to answer the six questions outlined below. For the individuals working with industry groups, we substituted "industry" for "company" within these questions.

- (1) Briefly describe your company's impacts (both positive and negative) on the environment.
- (2) Briefly describe your company's impacts (both positive and negative) on health.
- (3) Do any of your company's environmental impacts also impact health outcomes?
- (4) At your company, do individuals in charge of overseeing environmental issues collaborate with individuals in charge of overseeing health issues?
- (5) If so, how do they collaborate?
- (6) What might be the advantages/benefits of working on health and environmental impacts in an integrated manner at your company?
- (7) What might be the disadvantages of working on health and environmental impacts in an integrated manner at your company?

We compiled the answers of all participants and compared them to outline similarities and contradictions across different companies.

Results

The answers to the first question in our interviews confirmed that companies generally understand and acknowledge the impacts they have on the environment at different steps in their supply chains. Most companies also understood their health impacts but discussed them as being indirect impacts. A large apparel company we interviewed discussed that its impacts are indirect through processing chemicals and mining. The answers given by some of our interviewees suggested that they did not place the same level of importance on their health impacts as they do on environmental impacts.

We received a wide range of answers to the question asking whether or not the environmental impacts of the company or industry directly affect health outcomes. From Specialty Coffee Association Kim Elena Ionescu's point of view, coffee companies clearly impact health through environmental influences. She described that agrochemicals in farming can harm waterways and workers that are not wearing protective gear. She also stated that water contamination from processing coffee beans may impact the health of downstream communities. Christina Iskov from the Global Fashion Agenda also acknowledged the overlap between health and environmental outcomes by stating the public health and the environment are both harmed by the release of toxic chemicals in the textile sector. However, the overlap of health and environmental impacts was not clear to all our interviewees. A participant from a large food processing company stated: "Maybe I have not thought about this enough." The individual followed this statement by saying that he or she does not think there are any links between his or her company's environmental and health impacts.

When we asked participants whether individuals in charge of environment and sustainability collaborated with individuals in charge of health, we found a wide range of answers. A large food processing company stated that the Vice President of Corporate Social Responsibility (CSR) oversees sustainability and nutrition teams. The representative of the food processing company described that the CSR and nutrition teams collaborate to design foods and brands that integrate sustainability and nutrition. The nutrition and sustainability teams at this company are focused on finding the attributes consumers care about regarding nutrition and sustainability. They find that the consumers that care about nutrition also care about sustainability. Therefore, the CSR and nutrition teams work together to align their strategies and create brands that incorporate nutrition and sustainability.

On the other hand, the apparel sector did not seem to show collaboration between environment teams and health teams. Christina Iskov of the Global Fashion Agenda described that the issues of health and environment are usually addressed separately. Furthermore, a representative from a large apparel company stated that they do not integrate environment and health. They only have an employee health team that focuses on health within the community. The representative of this company stated that they do not work explicitly on health within the sustainability team either.

Through our interviews we found that there are many potential advantages to working on health and environmental issues in an integrated manner. The representative at a large food processing company stated that working jointly on health and environmental issues saves time and resources. This person said: "We can go to the consumer once and ask them about both issues at the same time." They followed this up by stating that working on health and environment in an integrated way allows them to put one product on the market that has both instead of two separate strategies for nutrition and sustainability. The respondent from the large food processing company also stated that by integrating health into sustainability activities allows their CSR actions to make more sense to outside parties.

A similar perspective was shared by a representative of a large apparel company. This individual stated: "There is a great advantage to be able to articulate environmental impacts on human health. It helps build the narrative based on health to explain why we want to make sourcing shifts in different ways. There is a lot of value to be able to articulate where environment and human health work together."

Kim Elena Ionescu from the Specialty Coffee Association suggested that there may be economic benefits to integrating health and environmental actions within companies. She explained that these economic benefits could come from reduced costs of medical treatments and fewer days missed caused by a healthier environment.

Helen Medina from Nestlé explained that her company's actions are based on a company strategy of "Creating Shared Value," which encompasses having a healthy environment and healthy people. Medina explained that in order for the company to be successful in creating shared value, their suppliers must have an environment in which they themselves can be healthy and productive. She stated that Nestlé's success is based on the success of their supplying farmers and that the farmers' health is essential to meeting Nestlé's demand. Medina concluded by saying that Nestlé looks at health and the environment of its supply chain in a holistic manner and that there are benefits to working on health and environment throughout the value chain.

The discussion we had with respondents regarding the disadvantages of integrating health and environmental strategies within companies yielded a few clear patterns. First, integration of these two issues would create more complexity. Second, integration may mean companies taking on larger projects that are more costly.

The representative of the large food processing company described that integration of health and environmental strategies would lead to challenges around needing to create more internal alignment. Breaking down silos between the nutrition team and the sustainability team would demand more complex problem solving and collaboration. Marion Fernando Moss from Nestlé agreed with this sentiment suggesting that integration increases the complexity of strategies and projects.

The second disadvantage mentioned was that integrating health and environmental strategies could make projects more costly. Christina Iskov from the Global Fashion Agenda suggested that solutions to these integrated problems are not fully developed and could be costly to implement. Kim Elena Ionescu from the Specialty Coffee Association agreed by stating that increasing the scope of company initiatives may make it hard to find funding for these projects.

In conclusion, our company interviews found that there are clear advantages to integrating health and environmental strategies and that some companies are already doing so in a successful manner. However, there are some strong concerns regarding the complexity of integration and the cost of integrated projects that may be barriers to companies implementing an integrated approach.

CONCLUSION

The findings of our report suggest that the link between health and environmental issues is real. Most companies in the food/agriculture and textile sectors clearly have environmental impacts that cause harm to human health and yet many of these companies do not face these issues explicitly. Our report finds that less than half of the biggest companies in these sectors act upon this inherent connection. However, we did find that a group of companies is clearly and purposefully working on environmental and health issues jointly within their value chains.

This brings us to the question, why are certain companies explicitly working on the connection between environmental and health issues in their value chains and others are not? One possible explanation for this is cultural and regulatory effects on CSR expectations. As we described in our results, European companies had the greatest frequency of understanding environmental and health linkages (65%) and the greatest frequency of environmentally linked health action (65%). On the other side of the spectrum, we found that Asian companies were the least likely to link environmental and health issues at a rate of 33%. We also found that North American companies fell between Europe and Asia in health and environmental performance.

The differences that we found between regions are not surprising given regulatory drivers on CSR activities. For example, large publicly listed companies in the European Union must disclose information on environmental performance, responsibility towards employees, human rights, anti-corruption, and diversity on board of directors.⁶⁷ On the other hand, companies in the United States only report CSR information voluntarily.⁶⁸ In addition to the influence of regulatory drivers, regional differences in CSR activities may be affected by cultural norms. Studies have found that in many instances

⁶⁷ European Union. 2014. Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 Amending Directive 2013/34/EU as Regards Disclosure of Non-Financial and Diversity Information by Certain Large Undertakings and Groups Text with EEA Relevance. Accessed on March 12, 2019. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095C>.

⁶⁸ Camilleri, M.A. 2016. "Corporate Social Responsibility Policy in the United States of America." In *Corporate Social Responsibility in Times of Crisis*, edited by Idowu, S.O., S. Vertigans, and A. Burlea Schiopoiu. Cham, Switzerland: Springer, 129–143.

European companies have higher CSR performance than North American and Asian companies.⁶⁹ These studies find that different cultures demand company attention to different CSR activities. In our case it seems that European countries emphasize the connection between company health and environmental impacts more than Asian countries, and that North American countries fall somewhere in between.

Another potential explanation for why some companies address environmentally linked health issues and some do not is that some of these linkages seem easier to make than others. For example, many companies are working on improving water quality infrastructure in developing countries as a way of alleviating the risk of waterborne diseases. The most common health issues that companies are connecting with their environmental strategies are the following: chemical pollution impacts on employee health; water pollution impacts on community sanitation and hygiene; and food waste and hunger. This would suggest that there are low-hanging fruits that companies are more willing and able to act upon when it comes to connecting environmental degradation and health outcomes within their value chains.

We also recognized that there were certain linkages that companies did not make. Companies did not seem to make the connection between climate change and health. Although many companies are setting goals to reduce their GHG emissions, they rarely connect these efforts to improving human health. Another issue that companies in the food/agriculture sectors did not address was antibiotic resistance. We expected food-processing companies to address this health and environmental link but did not find evidence from any of the ten companies we researched in this subsector. Lastly, we did not find that companies in the textile sector discussed textile worker exposure to air pollutants even though it is one of the greatest health impacts of the industry.

Although the sustainability report research resulted in important findings regarding the current level of health and environmental integration within companies as well as regional and issue-based trends, a holistic picture of the environment and health integration discussion is not complete without understanding the pros and cons of this integration. Our company and industry group interviews complete this discussion by providing some explanations for why companies should consider integrating health and environmental strategies and what barriers are holding them back. One common theme we found from these interviews is that integrating health and environmental goals and actions within a company can help it create a clear narrative explaining why it is performing CSR. It may help companies better target socially conscious customers who care strongly about health and the environment. By combining the issues the CSR teams work on, they can tell a more complete story of why their company cares and acts to improve their place in society.

On the other hand, companies seemed to be concerned about the greater complexity that comes with integrating health and environmental strategies. Our interviewees pointed out that health and environment teams are often siloed and have separate strategic goals. Integrating these teams could bring complexity and confusion to the individuals working on these issues. Furthermore, this integration asks for greater internal alignment that requires a long process of uncomfortable change within the company.

We cannot conclude our discussion without mentioning costs. Most CSR, environment, and health teams are cost centers within companies, and therefore creating more complexity and tackling larger linked projects may create more costs to the company. Although some of our interviewees mentioned the possibility of higher costs, others thought health and environmental integration could potentially lower costs. Therefore, it may be the case that integration leads to cost savings to some companies and cost increases to other. This may help explain why some companies have embraced the opportunity of integrating health and environmental actions while others have not.

We hope that the findings of this research will help invigorate a discussion within the corporate community on the opportunity of integration health and environmental strategies. Although we have provided the groundwork for understanding the importance of this issue and the current state of play within two sectors, further research is necessary to build upon our findings in a way that determines wherein lies the business case for integrated health and environmental strategies. We hope that the current state of play we have outlined in this report, in addition to the advantages and

⁶⁹ Fisher, V. 2017. An International Analysis of CSR Rankings and a Country's Culture. Senior Honor's Thesis, The University of Eastern Michigan. Accessed on December 12, 2018. Retrieved from: <https://commons.emich.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1560&context=honors>; Thanetsunthorn, N. (2015). The Impact of National Culture on Corporate Social Responsibility: Evidence from Cross Regional Comparison. *Asian Journal of Business Ethics* 4(35): 56.

disadvantages produced by our company interviews will be the launching pad for greater discussion and debate across the public and private sectors on how companies can take part in health and environmental leadership.

APPENDIX 1: COMPANY DATA

| Company | Sector | Country | Region | 2017 Sales (in Billions of US\$) | Health and Environment Link | Health and Environment Action |
|--------------------------|---------------------|----------------|---------------|----------------------------------|-----------------------------|-------------------------------|
| Adidas | Apparel/Accessories | Germany | Europe | 24.9 | Yes | Yes |
| Aeon | Food Retail | Japan | Asia | 75.3 | Yes | Yes |
| Anheuser-Busch InBev | Beverage | Belgium | Europe | 56.4 | Yes | No |
| Anta Sports Products | Apparel/Accessories | China | Asia | 2.5 | Yes | Yes |
| Archer Daniels Midland | Food Processing | United States | North America | 61.4 | No | No |
| Asahi Group Holdings | Beverage | Japan | Asia | 19.4 | No | No |
| Associated British Foods | Food Processing | United Kingdom | Europe | 20.3 | Yes | Yes |
| Carrefour | Food Retail | France | Europe | 91.3 | No | No |
| Chow Tai Fook Jewellery | Apparel/Accessories | Hong Kong | Asia | 7 | No | No |
| Christian Dior/LVMH | Apparel/Accessories | France | Europe | 49.3 | Yes | Yes |
| Coca-Cola | Beverage | United States | North America | 33.7 | No | No |
| Constellation Brands | Beverage | United States | North America | 7.6 | Yes | No |
| Couche Tard | Food Retail | Canada | North America | 47.2 | No | No |
| Danone | Food Processing | France | Europe | 27.8 | Yes | Yes |
| Diageo | Beverage | United Kingdom | Europe | 15.7 | Yes | Yes |
| Fast Retailing | Apparel/Shoe Retail | Japan | Asia | 18.2 | No | No |
| Femsa | Beverage | Mexico | North America | 25.2 | No | No |

| Company | Sector | Country | Region | 2017 Sales (in Billions of US\$) | Health and Environment Link | Health and Environment Action |
|------------------------|---------------------|----------------|---------------|----------------------------------|-----------------------------|-------------------------------|
| Gap | Apparel/Shoe Retail | United States | North America | 15.9 | Yes | Yes |
| General Mills | Food Processing | United States | North America | 15.7 | Yes | No |
| H&M | Apparel/Shoe Retail | Sweden | Europe | 23.7 | Yes | Yes |
| Heineken Holding | Beverage | Netherlands | Europe | 24.7 | Yes | Yes |
| Hermes International | Apparel/Accessories | France | Europe | 6.3 | Yes | Yes |
| Inditex | Apparel/Shoe Retail | Spain | Europe | 28.9 | Yes | Yes |
| Kellogg | Food Processing | United States | North America | 13.1 | Yes | Yes |
| Kering | Apparel/Accessories | France | Europe | 17.5 | No | No |
| Kirin Holdings | Beverage | Japan | Asia | 16.6 | Yes | No |
| Kraft Heinz Company | Food Processing | United States | North America | 26.2 | No | No |
| Kroger | Food Retail | United States | North America | 122.7 | Yes | Yes |
| L Brands | Apparel/Shoe Retail | United States | North America | 12.6 | Yes | Yes |
| Michael Kors Holdings | Apparel/Shoe Retail | United Kingdom | Europe | 4.6 | No | No |
| Mondelez International | Food Processing | United States | North America | 26.2 | No | No |
| Nestlé | Food Processing | Switzerland | Europe | 91.2 | Yes | Yes |
| Nike | Apparel/Accessories | United States | North America | 35.3 | Yes | Yes |
| Nordstrom | Apparel/Shoe Retail | United States | North America | 15.5 | No | No |

| Company | Sector | Country | Region | 2017 Sales (in Billions of US\$) | Health and Environment Link | Health and Environment Action |
|---|---------------------|-------------------|---------------|--|-----------------------------------|-------------------------------------|
| PepsiCo | Beverage | United States | North America | 64 | Yes | No |
| Pernod Ricard | Beverage | France | Europe | 10.2 | No | No |
| PVH | Apparel/Accessories | United States | North America | 8.9 | Yes | Yes |
| Ross Stores | Apparel/Shoe Retail | United States | North America | 14.1 | Yes | Yes |
| Royal Ahold Delhaize | Food Retail | Netherlands | Europe | 72.4 | Yes | Yes |
| Seven and I Holdings | Food Retail | Japan | Asia | 54.2 | No | No |
| Shenzhou International Group Holdings | Apparel/Accessories | China | Asia | 2.7 | No | No |
| Sysco | Food Retail | United States | North America | 57.8 | Yes | No |
| Tapestry | Apparel/Shoe Retail | United States | North America | 5.5 | Yes | Yes |
| Tesco | Food Retail | United Kingdom | Europe | 75.4 | No | No |
| TJX Cos | Apparel/Shoe Retail | United States | North America | 35.9 | No | No |
| Tyson Foods | Food Processing | United States | North America | 40 | Yes | Yes |
| VF | Apparel/Accessories | United States | North America | 12.3 | No | No |
| Wesfarmers | Food Retail | Australia | Australia | 53 | Yes | No |
| Wilmar International | Food Processing | Singapore | Asia | 43.8 | Yes | Yes |
| Woolworths | Food Retail | Australia | Australia | 43.3 | No | No |

APPENDIX 2: KEYWORD SEARCH TERMS

The terms searched were not necessarily complete words. This allowed for words with the same root as the term searched to be found.

Health/Environmental Links in Sustainability Reports

- Environment
 - Environmental
 - Environmentally
- Health
 - Healthy
 - Healthier
- Sustain
 - Sustainable
 - Sustainability
- Climate
 - Climate change
 - CO2
- Pollut
 - Pollution
 - Pollutants
- Air quality
- Water quality
- Clean
- Natur
 - Nature
 - Natural
 - Naturally
- Deforestation
- Disease
- Obesity
- Livelihood
- Waste

Nicholas Institute for Environmental Policy Solutions

The Nicholas Institute for Environmental Policy Solutions at Duke University is a nonpartisan institute founded in 2005 to help decision makers in government, the private sector, and the nonprofit community address critical environmental challenges. The Nicholas Institute responds to the demand for high-quality and timely data and acts as an “honest broker” in policy debates by convening and fostering open, ongoing dialogue between stakeholders on all sides of the issues and providing policy-relevant analysis based on academic research. The Nicholas Institute’s leadership and staff leverage the broad expertise of Duke University as well as public and private partners worldwide. Since its inception, the Nicholas Institute has earned a distinguished reputation for its innovative approach to developing multilateral, nonpartisan, and economically viable solutions to pressing environmental challenges.

The Bridge Collaborative

The Bridge Collaborative is a global change agent driving a fundamental shift in how we think, plan, fund and work across sectors to make bigger change faster. We unite leading experts and organizations in health, development and the environment with the shared evidence and tools to make a greater impact at the speed the world needs now. Established in 2016, the Bridge Collaborative is a partnership spearheaded by four founding organizations: The Nature Conservancy, PATH, the International Food Policy Research Institute (IFPRI) and Duke University. Our growing global alliance of scientists, practitioners and organizations is moving beyond business as usual with the aim of creating a more equitable and sustainable world. Because there’s only one way to solve today’s most critical problems: Together.

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