



# THE ELEPHANT IN THE BOARDROOM: WHY UNCHECKED CONSUMPTION IS NOT AN OPTION IN TOMORROW'S MARKETS

SAMANTHA PUTT DEL PINO, ELIOT METZGER, DEBORAH DREW, AND KEVIN MOSS

## EXECUTIVE SUMMARY

There has been a sea change in business leadership on environmental and sustainable development issues over the past 20 years. Many CEOs speak “sustainability,” and many multinational companies have invested resources to build internal capacity on sustainability. It has become common for these companies to establish greenhouse gas emissions reduction targets and renewable energy goals and to address water risk and deforestation. Indeed, it is difficult to imagine how the historic Paris Agreement on climate change or the United Nations’ wide-ranging Sustainable Development Goals could have been cemented without the support of business.

However, underneath this welcome progress lies an uncomfortable truth: Most businesses’ growth is still predicated on more people buying more goods. The world will have more than 9 billion people by 2050, and the middle class will have swelled by 3 billion by 2030. On top of this, consumer expectations for yet more are being stoked by trends such as fast fashion. The rapid expansion of consumption-driven markets in the coming decades is the anticipated engine for continued business growth.

The problem is that the planet’s natural systems and finite resources cannot keep up. Studies cited in this paper show that we are already at or close to the limits of the planet’s ability to provide. A continuation of business as usual would mean not just a slight additional strain, but three times as much consumption of the planet’s already overused resources.

## CONTENTS

Executive Summary .....	1
Introduction .....	4
How Consumption Is Changing in the 21st Century ...	6
A Closer Look at Implications for Three Products .....	10
Consumer Durables—Cars .....	11
Consumables—Beef .....	15
Fast-Moving Consumer Goods—Clothes .....	23
Recommendations .....	28
References .....	31
Endnotes.....	35
Acknowledgments.....	36

*Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues. Working papers may eventually be published in another form and their content may be revised.*

**Suggested Citation:** Putt del Pino, S., E. Metzger, D. Drew, and K. Moss. “The Elephant in the Boardroom: Why Unchecked Consumption Is Not an Option in Tomorrow’s Markets.” Washington, DC: World Resources Institute, March 2017. Available online at <http://www.wri.org/publication/elephant-in-the-boardroom>.

---

Without a change to current business models in which growth is predicated on selling more goods to more people, environmental stresses will pose increasing business risks and costs. Ultimately, these stresses will be a brake on business growth. Whether we look at consumer durables, fast-moving consumer goods, or consumables (this paper looks at all three), the pattern and risk of selling more stuff to more people is the same, and we see that improved practices are not sufficient to counteract anticipated global growth.

Fifteen years ago, climate change was the “elephant in the corporate boardroom.” Now the conversation has shifted to the point that more than 200 companies have made commitments to set science-based greenhouse gas reduction targets, a dramatic increase in ambition. Business growth predicated on consumption is the new elephant in the corporate boardroom. It is uncomfortable and unmentioned, both because the model has worked so well financially in the past and because addressing it challenges the traditional business model. Analysis of sustainability reports cited in this paper uncovers an alarming lack of attention to natural resource limits. The few quotes in this paper attributable to corporate spokespeople boldly referencing resource limitations are notable for their rarity.

It is necessary to insist not that people make do with less goods or that some people cannot have goods but rather that companies innovate new business models that deliver shareholder value and that shape and meet consumers’ needs in a different way. There are encouraging signs that some companies are examining their business models in a new light. Examples include companies that have put ideas like circular manufacturing and collaborative consumption into practice or that have created new ways of selling the services their products provide instead of selling the product itself. Several examples are discussed in this paper; however, none are yet mainstream.

The purpose of this paper is to begin to normalize the topic so that sustainability professionals, the C-suite, the board, and investors are able to openly recognize and discuss the challenges. It is only by having these conversations that businesses can start to identify transformational business models, models that will enable business to thrive by serving the markets of the future within the limits of the planet’s resources.

This working paper calls on companies to

1. **do the math** by looking openly and honestly at their dependency on natural resources and the associated limits on business growth;
2. **take a leadership role** by using their influence to change the conversation with key stakeholders; and
3. **transform the business** to one that will thrive in a resource-constrained environment.

Through the Sustainable Development Goals, the world has accepted the challenge of delivering growth in societal well-being while staying within the limits of the planet’s resources. Business sits at the nexus of this challenge. Future business success demands that business growth be delinked from increasing resource and environmental impact. Businesses that do so will be there to serve their customers and their shareholders. Those that do not will be outcompeted by disruptive new entrants that are more innovative and transformational.

## LETTER

To the Chief Executive Officer,

World Resources Institute (WRI) is working hard on many of the same challenges and opportunities that also keep you and your team busy. We aim to see the economy grow around the world, in such a way that meets the needs of all people today and the generations that follow. I want to extend my congratulations and appreciation for the leadership so many in the business world are showing on issues that are core to both our missions.

However, I am also offering a strong caution on a topic that we understand remains difficult for many businesses. In our conversations with companies, we have found that this topic is often the “elephant in the room” for the C-suite and the board.

Simply put, innovation is not keeping pace with global consumption. As more and more people enter the global middle class, with current models of consumption, the amount of materials needed to meet customer demands could triple by 2050 compared to 2000. In many places, however, current consumption rates are already causing the world to approach or exceed the limits of the planet’s ability to provide the raw materials, energy, and water needed to run business. Technology and efficiency improvement will help bridge the gap, but business growth purely through increased consumption is a risky strategy in such an environment.

We find that sustainability teams in most companies can comfortably talk about climate change and efficiency improvements but not about consumption. The conversation about the underlying model of consumption remains an uncomfortable one to raise because it speaks to the heart of the business model that has been so financially successful for the past century. Through this paper, we would like to make that a conversation business is both willing and able to have.

I know you will not have time to read a 36-page paper. I ask that you hand the paper off to your sustainability team and invite them to review it. Subject to their conclusions being similar to ours, I ask that you support them in creating the enabling conditions for a frank discussion within the business on the risks of current models of consumption and the possibilities to explore alternative transformational models. In this way we will ensure that business can continue to be the engine for growth that it has always been.

As a nonprofit research organization, we stand ready to offer our independent insights and look forward to discussing this further.

Sincerely,



Manish Bapna, Managing Director  
World Resources Institute  
Washington, DC

## INTRODUCTION

*“The rise in world affluence holds promise for better lives and also comes with significant risks to ecosystems if prevailing patterns of consumption, energy production, and waste persist.”*

So stated *Tomorrow’s Markets: Global Trends and Their Implications for Business*, a report published by the World Resources Institute, the United Nations Environment Programme, and the World Business Council for Sustainable Development in 2002 (Doering et al. 2002). The report summarized 19 environmental, economic, and demographic trends and topics, highlighting the implications for business leaders. Progress has been made on many of the topics. For example, since 2000 the number of people living in deep poverty has been cut in half, as has infant mortality, and there has been an increase in literacy and vaccinations. Companies are increasingly recognizing and reducing their exposure to water risk, setting goals to limit greenhouse gas (GHG) emissions, and committing to bold strategies like eliminating deforestation from their supply chains.

However, one of the other trends highlighted in the *Tomorrow’s Markets* report was consumption. Business innovation would need to be “radical,” not “incremental,” in order to meet the needs of consumers without damaging the planet’s natural resource base. Fifteen years later, progress on this topic remains small scale. Indeed, as this paper explores, continued and growing consumption of goods and services is now *the* threat and opportunity of our time. If not addressed, business dependency on increasing consumption will be the Achilles’ heel of the business model.

### Box 1 | Defining the Middle Class

Although there is no single definition of the terms *middle class* or *middle income*, most economists refer to it in terms of income and expenditures. Kharas and Gertz define the global middle class as households “with daily expenditures between \$10 and \$100 per

person in 2005 purchasing power parity.”<sup>a</sup> A more recent study by the Pew Research Center defined *middle income* as people earning between \$10 and \$20 a day in 2011 prices and purchasing power parities.<sup>b</sup> Banerjee and Duflo’s definition for the middle class in

developing countries includes those earning between \$2 and \$10 a day.<sup>c</sup> The terms *middle class* and *middle income* for the purposes of this paper generally refer to individuals whose incomes allow for some discretionary spending beyond basic necessities.

#### Notes:

<sup>a</sup> Kharas, Homi, and Geoffrey Gertz. 2010. “The New Global Middle Class: A Crossover from West to East.” In *China’s Emerging Middle Class: Beyond Economic Transformation*, edited by Li Cheng, 32–52. Brookings Institution Press. <http://www.jstor.org/stable/10.7864/j.ctt6wpd8c.6>.

<sup>b</sup> Kochhar, R. 2015. *A Global Middle Class Is More Promise than Reality: From 2001 to 2011, Nearly 700 Million Step out of Poverty, but Most Only Barely*. Washington, DC: Pew Research Center. [http://www.pewglobal.org/files/2015/08/Global-Middle-Class-Report\\_8-12-15-final.pdf](http://www.pewglobal.org/files/2015/08/Global-Middle-Class-Report_8-12-15-final.pdf).

<sup>c</sup> Banerjee, A. V., and E. Duflo. 2008. “What Is Middle Class about the Middle Classes around the World?” *Journal of Economic Perspectives* 22 (2): 3–28. <http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.22.2.3>.

#### In their own words . . .

*If we look on a global basis, in the west, we have probably hit peak stuff. We talk about peak oil. I’d say we’ve hit peak red meat, peak sugar, peak stuff, peak home furnishings. . . .<sup>a</sup>*

*What we mean by “peak stuff” is that we live in a world of finite resources and we recognize that consumption needs to reflect this. At IKEA, we are therefore seeking new ways to meet people’s needs and aspirations whilst staying within the limits of the planet.<sup>b</sup>*

<sup>a</sup> Howard, Steve. 2016. Chief Sustainability Officer, IKEA. *Guardian Sustainable Business Debate*, January.

<sup>b</sup> Engberg, Jonas. 2016. Sustainability Manager, IKEA Denmark. *Sustainable Brands* interview, February.

As the global population grows and prosperity increases, 3 billion people are projected to join the global middle class (see Box 1) in the next 15 years (Kharas 2010). Growth in this major consumer class provides an unprecedented opportunity for business. However, rapid global economic growth—estimated to be as much as 50-fold this century (Steer et al. 2016)—is placing extraordinary stress on the planet’s resources. Research by the United Nations International Resource Panel suggests resource use could triple by 2050 compared to a 2000 baseline (Fischer-Kowalski et al. 2011), but according to the Stockholm Resilience Centre, many environmental limits have already been exceeded at the planetary scale (see Box 2). Without action, business dependency on increasing consumption will be a brake on business growth and on aspirations to improve human well-being.

## Box 2 | Create a Better Future without Exceeding Physical Limits

To meet current demand for goods and services, companies are already collectively extracting resources faster than they can be replenished. This holds true at global and local levels. On a planetary scale, research by the Stockholm Resilience Centre<sup>a</sup> has shown that as a result of human activities, the world has reached a point where several of Earth's systems are overtaxed, disrupting essential natural systems that support life on this planet. This has resulted in climate change, loss of genetic diversity, and chemical pollution on a global scale.

Meanwhile, other impacts are felt acutely in local or regional contexts. Air quality and water stress are good examples of this. In many cities, increasing motorization and

fossil fuel-powered electrification have meant local residents face increasingly unhealthy air. Globally, use of conventional cars and traditional electric power are outpacing adoption of cleaner technologies that do not overwhelm local airsheds with pollution. Likewise, in many places an increasing demand for water is exceeding the capacity of local reservoirs and groundwater aquifers. By 2030 more than 50 countries will be facing medium, high, or extremely high water stress.<sup>b</sup>

To spur collective efforts in creating a better future, countries have outlined a set of 17 Global Goals.<sup>c</sup> Ratified by 193 countries, the goals outline a road map for where innovation is most needed. At the heart of the Global Goals is the

dual objective of growing societal well-being and human security while remaining within the confines of the planet's resources and their ability to replenish themselves. Serious companies will do this by considering whether their **core business model** contributes to growing social well-being *and* decreasing the pressure on the resources of the planet as defined by the goals and targets of the Global Goals. Focusing only on reducing some negative environmental impact or only on increasing social well-being is not sufficient. To meet the spirit of the Global Goals, sustainable core business models must drive an increase in social well-being with an ever-reducing environmental footprint, at the level of both the urgency and the ambition called for in the Global Goals.

## Notes:

<sup>a</sup> Steffen, W., K. Richardson, J. Rockström, S.E. Cornell, I. Fetzer, E.M. Bennett, R. Biggs, S.R. Carpenter, W. de Vries, C.A. de Wit, C. Folke, D. Gerten, J. Heinke, G.M. Mace, L.M. Persson, V. Ramanathan, B. Reyers, and S. Sörlin. 2015. "Planetary Boundaries: Guiding Human Development on a Changing Planet." *Science* 347 (6223). <http://science.sciencemag.org/content/347/6223/1259855>.

<sup>b</sup> Luo, T., R. Young, and P. Reig. 2015. *Aqueduct Projected Water Stress Country Rankings*. Washington, DC: World Resources Institute. <http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings>.

<sup>c</sup> For more information, see <https://sustainabledevelopment.un.org/sdgs>.

Currently, this is the "elephant in the boardroom." Few companies have publicly acknowledged the implications of meeting tomorrow's rapid growth in demand with current business models. For example, a review of 40,000 corporate sustainability reports between 2000 and 2014 found that only about 5 percent of companies mention some type of ecological limits. Of those, most did not provide detail on current or planned changes to address the recognized limits (Bjørn et al. 2016). If the limits of the fundamental business driver of selling more goods to more people continues to be ignored, it is difficult to imagine how businesses will thrive and accordingly how we will deliver improvements in well-being.

The need to live within the planet's resources and to lift people out of poverty has been widely recognized around the world. In September 2015, 193 countries ratified the UN Sustainable Development Goals—also known as the Global Goals. The 17 goals and accompanying 169 targets that constitute the Global Goals represent a powerful international vision for a better future. If achieved, by 2030 poverty and hunger will be eliminated, and economic prosperity will grow, supported by a stable climate and healthy land and water ecosystems.

Enabling public policies is crucial, but without the will and innovation of private enterprise, this vision of a sustainable world cannot be achieved. To ensure that the global community's social and environmental goals are met will require a full delinking of business growth from negative environmental and social impacts. To accomplish this will require fundamental shifts in the way consumer demands are shaped and met.

If companies—and their customers and communities around the world—are to thrive in tomorrow's markets, they first need to acknowledge the environmental limits involved in producing more goods for more people. CEOs need to acknowledge the elephant in the corporate boardroom and talk about the uncomfortable topic of our business dependency on consumption. The path forward is multifaceted (see Box 3), but normalizing the conversation is a vital first step necessary to delivering the transformational business models required.

## Box 3 | Where to Start the Consumption Conversation and Where to Take It Next

In the process of developing this working paper, contributors from a range of stakeholders have expressed their enthusiasm for what they consider to be a much-needed paper. But little here is completely new. If the challenges are understood, why have the issues proven so difficult to raise in polite business conversation? The reason is that the consumption challenge is a systemic one, and raising it leads to a range of other issues and concerns. The scope of this paper is not to solve all of these dilemmas. Rather, the intent is to frame and illustrate examples of these challenges—prompting more companies to ask tough questions and do more analysis internally. The authors want to help push the conversation forward and help companies start the process of addressing the elephant in the room.

- Consider that (1) GDP growth is the default measure for economic success in the countries where my company does business; (2) governments are pushing for growth, and even call on people to buy and consume more when the economy is slow; (3) my investors want to see growth in their share value; and (4) my customers enjoy acquiring new things. Why should business step out of line when all other parts of the system are calling for what we deliver?

*Answer:* Because, as this working paper argues, business models that rely on unchecked consumption and unlimited resources will not last. They will be replaced by better models that deliver more value with the resources available. As these models scale, companies that do not transform will fall by the wayside. Each part of the system must assess and respond to the risk.

*Answer (continued):* Business has been an engine of leadership on many environmental issues and, through brand influence and lobbying, has a powerful opportunity to compel changes in other parts of the system.

- Are we suggesting that the world halt (or reverse) economic growth and development in order to address environmental and social challenges?

*Answer:* No. A Business & Sustainable Development Commission report<sup>a</sup> states that the Global Goals create at least US\$12 trillion in private sector opportunities. The IFC<sup>b</sup> identifies \$23 trillion in opportunities between now and 2030 in just 21 emerging market economies. The business opportunities in a resource-constrained economy are immense. It just requires us to look through new lenses and be willing to transform.

- What does this mean for economies and populations that are just now reaching middle-income level? Or still struggling with widespread poverty?

*Answer:* The aspirations created and enjoyed by developed economies must not prevent other economies from achieving their ambitions and improving quality of life for all. The imperative is not that people make do with *less* goods or that some people cannot *have* goods. Instead, companies must innovate *new* business models to deliver goods and services in a *different way*, using their influence to *shape* markets and consumer demand such that economic growth no longer depends on the exhaustion of the planet's resources and disruption of natural systems. Companies, countries, and citizens will all have different starting points around the world but share the ambition for a better quality of life.

### Notes:

<sup>a</sup> BSDC (Business & Sustainable Development Commission). 2017. *Better Business Better World*. London, U.K.: BSDC. <http://report.businesscommission.org>.

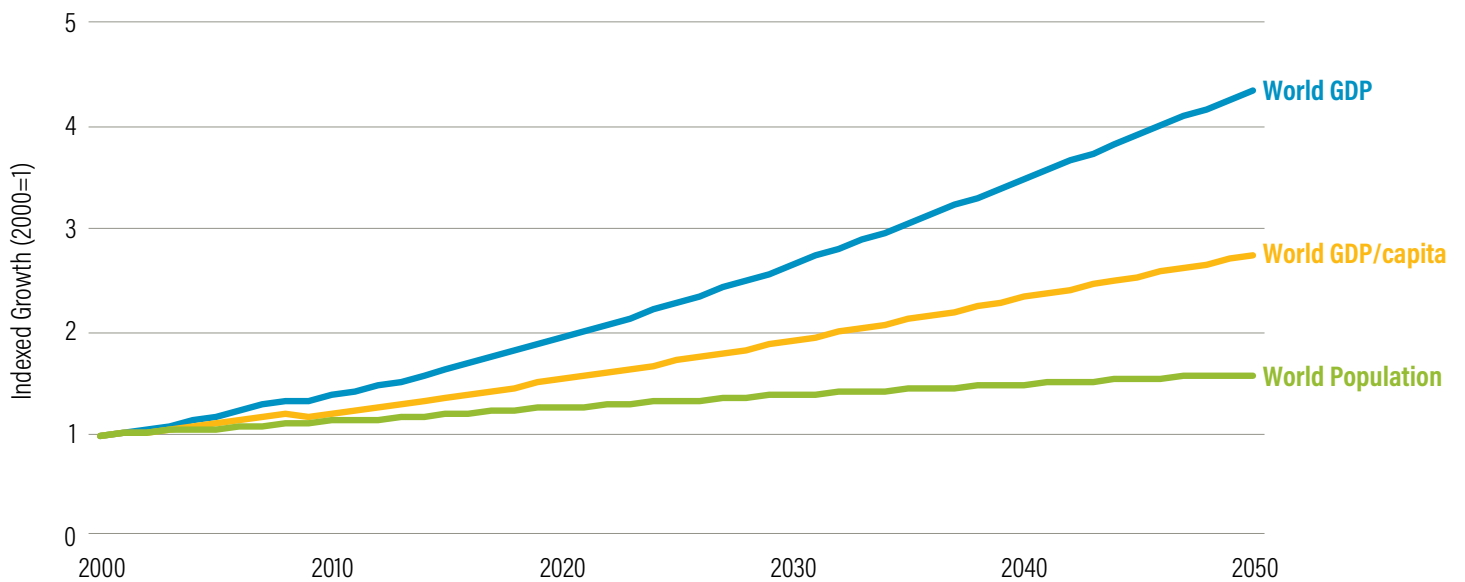
<sup>b</sup> IFC (International Finance Corporation). 2016. *Climate Investment Opportunities in Emerging Markets*. Washington, DC: IFC. [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES).

## HOW CONSUMPTION IS CHANGING IN THE 21ST CENTURY

This working paper challenges companies to examine the elephant in the corporate boardroom—the implications of a rapid increase in demand for their products in the 21st century. It illustrates how today's consumption patterns impact the world's resources and why incremental shifts will not be enough to sustain air, water, and land resources, or importantly, people. It takes a closer look

at a few familiar products to show how companies can embrace challenges related to a rapid increase in consumption. Specifically, there are examples of bold transformations—some happening at a small scale today—that can create vastly better options for how we move, eat, and dress. Companies that accelerate these innovations to keep pace with demand in tomorrow's markets while minimizing environmental risks and resource constraints will lead the creation of sustainable markets tomorrow.

Figure 1 | Global Population and Economic Growth Projections, 2000-2050



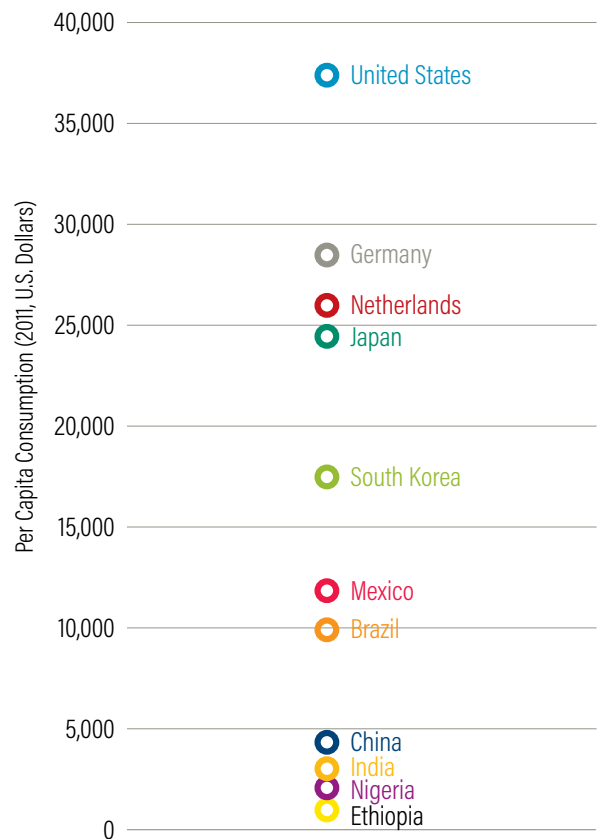
Sources: Data aggregated by WRI. Population data: United Nations, Department of Economic and Social Affairs, Population Division 2015a, 2015b. GDP data: OECD 2017.

First, look at two basic underlying factors: population and economic growth. The long-term outlook suggests there will be 8.5 billion people on the planet in 2030 and more than 9.5 billion by 2050. Meanwhile, global economic production is projected to grow at a faster rate. Gross domestic product (GDP) per capita in 2050 is projected to be three times as much as in 2000. Overall GDP more than quadruples over that period (see Figure 1).

Second, look at expected patterns of consumption (as measured by household expenditures, accounting for differences in purchasing power) and the relation to economic growth. A closer look at emerging and developing markets shows that in 2011 (the most recent data available for comparison), annual per capita consumption in these countries was just a fraction of the per capita spending in the developed economies of Asia, Europe, and North America (see Figure 2).

Consumption will likely increase rapidly over the next 15 years, particularly in emerging and developing markets. For example, in 2010, 50 million people in India—only 5 percent of the population—had reached middle-income levels. The Indian middle class has now doubled to 100 million people, and estimates project that it could double again to 200 million by 2020 and reach 475 million by 2030 (Ernst & Young 2013).

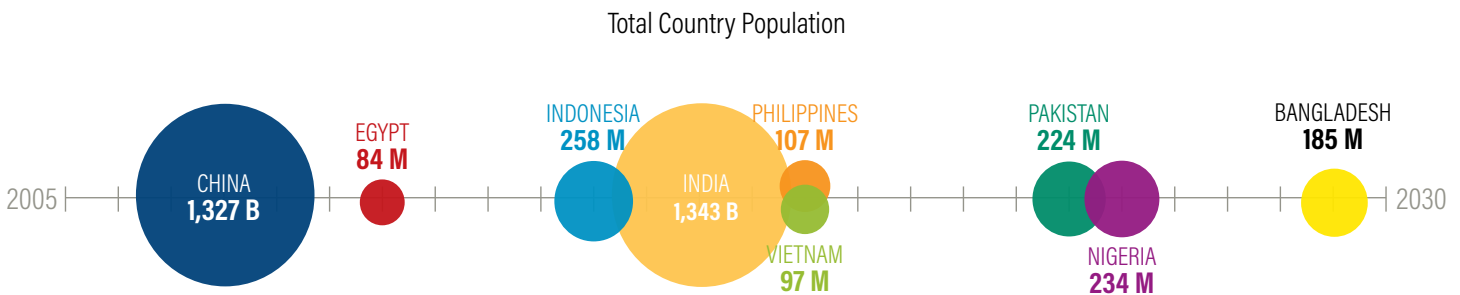
Figure 2 | Per Capita Consumption (2011, US\$)



Note: Comparison of illustrative countries' real household expenditures.

Source: World Bank 2014b.

Figure 3 | Countries That Have or Are Expected to Achieve the Middle-Class Effect between 2005 and 2030



Source: Ernst & Young 2013.

Many other countries could see their middle classes expand over the next 15 years as well. Ernst & Young (2013), for example, has pointed to the “middle-class effect” that occurs when average per capita income reaches \$6,000 per year. At this point, consumption (real household expenditures) accelerates and contributes to further growth of the middle class. There is a pipeline of several fast-growing, populous countries that have recently hit this benchmark or will in the next 15 years (Ernst & Young 2013; see Figure 3).

Increased consumption has positive and negative consequences. Growing economic prosperity means millions more people are able to improve their quality of life. This is an extraordinary market opportunity for businesses to provide better goods and services to meet those demands. However, this growth in consumption leads to an increase in the burden on the resources and natural systems of the planet and has long-term implications for environmental sustainability and, therefore, human and economic sustainability.

One indicator of the impact of consumption on the planet is material throughput, which refers to the total amount of materials used during each stage of the economic cycle. Many materials are a finite resource, but even for those that are not, processing materials from extraction through manufacture, distribution, and end-of-life treatment requires the use of land, water, and energy.

Remaining within the planetary boundaries will require that we grow the economy while reducing not just extraction of virgin materials but the total throughput of materials. There is a business rationale for this too. As resources and natural systems become overextended, supply chain risks and costs will increase for companies.

As with carbon emissions, the objective is to decouple economic growth, materials use, and environmental impact. A relative decoupling is defined by the Organisation for Economic Co-operation and Development (OECD) as achieving faster growth in the economy than in materials use. An absolute decoupling occurs when the economy grows and materials usage decreases (OECD 2016). While relative decoupling is occurring globally (OECD 2016), absolute decoupling has not yet been achieved in advanced economies (Wiedmann et al. 2013).

According to the United Nations International Resource Panel (IRP), if increased consumption is met with today’s business models, even with the continuation of current patterns of relative resource decoupling, resource use would triple by 2050 compared to a 2000 baseline (Fischer-Kowalski et al. 2011). Planetary boundaries research, however, shows us that we do not have the capacity for a tripling of resource use (see Box 2). Something has to give. Whether we see this growth in prosperity therefore depends on the extent to which economic growth—which is needed for human well-being—can be decoupled from both resource use and environmental impact. The IRP has outlined three scenarios for resource use in 2050 (adapted for Figure 4). Four categories of primary raw materials are included: construction minerals, ores and industrial minerals, fossil fuels, and biomass.

- **IRP SCENARIO 1.** Resource use per capita in industrialized countries stabilizes at 2000 levels, and the resource use per capita of developing countries achieves the levels of industrialized countries. Annual global resource extraction would triple. According to the IRP, available resources would be exhausted, and the planet would likely be unable to absorb the resulting environmental impacts.



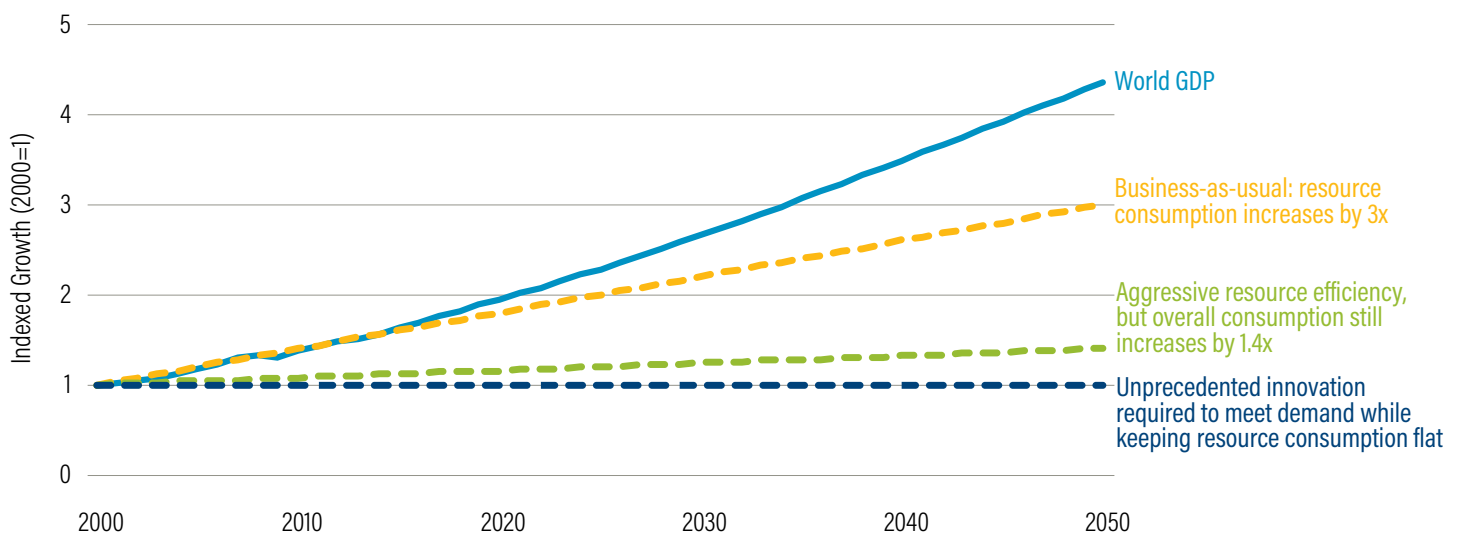
- **IRP SCENARIO 2.** In this scenario, industrialized countries reduce per capita resource use by half between 2000 and 2050, for an overall absolute reduction. All other countries increase their per capita resource use to the now reduced resource use levels of industrialized countries. Resource extraction globally would increase by about 40 percent. To achieve this scenario, considerable innovation would be needed to significantly increase resource productivity.
- **IRP SCENARIO 3.** With the third IRP scenario, global resource consumption in 2050 would be at 2000 levels. Industrialized countries would reduce resource use by a “far-reaching” factor of three to five. Developing countries would reduce resource use by 10 percent to 20 percent. Given population growth, environmental stresses would be comparable to today. This scenario is consistent with the per capita GHG emissions recommended by the Intergovernmental Panel on Climate Change to limit warming to no more than 2°C, but concerns about the potential to restrict development will make it challenging (Fischer-Kowalski et al. 2011). The spirit of this scenario is one of unprecedented innovation. It suggests that in addition to the necessity for developed countries to scale new models of consumption that significantly reduce resource use, developing countries will also need to harness ingenuity to leapfrog over today’s outmoded systems.

To put Scenario 3 into perspective, for a company to maintain product volumes (assuming the “far reaching” reduction in resource use in industrialized countries), a product designer would design a product (e.g., a T-shirt, a microwave oven, a toy) with 75 percent less resources across the entirety of the product life cycle, from extraction through manufacture, use, and end-of-life treatment. This is a daunting task indeed. New technologies, cradle to cradle, and circular manufacturing models (see Box 4) would need to be scaled significantly.

Another approach to accomplish Scenario 3 would be to reduce product volumes. Halving the number of products purchased, for example, has the potential of halving the resource efficiency challenge. Product longevity and business transformation to, for example, the sharing economy and product-as-a-service business models (see Box 4) would need to be scaled.

These outlooks are eye opening. To achieve a prosperous future for all within the limits of Earth’s resources is an unprecedented but now necessary challenge. It will require the unleashing of business innovation and political will. This is the task to which today’s sustainability leaders are called. So what does it mean in the context of some of today’s familiar products?

Figure 4 | Priority for 2000-2050: Meet Greater Consumer Demand with Far Less Resources



Sources: Based on raw data from OECD; Fischer-Kowalski et al. 2011.

**CIRCULAR ECONOMY:** An economy-wide approach to environmental impact, broadening the cradle-to-cradle concept. The model rejects the idea that the economy must shrink or be moved to a steady state in order to be sustainable. Rather, the economy can grow with a systemic circular approach to all product, service, and infrastructure decisions, such that value is not wasted along the value chain but maintained and reinvested.

**CRADLE TO CRADLE:** A product-oriented approach to reducing environmental impact by “closing the loop” on the take-make-waste model. Instead of disposing of materials as waste at the end of a product’s life, materials have value as the input to a next iteration of product or service.

**DEMATERIALIZATION, MATERIALS DECOUPLING, MATERIALS EFFICIENCY:** Overlapping terms capturing the intent of eliminating the link between economic growth and materials throughput.

**ECO-EFFICIENCY:** Refers to the concept of creating value while minimizing resource use and waste.

**INDUSTRIAL ECOLOGY:** A science- and research-oriented approach to understanding and reducing the environmental impact of industry by studying material and energy flows through industrial systems.

**PRODUCT AS A SERVICE:** A commercial mechanism for the relationship between company and the customer in which the company does not sell the physical product (for example, lightbulbs) but instead sells the service

(for example, lumens of light). In this relationship, the company is incentivized to make the product and the service as durable and resource efficient as possible.

**REDUCE, REUSE, RECYCLE:** Offers a hierarchy of sustainability value. Recycle is good, reuse is better, and reduce best of all.

**SHARING ECONOMY:** Maximization of underutilized assets through sharing. Applies best to capital assets such as cars and housing. Also known as collaborative consumption.

**TAKE-MAKE-WASTE:** The traditional business model in which materials are extracted from the ground, used to make a product, and then disposed of at the end of the product’s life. Also known as a *linear* model.

## A CLOSER LOOK AT IMPLICATIONS FOR THREE PRODUCTS

Billions more people will soon be able to afford a better life. Economic development and higher incomes shift consumption patterns in fundamental ways. For example, as incomes rise, people tend to consume more resource-intensive foods like meat and dairy (Ranganathan et al. 2016). Increased discretionary spending also allows consumers to have expanded choices around consumer durables like personal automobiles and to make lifestyle choices based more on personal preference than on basic necessity. This is exemplified by the growth of the fast fashion industry. As previously noted, accelerating consumption has serious ramifications for the world’s climate, water, and land, and it could act as the brake on sustainable development.

At present, multinational companies fall broadly into three categories of understanding about the sustainability challenges of tomorrow’s markets. These categories generally track against the three IRP scenarios outlined in the “How Consumption Is Changing in the 21st Century” section of this paper:

- Some companies are **ignoring** those challenges and are continuing to produce and sell products using 20th-century business models.

- Some companies are **improving** their practices to address those challenges, investing heavily in cleaner production methods and efficiency improvements for existing products and business models. While these are necessary and important steps, they stop short of altering consumption patterns.
- Some companies are acknowledging and **embracing** those challenges, not only improving production efficiency but also radically changing the business models and value propositions they offer customers.

Some companies have started to acknowledge the bigger challenges that also pose clear business risks—like climate change, deforestation, or water scarcity—and are increasingly recognizing the business benefits of environmental stewardship. Some companies, like Unilever and Nike, have set ambitious goals to expand their business while cutting their impact in half. Goals that begin to decouple business growth from environmental impact are crucial because the volume of resources being used to meet exploding consumer demand—and the related environmental impact—is headed into impossible territory. That is, the impacts of unchecked growth undermine our ability to thrive because the planet’s resources and natural systems cannot sustain the growth. Sustainability strategies that fail to address this fundamental problem will not suffice, because the

environmental impacts of meeting the volume of demand will far outweigh efforts to make production cleaner or more efficient. Instead, companies in tomorrow's markets must meet customer needs in new and better ways that can delink business growth from environmental impact.

In this section, we explore three categories of products: consumer durables, represented by personal automobiles; consumables, represented by beef; and other fast-moving consumer goods, represented by apparel.<sup>1</sup> For each of these products, we explore how the challenge of consumption is being **ignored**, examples of strategies companies are deploying to **improve** practices to address the challenge, and examples of strategies that suggest the challenge has been **embraced** by some companies. The examples are not exhaustive. Neither is the discussion an attempt to provide systematic solutions to the challenges of personal mobility, food security, or clothing. Rather, it is an effort to show how some strategies are insufficient to meet the scale of the challenge, whereas others show promise.

## CONSUMER DURABLES—CARS

*Roughly 100 years ago, with innovations like Henry Ford's assembly line, companies started producing automobiles that were affordable for the average U.S. household. Demand and consumption increased rapidly throughout the 20th century as car ownership transformed personal mobility and shaped growing American cities.*

*Today U.S. households far outspend other countries on transportation (see Figure 5). Much of this high spending is related to personal automobile ownership. In car-dependent American communities, transportation costs can amount to 25 percent of a family's income (USDT 2014).*

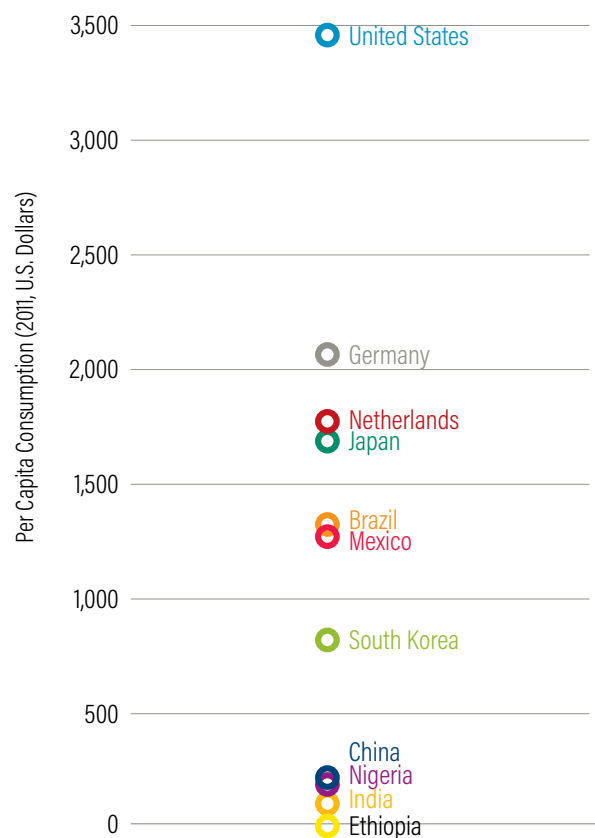
*Worldwide, automobile ownership varies widely across countries. In the United States, there are more than 80 vehicles for every 100 people. There are far fewer vehicles per person in emerging economies—including Brazil (20 per 100); China (10 per 100); and India (2 per 100; OICA 2017)—but more people in growing countries will soon reach the point where they can afford a car.*

*Countries are already motorizing rapidly. In 2005 there were 900 million vehicles on the road globally. By 2010 the world had surpassed 1 billion and reached 1.25 billion in 2015. That represents an increase of more than 40 percent in the span of a decade, in part due to rapid growth in China (+351 percent), India (+171 percent), and Brazil (+81 percent; OICA 2017).*

*China became the world's largest automobile market in 2009, when new sales exceeded 10 million units. By 2015 that had more than doubled to 21 million units (OICA 2016). For perspective, it took the United States 20 years to double new car sales from 5 million to 10 million. Projections suggest India is next. It could become the third-largest car market by 2030, leaping over Brazil, Germany, and Japan.*

*So what will companies do to meet demand in tomorrow's markets? Some companies will choose to **ignore** the implications of increased consumption and continue selling more cars to more people. Others, however, are recognizing that more cars on the road undermine efforts to address air quality locally and GHGs globally, and also exacerbate challenges like congestion and road safety. Will recognition of those factors—and the potential value of alternatives—help motivate companies to **embrace** new and better approaches to consumption?*

Figure 5 | Annual per Capita Spending (2011, US\$) on Transport



Note: Comparison of illustrative countries' real expenditures on purchases of vehicles, operation of personal transport equipment, and transport services.

Source: World Bank 2014b.

---

## Ignore

With an increasing number of households able to spend more on transportation, companies could stick with current business models and sell more cars to more people. According to various projections, there could be more than 2 billion motorized vehicles on the road by 2030.<sup>2</sup> However, companies that are meeting future demand with business-as-usual approaches are ignoring challenges such as climate change, air quality, and congestion:

- Today GHG emissions from transportation contribute more than one-fifth of the global total and are growing fast (Kahn Ribeiro et al. 2007). In a business-as-usual scenario, global GHG emissions from transport would increase 55 percent from 2010 to 2030 (Gota et al. 2015).
- Air pollution from motor vehicles contributes to millions of premature deaths each year (WHO 2014). The price tag for road air pollution and the associated health costs (e.g., productivity and lives lost to lung and heart disease, respiratory illnesses) amounted to \$1 trillion in 2010 across OECD countries. Adding the costs in China and India brings the total to \$3 trillion (OECD 2014).
- Gridlock is costing countries billions of dollars per year. Congestion is reducing GDP anywhere from 1 percent to 5 percent in many countries, and as much as 10 percent in some megacities, such as Beijing and São Paulo (United Nations Human Settlements Programme 2015; Zhao et al. 2015).

Some in the auto industry have started to recognize the impossibility of continuing with business as usual. As Bill Ford Jr. (2011), chair of Ford Motor Company, has observed: “It’s clear that the mobility model that we have today simply will not work tomorrow.”

## Improve

Beyond business as usual, it is fair to assume that technologies could improve the performance of the cars that companies could be selling in tomorrow’s markets—reducing impacts on air quality, climate change, and, potentially, congestion. But would those improvements be enough to keep up with the sheer number of cars being sold and driven?

Vehicles are more efficient today than they were 15 years ago, yet total global GHG emissions from cars and trucks continue to increase (see Figure 6). Efficiency improvements have not been able to keep pace with the growth in the total number of cars sold.

There are more efficiency opportunities to exploit, but an ever-increasing number of cars on the road would overwhelm any progress made on congestion and air impacts. For example, it is possible that new cars in 2030 will emit only half as much CO<sub>2</sub> as today’s models (Kahn Ribeiro et al. 2007). But how long before those cars make up a significant portion of the global total? The average car in the United States is 11 years old, and that is expected to increase over the coming years (IHS Markit 2014). If auto manufacturers wait for new, cleaner, electric vehicles (EVs) to penetrate the market, it will be longer before they see a significant impact on CO<sub>2</sub> emissions. EVs are only 0.1 percent of the total global vehicle stock. Current goals and trends in various countries suggest that could increase to 3 percent by 2020, which would fall short of the rapid increase needed (IEA 2016a). Even with faster adoption, companies still face basic resource challenges in meeting demand for more and more vehicles. A majority of automotive executives surveyed by PwC noted that metals and mineral scarcity is already a “pressing issue” and a source of even greater risk in the future (PwC 2011).

---

### *In their own words . . .*

*By birth and by choice, I’ve been involved with the auto industry my entire life, and for the past 30 years, I’ve worked at Ford Motor Company. And for most of those years, I worried about, how am I going to sell more cars and trucks? But today I worry about, what if all we do is sell more cars and trucks? What happens when the number of vehicles on the road doubles, triples, or even quadruples?<sup>2</sup>*

—Bill Ford Jr., chair, Ford Motor Company

---

<sup>2</sup> Ford, B., Jr. 2011. “A Future beyond Traffic Gridlock.” TED Talks. [https://www.ted.com/talks/bill\\_ford\\_a\\_future\\_beyond\\_traffic\\_gridlock/transcript?language=en](https://www.ted.com/talks/bill_ford_a_future_beyond_traffic_gridlock/transcript?language=en).

## Embrace

Considering current motorization trends, efficiency or incremental EV market penetration alone will not be sufficient to meet mobility challenges in tomorrow's markets. Other measures and innovations will be needed, for example, to meet the ambition science suggests is necessary to keep global temperatures from rising more than 2°C.

A full recognition and response to the scale of the challenge would mean a bigger, faster change. It could involve an acceleration of electrified transport and decarbonization of the power grid. In such a scenario (as one study suggests), scaling the total number of EVs from 1 million in 2015 to 20 million by 2020 and 140 million by 2030 would align with a 2°C target (IEA 2016a). This would mean companies embrace a collective target of selling 7 million EVs per year by 2020 (CEM 2016). Even in that scenario, there will be important questions around congestion and the natural resources needed to produce and power those vehicles (i.e., battery technologies and electricity sources).

Better yet would be wider and fuller adoption of the “avoid-shift-improve” framework (see Box 5). Such an approach can provide broader access to mobility while prioritizing people and local quality of life. Car companies have arguably been most focused on “improve” strategies, including advancements in fuel efficiency improvements through opportunities with light weighting, for example. Companies are also embracing other new technologies (e.g., autonomous vehicles) and new business models such as car sharing (e.g., Zipcar or car2go) or e-hailing services (e.g., Uber or Lyft) that could potentially disrupt the auto industry's traditional business model. The jury is still out as to whether those alternative models will have significant environmental benefits, but their rapid impact on mobility choices in many cities is undeniable. McKinsey & Company suggests those companies pioneering “new business models could expand automotive revenue pools by about 30 percent, adding up to USD 1.5 trillion” (Gao et al. 2016). Likewise, companies that are not innovating could see car sales slow as car sharing and e-hailing approach the \$1 trillion market they are expected to reach (or exceed) by 2030 (Gao et al. 2016). As many as one in ten cars sold in 2030 could be shared vehicles, slowing overall new car sales growth to 2 percent annually (down from 3.6 percent in recent years; Gao et al. 2016). Some have even suggested that markets like the United States may hit “peak car ownership” as soon as 2020 (Walker and Johnson 2016).

## Box 5 | The Avoid-Shift-Improve Framework

The avoid-shift-improve framework, which underpins the analysis and recommendations of the UN secretary-general's High-Level Advisory Group on Sustainable Transport, outlines three priorities for shifting mobility to more sustainable models:

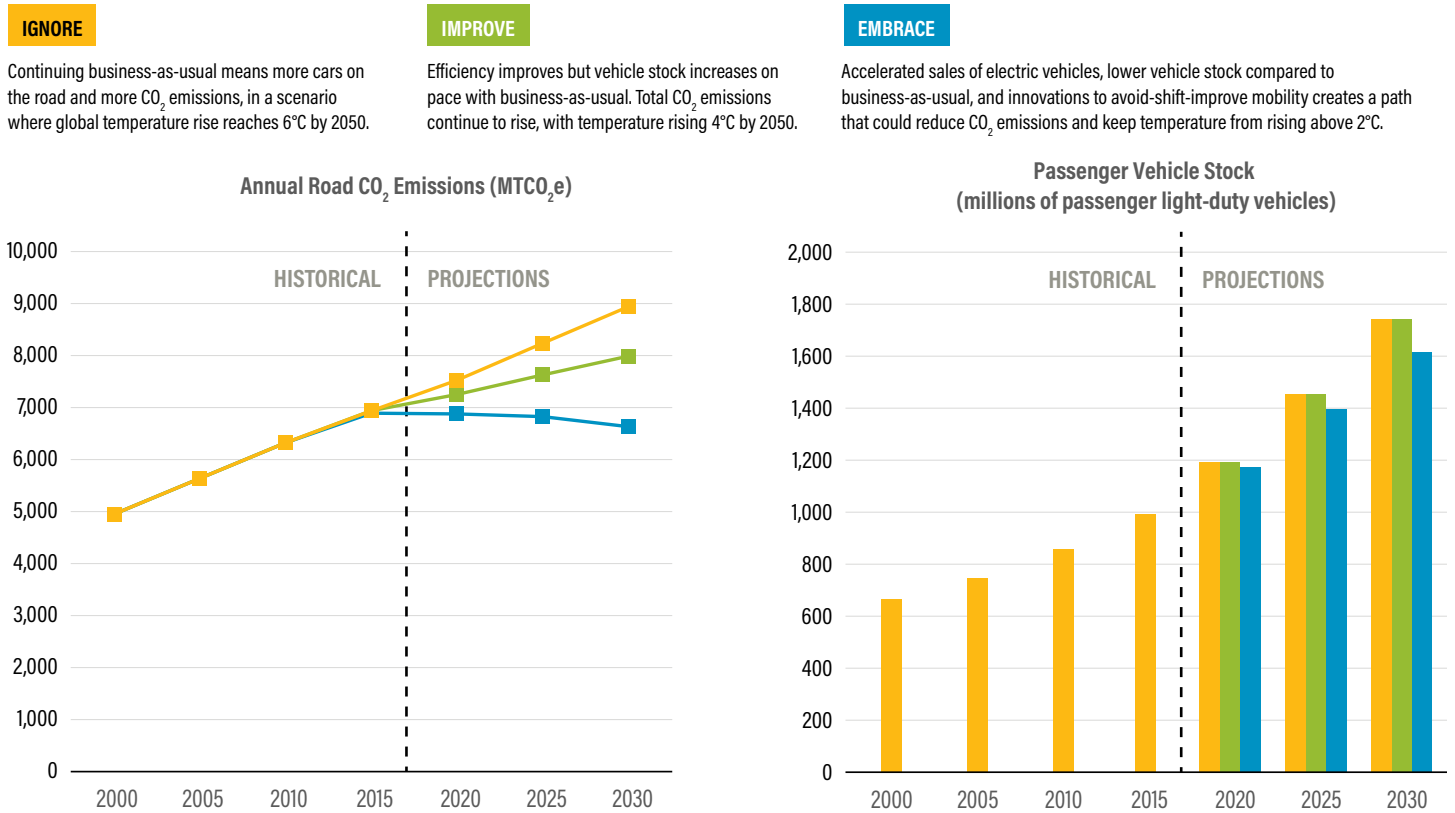
- implementing more compact, connected urban planning that enables and incentivizes people to *avoid* inefficient or unnecessary travel;
- providing and incentivizing the use of better, more efficient modes of transport like bus rapid transit to encourage people to *shift* their transport modes away from inefficient single-user alternatives; and
- creating the technologies and policies to *improve* the environmental performance of all mobility options.

For more information, see *Mobilizing Transport for Sustainable Development*, <https://sustainabledevelopment.un.org/content/documents/2375Mobilizing%20Sustainable%20Transport.pdf>.

For additional resources, see <http://www.wrirosscities.org/tags/avoid-shift-improve-asi>.

Meanwhile, there is untapped potential in helping people avoid unnecessary trips or making it easier and more convenient to *shift* to other, more efficient modes of transportation (Cazzola and Teter 2016). Companies that recognize that more congestion and increasing air quality concerns could limit the volume of cars can look for new opportunities to create value in the realm of “avoid” and “shift.” These could include business models that reap rewards from safer and better-designed cities with enhanced walkability and increased access to bike, bus, and rail options. Involvement and influence in these areas would indicate whether leaders in the auto industry are moving at the pace and scale needed to ensure sustainability in tomorrow's markets—one in which they are not reliant on selling more cars to more people. Auto manufacturers will not be able to change the system on their own, of course. They will need investors, customers, and governments to all embrace the shift from volume to value.

Figure 6 | Efficiency Improvements Alone Will Not Reduce Total CO<sub>2</sub> Emissions from Cars



Source: IEA 2016b.

## Big Challenges and Questions for Tomorrow's Markets: Lessons from Auto Examples

Embracing changes in tomorrow's markets will mean encouraging and enabling radical innovations, which come with challenges of their own. Companies that have been built in the ambition of Henry Ford to "democratize the automobile" are now confronting a future where the best path forward cannot be selling more cars to more people. Instead, they could be democratizing new services and access to mobility. Meanwhile, that transition has potential impacts on jobs and local economies that have relied on traditional auto manufacturing and sales. Analysis of the transition to a low-carbon economy in the United States, for example, suggests employment in motor vehicle parts manufacturing would decrease slightly by 2030 (approximately 15,000 to 24,000 fewer jobs in that sector; but the analysis shows a net addition to the overall economy of more than 1 million jobs; ICF International 2015). These challenges raise questions that auto industry leaders—as well as leaders in other industries—should be asking and answering.

**Congestion relief. How will companies scale new business models and move on from car sales volume as their top priority?** Subscription and service-based business models, and other opportunities to avoid or shift mobility, could be more attractive to future customers—particularly those in crowded, polluted cities. The emergence of these models requires companies to better understand and ensure that new mobility services enabled by technology, such as e-hailing and autonomous vehicles, have net benefits for people and the environment. We must also find models in which companies make money with solutions that help customers avoid unnecessary trips or increase the convenience of alternatives (walking, bike, bus, rail). Car companies may also have competencies that match up nicely with a circular economy, considering their experience with financing, leasing, and extensive used parts infrastructure. Could these form the foundations for more circular models for tomorrow's cars? Could this help accelerate market penetration of new technologies and get older, polluting cars off the road?

**Socioeconomic engines. How will companies create and execute long-range workforce transition plans?**

Lost in all the intrigue and excitement of new models and technologies are the people who will potentially be out of a job. What happens to those whose livelihoods depend on the old models? The top 10 automakers account for more than 75 percent of global sales and employ more than 2.5 million people. Millions more work in associated businesses like car dealerships, automotive repair shops, and parts suppliers. Communities face the prospect of huge employment challenges—and potential civic unrest—if thousands lose jobs due to automation and efficiency leaps (Chase 2016). These employment challenges cannot be ignored and deserve careful thought now, before the window for investments and adaptation closes. Like many industries, automakers ought to be thinking through the long-term implications for their workforce and value chain as the sector evolves.

**CONSUMABLES—BEEF** 

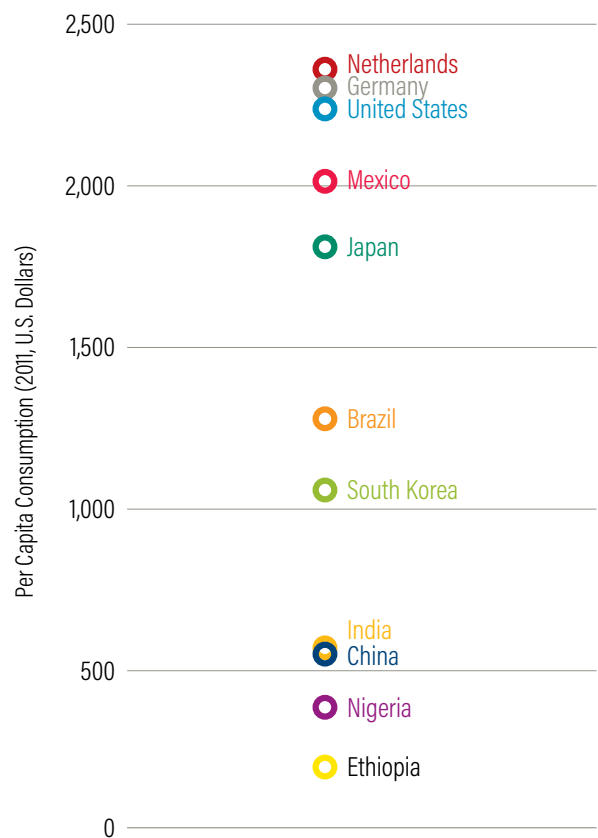
Millions of people are hungry, undernourished, or have poor diets. What people eat, how much they eat, and how often is a complex interplay between personal choice, religious faith, cultural preferences, food availability, and economic status. There is one absolute requirement of the global food system, and that is to ensure each and every person has sufficient nutrition. The modern food system is incredibly complex, inefficient, and vulnerable. Food exports globally were valued at nearly \$1.5 trillion in 2014 (WTO 2015). By 2050 a food gap will exist, meaning there will be a need for 70 percent more food than is available today to feed the world's nearly 10 billion people (Ranganathan et al. 2016).

Animal-based proteins have the highest impact on the environment of any food, and beef is the most impactful. Consumption of beef is trending upward in many countries. With the exception of countries like Brazil and Argentina, the highest per capita meat consumption occurs in developed countries (see Figure 7), but it is also growing in emerging economies (Ranganathan et al. 2016). Overall, worldwide consumption of animal-based foods (meats and dairy) is expected to increase 79 percent between 2006 and 2050, and beef demand by 95 percent (Ranganathan et al. 2016).

As incomes rise, meat becomes a more significant part of diets (Ranganathan et al. 2016). As more people in emerging economies are able to spend more on food, one of the most important questions is: “How much meat will they buy?” Likewise, for those countries already consuming high amounts of meat, the question is: “Can they be persuaded to shift their diets to other sources of protein?”

So what will companies do to meet demand in tomorrow's markets? Will they (and their customers) **ignore** the impacts of increased beef consumption? Or will they innovate and **embrace** new options for meeting customers' needs?

Figure 7 | Annual per Capita Spending (2011, US\$) on Food and Nonalcoholic Beverages



Comparison of illustrative countries' real expenditures on food products and nonalcoholic beverage purchased for consumption at home (excludes food products and nonalcoholic beverages sold for immediate consumption away from home by hotels, restaurants, cafes, bars, kiosks, street vendors, automatic vending machines, etc.; cooked dishes prepared by restaurants for consumption off their premises; cooked dishes prepared by catering contractors, whether collected by the customers or delivered to the customer's home; and products sold specifically as pet foods).

Source: World Bank 2014b.

---

## Ignore

Companies could choose a business-as-usual approach to close the global food gap, but that could have immense negative impacts on the environment. Croplands, pastures, and rangelands already occupy nearly half of the world's potentially vegetated lands (Zomer et al. 2016). Agriculture is estimated to be the dominant driver of 80 percent of the world's deforestation, including that seen in tropical regions (Kissinger et al. 2012). Agriculture accounts for 70 percent of all freshwater withdrawn from rivers, lakes, and aquifers (Searchinger et al. 2013), and it accounts for 80 percent to 90 percent of freshwater that is consumed and not returned (Foley et al. 2005). Agriculture and related land-use change accounted for nearly one-quarter of global GHG emissions in 2010 (Searchinger et al. 2013). By 2050 these sources could be responsible for as much as 70 percent of the total allowable global emissions "budget" that would limit global warming to 2°C (Ranganathan et al. 2016).

Meeting increased demand for conventional beef products, in particular, puts a heavy strain on the environment. Beef is the most resource-intensive protein, requiring more land and water and generating more GHG emissions than other animal or plant protein sources (see Figure 8; Ranganathan et al. 2016). The world's cattle population is expected to grow from 1.5 billion in 2000 to 2.6 billion in 2050 (Rosegrant and Thornton 2008). Brazil has the fastest-growing cattle population (see Figure 9), which has contributed to deforestation in the Amazon, one of the most biologically rich regions of the world. Nearly 60 million cattle in Brazil (a third of the country's total) are located in the Amazon biome (Zero Deforestation Cattle 2015).

Not all cattle are reared for beef. While India consumes the least amount of beef per capita in the world (OECD-FAO 2016), it is among the top dairy producing countries in the world.<sup>3</sup> According to the UN FAO, India is the world's top milk producer with 18 percent of global production,<sup>4</sup> 83 percent of which comes from cattle.<sup>5</sup> In fact, the country rears more cattle than the United States, the world's largest beef producer. Livestock contributed 63.4 percent of India's total agriculture GHG emissions in 2007 (total agriculture GHG emissions were 334.41 million tons [303.37 million t] CO<sub>2</sub> eq; INCCA 2010).

In addition to the environmental impacts of beef, there are also implications for human health and animal welfare. Diets with too much red and processed meat can

---

### *In their own words . . .*

*The leadership of the food industry is critical to devising innovative products, solutions and approaches that will nourish the world's poor, unlock employment opportunities, and open new markets.<sup>9</sup>*

*—Lord Mark Malloch-Brown, chair of the Business Commission on Sustainable Development*

<sup>9</sup> BSDC (Business & Sustainable Development Commission). 2016. "The Business Commission Welcomes New Commissioner, Grant F. Reid, CEO of Mars, Incorporated." <http://businesscommission.org/news/the-business-commission-welcomes-new-commissioner-grant-f-reid-ceo-of-mars-incorporated>.

---

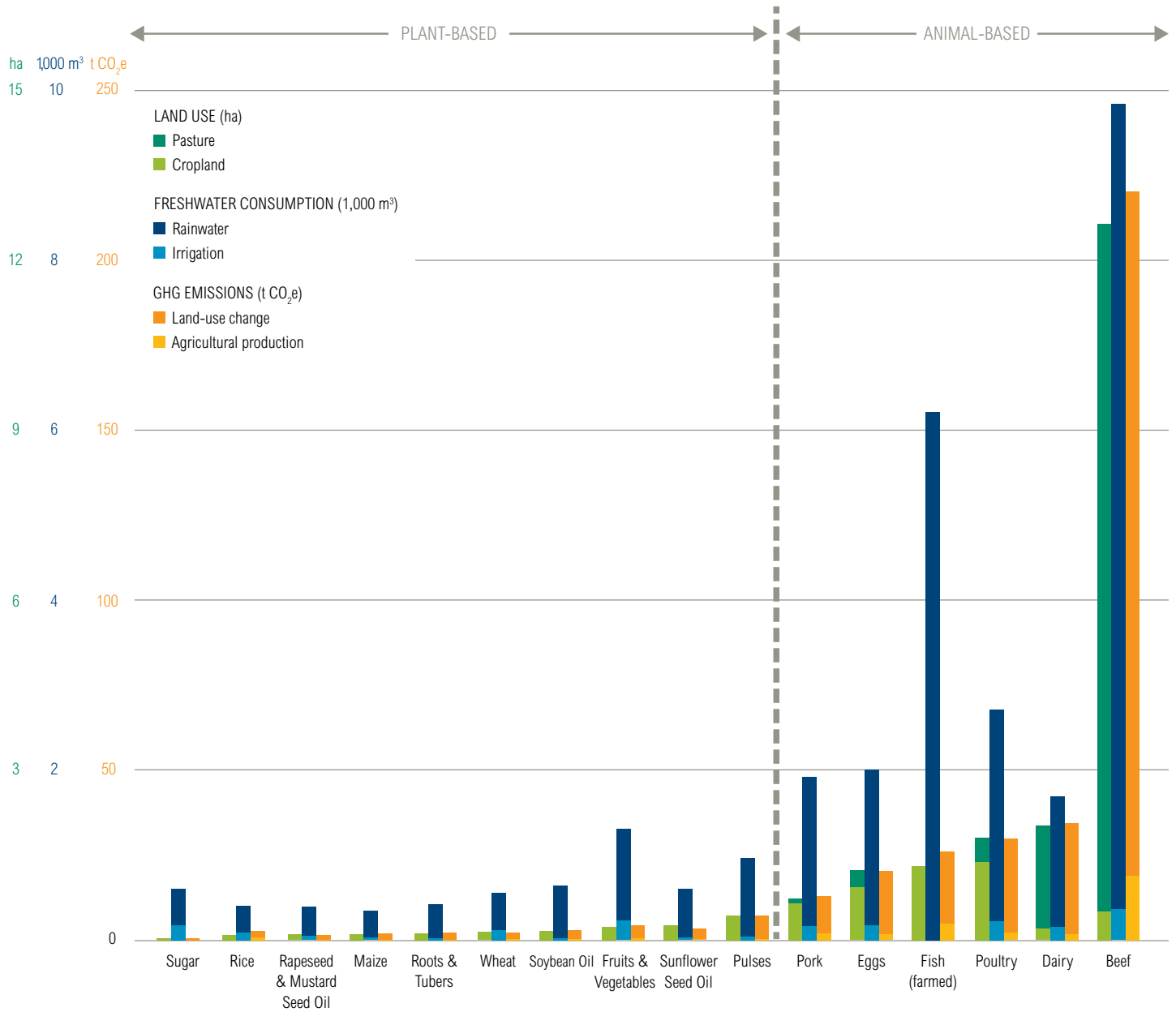
contribute to heart disease, certain cancers (Pan et al. 2012), type 2 diabetes (Micha et al. 2010), stroke (Kaluzka et al. 2012), and premature death (Sinha et al. 2009). A study by the Harvard School of Public Health found that for each additional 3 ounces (85 g) of unprocessed red meat consumed each day, study participants' risk of dying from cardiovascular disease increased by 13 percent (Pan et al. 2012). Meanwhile, the trade-offs between animal welfare and resource efficiency are enormous. Research has shown conventional U.S. beef farming requires fewer animals (56.3 percent), less water (24.8 percent), less land (55.3 percent), and less fossil fuel energy (71.4 percent) to produce the same amount of beef as grass-fed systems typically used in the past (Capper 2012). Concerns persist about freedom of movement, use of antibiotics, diet, and slaughterhouse practices, among other issues. Companies that ignore these challenges and provide meat-based products en masse are missing opportunities to shift demand to other, less-impactful food and protein sources (see Box 6).

Despite the negative impacts of increased consumption, global data suggest diets are trending toward more beef demand in many parts of the world. Per capita consumption in several countries, including Brazil and the United States, currently exceeds the world average (see Figure 10). Per capita beef consumption is also growing in other large countries such as China, but the government has taken notice. In 2016 China's health ministry published new dietary guidelines, including a new recommendation on daily meat consumption per capita. If these guidelines are followed, emissions of CO<sub>2</sub>-equivalent from China's livestock industry could fall by 1.1 billion tons (1 billion t) by 2030 (Milman and Leavenworth 2016).



Figure 8 | GHG, Land, and Water Impacts of Protein Sources for Human Consumption

PER MILLION KILOCALORIES CONSUMED



Notes: Data presented are global means. Entries are ordered left to right by amount of total land use. Indicators for animal-based foods include resource use to produce feed, including pasture. Tons of harvested products were converted to quantities of calories and protein using the global average edible calorie and protein contents of food types as reported in FAOSTAT database. "Fish" includes all aquatic animal products. Freshwater use for farmed fish products is shown as rainwater and irrigation combined. Land use and greenhouse gas emissions estimates are based on a marginal analysis (i.e., additional agricultural land use and emissions per additional million calories or ton of protein consumed). Based on the approach taken by the European Union for estimating emissions from land-use change for biofuels, land-use change impacts are amortized over a period of 20 years and then shown as annual impacts. Land use and greenhouse gas emissions estimates for beef production are based on dedicated beef production, not beef that is a coproduct of dairy. Dairy figures are lower in GlobAgri than some other models because GlobAgri assumes that beef produced by dairy systems displaces beef produced by dedicated beef-production systems.

Source: Reproduced from Ranganathan et al. 2016.

Box 6 | **Shifting Diets**

Shifting diets away from animal-based foods (especially beef) and toward plant-based foods is just one of several strategies the world should pursue in order to adequately feed nearly 10 billion people by 2050 in a manner that advances economic development and reduces pressure on the environment.

One set of solutions focuses on improving agricultural production, such as sustainably increasing crop yields, livestock pasture productivity, and aquaculture productivity.

Importantly, consumption-focused solutions will also be necessary. Besides shifting diets, solutions that make food consumption patterns more sustainable include reducing food loss and waste, achieving replacement-level fertility, and avoiding biofuel competition for crops and land.

For more detail, see the World Resources Report: Creating a Sustainable Food Future series at <http://www.wri.org/our-work/project/world-resources-report/world-resources-report-2013-2016-creating-sustainable-food>.

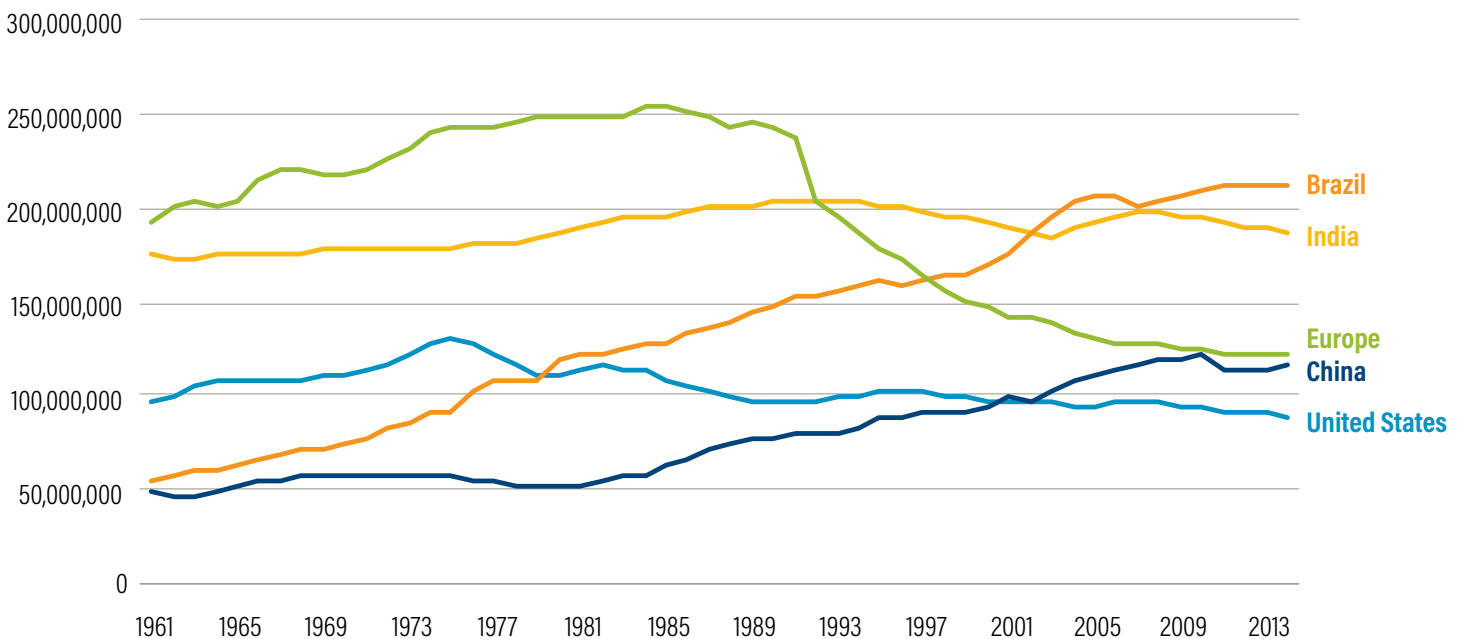
**Improve**

Businesses that aim to improve the sustainability of the food system generally focus on reducing food waste or environmental impacts in supply chains. These are critical steps and important companion strategies to those that address the overall increase in demand for beef.

**Addressing food waste**

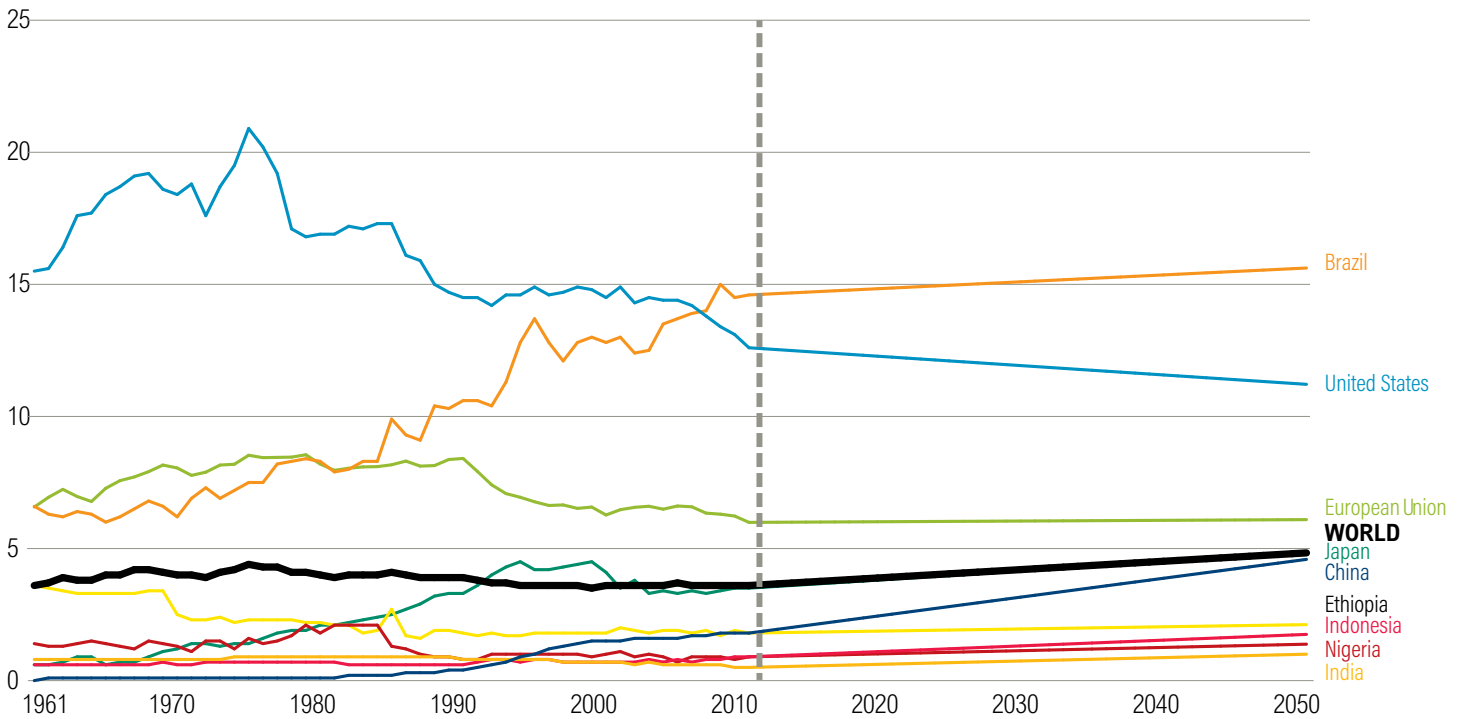
Minimizing food waste is an important step the world can take to address the food gap. Twenty percent of the world's meat is lost or wasted every year, equivalent to 75 million cows.<sup>6</sup> Companies in developed countries are getting more efficient in curbing waste during production and distribution. For example, in Europe only 12.8 percent of meat waste occurs during the production, postharvest handling and processing stages, and distribution. (Similar waste is observed in North America and Oceania, where 13.5 percent of meat waste occurs before the product reaches the consumer.) In sub-Saharan Africa, however, production-stage meat waste accounts for 27.7 percent of meat waste (Gustavsson et al. 2011).

Figure 9 | **Countries with the Largest Cattle Populations**



Source: FAO 2016.

Figure 10 | Per Capita Beef Availability\* Is Projected to Rise by 2050 (g/capita/day)



\*"Availability" refers to the amount of food available in a country at the point of purchase (e.g., at a supermarket or in a restaurant). It is slightly higher than "consumption," due to consumer food waste. Source: Reproduced from Ranganathan et al. 2016.

Fortunately, new global goals and guidance exist for companies interested in reducing food waste. The UN Sustainable Development Goal 12.3 calls for a halving of per capita global food waste, and a group of CEOs have stepped up to lead business efforts to meet that ambition. In doing so, companies will inventory how much food is lost or wasted along supply chains and develop strategies to eliminate wasteful processes. The Food Loss and Waste Protocol has established comprehensive guidance for completing such an inventory. It was developed through a multistakeholder initiative that included government agencies, intergovernmental agencies, nongovernment organizations, businesses, and academic institutions from around the world.<sup>7</sup> Similar to a corporate GHG inventory, it enables companies to adopt targets and develop focused strategies.

### Better Beef




Some companies have recognized the impact that beef has on the environment. For example, in 2010 the Consumer Goods Forum, a global member-driven network that aims to bring together consumer goods manufacturers and retailers to encourage efficient and positive changes in business models, set a goal of zero net deforestation by

2020. The Consumer Goods Forum also encourages all of its members who source beef from Brazil to support the Global Roundtable for Sustainable Beef,<sup>8</sup> a multi-stakeholder initiative that brings together beef producers, processors, retailers, and civil society to work toward more sustainable beef. The roundtable defines sustainable beef as "a socially responsible, environmentally sound and economically viable product that prioritizes Planet, People, Animals and Progress."<sup>9</sup>

### Embrace

Recognizing and responding to the challenges created by increased beef demand would mean a drastic shift in consumption patterns. According to one recent study, a shift to a healthier diet would require that red meat consumption decrease by 56 percent globally relative to 2050 baseline projections. In high-income Western countries, the decrease would be 78 percent (Springmann et al. 2016). It would also mean limiting excessive calorie intake (e.g., added sugars) and increasing consumption of fruits and vegetables by 25 percent globally. These changes could avoid 5.1 million deaths each year and save \$735 billion in health-related costs, compared to the 2050 baseline

Table 1 | **Global Effects of Reducing Beef Consumption on Agricultural Land Use and GHG Emissions in 2009**

SCENARIO <sup>a</sup>	REDUCTION IN AGRICULTURAL LAND USE <sup>b</sup> (MILLION HA)	AVOIDED FUTURE GHG EMISSIONS FROM AGRICULTURAL LAND-USE CHANGE <sup>c</sup> (MILLION TONS CO <sub>2</sub> E)	REDUCTION IN GHG EMISSIONS FROM AGRICULTURAL PRODUCTION (MILLION TONS CO <sub>2</sub> E)
<b>AMBITIOUS BEEF REDUCTION</b> APPLIED TO 1,463 M PEOPLE 	291 Pastureland 15 Cropland TOTAL 307	98,298	418
<b>SHIFT FROM BEEF TO PORK AND POULTRY</b> APPLIED TO 1,952 M PEOPLE 	196 Pastureland -26 Cropland TOTAL 170	51,116	238
<b>SHIFT FROM BEEF TO LEGUMES</b> APPLIED TO 1,952 M PEOPLE 	211 Pastureland 7 Cropland TOTAL 218	66,396	299

Notes:  
 Figures may not total correctly due to rounding.  
<sup>a</sup> Reference scenario included a world population of 6.8 billion, agricultural land use of 5 billion hectares (3.4 billion hectares of pastureland and 1.6 billion hectares of cropland), and 6.9 billion tons of greenhouse gas emissions from agricultural production.  
<sup>b</sup> "Cropland" includes land for aquaculture farms.  
<sup>c</sup> These estimates assume that the diet changes are sustained over time. If other improvements to the food system (e.g., yield gains) allowed the world to avoid future land-use change, these scenarios would allow some existing agricultural lands to revert to native vegetation and sequester the equivalent amount of carbon.

Source: GlobAgri model.  
 Reproduced from Ranganathan et al. 2016.

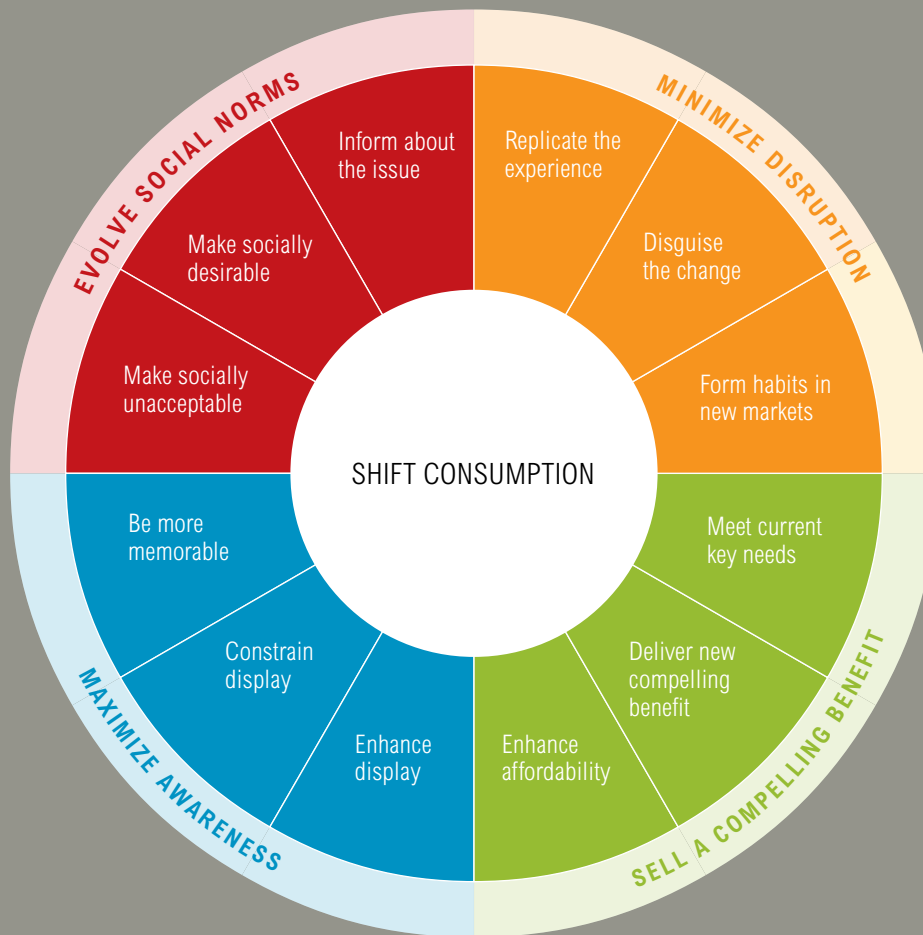
projection (Springmann et al. 2016). Overall, a shift to a healthier diet could reduce mortality between 6 percent and 10 percent when compared to a business-as-usual diet scenario in 2050, and more than half of the avoided deaths would be due to decreased red meat consumption (Springmann et al. 2016).

The potential for lower GHG emissions is massive—especially by avoiding land-use change, since beef production (regardless of the production system) uses large amounts of land. WRI’s *Shifting Diets* research (see Box 6) estimated that shifting diets of today’s “high beef consumers” could free up 371 million to 741 million acres (150 million to 300 million ha) of agricultural land. It would reduce pressure on forests and reduce emissions from future land-use change by 51 billion to 98 billion tons (46 billion to 89 billion t) of CO<sub>2</sub>, depending on the size of the shift.

For comparison, total global emissions in 2009 were 44 billion tons (40 billion t) of CO<sub>2</sub>e (Ranganathan et al. 2016).

Reducing the impacts of beef does not require a global shift to vegetarianism but rather a reduction of beef consumption in countries where per capita consumption is above the world average of 0.11 ounces (3.2 g) of protein. *Shifting Diets* explored three scenarios of beef reduction: an ambitious global 30 percent beef reduction; a global shift from beef toward poultry and pork, which would reduce beef consumption by one-third in areas where per capita beef consumption is above the world average; and, a scenario similar to the second scenario, but in which beef would be replaced by plant-based proteins (pulses and soy). Each of these three scenarios would significantly reduce environmental impacts on the global environment (see Table 1).

Box 7 | **The Shift Wheel—Four Strategies to Shift Consumption**



**MINIMIZE DISRUPTION.** Changing food consumption behavior typically involves changing ingrained habits. This strategy seeks to minimize the disruption to consumers' habits caused by the shift. It can include minimizing changes associated with the shift, such as taste, look, texture, smell, packaging, and the product's location within a store.

**SELL A COMPELLING BENEFIT.** Selling a compelling benefit requires identifying and delivering product attributes (such as health or affordability) that will be sufficiently motivating to the consumer to stimulate a behavior change. As plant-based proteins can be less expensive than animal-based ones, companies may have an opportunity to sell reformulated products with a greater share of plant-based ingredients at a lower price and/or an increased profit.

**MAXIMIZE AWARENESS.** The more consumers see or think of a product, the greater the chance they will consider purchasing it. Enhancing the availability and display of the more sustainable food choice and creating memorable advertising campaigns can increase a product's visibility and the chance that consumers will purchase it.

**EVOLVE SOCIAL NORMS.** What people eat is highly influenced by cultural environment and social norms. Informing and educating consumers, along with efforts to make the preferred food more socially desirable or the food to be shifted from less socially desirable, can influence or change the underlying social and cultural norms that underlie people's purchasing decisions.

Source: Ranganathan, J., D. Vennard, R. Waite, B. Lipinski, T. Searchinger, P. Dumas, A. Forslund, H. Guyomard, S. Manceron, E. Marajo-Petitson, C. Le Mouël, P. Havlik, M. Herrero, X. Zhang, S. Wirsenius, F. Ramos, X. Yan, M. Phillips, and R. Mungkung. 2016. "Shifting Diets for a Sustainable Food Future." Working Paper, Creating a Sustainable Food Future, Installment 11. Washington, DC: World Resources Institute. <http://www.wri.org/publication/shifting-diets>.

Companies can help consumers transition away from beef by shifting their own business models to sell pork and poultry rather than beef or entering the alternative protein market and provide products such as plant-based meat substitutes. Plant-based food and beverage markets exceeded \$44.9 billion in U.S. sales in 2016, up 3.5 percent from the year before, outpacing the total food and beverage industry (Watrous 2016). Companies like MorningStar Farms,<sup>10</sup> Beyond Meat,<sup>11</sup> and the 67 company members of the Plant Based Foods Association<sup>12</sup> demonstrate the demand for plant-based foods. Larger, more traditional food and beverage companies also see potential in plant-based foods. Mathis Martines, Kroger Company's lead for Emerging Brands, Innovation, and Merchandising Solutions segment, said during the Natural Products Expo East in 2016, "One of the biggest things that we have to go after is the plant-based foods industry because it's important for the health of our customer, and it's important to the health of our company. . . . As we move forward, we see this only growing" (Watrous 2016).

Plants are not the only source of alternative protein to beef. Insects have made a surprising, if niche, entry into some Western markets. Eating insects is not yet common in Western countries, but an estimated 1,900 species of insects are eaten as a regular part of the diets of some 2 billion people globally (FAO 2013). In the United States, more than 25 start-ups selling bug-based food like cricket flour, mealworms, and insect protein bars have been launched in the last three to four years (Tarkan 2015). Insects are an efficient source of protein. As much as 89 percent of the protein is digestible, and up to 80 percent of the insect can be consumed, depending on the species, compared to only 55 percent for chicken and 40 percent for cattle (WRAP 2015). Investors are also seeing the potential in insect protein, particularly cricket powder. Lauren Jupiter, managing partner at AccelFoods, said, "Portable protein is a \$55 billion market across snack bars, protein powder and protein ingredients. . . . This total global market expands to \$371 billion when considering the applications for crickets and cricket ingredients in pet food, nutraceuticals, livestock feed, and other industrial uses" (Finley 2016).

## Big Challenges and Questions for Tomorrow's Markets: Lessons from Food Examples

### **Shifting diets. How can companies help consumers find, enjoy, and buy more sustainable options?**

Limiting the environmental impacts of meat, especially beef, will require significant changes in consumption patterns. In particular, those who already consume more than the global per capita average will need to cut their consumption. Companies can deploy a number of strategies to influence consumer choice (see Box 7), and some companies are already taking some of the steps (see Box 8). Can food companies accommodate a shift to alternative sources of protein by diversifying their product portfolio? How will beef providers rebrand themselves? What are the implications of less beef consumption on companies whose business models are built on cheap, easy access to beef, like some fast-food restaurants?

### **Waste not, want not. How can companies help meet the Global Goal to cut food waste in half globally by 2030 (or sooner)?**

Companies have an incentive to reduce food that is wasted during the production process as this directly impacts the bottom line. The challenge is much harder on the retail side of the equation. In industrialized countries, more than 55 percent of all food loss and waste (in terms of calories) occur at the retail and consumption stages (Gustavsson et al. 2011). There need to be more widely recognized commercial incentives for food sellers to discourage overbuying of food. What types of business models would allow food sellers to grow their business even if they sell less product?

#### Box 8 | **WRI's Better Buying Lab**

Although consumers may state that they prefer food that has less environmental impact, meat consumption continues to grow globally, and changing consumer behavior is difficult. The Better Buying Lab, launched in 2016, convenes experts from consumer research, behavioral economics, and marketing strategy, along with food companies, to research, test, and scale new strategies that help consumers select sustainable, plant-based foods.

Better Buying Lab partners include Google, Hilton Worldwide, Panera Bread, Quorn, Sainsbury's, Sodexo, Stanford University, Triniti Marketing, Unilever Food Solutions, and WRAP.

For more information, see <http://www.betterbuyinglab.org>.

## FAST-MOVING CONSUMER GOODS—CLOTHES

Average households in the United States spend roughly six times as much on clothes as those in a major emerging economy like Brazil (see Figure 11). Spending around the world is projected to increase, and the advent of fast fashion means more and more clothes are being produced per dollar spent. The number of clothes the average consumer purchases has increased 60 percent between 2000 and 2014, and the clothes are kept about half as long (Remy et al. 2016).

There is no authoritative estimate of the size of the global apparel industry. Estimates vary from \$900 billion to \$3 trillion, depending in part on how the industry is defined. What is clear is that the industry generates huge profits. It is also responsible for 10 percent of the world's GHG emissions (Zaffalon 2010), uses 1.32 trillion gallons (5 trillion L) of water for dyeing processes a year (Maxwell et al. 2015), and sends an estimated 48 billion to 144 billion square yards (40 billion to 120 billion sq. m) of fabric from factory scraps to the landfill each year (Reverse Resources 2016).

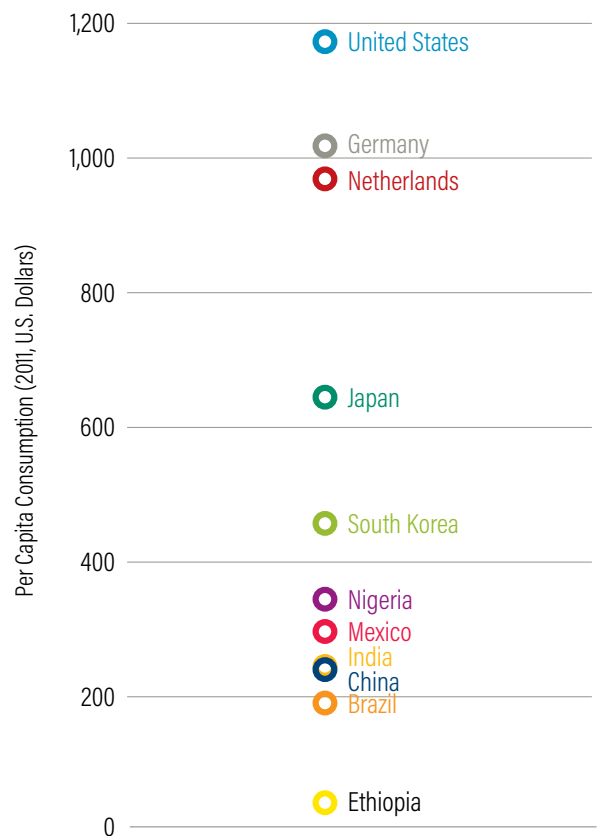
Notably, the textile and apparel industries directly employ more than 40 million people worldwide—mostly women (Kirchain et al. 2015)—and the industry represents a significant percentage of overall employment in several countries (see Figure 12). These industries can create jobs indirectly, too. For example, according to some estimates, for every textile job in India, there are an additional 1.2 jobs in associated industries (Gugnani et al. 2012). However, issues of worker safety and unsafe working conditions came to the forefront in 2013 when a garment factory in Bangladesh's Rana Plaza, largely dedicated to Western brands, collapsed, killing more than 1,100 workers and seriously injuring over 2,000 (HRW 2015).

What are the environmental implications if the industry **ignores** the environmental and social cost of today's business model? Will companies continue to produce and sell clothes at ever-increasing rates, or will they **embrace** new, better models that benefit both customers and workers across the value chain?

### Ignore

Meeting increasing demand for apparel with today's production and consumption models would have an enormous impact on the environment. The industry currently emits 10 percent of global GHGs (Zaffalon 2010) and is responsible

Figure 11 | Annual per Capita Spending (2011, US\$) on Clothing and Footwear



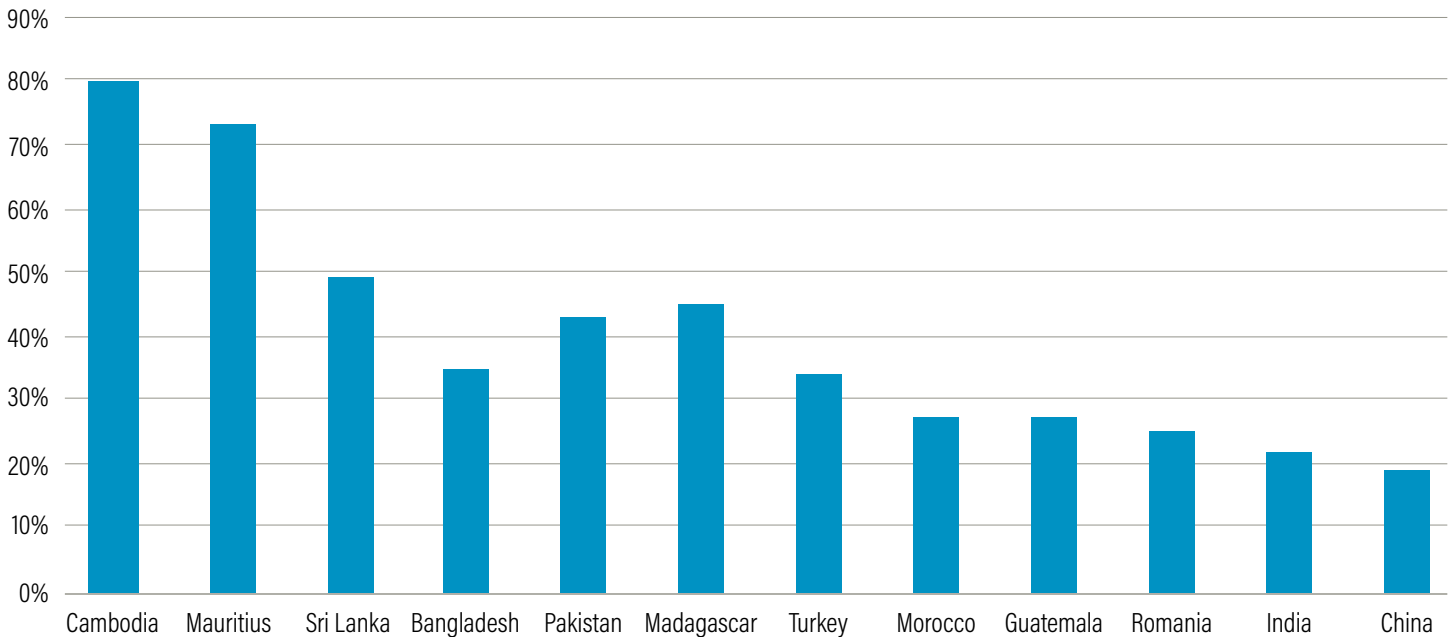
Note: Comparison of illustrative countries' real expenditures on clothing materials; garments for men, women, children, and infants; other articles of clothing and clothing accessories; cleaning, repair, and hire of clothing; all footwear for men, women, children, and infants; and repair and hire of footwear.

Source: World Bank 2014b.

for up to a fifth of industrial water pollution globally (World Bank 2014a). A single mill can use 200 tons (181 t) of water for each ton of fabric during the dyeing process (Greer et al. 2013), releasing up to 72 toxic chemicals into the local water supply (World Bank 2014a), with potential adverse effects on the health of millions of people.

Natural fibers like cotton and wool, and synthetic materials like nylon, polyester, acrylic, and rayon, are commonly used to make clothes. In terms of environmental impact, however, there can be many trade-offs between different materials. Cotton takes up 2.4 percent of the world's arable land but accounts for 24 percent of the world's insecticide and 11 percent of the world's pesticide sales (Davis 2003). Between 1996 and 2005, cotton accounted for 3 percent of the global water footprint for crop production (Mekonnen and Hoekstra 2011). Producing cotton

Figure 12 | **Garment Industry Employment as a Percentage of Total Manufacturing Jobs in Select Countries**



Source: McNamara 2008.

for a single T-shirt can use 713 gallons (2,700 L) of water (WWF 2013). Synthetic materials require less water than cotton but can use two to four times more energy (see Figure 13). Other factors that can influence the environmental impact of clothing production include where and how crops are grown, whether nonrenewable resources like oil are the foundation for the material, and the type and volume of chemicals used for manufacturing, dyeing, and finishing garments (NRDC 2012).<sup>13</sup>

The apparel and textile industries are moving away from natural fibers toward man-made fibers. Cotton is gradually constituting less of the total fiber use as polyester in particular becomes more common. Polyester production has gone from 5.2 million tons (4.7 million t) in 1980 to 19.2 million tons (17.4 million t) in 2000 and 46.1 million tons (41.8 million t) in 2014 (*Textile World* 2015), and it is projected to rise to 71.6 million tons (65 million t) in 2030 (Wilson 2016). In 2010 synthetic fibers accounted for 60.1 percent of fiber consumed, and cotton was 32.9 percent (ICAC/FAO 2013).

The move to man-made fibers is significant considering that in 2010, for example, the fashion industry produced more than 150 billion garments, enough for every person in the world to have more than 20 new pieces of clothes each (Kirchain et al. 2015). This volume is largely due to fast fashion; that is, the practice of increasing produc-

tion to get more styles to market as quickly and cheaply as possible, rather than seasonally<sup>14</sup> (see Figure 14). This business model started to gain traction in the early 1990s (Bhardwaj and Fairhurst 2010). Fast fashion now has more than the traditional spring/summer and fall/winter seasons. For example, Zara, a fast fashion leader, has between 50 and 100 micro-seasons per year (Siegle 2015). This phenomenon creates an enormous amount of waste. In the United States, for example, on average each person gets rid of 81 pounds (36.7 kg) of textiles every year, adding up to 12.83 million tons (11.64 million t) of textile waste; approximately 85 percent goes into a landfill, contributing to nearly 8 percent of all municipal solid waste generated in the United States every year (EPA 2015).

*In their own words . . .*

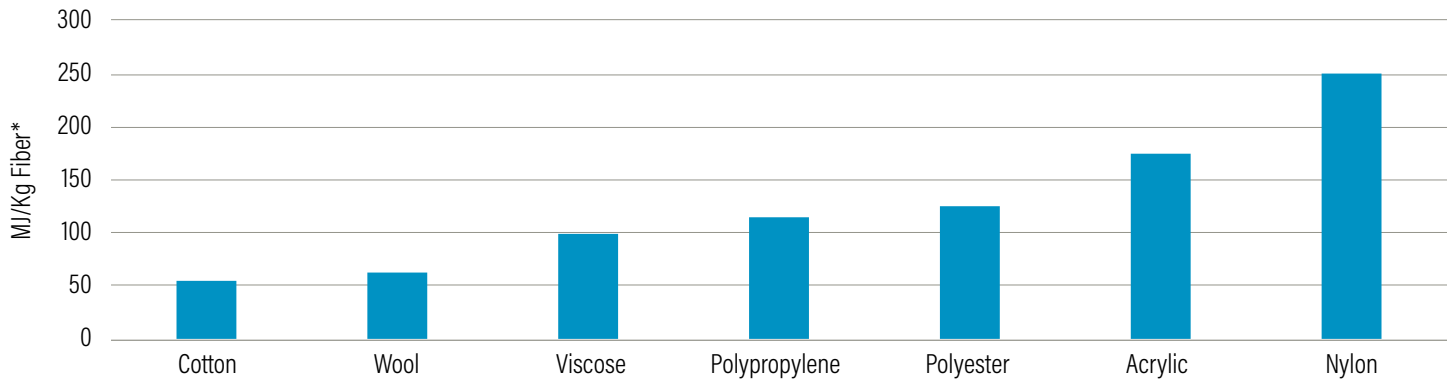
*Our goal is to keep everything we manufacture out of a landfill—forever.<sup>9</sup>*

*—Cynthia Power, facilitating manager,  
Green Eileen, Eileen Fisher, Inc.*

<sup>9</sup> Khamamayzer, A. 2016. "Eileen Fisher Has Designs on Keeping Clothing out of Landfills." *GreenBiz*, November 21. <https://www.greenbiz.com/article/eileen-fisher-has-designs-keeping-clothing-out-landfills>.

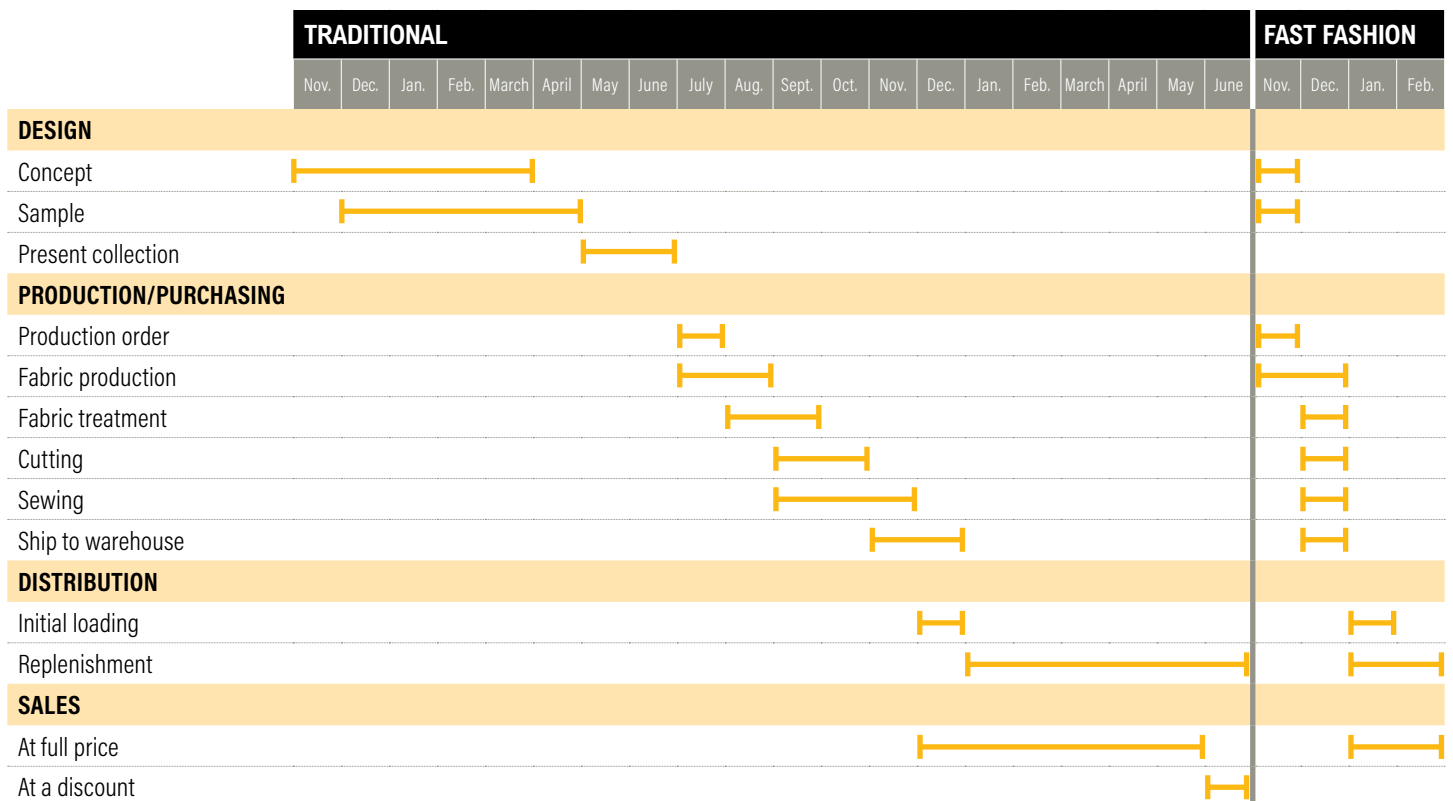


Figure 13 | Synthetic Fibers Are More Energy-Intensive than Natural Ones



\*Average weight of a T-shirt is approximately 6.4 ounces (181 g).  
Sources: Barber and Pellow 2006; Kirchain et al. 2015.

Figure 14 | Traditional versus Fast Fashion Design-to-Sales Process



Source: Caro and Martínez-de-Albéniz 2013.

## Improve

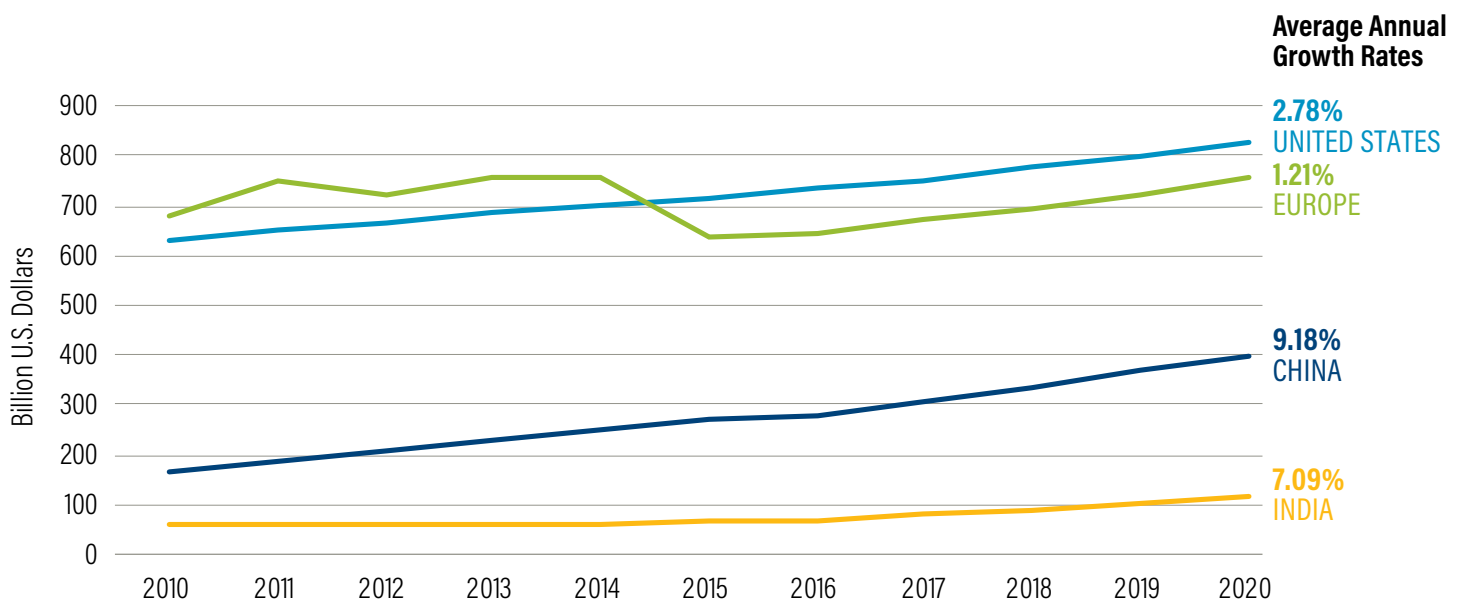
Many in the apparel industry have taken notice of the need to reduce environmental impacts. For example, the Sustainable Apparel Coalition (comprising over 180 industry brands, manufacturers, and suppliers) has built a tool—the Higg Index—to help companies measure the environmental, social, and labor impacts of their products and services.<sup>15</sup> Technology has a role to play in radically limiting waste and maximizing resource use. For example, Nike engineered a new technology called Nike Flyknit that reportedly reduces the manufacturing waste from each shoe by 60 percent.<sup>16</sup> Between 2012 and 2016, Nike reduced waste by over 3.5 million pounds (1.6 million kg; Malik Chua 2016).

As with automobiles and meat, growth expectations create an increasingly high bar for innovation. The upward trend of total spending on clothing for the past several years is projected to continue as the decade plays out. The rate of increased spending varies, however. For example, although the United States currently spends the most on apparel, by 2020 spending in India will have grown almost 2.5 times faster, and in China about 3.3 times faster (see Figure 15).

## Embrace

Radical shifts are needed to keep up with the pace, scale, and impact of fast fashion in tomorrow's markets. Designing clothes for longevity can limit environmental impacts and create jobs. Patagonia's Worn Wear program employs 45 people making about 40,000 repairs per year on clothing.<sup>17</sup> Paul Dillinger, head of Global Product Innovation at Levi Strauss & Co., believes in the importance of creating not only durable products but also a relationship of shared values between the company and the customer such that products—clothes in this case—are no longer considered a disposable item (Segran 2017). Other companies are challenging the assumption that ownership is the only way for consumers to experience clothes. For example, MUD Jeans offers a leasing service for jeans, complete with free repair.<sup>18</sup> Gwynnie Bee allows members to rent and continuously exchange from one to three items of clothing,<sup>19</sup> similar to the model Netflix used in its early days of DVD rental. Some companies are building their businesses around a return to slow fashion. The term *slow fashion* was coined in 2008 by sustainable design consultant Kate Fletcher and refers to an approach to clothing—and fashion—that takes a systemic approach to the entire clothing cycle, from design to potential reuse, and makes it sustainable (Phelan 2012). An example of

Figure 15 | **Historic and Projected Spending on Apparel in Key Markets**



Source: Planet Retail 2016.

a slow fashion company is U.S.-based Zady. One of the company's T-shirts, for example, is made domestically by eco- and labor-friendly suppliers with U.S.-grown organic cotton spun by a family cooperative. Soraya Darabi, one of Zady's cofounders, noting the cost of the company's products, says, "It is a little bit of an upfront investment, but it's also, we believe, the way of the future—to own fewer but better things" (Blair 2015).

Some companies have built their entire business around the idea of eliminating waste through circular manufacturing processes. Tonlé uses preconsumer waste—specifically the factory remnants of mass clothing manufacturers—as the raw materials for its clothing line.<sup>20</sup> Eileen Fisher Inc. is using recycled and reclaimed fibers.<sup>21</sup> Evrnu is creating new technologies that use discarded clothing to make new fibers.<sup>22</sup> Clothing reuse is also a thriving market. In the United States alone, the number of resale stores grew 7 percent a year in both 2014 and 2015 and now totals more than 25,000 stores (NARTS 2017).

---

***In their own words . . .***

*We've set a moonshot challenge to double our business with half the impact. It's a bold ambition that's going to take much more than incremental efficiency—it's going to take innovation on a scale we've never seen before. It's a challenge we are setting for ourselves, our collaborators, and our partners as we move toward a circular economy future.<sup>a</sup>*

*—Hannah Jones, Chief Sustainability Officer, Nike*

<sup>a</sup> Butler-Young, S. 2016. "How Nike Plans to Double Its Business with Half the Environmental Impact." *Footwear News*, May 11. <http://footwearnews.com/2016/business/retail/nike-plans-double-business-environmental-impact-2015-sustainability-report-220481/>.

---

## **Big Challenges and Questions for Tomorrow's Markets: Lessons from Apparel Examples**

**Prosperous people. How will companies scale new people-centered value chains and business models?** As with the automotive industry, major business model changes could have significant implications for employment. In the case of apparel, could efforts to improve product longevity provide new opportunities for workers skilled at repairs? Could fiber collection for circular manufacturing be a job creator, or will those systems be automated? If sharing economy models were scaled, how could the threat to the livelihoods of industry workers be managed?

**Fashion for all. How will companies make circular apparel models that are accessible to all customers—not just the wealthiest few?** Current business models that attempt to delink business growth from environmental impact tend to be accessible only to more affluent consumers. Can companies create pricing structures that bring the products created through these types of business models within reach of less-affluent consumers so they can become more mainstream? Fast fashion giant Inditex—the company that owns the Zara brand—had revenues in 2015 of \$29.74 billion (Inditex 2016), and H&M reached \$24.51 billion in 2016 (H&M 2016). The incredible speed at which the fast fashion industry has grown demonstrates customer demand for cheaper clothes. Is it possible to effect the types of cultural changes that would be needed for a wholesale shift away from fast fashion? Or will circular manufacturing be able to keep up?

**Combine great minds. Who will create the pre-competitive research and development efforts that accelerate circular clothing technologies?**

For circular manufacturing to scale, further technological advances will be required. Cotton, for example, is difficult to recycle. The process of turning postconsumer garments back into a raw material shortens the staple length of the fibers, impacting their softness, strength, and quality (Bain 2015). Some advances are being made, however. For example, in 2016 Levi Strauss and Evrnu partnered to create the first-ever pair of blue jeans using recycled T-shirts, in a process that also used 98 percent less water than virgin cotton products (Samaniego 2016). More encouraging breakthroughs like this will be required to meet demand in tomorrow's markets sustainably.

## RECOMMENDATIONS

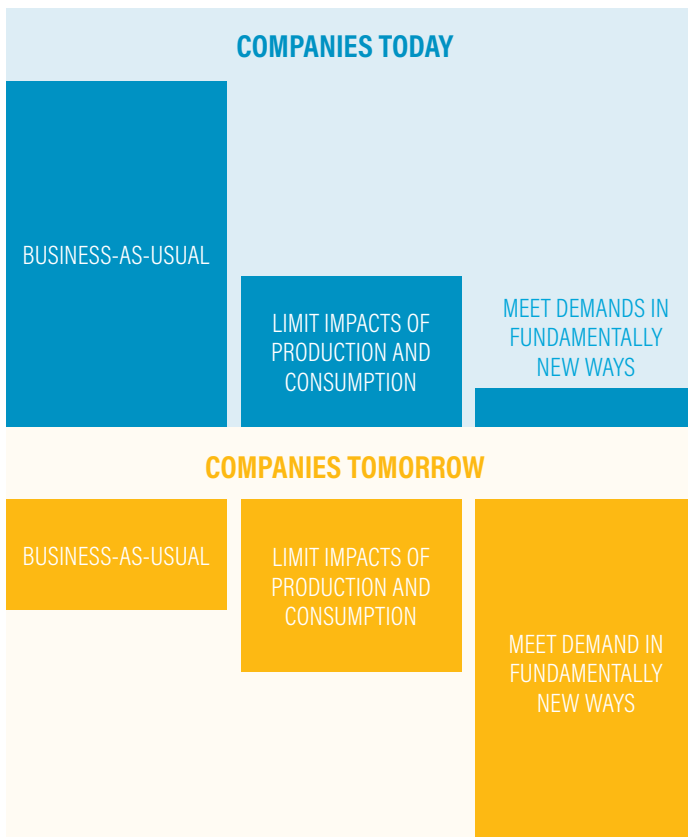
In light of today’s challenges and the immense, rapid growth in demand on the horizon, companies that want to thrive in the future will need to embrace fundamentally different ways of meeting consumer needs. Current business models cannot meet the massive demand increase emerging in the 21st century without devastating environmental consequences. To **ignore** the impacts of business as usual on the environment and customers is incompatible with long-term business prosperity and a sustainable future. The take-make-waste or linear model (see Box 4) was created—and worked well—when there were fewer people on the planet and less strain on natural resources and the climate. In the coming decades, companies holding fast to this model risk being outcompeted by more forward-thinking companies.

Efforts to **improve** practices are essential and can complement strategies that **embrace** the challenge of meeting growing consumer demand within environmental

limits. Ultimately, in tomorrow’s markets, a dramatic scaling of new approaches will be needed (see Figure 16). WRI and other organizations offer resources, expertise, and partnership toward this end (see Box 9).

But where to start? How can corporate boards embrace the elephant in the room? WRI challenges executives to test the durability of their business strategies in a resource- and climate-constrained world, determine whether they risk being outcompeted by businesses that are able to operate successfully with these constraints, then explore and quickly scale alternative business models. This means doing the math on consumer demand and estimating the associated social and environmental impacts across the value chain. It means influencing stakeholders to collaborate on understanding and acting on the impacts of unchecked consumption. Finally, it means identifying new business models (see Box 4) and the specific locations where they can be tested quickly, with a path toward market transformation. WRI offers a set of three actions that we welcome companies to test and refine together with us and other partners.

Figure 16 | **Company Responses to Meeting Consumer Demand Sustainably**



### Action 1: Do the Math

**Understand what exceeding planetary boundaries means for the company’s ability to meet demand for products with current practices, business models, technologies.** For example, take a life-cycle assessment of one of your products and put it up against global demand for that product in 2030. Even a simple “back of the envelope” analysis can reveal the urgent need for business model innovation to meet the projected growth in demand within environmental limits.

#### Questions to consider

- Does your company’s growth model depend on selling more products to more people?
- What are the environmental and social risks—and their costs—of your company’s and your industry’s growth?
- Will increasing natural resource scarcity present new constraints to company growth and/or to your product portfolio?
- Are your company’s business practices in alignment with a 2°C world and with healthy ecosystems and people?
- How does sustaining the livelihoods of people in your company and supply chain factor into your plans?

## Action 2: Lead the Industry

### Use your influence to change conversations with customers, investors, policy makers, and peers.

Reach out to stakeholders in your value chain to emphasize new opportunities to collaborate together.

#### Questions to consider

- Are you communicating the scale of the challenge and opportunity to relevant stakeholders, such as investors, customers, and policy makers?
- Are you pushing your peers and identifying new industry partners?
- What platforms are available to amplify your message?
- What collaboration opportunities would enable you to accelerate action?
- What could you achieve together with others that you cannot achieve alone?
- Does your consumer marketing change people's desires in ways that will alleviate or exacerbate the problem?

## Box 9 | Examples of Organizations That Collaborate with Business on Sustainable Development

### UNITED NATIONS ENVIRONMENT PROGRAMME (UN ENVIRONMENT)

UN Environment works to promote resource efficiency and sustainable consumption and production in both developed and developing countries. The focus is on achieving increased understanding and implementation by public and private decision makers, as well as civil society, of policies and actions for resource efficiency and sustainable consumption and production. This includes the promotion of sustainable resource management from a life-cycle perspective for goods and services. UN Environment's activities are focused on specific tools, encompassing policies, market-based instruments, and voluntary approaches. Its work has four central themes:

1. strengthening and communicating the knowledge base for resource efficiency and sustainable consumption and production;
2. building governmental capacity;
3. consolidating and extending partnerships with business and industry; and
4. promoting more sustainable lifestyles for individuals, including enhancing informed decision making.

For more information, see <http://web.unep.org/resourceefficiency/who-we-are/overview>.

### UNITED NATIONAL GLOBAL COMPACT (UNGC)

The UNGC is a voluntary initiative based on CEO commitments to implement universal sustainability principles and to take steps to support the United Nations' goals. Engagement with companies around the world is accomplished through a number of platforms; for example:

- **Pathways to Low-Carbon and Resilient Development** aims to mobilize the private sector to become a catalyst for enhancing country-level action to meet the ambitions of the Paris Agreement and the Global Goals. The action platform will provide a collaborative space for companies and key stakeholders to share, learn, and identify effective ways to contribute to Nationally Determined Contribution and Global Goal implementation.

For more information, see <https://www.unglobalcompact.org/take-action/action/low-carbon-development>.

- **Project Breakthrough:** Aligned with the UN Global Compact's priority of translating the new 2030 Sustainable Development Goals into business action, Project Breakthrough aims to challenge and stretch prevailing business mind-sets into new opportunity spaces. The initiative is a partnership between the UNGC, Global Compact LEAD, and Volans.

For more information, see <http://breakthrough.unglobalcompact.org/>.

### WORLD BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT (WBCSD)

The WBCSD is a global CEO-led organization of some 200 businesses and partners working together to accelerate the transition to a sustainable world, where 9 billion people live well, and within planetary boundaries. The organization's Action 2020 platform provides opportunities for businesses to contribute business solutions to environmental and social challenges, working toward societal "must-haves" informed by science. This is accomplished through six programmatic clusters. Two of these clusters in particular address the challenges of consumption:

- The Sustainable Lifestyles cluster works to understand the world that we need to create—technically, practically, and emotionally—to enable and inspire more sustainable lifestyles.
- The Sustainable Materials cluster works to reinvent how companies find, use, and dispose of the materials that flow through global markets.

For more information, see <http://www.wbcd.org>.

## Action 3: Transform the Business

**Align corporate strategy with tomorrow's markets within the constraints of the planet's resources; launch and integrate new and better ways of delivering value to customers.** Ensure that company goals are consistent with the limits of natural systems and match the holistic ambition of the UN Sustainable Development Goals. Starting in those cities and countries where the pressures and business risks are most acute, or where conditions favor learning and success, launch and scale business models that account for demand growth in tomorrow's markets (see Figure 17).

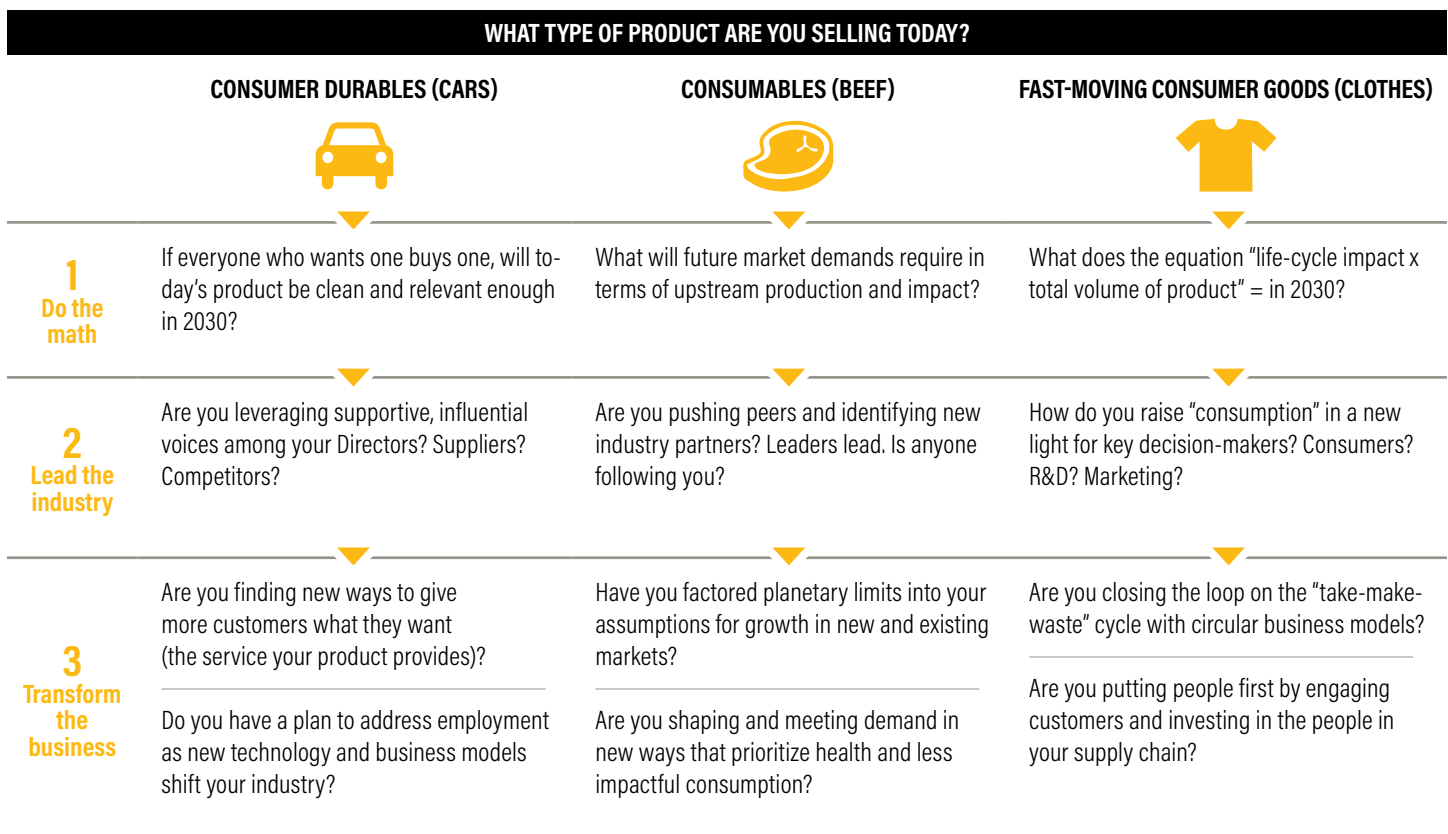
### Questions to consider

- At the corporate level, has your company established environmental goals across all impact areas (such as climate, water, and land) that are anchored in environmental science (Putt del Pino et al. 2016)?

- For products, have you considered consumption-based targets to communicate your company's aspirations to move away from volume as a measure of success (for example, going from volume to quality, disposable to durable) and to catalyze company innovators to pursue models for business growth that are decoupled from environmental impact?
- Does your company's strategic approach match the ambitions of the Sustainable Development Goals across its environmental, social, and economic pillars?
- Have you drawn lessons from other companies that have undertaken business model transformations?
- Have you identified the policy changes that would enable you to scale new business models in your most important markets?

Businesses that embrace these actions will have the longevity to serve their customers and their shareholders in tomorrow's markets. Those that do not will risk being outcompeted by disruptive new entrants that are more innovative and transformational.

Figure 17 | Questions to Consider



## REFERENCES

- Bain, M. 2015. "Why Cotton Is So Difficult to Recycle—and How Clothing Retailers Hope to Change That." *Quartz*, August 26. <https://qz.com/487423/why-cotton-is-so-difficult-to-recycle-and-how-clothing-retailers-hope-to-change-that/>.
- Banerjee, A.V., and E. Duflo. 2008. "What Is Middle Class about the Middle Classes around the World?" *Journal of Economic Perspectives* 22 (2): 3–28. <http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.22.2.3>.
- Barber, A., and G. Pellow. 2006. "LCA: New Zealand Merino Wool Total Energy Use." Paper prepared for the 5th Australian Life Cycle Assessment Society (ALCAS) Conference, Melbourne. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.553.6556&rep=rep1&type=pdf>.
- Bhardwaj, V., and A. Fairhurst. 2010. "Fast Fashion: Response to Changes in the Fashion Industry." *International Review of Retail, Distribution and Consumer Research* 20 (1): 165–73. doi:10.1080/09593960903498300.
- Bjørn, A., N. Bey, S. Georg, I. Røpke, and M.Z. Hauschild. 2016. "Is Earth Recognized as a Finite System in Corporate Sustainability Reporting?" *Journal of Cleaner Production*, January, 1–12. <http://dx.doi.org/10.1016/j.jclepro.2015.12.095>.
- Blair, E. 2015. "Slow Fashion Shows Consumers What It's Made Of." NPR, April 24. <http://www.npr.org/2015/04/24/401764329/slow-fashion-shows-consumers-what-its-made-of>.
- BSDC (Business & Sustainable Development Commission). 2016. "The Business Commission Welcomes New Commissioner, Grant F. Reid, CEO of Mars, Incorporated." <http://businesscommission.org/news/the-business-commission-welcomes-new-commissioner-grant-f-reid-ceo-of-mars-incorporated>.
- BSDC. 2017. Better Business Better World. London, U.K.: BSDC. <http://report.businesscommission.org>.
- Butler-Young, S. 2016. "How Nike Plans to Double Its Business with Half the Environmental Impact." *Footwear News*, May 11. <http://footwearnews.com/2016/business/retail/nike-plans-double-business-environmental-impact-2015-sustainability-report-220481/>.
- Capper, J.L. 2012. "Is the Grass Always Greener? Comparing the Environmental Impact of Conventional, Natural and Grass-Fed Beef Production Systems." *Animals* 2 (2): 127–43. doi:10.3390/ani2020127.
- Caro, F., and V. Martínez-de-Albéniz. 2013. "Operations Management in Apparel Retailing: Processes, Frameworks and Optimization." *Boletín de Estadística e Investigación Operativa* 29 (2): 103–16.
- Cazzola, P., and J. Teter. 2016. "Energy Analysis and Modelling Transport." Paper prepared for the International Energy Agency Energy Training Week, International Energy Agency, June 6–10. [https://www.iea.org/media/training/eetw2016/transport/D.1\\_Quantative\\_Transport.pdf](https://www.iea.org/media/training/eetw2016/transport/D.1_Quantative_Transport.pdf).
- CEM (Clean Energy Ministerial). 2016. "Electric Vehicles Initiative (EVI)." [www.cleanenergyministerial.org/Our-Work/Initiatives/Electric-Vehicles](http://www.cleanenergyministerial.org/Our-Work/Initiatives/Electric-Vehicles).
- Chase, R. 2016. "Self-Driving Cars Will Improve Our Cities. If They Don't Ruin Them." *Backchannel* (blog), August 10. <https://backchannel.com/self-driving-cars-will-improve-our-cities-if-they-dont-ruin-them-2dc920345618#g2ylrjchf>.
- Dargay, J., D. Gately, and M. Sommer. 2007. "Vehicle Ownership and Income Growth, Worldwide: 1960–2030." *Energy Journal* 28 (4): 143–70. [https://www.econ.nyu.edu/dept/courses/gately/DGS\\_Vehicle%20Ownership\\_2007.pdf](https://www.econ.nyu.edu/dept/courses/gately/DGS_Vehicle%20Ownership_2007.pdf).
- Davis, T., ed. 2003. *Agricultural Water Use and River Basin Conservation*. Gland, Switzerland: World Wildlife Fund. [assets.panda.org/downloads/agwaterusefinalreport.pdf](https://assets.panda.org/downloads/agwaterusefinalreport.pdf).
- Doering, D.S., A. Cassara, C. Layke, J. Ranganathan, C. Revenga, D. Tunstall, and W. Vanasselt. 2002. *Tomorrow's Markets: Global Trends and Their Implications for Business*. World Resources Institute, United Nations Environment Programme, and World Business Council for Sustainable Development. <http://www.wri.org/publication/tm-tomorrows-markets>.
- Engberg, Jonas. 2016. Sustainability Manager, IKEA Denmark. Sustainable Brands interview, February.
- EPA (Environmental Protection Agency). 2015. *Advancing Sustainable Materials Management: 2013 Fact Sheet. Assessing Trends in Material Generation, Recycling and Disposal in the United States*. Washington, DC: EPA. [https://www.epa.gov/sites/production/files/2015-09/documents/2013\\_advncng\\_smm\\_fs.pdf](https://www.epa.gov/sites/production/files/2015-09/documents/2013_advncng_smm_fs.pdf).
- Ernst & Young. 2013. *Hitting the Sweet Spot: The Growth of the Middle Class in Emerging Markets*. London, UK: Ernst & Young. [http://www.ey.com/Publication/vwLUAssets/Hitting\\_the\\_sweet\\_spot/%24FILE/Hitting\\_the\\_sweet\\_spot.pdf](http://www.ey.com/Publication/vwLUAssets/Hitting_the_sweet_spot/%24FILE/Hitting_the_sweet_spot.pdf).
- FAO (Food and Agriculture Organization of the United Nations). 2013. *Edible Insects: Future Prospects for Food and Feed Security*. Rome, Italy: FAO. <http://www.fao.org/docrep/018/i3253e/i3253e.pdf>.
- FAO. 2016. (Database.) *Live Animals*. FAOSTAT. Accessed December 5, 2016.
- Finley, K. 2016. "You'll Eat Bugs. These Investors Are Betting Millions on It." *Wired*, March 7. <https://www.wired.com/2016/03/investors-bet-millions-wont-balk-eating-bugs/>.
- Fischer-Kowalski, M., M. Swilling, E.U. von Weizsäcker, Y. Ren, Y. Moriguchi, W. Crane, F. Krausmann, N. Eisenmenger, S. Giljum, P. Hennicke, P. Romero Lankao, A. Siriban Manalang, and S. Sewerin. 2011. A report of the Working Group on Decoupling Natural Resource Use and Environmental Impacts from Economic Growth. Nairobi, Kenya: United Nations Environment Programme, International Resource Panel.
- Fisher, E. 2017. "Sustainable Fibers." Eileen Fisher. <http://www.eileenfisher.com/sustainable-fibers/recycled-fibers-less-waste-less-energy/>.
- Foley, J.A., R. DeFries, G.P. Asner, C. Barford, G. Bonan, S.R. Carpenter, F.S. Chapin, M.T. Coe, G.C. Daily, H.K. Gibbs, J.H. Helkowski, T. Holloway, E.A. Howard, C.J. Kucharik, C. Monfreda, J.A. Patz, I.C. Prentice, N. Ramankutty, and P.K. Snyder. 2005. "Global Consequences of Land Use." *Science* 309 (6): 570–74. doi:10.1126/science.1111772.

Ford, B., Jr. 2011. "A Future beyond Traffic Gridlock." TED Talks. [https://www.ted.com/talks/bill\\_ford\\_a\\_future\\_beyond\\_traffic\\_gridlock/transcript?language=en](https://www.ted.com/talks/bill_ford_a_future_beyond_traffic_gridlock/transcript?language=en).

Gao, P., H.W. Kaas, D. Mohr, and D. Wee. 2016. "Disruptive Trends That Will Transform the Auto Industry." McKinsey & Company. <http://www.mckinsey.com/industries/high-tech/our-insights/disruptive-trends-that-will-transform-the-auto-industry>.

Gota, S., C. Huizenga, K. Peet, and G. Kaar. 2015. *Emissions Reduction Potential in the Transport Sector by 2030: Key Findings*. Paris, France: Paris Process on Mobility and Climate. <http://ppmc-cop21.org/wp-content/uploads/2015/08/Emission-Reduction-Potential-in-the-Transport-Sector-by-2030.pdf>.

Greer, L., S. Keane, C. Lin, and J. Meinert. 2013. *NRDC's 10 Best Practices for Textile Mills to Save Money and Reduce Pollution*. New York: Natural Resources Defense Council. <https://www.nrdc.org/sites/default/files/responsible-sourcing-guide.pdf>.

Gugnani, A., P. Saxena, P. Narang, B. Prakash, and K.P. Brahma. 2012. *Textile & Apparel Compendium 2012*. Gurgaon, India: Technopak Advisors Pvt. Ltd. [http://www.technopak.com/files/Technopak\\_Compendium\\_Textile\\_Apparel\\_2012.pdf](http://www.technopak.com/files/Technopak_Compendium_Textile_Apparel_2012.pdf).

Gustavsson, J., C. Gederberg, U. Sonesson, R. van Otterdijk, and A. Meybeck. 2011. *Global Food Losses and Food Waste—Extent, Causes and Prevention*. Rome, Italy: FAO. <http://www.fao.org/docrep/014/mb060e/mb060e.pdf>.

H&M (Hennes & Mauritz AB). 2016. *Full-Year Report*. <https://about.hm.com/content/dam/hmgrouppublications/documents/masterlanguage/cision/2017/01/1869818.pdf>.

Howard, Steve. 2016. Chief Sustainability Officer, IKEA. *Guardian Sustainable Business Debate*, January.

HRW (Human Rights Watch). 2015. *Whoever Raises Their Head Suffers the Most: Workers' Rights in Bangladesh's Garment Factories, 2015*. New York: Human Rights Watch. [https://www.hrw.org/sites/default/files/report\\_pdf/bangladesh0415\\_web.pdf](https://www.hrw.org/sites/default/files/report_pdf/bangladesh0415_web.pdf).

ICAC/FAO (International Cotton Advisory Committee)/(Food and Agriculture Organization of the United Nations). 2013. *World Apparel Fiber Consumption Survey, 2013*. Washington, DC: ICAC. [https://www.icac.org/cotton\\_info/publications/statistics/world-apparel-survey/FAO-ICAC-Survey-2013-Update-and-2011-Text.pdf](https://www.icac.org/cotton_info/publications/statistics/world-apparel-survey/FAO-ICAC-Survey-2013-Update-and-2011-Text.pdf).

ICF International. 2015. "Economic Analysis of US Decarbonization Pathways." Study. NextGen Climate America, Inc. <https://nextgenamerica.org/wp-content/uploads/2015/11/ICF-Study-Decarb-Econ-Analysis-Nov-12-2015-Final3.pdf>.

IEA (International Energy Agency). 2016a. *Global EV Outlook 2016: Beyond One Million Electric Cars*. Paris, France: IEA. [https://www.iea.org/publications/freepublications/publication/Global\\_EV\\_Outlook\\_2016.pdf](https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf).

IEA. 2016b. "Energy Technology Perspectives 2016." <http://www.iea.org/etp/etp2016/>.

IFC (International Finance Corporation). 2016. *Climate Investment Opportunities in Emerging Markets*. Washington, DC: IFC. [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES).

IHS Markit. 2014. "Global Platform Shift Creates Opportunity for Aftermarket, IHS Automotive Reports." <http://news.ihsmarket.com/press-release/aapex/global-platform-shift-creates-opportunity-aftermarket-ihs-automotive-reports>.

INCCA (Indian Network for Climate Change Assessment). 2010. *India: Greenhouse Gas Emissions 2007*. New Delhi, India: Ministry of Environment and Forests, Government of India. [http://www.moef.nic.in/downloads/public-information/Report\\_INCCA.pdf](http://www.moef.nic.in/downloads/public-information/Report_INCCA.pdf).

Inditex. 2016. "FY2015 Results." <https://www.inditex.com/documents/10279/197087/Full+year+2015+Results.pdf/789f186b-b09b-4501-9b77-08ea011af993>.

Kahn Ribeiro, S., S. Kobayashi, M. Beuthe, J. Gasca, D. Greene, D.S. Lee, Y. Muromachi, P.J. Newton, S. Plotkin, D. Sperling, R. Wit, and P.J. Zhou. 2007. "Transport and Its Infrastructure." In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, and L.A. Meyer. Cambridge, UK, and New York: Cambridge University Press. <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter5.pdf>.

Kaluza, J., A. Wolk, and S.C. Larsson. 2012. "Red Meat Consumption and Risk of Stroke: A Meta-analysis of Prospective Studies." *Stroke* 43 (10). <https://doi.org/10.1161/STROKEAHA.112.663286>.

Khalamayzer, A. 2016. "Eileen Fisher Has Designs on Keeping Clothing out of Landfills." *GreenBiz*, November 21. <https://www.greenbiz.com/article/eileen-fisher-has-designs-keeping-clothing-out-landfills>.

Kharas, H. 2010. "The Emerging Middle Class in Developing Countries." Working Paper No. 285. Paris, France: Organisation for Economic Co-operation and Development. <https://www.oecd.org/dev/44457738.pdf>.

Kharas, Homi, and Geoffrey Gertz. 2010. "The New Global Middle Class: A Crossover from West to East." In *China's Emerging Middle Class: Beyond Economic Transformation*, edited by Li Cheng, 32–52. Washington, DC: Brookings Institution Press. <http://www.jstor.org/stable/10.7864/j.ctt6wpd8c.6>.

Kirchain, R., E. Olivetti, T.R. Miller, and S. Greene. 2015. *Sustainable Apparel Materials*. Cambridge, MA: Materials Systems Laboratory, Massachusetts Institute of Technology. <http://msl.mit.edu/publications/SustainableApparelMaterials.pdf>.

Kissinger, G., M. Herold, and V. De Sy. 2012. *Drivers of Deforestation and Forest Degradation: Synthesis Report for REDD+ Policymakers*. Vancouver, Canada: Lexeme Consulting. [https://www.forestcarbonpartnership.org/sites/fcp/files/DriversOfDeforestation.pdf\\_N\\_S.pdf](https://www.forestcarbonpartnership.org/sites/fcp/files/DriversOfDeforestation.pdf_N_S.pdf).

Kochhar, R. 2015. *A Global Middle Class Is More Promise than Reality: From 2001 to 2011, Nearly 700 Million Step out of Poverty, but Most Only Barely*. Washington, DC: Pew Research Center. [http://www.pewglobal.org/files/2015/08/Global-Middle-Class-Report\\_8-12-15-final.pdf](http://www.pewglobal.org/files/2015/08/Global-Middle-Class-Report_8-12-15-final.pdf).



- Luo, T., R. Young, and P. Reig. 2015. *Aqueduct Projected Water Stress Country Rankings*. Washington, DC: World Resources Institute. <http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings>.
- Malik Chua, J., 2016. "Nike Celebrates Four Years of Flyknit, Now Uses Recycled Polyester." *Ecouterre*, February 2. <http://www.ecouterre.com/nike-celebrates-four-years-of-flyknit-now-uses-recycled-polyester/>.
- Maxwell, D., L. McAndrew, and J. Ryan. 2015. *The State of the Apparel Sector 2015 Special Report—Water*. Report for the Global Leadership Award in Sustainable Apparel. [http://glasaaward.org/wp-content/uploads/2015/05/GLASA\\_2015\\_StateofApparelSector\\_SpecialReport\\_Water\\_150624.pdf](http://glasaaward.org/wp-content/uploads/2015/05/GLASA_2015_StateofApparelSector_SpecialReport_Water_150624.pdf).
- McNamara, K. 2008. *The Global Textile and Garments Industry: The Role of Information and Communication Technologies (ICTs) in Exploiting the Value Chain*. Innovation and Entrepreneurship. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/124691468337235836/The-global-textile-and-garments-industry-the-role-of-Information-and-Communication-Technologies-ICTs-in-exploiting-the-value-chain>.
- Mekonnen, M.M., and A.Y. Hoekstra. 2011. "The Green, Blue, and Grey Water Footprint of Crops and Derived Crop Products." *Hydrology and Earth System Sciences* 15: 1577–1600. [http://waterfootprint.org/media/downloads/Mekonnen-Hoekstra-2011-WaterFootprintCrops\\_1.pdf](http://waterfootprint.org/media/downloads/Mekonnen-Hoekstra-2011-WaterFootprintCrops_1.pdf).
- Micha, R., S.K. Wallace, and D. Mozaffarian. 2010. "Red and Processed Meat Consumption and Risk of Incident Coronary Heart Disease, Stroke, and Diabetes Mellitus." *Circulation* 121: 2271–83. <https://doi.org/10.1161/CIRCULATIONAHA.109.924977>.
- Milman, O., and S. Leavenworth. 2016. "China's Plan to Cut Meat Consumption by 50% Cheered by Climate Campaigners." *Guardian* (Manchester), June 20. <https://www.theguardian.com/world/2016/jun/20/chinas-meat-consumption-climate-change>.
- NARTS: The Association of Resale Professionals. 2017. "Industry Statistics and Trends." <http://www.narts.org/i4a/pages/index.cfm?pageid=3285>.
- NRDC (Natural Resources Defense Council). 2012. "Fiber Selection: Understanding the Impact of Different Fibers Is the First Step in Designing Environmentally Responsible Apparel." <https://www.nrdc.org/sites/default/files/CBD-Fiber-Selection-FS.pdf>.
- OECD (Organisation for Economic Co-operation and Development). 2014. *The Cost of Air Pollution: Health Impacts of Road Transport*. Paris, France: OECD Publishing. <http://dx.doi.org/10.1787/9789264210448-en>.
- OECD. 2016. *Policy Guidance on Resource Efficiency*. Paris, France: OECD Publishing. <http://dx.doi.org/10.1787/9789264257344-en>.
- OECD. 2017. "GDP Long-Term Forecast." [http://www.oecd-ilibrary.org/economics/gdp-long-term-forecast/indicator/english\\_d927bc18-en](http://www.oecd-ilibrary.org/economics/gdp-long-term-forecast/indicator/english_d927bc18-en).
- OECD-FAO (Organisation for Economic Co-operation and Development)- (Food and Agriculture Organization of the United Nations). 2016. *Meat Consumption*. Agricultural Outlook Database. Accessed December 12, 2016. <https://data.oecd.org/agroutput/meat-consumption.htm>.
- OICA (International Organization of Motor Vehicle Manufacturers). 2016. "2012–2016 Half-Year Sales Statistics." <http://www.oica.net/2012-2016-half-year-sales-statistics/>.
- OICA. 2017. "Vehicles in Use." <http://www.oica.net/vehicles-in-use-2/>.
- Pan, A., Q. Sun, A.M. Bernstein, M.B. Schulze, J.E. Manson, M.J. Stampfer, W.C. Willett, and F.B. Hu. 2012. "Red Meat Consumption and Mortality: Results from 2 Prospective Cohort Studies." *Archives of Internal Medicine* 172 (7): 555–63. doi:10.1001/archinternmed.2011.2287.
- Phelan, H. 2012. "The Slow Fashion Movement: 10 Brands That Are Doing It Right." *Fashionista*, December 10. <http://fashionista.com/2012/12/the-slow-fashion-movement-what-it-is-and-the-10-brands-that-are-doing-it-right#1>.
- Planet Retail. 2016. <http://www1.planetretail.net/>.
- Putt del Pino, S., C. Cummis, S. Lake, K. Rabinovitch, and P. Reig. 2016. "From Doing Better to Doing Enough: Anchoring Corporate Sustainability Targets in Science." Working Paper. Washington, DC: World Resources Institute and Mars Incorporated. <http://www.wri.org/publications/doing-enough-corporate-targets>.
- PwC. 2011. *Minerals and Metals Scarcity in Manufacturing: The Ticking Time Bomb*. PricewaterhouseCoopers Accountants N.V. <http://www.gilcommunity.com/files/4113/6318/4685/impact-of-minerals-metals-scarcity-on-business.pdf>.
- Ranganathan, J., D. Vennard, R. Waite, B. Lipinski, T. Searchinger, P. Dumas, A. Forslund, H. Guyomard, S. Manceron, E. Marajo-Petitson, C. Le Mouël, P. Havlik, M. Herrero, X. Zhang, S. Wirsenius, F. Ramos, X. Yan, M. Phillips, and R. Mungkung. 2016. "Shifting Diets for a Sustainable Food Future." Working Paper, Creating a Sustainable Food Future, Installment 11. Washington, DC: World Resources Institute. <http://www.wri.org/publication/shifting-diets>.
- Remy, N., E. Speelman, and S. Swartz. 2016. "Style That's Sustainable: A New Fast-Fashion Formula." McKinsey & Company. <http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/style-thats-sustainable-a-new-fast-fashion-formula?cid=sustainability-emi-alt-mip-mck-oth-1610>.
- Reverse Resources. 2016. "How Much Does Garment Industry Actually Waste?" <http://reverseresources.net/news/how-much-does-garment-industry-actually-waste>.
- Rosegrant, M.W., and P.K. Thornton. 2008. "Do Higher Meat and Milk Prices Adversely Affect Poor People?" *ID21 Insights* 72 (4). <https://cgspace.cgiar.org/handle/10568/2363>.
- Samaniego, D., ed. 2016. "Levi Strauss & Co. + Evrnu Create First Pair of Jeans from Post-consumer Cotton Waste." Levi Strauss & Co. <http://www.levistrauss.com/unzipped-blog/2016/05/levi-strauss-co-evrnu-create-first-pair-of-jeans-from-post-consumer-cotton-waste/?platform=hootsuite>.
- Searchinger, T., C. Hanson, J. Ranganathan, B. Lipinski, R. Waite, R. Winterbottom, A. Dinshaw, and R. Heimlich. 2013. "Creating a Sustainable Food Future. A Menu of Solutions to Sustainably Feed More than 9 Billion People by 2050." World Resources Report 2013–2014 Interim Findings. Washington, DC: World Resources Institute. <http://www.wri.org/publication/creating-sustainable-food-future-interim-findings>.
- Segran, E. 2017. "Levi's Is Radically Redefining Sustainability." *Fast Company*, February 9. <https://www.fastcompany.com/3067895/moving-the-needle/levis-is-radically-redefining-sustainability>.

- Siegle, L. 2015. "5 Tips for Shopping Smarter." *The True Cost*. <http://truecostmovie.com/learn-more/buying-better/>.
- Sinha, R., A.J. Cross, B.I. Graubard, M.F. Leitzmann, and A. Schatzkin. 2009. "Meat Intake and Mortality: A Prospective Study of over Half a Million People." *Archives of Internal Medicine* 169 (6): 562–71. <https://www.ncbi.nlm.nih.gov/pubmed/19307518>.
- Sperling, D., and D. Gordon. 2010. *Two Billion Cars: Driving toward Sustainability*. New York: Oxford University Press.
- Springmann, M., H.C.J. Godfray, M. Rayner, and P. Scarborough. 2016. "Analysis and Valuation of the Health and Climate Change Cobenefits of Dietary Change." *Proceedings of the National Academy of Sciences of the United States of America* 113 (15): 4146–51. doi:10.1073/pnas.1523119113.
- Steer, A., D. Waughray, G. Ellison, and M. McGregor. 2016. "The Great Decoupling: Our Human Economic Footprint and the Global Environmental Commons." Draft. Global Environment Facility and International Union for Conservation of Nature. [https://www.iucn.org/sites/dev/files/the\\_great\\_decoupling\\_10\\_10\\_16.pdf](https://www.iucn.org/sites/dev/files/the_great_decoupling_10_10_16.pdf).
- Steffen, W., K. Richardson, J. Rockström, S.E. Cornell, I. Fetzer, E.M. Bennett, R. Biggs, S.R. Carpenter, W. de Vries, C.A. de Wit, C. Folke, D. Gerten, J. Heinke, G.M. Mace, L.M. Persson, V. Ramanathan, B. Reyers, and S. Sörlin. 2015. "Planetary Boundaries: Guiding Human Development on a Changing Planet." *Science* 347 (6223). <http://science.sciencemag.org/content/347/6223/1259855>.
- Tarkan, L. 2015. "Why These Startups Want to Eat Bugs." *Fortune*, August 25. <http://fortune.com/2015/08/25/edible-insects-bug-startups/>.
- Textile World*. 2015. "Man-Made Fibers Continue to Grow." February 3. <http://www.textileworld.com/textile-world/fiber-world/2015/02/man-made-fibers-continue-to-grow/>.
- United Nations, Department of Economic and Social Affairs, Population Division. 2015a. (Database.) *Estimates and Projections*. Accessed December 22, 2016. <https://esa.un.org/unpd/wpp/>.
- United Nations, Department of Economic and Social Affairs, Population Division. 2015b. *World Population Prospects: The 2015 Revision* (DVD). Projections using medium fertility variant, 2015–2100.
- United Nations, Department of Economic and Social Affairs, Population Division. 2016. *The World's Cities in 2016—Data Booklet*. [http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the\\_worlds\\_cities\\_in\\_2016\\_data\\_booklet.pdf](http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2016_data_booklet.pdf).
- United Nations Human Settlements Programme. 2015. *Habitat III Issue Paper 19—Transport and Mobility*. [http://unhabitat.org/wp-content/uploads/2015/04/Habitat-III-Issue-Paper-19\\_Transport-and-Mobility-2.0.pdf](http://unhabitat.org/wp-content/uploads/2015/04/Habitat-III-Issue-Paper-19_Transport-and-Mobility-2.0.pdf).
- USDOT (United States Department of Transportation). 2014. "Transportation and Housing Costs." [https://www.fhwa.dot.gov/livability/fact\\_sheets/transhouse\\_attch1.cfm](https://www.fhwa.dot.gov/livability/fact_sheets/transhouse_attch1.cfm).
- Walker, J., and C. Johnson. 2016. *Peak Car Ownership: The Market Opportunity of Electric Automated Mobility Services*. Boulder, CO: Rocky Mountain Institute. [https://rmi.org/Content/Files/CWRRMI\\_POVdefection\\_FullReport\\_L12.pdf](https://rmi.org/Content/Files/CWRRMI_POVdefection_FullReport_L12.pdf).
- Watrous, M. 2016. "Expo East 2016: Plant-Based a Powerful Force in the Food Industry." *Food Business News*, September 27. [http://www.foodbusinessnews.net/articles/news\\_home/Consumer\\_Trends/2016/09/Expo\\_East\\_2016\\_Plantbased\\_a\\_po.aspx?ID=%7BD9098A27-0B58-4122-BAE2-5BC1AAAFBD98%7D&cck=1](http://www.foodbusinessnews.net/articles/news_home/Consumer_Trends/2016/09/Expo_East_2016_Plantbased_a_po.aspx?ID=%7BD9098A27-0B58-4122-BAE2-5BC1AAAFBD98%7D&cck=1).
- WHO (World Health Organization). 2014. "7 Million Premature Deaths Annually Linked to Air Pollution." <http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/>.
- Wiedmann T.O., H. Schandl, M. Lenzen, D. Moran, S. Suh, J. West, and K. Kanemoto. 2013. "The Material Footprint of Nations." *Proceedings of the National Academy of Sciences of the United States of America* 112 (20): 6271–76. doi:10.1073/pnas.1220362110.
- Wilson, A. 2016. "Volatility Is Here to Stay. . ." Innovation in Textiles. <http://www.innovationintextiles.com/volatility-is-here-to-stay/>.
- World Bank. 2014a. *The Bangladesh Responsible Sourcing Initiative: A New Model for Green Growth?* Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/614901468768707543/The-Bangladesh-Responsible-Sourcing-Initiative-A-new-model-for-green-growth>.
- World Bank. 2014b. 2011 *International Comparison Program Results*. Washington, DC: World Bank. doi:10.1596/978-1-4648-0329-1. [http://siteresources.worldbank.org/ICPEXT/Resources/ICP\\_2011.html](http://siteresources.worldbank.org/ICPEXT/Resources/ICP_2011.html).
- WRAP. 2015. *Food Futures: From Business as Usual to Business Unusual*. Report. [http://www.wrap.org.uk/sites/files/wrap/Food\\_Futures\\_%20report\\_0.pdf](http://www.wrap.org.uk/sites/files/wrap/Food_Futures_%20report_0.pdf).
- WTO (World Trade Organization). 2015. *International Trade Statistics*. Geneva, Switzerland: World Trade Organization. [https://www.wto.org/english/res\\_e/statistics\\_e/its2015\\_e/its15\\_toc\\_e.htm](https://www.wto.org/english/res_e/statistics_e/its2015_e/its15_toc_e.htm).
- WWF (World Wildlife Fund). 2013. "The Impact of a Cotton T-Shirt: How Smart Choices Can Make a Difference in Our Water and Energy Footprint." January 16. <https://www.worldwildlife.org/stories/the-impact-of-a-cotton-t-shirt>.
- Zaffalon, Valerio. 2010. "Climate Change, Carbon Mitigation and Textiles." *Textile World* 160 (4): 34. <http://www.ccpitex.com/eng/texInfo/42652.html>.
- Zero Deforestation Cattle. 2015. "A Path Towards Zero Deforestation Cattle." Collaborative Project between National Wildlife Federation and the Gibbs Land Use and Environment Lab. <http://www.zerodeforestationcattle.org/#home>.
- Zhao, X., A. Mahendra, N. Godfrey, H. Dalkmann, P. Rode, and G. Floater. 2015. *Unlocking the Power of Urban Transit Systems for Better Growth and a Better Climate*. Technical note. London, UK, and Washington, DC: New Climate Economy. [http://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/Unlocking-the-power-of-urban-transport-systems\\_web.pdf](http://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/Unlocking-the-power-of-urban-transport-systems_web.pdf).
- Zomer, R., H. Neufeldt, J. Xu, A. Ahrends, D. Bossio, A. Trabucco, M. van Noordwijk, and M. Wang. 2016. "Global Tree Cover and Biomass Carbon on Agricultural Land: The Contribution of Agroforestry to Global and National Carbon Budgets." *Scientific Reports* 6 (29987). doi:10.1038/srep29987.

## ENDNOTES

1. Depending on the classification system, both food and apparel may be categorized as fast-moving consumer goods.
2. See, for example, D. Sperling and D. Gordon, "Two Billion Cars: Driving toward Sustainability," <http://onlinepubs.trb.org/onlinepubs/trnews/trnews259billioncars.pdf>; and J. Dargay, D. Gately, and M. Sommer, "Vehicle Ownership and Income Growth, Worldwide: 1960–2030," [https://www.econ.nyu.edu/dept/courses/gately/DGS\\_Vehicle%20ownership\\_2007.pdf](https://www.econ.nyu.edu/dept/courses/gately/DGS_Vehicle%20ownership_2007.pdf).
3. For more information on cattle, see the Food and Agriculture Organization of the United Nations Dairy Production and Products page: <http://www.fao.org/agriculture/dairy-gateway/milk-production/dairy-animals/cattle/en/#.WEXCxbIrlJQI>.
4. For more information on milk production, see the Food and Agriculture Organization of the United Nations Dairy Production and Products page: <http://www.fao.org/agriculture/dairy-gateway/milk-production/en/#.WEXChLlrJQI>.
5. For more information on dairy animals, see the Food and Agriculture Organization of the United Nations Dairy Production and Products page: <http://www.fao.org/agriculture/dairy-gateway/milk-production/dairy-animals/en/#.WEXCnblrlJQI>.
6. For more information on the Food and Agriculture Organization of the UN SAVE FOOD: Global Initiative on Food Loss and Waste Reduction, see <http://www.fao.org/save-food/resources/keyfindings/infographics/meat/en/>.
7. For more information on the Food Loss and Waste Protocol, see <http://flwprotocol.org/about/the-flw-protocol/>.
8. For more information on the Consumer Goods Forum and its stance on sustainable beef, see <http://www.theconsumergoodsforum.com/sustainability-strategic-focus/climate-change/deforestation/beef> and <http://www.theconsumergoodsforum.com/about-the-forum/our-mission>.
9. For more information on the Global Roundtable for Sustainable Beef, see <http://www.grsbeef.org/page-1861859> and <http://www.grsbeef.org/>.
10. For more information on MorningStar Farms, see <https://www.morningstarfarms.com/>.
11. For more information on Beyond Meat, see <http://beyondmeat.com/about>.
12. For more information on the member companies in the Plant Based Foods Association, see [https://www.plantbasedfoods.org/our-members/4/?search-column=all&filtered\\_text=morningstar&search=1](https://www.plantbasedfoods.org/our-members/4/?search-column=all&filtered_text=morningstar&search=1).
13. For more information on the most impactful aspects of the fashion industry, see <http://www.cleanbydesign.org/>.
14. For Investopedia's details surrounding fast fashion, see <http://www.investopedia.com/terms/f/fast-fashion.asp>.
15. For more information on the Sustainable Apparel Coalition, see <http://apparelcoalition.org>.
16. For more information on Nike's Sustainable Performance Innovation work, see [http://www.nike.com/us/en\\_us/c/sustainability](http://www.nike.com/us/en_us/c/sustainability).
17. For more information on Patagonia's Worn Wear initiative, see <http://www.patagonia.com/worn-wear.html>.
18. For more information on MUD Jeans, see <http://mudjeans.eu/>.
19. For more information on Gwynnie Bee, see <https://closet.gwynniebee.com>.
20. For more information on Tonlé, see <https://tonle.com>.
21. For more information on Eileen Fisher's sustainable fibers program, see <http://www.eileenfisher.com/sustainable-fibers/recycled-fibers-less-waste-less-energy/>.
22. For more information Evrnu, see <http://www.evrnu.com/technology/>.

---

## ACKNOWLEDGMENTS

The authors would like to express deep gratitude to WRI colleagues Cynthia Cummis, Daryl Ditz, Helen Ding, Sofia Faruqi, Alyssa Fischer, Craig Hanson, Lindsey Longendyke, Jonathan Mason, Paul Reig, Katerina Elias-Trostmann, Stephanie Tye, Daniel Vennard, and Richard Waite, as well as Mike Berners-Lee (Small World Consulting), Garrette Clarke (UN Environment), John Elkington (Volans), Vera Guenther (UN Environment), Tony Henshaw (Aditya Birla Group), Julian Hill-Landolt (WBCSD), Steve Howard (IKEA), Katherine Neebe (Walmart), Moira O'Brien-Malone (UN Environment), and Dawn Rittenhouse (DuPont) for their constructive feedback on earlier versions of the working paper. Our appreciation also goes to colleagues Genevieve Yehoume for her attention to detail and to Liz Cook for her wise counsel.

We also appreciate the in-kind contribution of data from Planet Retail and the countless insights from WRI's corporate partners that informed the premise of this paper. A special thanks goes to those thought leaders who participated in the January 2017 "Breakthroughs in Tomorrow's Markets" meeting.

Finally, we thank our fantastic editors (Alex Martin, Emily Matthews, Lauri Scherer) and design team (Carin Hall, Carni Klirs, Julie Moretti) for all their help during the production process.

## ABOUT THE AUTHORS

**Samantha Putt del Pino** is director of Sustainable Business Initiatives in WRI's Business Center.

**Eliot Metzger** is a senior associate in WRI's Business Center.

**Deborah Drew** is a research analyst in WRI's Business Center.

**Kevin Moss** is global director of WRI's Business Center.

## ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

### Our Challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

### Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

### Our Approach

#### COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

#### CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

#### SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.



Copyright 2017 World Resources Institute. This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of the license, visit <http://creativecommons.org/licenses/by/4.0/>.