UNRAVELING THE ROLE OF THE PRIVATE SECTOR

Where industries can contribute to the Sustainable Development Goals

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ACCESS TO CLARITY

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EXECUTIVE SUMMARY

The United Nations Sustainable Development Goals (SDGs) are expected to be the cornerstone of the post-2015 development agenda. Engaging the private sector is widely considered to be pivotal for achieving these SDGs. This landscape study by Index Initiative – with support from the Dutch Ministry of Foreign Affairs – identifies 15 industries well positioned to contribute to the SDGs and the specific areas in which they can have the greatest impact. Based on the results of this study, five industries have been selected for which the feasibility of an *industry index for sustainable development* will be further assessed.

Indices of this kind initiate stakeholder dialogue, clarify societal expectations and rank individual companies according to the extent to which they meet these expectations. By comparing companies in the same industry to one another, each index rewards good practice and provides a transparent means by which companies can monitor their own performance and that of their peers. Furthermore, the insights provided by an index make it an invaluable resource for industry stakeholders, governments, financial institutions, civil society and academia.

The findings of this landscape study demonstrate that all 15 industries have the potential to make a significant contribution to the SDGs, but the nature of this contribution differs. This can be summarized as follows:

- *Transition* towards new business models that enable a low-carbon and circular economy. This applies most to the automotive, chemical, electric utilities and oil & gas industries. Transitions in these industries will significantly contribute to the SDGs on energy (7), sustainable production and consumption (12) and climate change (13).
- Improve *compliance* with stringent national and international labor, health & safety and environmental standards throughout the supply chain. This is most relevant to the apparel, consumer electronics, food retail and oil & gas industries as significant parts of production take place in low-wage countries. Improved compliance will contribute to the SDGs on productive employment and decent work (8) and sustainable production and consumption (12).
- Demonstrate *stewardship* of natural resources and ecosystems. This is most applicable to agricultural commodity traders, pulp & paper and seafood industries. Stewardship by these industries will contribute to the SDGs on food security and sustainable agriculture (2), oceans (14) and terrestrial ecosystems (15).
- Provide *access* to products and services that have become issues of equity. This is most relevant for electric utilities, mobile telecommunications services, publishing and waste-management services. More equitable access will contribute to the SDGs on inclusive and sustainable industrialization (9) and inequality (10).
- Implement more sustainable production methods to progressively lower *environmental footprints*. This applies to cement & aggregates, food retailers and meat & poultry, and will impact the SDGs on sustainable agriculture (2), sustainable production and consumption (12), climate change (13) and terrestrial ecosystems (15).

By applying additional qualifying and conditional criteria, five industries were selected whose contribution to the SDGs is unique, actionable and significant. They are agricultural commodity traders, chemicals, mobile telecommunications services, oil & gas and seafood. These industries will be subject to further feasibility studies. These studies will be started in 2015 and the first results are expected to be published during the course of 2016.

LIST OF ABBREVIATIONS AND ACRONYMS

AFR	Alternative fuels and raw materials
ASC	Aquaculture Stewardship Council
BoP	Base of the Pyramid
BCI	Better Cotton Initiative
BRIC	Brazil, Russia, India and China
CAGR	Compound annual growth rate
CCS	Carbon capture and storage
CSI	Cement Sustainability Initiative
CSR	Corporate social responsibility
DALY	Disability-adjusted life year
EICC	Electronic Industry Citizenship Coalition
EITI	Extractive Industries Transparency Initiative
EMF	Electromagnetic fields
EPR	Extended producer responsibility
FAO	Food and Agriculture Organization of the United Nations
FPIC	Free, prior and informed consent
GDP	Gross domestic product
GHG	Greenhouse gas
Gt	Gigaton
ICT	Information and communications technology
ICCA	International Council of Chemical Associations
IEA	International Energy Agency
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunication Union
IUU	Illegal, unreported or unregulated
MSC	Marine Stewardship Council
MSW	Municipal solid waste
Mt	Megaton
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
RMG	Ready-made garment
SDGs	Sustainable Development Goals
SME	Small and medium-sized enterprise
STM	Scientific, technical and medical
TNC	Transnational companies
ToC	Theory of Change
UN	United Nations
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization

INTRODUCTION

INTRODUCTION

The Rio+20 conference in 2012 marked a change in the thinking about the role of the private sector in sustainable development. Sustainable development has traditionally been the domain of governments, civil society and academia, and the private sector had no real place in the debate nor seemed to aspire to one. If the private sector was discussed at all in the context of sustainable development, it was for two principle and opposing reasons: the private sector creates much needed employment and tax revenue, but their operations often come at the expense of the environment and communities in which it operates. This led to the consensus that economic growth should be stimulated through business-friendly policies but contain the negative impact through better regulation and voluntary standards.

While the need for economic growth is as relevant as ever, the development community is beginning to understand that the private sector has more to offer. For their part, more and more corporate leaders are acknowledging that their companies do not succeed in splendid isolation. These leaders are becoming increasingly vocal on issues such as climate change, inequality, biodiversity and health as they realize how these materially impact the success of their business. They are also becoming aware of how well many companies are positioned to make a meaningful contribution to the sustainable development agenda through their products and operations. This, in turn, can open up new markets and opportunities for growth.

These insights are changing the narrative from *do no harm* towards *the future we want*, recognizing that participation of the private sector is important for the achievement of sustainable development. Many companies have already taken steps to better understand their unique influence and to integrate sustainability into their strategies, product life cycles, supply chains and operations. However, companies that consider their business immune to sustainability challenges still dominate the other side of the spectrum, with every shade of gray in between.

In such a diverse landscape, the term 'private sector' is effectively meaningless when one talks about the role of companies in relation to sustainable development. We have to be industry specific. This landscape study identifies 15 global industries that are well positioned to contribute to the SDGs and the areas in which they can have the greatest impact.

ABOUT INDEX INITIATIVE

Index Initiative develops indices that encourage and inspire companies to initiate positive change. Our vison is a world in which companies serve society's greatest needs.
With every new index we introduce we initiate dialogue, clarifying the unique social and environmental contribution companies can make as well as society's expectations of those companies.

Every index ranks the leading companies in a specific industry according to their efforts to meet these expectations. By comparing companies to one another, the index rewards good practice and provides a transparent means by which companies can monitor their own performance and that of their peers. Furthermore, the insights provided by the index make it an invaluable resource for industry stakeholders, governments, investors, civil society and academia.

The Access to Medicine Index, first published in 2008, is an excellent example of the positive influence an index can have on stimulating companies to play a bigger part in addressing societal needs. Other indices that Index Initiative draws inspiration from are the Access to Seeds Index, the Responsible Mining Index and the Access to Nutrition Index.

Our objective in the coming years is to introduce a suite of similarly influential indices for the industries best positioned to contribute to an equitable, sustainable society.

OBJECTIVES OF THE LANDSCAPE STUDY

The main objective of this landscape study is to identify the areas in which industries are best positioned to serve society's greatest needs. Index Initiative relied on the work of the UN General Assembly's Open Working Group on Sustainable Development Goals as it offers a comprehensive and widely acknowledged framework of these needs. The Open Working Group proposed a universal set of 17 SDGs that are expected to shape the post-2015 development agenda. A United Nations summit for the adoption of the post-2015 development agenda will be held from September 25-27, 2015 in New York.

Taking the 17 SDGs as a starting point, the study identifies the most pressing sustainability issues, opportunities and societal expectations for 15 global industries. In addition, it addresses important characteristics of each industry and the main players. Based on these findings, the landscape study assesses the areas in which each industry is best positioned to contribute to the preliminary SDGs. As part of the landscape study, Index Initiative developed a set of key preconditions for potentially impactful industry indices. These preconditions are outlined in Appendix 1 (Theory of Change for Industry Indices for Sustainable Development) and Appendix 2 (Index Design Principles).

FEASIBILITY STUDIES

Based on the results of the landscape study, five industries have been selected for a full feasibility study. These industry-specific feasibility studies will seek to understand *if* and *how* an index can add value by creating clarity on three levels:

1 The (potential) *contribution* of the industry to society
The SDGs serve as a primary point of reference. To justify a new index, an industry's contribution to the SDGs should be unique, significant and actionable. Indices will focus on these specific themes in order to add value to existing sustainability benchmarks by organizations including MSCI, Sustainalytics, FTSE4Good, Dow Jones Sustainability Index and NGOs that assess company performance on mainstream environmental, social and governance indicators or specific sustainability issues.

2 *Stakeholder expectations* of the industry
Stakeholders often have diverging expectations of an industry, offering companies in that industry little clarity on direction. Stakeholder dialogue helps to identify common ground among key stakeholders, providing companies with a clear path forward.

3 The *performance* of individual companies in the industry
Knowing how companies perform against relevant SDGs and stakeholder expectations relative to each other creates transparency and accountability. This, in turn, can stimulate companies to do better and encourage the adoption of best practices.

METHODS AND CONSIDERATIONS

INTERPRETATION OF THE SUSTAINABLE DEVELOPMENT GOALS

The 17 preliminary SDGs proposed by the Open Working Group were still under negotiation at the time of this study. Index Initiative therefore proceeded on the assumption that the wording and exact targets would be subject to change but that the overall structure and sustainability themes addressed would remain intact. Although the 169 accompanying targets were used to gain a better understanding of the intended breadth and depth of the various goals, this study does not assess the link between industries and those specific targets.

SELECTION OF INDUSTRIES

The following considerations were made for including industries in this study:

- To ensure diversity, at least one (sub-)industry from each sector was included. Inclusion was based on the Industry Classification Benchmark (ICB) and the Global Industry Classification Standard (GICS).
- Based on the judgment of industry experts, industries expected to make a major and/or unique potential contribution to the SDGs were prioritized.

The following considerations were made for excluding industries from this study:

- Industries that compete regionally rather than globally and that have no large, comparable players were excluded.
- All financial industries were excluded to prevent repeating the work currently being undertaken by the Dutch Association of Investors for Sustainable Development (VBDO, www.vbdo.nl/en) to identify opportunities for various indices in the financial sector.
- The pharmaceutical, mining, seed and food & beverage industry were excluded from this study as they are already covered by indices (some still under development) that served as direct inspiration for this project, notably the Access to Medicine Index, Responsible Mining Index, Access to Seeds Index and Access to Nutrition Index.

Given these considerations, the landscape study encompasses the following industries, in alphabetical order:

1 AGRICULTURAL COMMODITY TRADERS
2 APPAREL
3 AUTOMOTIVE
4 CEMENT & AGGREGATES
5 CHEMICALS
6 CONSUMER ELECTRONICS
7 ELECTRIC UTILITIES
8 MEAT & POULTRY
9 MOBILE TELECOMMUNICATIONS SERVICES
10 OIL & GAS
11 PUBLISHING
12 PULP & PAPER
13 RETAIL (FOOD)
14 SEAFOOD
15 WASTE MANAGEMENT

Each industry chapter contains a list of largest companies, based on the most relevant and available indicators for each industry (revenue, production volume, production capacity, subscribers or capital expenditure). These lists illustrate the largest companies in each of the 15 industries but do not reflect the eventual scope of new indices as the scope and inclusion of companies will be determined after extensive stakeholder dialogue.

RESEARCH METHODS AND LIMITATIONS

Initial desk research was conducted for each industry. A wide variety of sources were consulted to ensure a balanced view of the role of each industry. All industry chapters were thoroughly reviewed by industry experts. We assessed relevant developments that have had an impact on the industry or the dominant business model; the size and characteristics of the industry and its largest players; and sustainability issues and dilemmas the industry is facing. Furthermore, we determined the (potential) contribution of each industry to the SDGs by applying the following criteria:

- The industry can meaningfully influence its contribution by (enhancing) its products, services, supply chains and operations, i.e. the SDG is close to the industry's core business.
- The role of the industry in achieving the SDG is significant, i.e. the contribution of the industry is direct and its impact on the SDG is considerable.

Important industry issues can often be linked to multiple SDGs due to the widespread effects of particular issues and some overlaps in the SDGs themselves. For example, polluting, high-emission industries can have an impact on health (SDG 2), climate change (SDG 13), ecosystems (SDG 15) and oceans (SDG 14). Industries that outsource to low-wage countries can have an impact on poverty (SDG 1) and employment and decent work (SDG 8). Although this creates significant repetition in the report, it is important to show the whole picture and to assess the full contribution of each industry to the SDGs.
Although often not explicitly mentioned, the identification of additional initiatives that aim to improve sustainability in specific or across multiple industries, through advocacy, partnerships and increased transparency and accountability, was an integral part of the research process. Together with a range of other selection criteria, these were an important consideration when selecting the industries subject to further feasibility studies.
In identifying the relevant sustainability issues for each industry, we consulted materials published by multilateral organizations, (publicly funded) international knowledge institutes, civil society organizations, consultancies, industry associations and companies themselves. In addition, scientific articles and media sources were used as a reference for more specific issues like climate change and responsible business conduct violations that have received coverage in mainstream media.

Sales figures and other company information were obtained from financial databases, annual reports, company websites and industry reports.

The materials studied provided a wealth of (sometimes conflicting) perspectives.
We have strived for balance and objectivity in representing the role of and challenges faced by each industry. Complete objectivity is rarely possible, however, and we acknowledge that there may be readers who disagree with the framing of certain issues.

It should also be noted that no companies or stakeholders were consulted directly in the course of this landscape study, which limits its depth to a degree. Extensive stakeholder consultation will, however, be an integral part of the subsequent feasibility studies.

1 AGRICULTURAL COMMODITY TRADERS

FELICITY LAWRENCE
Author of the food business exposés *Not on the Label* and *Eat Your Heart Out*

"By mid-morning snack you will certainly have encountered their products several times already wherever you are in the world, whether it is the corn in your flakes, the wheat in your bread, the orange in your juice, the sugar in your jam, the chocolate on your biscuit, the coffee in your cup. By the end of the day, if you've eaten beef, chicken or pork, consumed anything containing salt, gums, starches, gluten, sweeteners or fats, or bought a ready meal or a takeaway, they will have shaped your consumption even further."

INTRODUCTION

Trade in agricultural products connects farmers to consumers, making it a crucial part of the global food system. Whereas most agricultural produce is produced and consumed in the same country, the market for globally traded agricultural commodities is enormous, allowing crops grown by farmers in the tropics to be sold on international markets to consumers in the West and increasingly in Asia and the Middle East.

Despite the fundamental and growing importance of agricultural commodity trading, the main actors in the market – which include some of the most powerful companies in the food and agri business – are not well known. This changed to some extent when food prices soared in 2008. Although the precise cause of these price spikes remains unresolved, they focused attention on the global food system and the role of agricultural commodity traders in influencing food prices and shortages.

One area where the operations of these companies have attracted particular scrutiny and criticism is agriculture. Producing, processing and transporting most of the world's internationally traded food can have serious socioecological implications. These include but are not limited to deforestation, chemical overload of soils and freshwater resources, and GHG emissions. At the same time, agricultural commodity traders are in the powerful position of being able to produce and distribute food for the growing populations of developing countries and can play a key role in achieving food security, including building up a production base.

INDUSTRY ANALYSIS

In 2012, trade in agricultural products exceeded $1.3 trillion[1]. Agricultural commodity traders possess high horizontal market power: while around a billion farmers produce food for the world's six billion consumers, no more than 500 companies control the supply chain connecting the two. Traders are the smallest group among these companies, with retailers (e.g. Walmart) and manufacturers (e.g. Nestlé) making up the majority of the rest. Of the agricultural commodity traders, the biggest ones control a relatively large amount of the total traded volume. What makes traders unique in the global food supply chain is that their activities are diverse and influence almost every facet of agricultural commodity production and trade. Their activities can be categorized as:

AGRICULTURAL PRODUCTION

This includes the provision and sometimes production of farm inputs (seeds, fertilizer, pesticides and herbicides), direct crop and livestock production (ownership of farms and ranching operations), indirect crop and livestock production (contract farming) and services to farmers (extension services, insurance, weather forecasts).

PROCESSING

Whereas large agricultural commodity traders produce and sell a great deal of directly consumable grain, many crops require further processing. This includes grain milling, oil crushing/pressing, silage (animal feed) and biofuel production.

STORAGE AND TRANSPORTATION

Agricultural commodity traders operate extensive networks for agricultural commodity storage, distribution and transport. These are essential in ensuring that food does not spoil and can be moved from places of production to places of consumption in an efficient and timely manner.

INVESTMENT AND RISK MANAGEMENT

Traditionally, traders have used financial risk management methods like hedging to protect their business interests. Given the small profit margins and large price fluctuations in agricultural commodity markets, these practices are an important part of their core business. In recent decades, activities analogous to the work of conventional financial institutions have increased, becoming major business areas of agricultural commodity traders. This includes speculation in positions on commodity markets and, more recently, diversification of financial portfolios to other markets. CarVal Investors (founded by Cargill), for example, specializes in commercial real estate, corporate securities and consumer loans. In addition, traders are active in the acquisition of land for agricultural production. Expanding control over arable land secures their supply of food commodities to global markets.

Traditionally four major players, known as the ABCD traders, have dominated the trade in agricultural commodities: Archer Daniels Midland (ADM), Bunge, Cargill and Louis Dreyfus. In 2014, they had combined revenues of more than $300 billion. However, the rapid rise of new players is increasing global competition for the ABCD traders. As the middle classes in the BRIC countries (Brazil, Russia, India and China) increase in size, so does their demand for meat, which in turn pushes up demand for animal feed. This, coupled with the desire of major Asian economies to be independent of American and European agricultural commodity traders, has led to the emergence of competitors to the ABCD traders in China, Malaysia, Singapore and elsewhere. However, several of the traditional quartet of traders have significant stakes in the newer oriental companies. ADM, for instance, is the second-largest shareholder of Wilmar International, the world's largest palm-oil company based in Singapore.

Another factor that has begun to erode the market power of long-established traders is the increasing availability of information technology. Whereas 25 years ago, knowing that it had rained in California and that the Brazilian Cerrado was experiencing a dry spell was costly information held by ABCD companies on account of their global presence, such information is now only a click away at no cost at all. This information is particularly important for speculation on food prices, one of the main areas of concern regarding agricultural commodity trading.

TABLE 1

LARGEST AGRICULTURAL COMMODITY TRADERS BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($billion)
1	Cargill	US	134.9
2	Archer Daniels Midland	US	81.2
3	Louis Dreyfus	France	63.6
4	COFCO	China	63.3*
5	Bunge	US	61.3
6	Mitsubishi (Living Essentials Group)	Japan	46.8*
7	Wilmar International	Singapore/Malaysia	44.0
8	ITOCHU (Food)	Japan	36.8*
9	Marubeni (Food)	Japan	33.5*
10	CHS	US	28.8
11	Glencore (Agricultural Products)	Switzerland	25.8
12	Olam	India/Singapore	19.4
13	Vitol (Other Trading)	The Netherlands	19.0*
14	Continental Grain Company	US	15.0*

* The company does not disclose detailed revenues from agricultural activities. The best available estimate has been used.

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

SUSTAINABLE AGRICULTURE

Farmers producing commodity-like products mainly compete on price and volume as their products are interchangeable with those of neighboring or overseas farmers. This focus risks further incentivizing farmers and governments to externalize the ecological and human cost of agricultural production in order to remain competitive. This creates a race to the bottom, potentially driving soil degradation, deforestation, hazardous labor conditions and water shortages. The ecological and human implications of modern agriculture emphasize the need for sustainable and inclusive production methods.

International companies that operate in agricultural value chains, such as retailers, food processors and commodity traders, are often criticized for not doing enough to promote sustainable agriculture. Major food processing companies and food retailers have responded by improving the sustainability of their supply chains. This, in turn, puts increased pressure on agricultural commodity traders to facilitate the trade in sustainable products and use their relationships with farmers to stimulate and facilitate the adoption of more sustainable production methods.

GREENHOUSE GAS EMISSIONS

The production of inputs, as well as mechanized farm operations like harvesting and tillage, are associated with high amounts of greenhouse gas (GHG) emissions. It is estimated that agriculture, including livestock production, is currently responsible for 19-29% of total GHG emissions[2]. Many existing strategies to increase food production are at odds with climate change goals. This shows the need for more 'climate-smart agriculture', according to the World Bank and other international institutions[3]. Agricultural commodity traders can promote climate-smart agriculture by:

- Enabling farmers to increase their production sustainably (lowering the emission per unit produced) through the use of better agricultural practices and more efficient inputs.
- Promoting the sourcing of agricultural commodities from areas where they cause the fewest emissions and least environmental damage.
- Reducing emissions in their own processing, storage and trading operations.

BIOFUELS

Biofuels are currently in high demand as alternatives for fossil fuels, with government subsidies and various ethanol-petrol mixtures widely available throughout the world. Many bioethanol fuels have a lower overall carbon intensity than fossil fuels such as petrol and diesel. While this provides a key solution for resource scarcity and limiting the effects of climate change, the demand for biofuels is leading to land use change and deforestation. Biofuel production can interfere with food production, drive the degradation of ecosystems and lead to conflicts over land rights. Agricultural commodity traders are key players in biofuels and can help to achieve better allocation of biofuel production through their investments and sourcing decisions[4].

POSTHARVEST LOSSES

The FAO estimates that each year about a third of all food produced for human consumption is lost or wasted, generating about 1.3 billion tons of food waste[5]. The FAO also estimates that 54% of this combined food loss and waste occurs 'upstream' during production, postharvest handling and storage[5]. Beside the direct economic cost – equivalent to $750 billion – food loss and waste also puts pressure on scarce natural resources[5,6]. For example, one of the main causes of food insecurity in Africa is the high prevalence of storage pests[7]. Agricultural commodity traders can help to reduce postharvest losses by investing in, and ensuring better access to, processing, storage and transportation facilities. This is particularly important in developing countries where the share of postharvest losses (compared to food wasted by retailers and consumers) is most significant. Quality checks incorporated in these networks, e.g. on storage and transport temperatures, can additionally play a role in improving food safety and preventing the spread of diseases.

MARKET ACCESS

Market access is crucial and often lacking for smallholder farmers who (aspire to) sell surplus harvest. Inadequate infrastructure is one of the factors hindering trade. The features of commodity trading (low cost, high volumes and availability) favor large-scale farmers and thereby risk undermining market access for smallholders as well as local agribusinesses in developing countries. This bias leaves the potential of the majority of smallholder farmers untapped. Agricultural commodity traders interested in tapping into this potential can facilitate the integration of smallholder farmers, small-scale industrial and other enterprises into global value chains and markets. They can also invest in suitable infrastructure, access to financial services and building capacity[8].

LAND ACQUISITIONS

It is in the interest of agricultural commodity traders to expand control over arable land in order to secure supply of agro-commodities to global markets. Although this can help to ensure the availability of food for the growing world population, the circumstances under which this land is acquired and the implications both for the land converted for cultivation and the people occupying that land, are in some ways unsustainable. Land deals have been criticized for their lack of consultation with indigenous people, corruption and forceful displacements of inhabitants[9]. The history of land conversion, including deforestation, for agricultural commodity production furthermore forebodes negative environmental consequences of land acquisition. Many of these negative consequences are a result of poor rule of law and institutional weaknesses in least developed and developing countries. Especially in circumstances where states are unwilling or unable to protect the interests of local communities, agricultural commodity traders have a responsibility to prevent conflicts over land rights by consulting all stakeholders[10].

PRICE VOLATILITY

The revenues of agricultural commodity traders are highly dependent on their financial position, causing them to compete on market and production insights. Due to their willingness to take risks that other players in the value chain are unwilling or unable to take, they have become very influential links in agricultural value chains. The effects of this 'financial position' on price formation have been extensively debated in the years since 2008. Although it is unlikely that agricultural commodity traders contributed to the food price hike in 2008, commentators such as Oxfam have condemned speculation on and profiting from food shortages as deeply unethical. Regulation in the US and EU has since tightened the rules for agricultural commodity traders' financial activities although there is significant room for greater transparency by these companies[11].

RELATIONSHIP WITH THE SDGS

IMPACT OF THE AGRICULTURAL COMMODITY TRADERS INDUSTRY

LIVELIHOOD OF SMALLHOLDER FARMERS

According to the World Bank, 75% of the world's poor live in rural areas and an estimated 86% of the rural poor depend directly or indirectly on agriculture for their livelihoods. In terms of poverty reduction, growth in agriculture is at least twice as effective as growth outside agriculture. It reduces poverty directly (raising incomes) and indirectly (creating employment and reducing food prices). Making smallholders more competitive and sustainable and stimulating inclusiveness can have enormous positive effects on poverty reduction in rural areas[12].

TRADE IN SUSTAINABLY PRODUCED AGRICULTURAL PRODUCTS

Farmers producing commodity-like products compete predominantly on price and volume as their products are interchangeable with those of their competitors. This focus can incentivize farmers and governments to externalize the ecological and human cost of agriculture in order to remain competitive, ultimately harming local ecosystems. Agricultural commodity traders can use their initial trade relationship with smallholder farmers to enable them to become more sustainable and competitive by providing market access, inputs, financial services and extension services. In addition, as key players in the global food system, they can facilitate the trade in sustainably produced products.

FOOD SAFETY

There is a notable time lag between the purchase of agricultural commodities and the arrival at their final destination. Storage and transportation conditions throughout the supply chain can be substandard[13]. By investing in modern processing, storage and transportation systems, agricultural commodity traders can help to ensure food safety and prevent diseases.

INCLUSION OF WOMEN IN OUTREACH

According to the FAO, women in agriculture are disadvantaged in many ways: e.g., they have lower access to productive resources, control less land which is often of poorer quality and on which their tenure is insecure, they own fewer working animals, are less likely to use modern inputs such as improved seeds, fertilizers, pest control measures and mechanical tools, use less credit and often do not control credits they obtain[14]. By explicitly including women, agricultural commodity traders can contribute to the social empowerment of rural women.

SUSTAINABLE AGRICULTURE

Agriculture is the single largest user of freshwater resources, consuming approximately 70% of all surface water supplies[15]. The majority of this water is recycled back to surface and groundwater. Without environmental safeguards to prevent the harmful build-up of agrochemicals, this leads to the deterioration of soil and water ecosystems[16]. Agricultural commodity traders can help to improve water efficiencies and work with farmers to ensure that agricultural activities do not adversely affect water quality.

LOCAL EMPLOYMENT

Companies can create local employment by investing in value-added activities in developing countries.

INCOMES FOR (SMALLHOLDER) FARMERS

By improving market access for (smallholder) farmers, agricultural commodity traders can contribute to increasing the incomes of farmers contracted for crop production. In addition, investments in suitable infrastructure, access to financial services and efforts to build organizational capacity can stimulate productivity thereby improving incomes.

TRANSPARENCY AND PRICE VOLATILITY

Commodity markets have significant impacts on nations and people. The agricultural commodity market is characterized by a degree of price volatility, which is a fundamental feature of that market and one of the main sources of risk for traders[17]. Although it is argued that speculation is important for efficiently functioning markets as it provides liquidity and helps farmers and other players to offset exposure to future price fluctuations, excessive speculation can lead to disproportionate and unwarranted fluctuations and changes in commodity prices[18]. Agricultural commodity traders can increase transparency in order to promote a better understanding of price formation and avoid contributing to extreme price volatility.

POSTHARVEST LOSSES

Over half of all food losses and waste occurs during production, postharvest handling and storage. Agricultural commodity traders can help to reduce postharvest losses by investing in and ensuring better access to processing, storage and transportation facilities, in particular in developing countries where the share of postharvest losses is most significant.

AGRICULTURE-RELATED GHG EMISSIONS

Agriculture is a major contributor to climate change and responsible for 19-29% of total GHG emissions. Agricultural commodity traders can help to reduce agriculture-related GHG emissions by encouraging farmers to adopt climate-smart production methods, sustainably increasing production while lowering the emissions per unit produced. In addition, traders can promote the efficient sourcing of agricultural commodities from areas where they cause the least environmental damage and reduce emissions in their own processing, storage and trading operations. Traders can also promote a better allocation of sustainable biofuel production by avoiding competition for land and food crops, through their sourcing and investment decisions.

ENERGY EFFICIENCY

Modern agriculture requires energy in all areas of production: farm machinery, water management, irrigation, cultivation, harvesting, drying and transportation[19]. In addition, the indirect use of energy through energy-intensive inputs such as fertilizer and pesticides further increases the energy usage of agricultural production. Agricultural commodity traders can improve energy efficiency across all activities, in particular during the transportation and processing phase. This can help to reduce GHG emissions.

DUE DILIGENCE

Agriculture is the major cause of deforestation in many countries[20]. As key players in agricultural commodity supply chains, agricultural commodity companies play an important role in reducing the deterioration of places of high or unique biodiversity by implementing due diligence processes in sourcing decisions and land acquisitions. This can minimize the risk of unsustainable or even illegal products.

CONFLICTS OVER LAND RIGHTS

With increased control over arable land by agricultural commodity traders, conflicts over land rights can be prevented by consulting all stakeholders.

PARTNERSHIPS ALONG AGRICULTURAL VALUE CHAINS

In order to improve and scale up the sustainability of agriculture, partnerships with all actors in agricultural value chains are important. This should include civil society and governments.

THE INDUSTRY AS A DRIVER OF CHANGE

The main agricultural commodity traders emphasize their role in achieving food security and driving sustainable change in agricultural production – in many ways rightly so as shown by the numerous (potential) impacts on SDGs. However, it is clear that challenges remain and that companies need to increase their transparency and due diligence efforts.

With a growing population and an even faster growing demand for food as meat-rich diets become more affordable, the competition for scarce agricultural resources is set to increase. At the same time, consumers are demanding greater insights into where their food comes from, how it is produced and the health risks associated with it. More fundamentally, the race to the bottom in the producer base of agricultural commodities has increasingly led to sustainability issues that threaten the global food supply.

Traders are recognizing this to varying extents. Many of them have gone through different stages in remedying the 'commodity cycle', starting with CSR-oriented projects, followed by certification and traceability. Some are now starting to see that they need to go beyond both. As a result, these companies are extending their reach into and control of their supply chains. Whereas other major players in the food game have responded to demands by consumers and civil society to improve the sustainability and transparency of their supply chains, commodity traders still lag behind. However, efforts by NGOs and research institutions to inform the public and incentivize other players in the food industry (mainly those that are closer to consumers and experience higher brand visibility) to take action, have had some effect. It has created a wealth of information regarding agricultural production and supply chains, contributing to increased transparency. This transparency can in turn facilitate a race to the top, with commodity traders no longer competing on price and volume alone but also on efforts to move agricultural production towards greater sustainability.

2 APPAREL

INTRODUCTION

The average woman buys roughly half the bodyweight of a mannequin – 28kg – in clothes a year from an industry that produces around 80 billion new garments annually[21]. Trends and styles come and go and what is in fashion today can be out of fashion tomorrow. In order to keep up with trends, the 'fast-fashion' business model has become very important in the apparel industry. This model allows companies to respond quickly to the latest trends through short production and lead times, resulting in a high speed-to-market. To reduce costs in the production of fabrics and clothing, outsourcing to low-income countries like China and Bangladesh has become common practice in the last decades. An estimated 25 million workers are employed in garment factories in developing countries.

Although consumers enjoy the ever-growing offering of cheap new designs, the fast-fashion model and corresponding outsourcing has also triggered concerns. These concerns reached their height after the Rana Plaza factory collapsed in Bangladesh in April 2013, killing more than 1,000 people. The apparel industry faces intense stakeholder scrutiny, in particular with regard to labor and health & safety issues. A growing number of companies are taking a more proactive approach to address human rights, worker safety and increased transparency in the supply chain. Despite these improvements, however, further action is needed.

INDUSTRY ANALYSIS

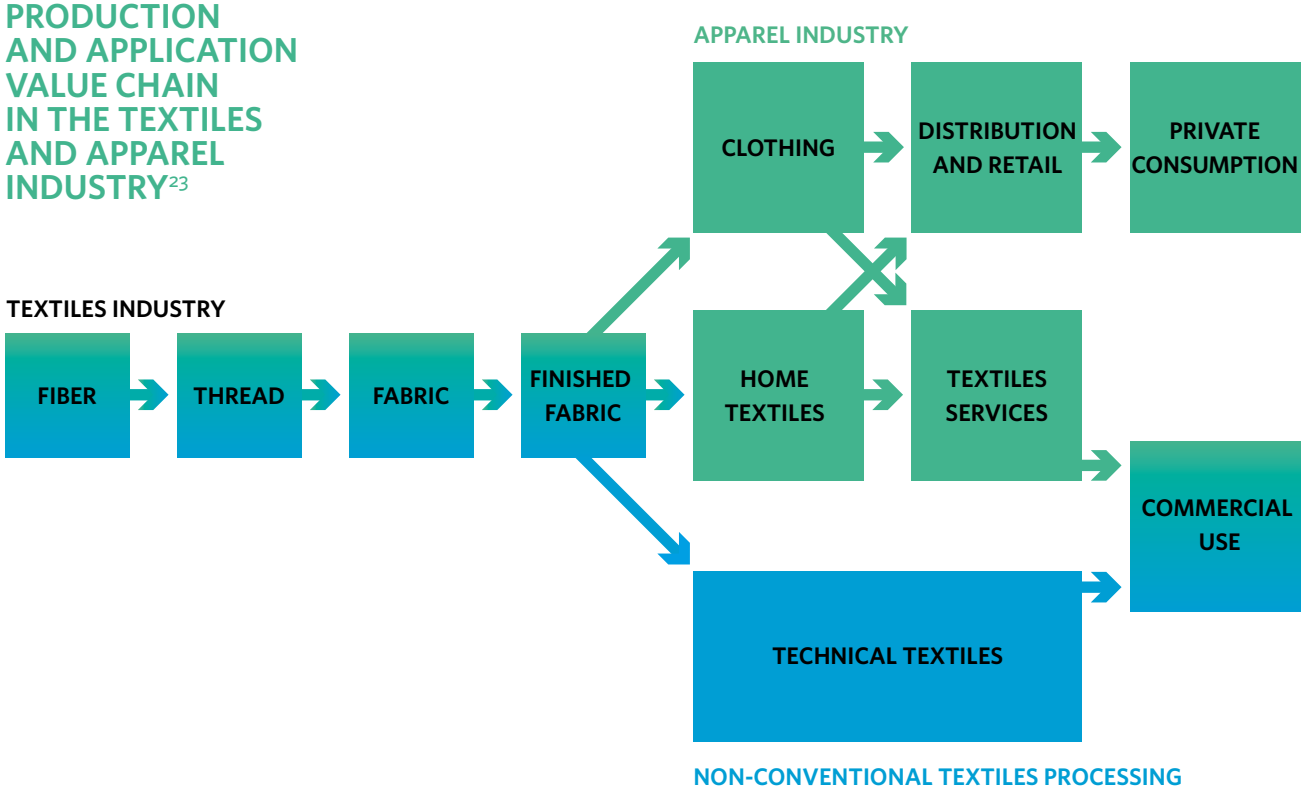
The apparel industry is worth more than $1,175 billion[22]. It is a highly diverse industry covering a variety of end products ranging from high-tech synthetic yarns to woolen fabrics, cotton bed linen to industrial filters, nappies to couture. This diversity of end products corresponds to a multitude of industrial processes, enterprises and market structures. The value chain in the textiles and apparel industry comprises several subsectors as illustrated in figure 1. As can be observed, the value chain is long and has several tiers. Often, the contracted factory has two or three tiers of subcontractors that produce (a large) part of the order. The apparel industry contains three types of lead firms: retailers, marketers and branded manufacturers.

The apparel industry plays an important role in the global economy. A forerunner of globalization, it was one of the first industries to actively include developing countries into its supply chain. The industry is considered a catalyst for national development and industrialization, and has been a natural 'starter' industry for export-oriented countries[24]. Most of the production takes place in low-wage countries. There is a race to the bottom, with clothing buyers tending to look for the cheapest production locations. China was a popular choice for some time, but wage increases have shifted production to countries like Vietnam, Bangladesh, Laos, Cambodia and recently Myanmar. A number of African countries, including Ethiopia and Lesotho, are also developing as production centers. Investment in the African textile industry – notably from India, Turkey, China, Bangladesh and South Korea – is on the rise.

The 20 largest apparel companies by revenue are listed in table 2. Companies producing mainly fibers and other textiles and department stores with limited or no private-label apparel were excluded at this point. The largest companies include apparel retailers (e.g. H&M, Inditex, Gap), department stores (e.g. Kohl's, Nordstrom) and international brands (e.g. Nike, Adidas). It should be noted that these companies only represent a limited share of the total apparel market as national/regional apparel companies and SMEs play a significant role in the industry.

FIGURE 1

PRODUCTION AND APPLICATION VALUE CHAIN IN THE TEXTILES AND APPAREL INDUSTRY[23]



ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

Many relevant issues for the industry can be found in the production phase and are related to the often complex, global supply chains that apparel companies manage.

HEALTH & SAFETY

The collapse of the Rana Plaza factory in Bangladesh in 2013 highlighted the lack of health & safety in factories where clothing is produced. Key suppliers in the apparel industry are clothing manufacturers and wholesalers. These are often small- to medium-sized enterprises located in low-wage countries. A common practice in the industry is indirect sourcing (subcontracting), often through purchasing agents. This can happen without the client's knowledge. With each subcontract, margins get smaller and oversight becomes more distant[25]. Factory owners at the bottom of the sector often do not make the most basic investments to ensure safe working conditions, and corruption is frequently the cause of buildings that do not comply with local health & safety regulations.

Companies have developed codes of conduct that manufacturers must meet to retain their supplier status. These include private standards developed by buyers as well as standards set by multilaterals such as the ILO Better Work program and multi-stake-holder initiatives such as the Ethical Trade Initiative.

Following the Rana Plaza tragedy, the industry faced intense stakeholder pressure to improve working conditions and health & safety measures at supplier factories. As a result, two major private initiatives were launched: the Accord on Fire and Building Safety in Bangladesh ('the Accord') and the Alliance for Bangladesh Worker Safety ('the Alliance'). The Accord is an independent, legally binding agreement between brands and trade unions designed to work towards a safe and healthy Bangladesh

ready-made garment (RMG) industry. It was developed by apparel companies, Bangladeshi and global unions, and labor rights NGOs. The Alliance, founded by North American companies that did not sign the Accord, is a five-year undertaking to improve health & safety measures in the Bangladesh RMG industry. A recent study by the Center for Business and Human Rights at NYU Stern School of Business notes that although 'these initiatives have both undertaken ambitious programs to inspect the top tier of factories, neither is targeting the most vulnerable factories producing for the export market'[25]. In total, both initiatives cover about 1,894 factories out of the approximately 5,000-6,000 factories that are part of the export garment sector in Bangladesh[25].

FREEDOM OF ASSOCIATION AND COLLECTIVE BARGAINING

Freedom of association is recognized as a fundamental human right, guaranteed by a number of international treaties and conventions like the Universal Declaration of Human Rights. This right is often violated in production countries. Trade unions are oppressed and union organizers intimidated, including physically. Collective bargaining is limited or absent. Manufacturers can impede or obstruct workers attempts to organize.

BONDED OR FORCED LABOR

According to the ILO, the term 'forced labor' refers to situations in which women and men, girls and boys are made to work against their free will, or coerced by their recruiter or employer. Coercion includes violence or threats of violence, or more subtle means such as accumulated debt, retention of identity papers or threats of denunciation to immigration authorities. Forced labor is found in several parts of the apparel supply chain, including cotton production, the spinning sector and textile mills[26].

LIVING WAGE AND WORKING HOURS

Wages paid in the garment sector are often insufficient for workers to have an adequate standard of living and pay for all basic needs such as food, rent, transport etc. The international community considers a living wage to be a human right, enshrined in international conventions and declarations[27]. According to Article 23 of the Universal Declaration of Human Rights, 'everyone who works has the right to just and favorable remuneration ensuring for himself and his family an existence worthy of human dignity'. This should be earned during normal working hours (the norm set by the ILO is a maximum of 48 hours per week). However, excessive working hours and forced (unpaid) overtime, particularly when order deadlines are approaching, remain common in the industry.

The Asia Floor Wage has calculated what a living wage should be for workers and compares this to current minimum wages. It shows there is a large gap between minimum wage standards and what is actually required to live on[28]. However, there exists no generally agreed definition and methodology for determining living wages[27] and, according to the Dutch Fair Wear Foundation, 'no single actor – worker, union, factory, brand, government, consumer – alone has the power to "just" pay higher wages, in any sustainable way'[29].

CHILD LABOR

The UN Convention on the Rights of the Child stipulates that all work done by children under the age of 15 – and all hazardous work done by children under the age of 18 – is illegal. In the textile and apparel industry, children are employed at all stages of the supply chain: from cotton picking and yarn spinning to the different phases of putting garments together, known as cut-make-trim. Children also work in large factories and small informal factories, subcontracted workshops and in their own homes. Although child labor at first-tier suppliers of export garments has decreased significantly since the late 1980s, the problem still persists, particularly at (unauthorized) subcontractor factories

TABLE 2

LARGEST APPAREL COMPANIES BY REVENUE

	COMPANY	COUNTRY	CATEGORY	COMPANIES AND BRANDS	2014 SALES ($million)
1	Wal-Mart Stores	US	Retail	Private-label brands: Baby George, Faded Glory, No Boundaries, Simply Basic, Starter Clothing Line	473,076 *
2	TJX Companies	US	Retail	T.J. Maxx, Marshalls, HomeGoods, Sierra Trading Post, Winners, HomeSense	29,078
3	Nike	US	Branded	-	27,799
4	Inditex	Spain	Retail	Zara, Pull&Bear, Massimo Dutti, Bershka, Stradivarius, Oysho, Zara Home, Uterqüe	20,448
5	H & M Hennes & Mauritz	Sweden	Retail	H&M, COS, Monki, Weekday, Cheap Monday, & Other Stories	19,583
6	Kohl's	US	Retail	Private-label brands: Apt. 9, The Big One, Croft&Barrow, Helix, Home Classics, etc.	19,023 *
7	The Gap	US	Retail	Gap, Banana Republic, Old Navy, Athleta, INTERMIX	16,435
8	Adidas Group	Germany	Branded	Adidas, Reebok, TaylorMade, Rockport, CCM	15,741
9	Marks & Spencer	UK	Retail	Private-label brands: Per Una, St Michaels	15,309 *
10	Nordstrom	US	Retail	Private-label brands: Treasure&Bond, Halogen, Tarnish, Classiques Entier etc.	13,506 *
11	Fast Retailing	Japan	Retail	Uniqlo, Theory, Comptoir des Cotonniers, Princesse tam.tam, J Brand	13,290
12	J.C. Penney	US	Retail	Private-label brands: Adonna, Ambrielle, A.N.A., Arizona, City Streets, Claiborne, Cooks, Decree, Flirtitude, the Foundry Supply & Co., JF J.Ferrar, JCP, JCPenney Home, Liz Claiborne, Made for Life, Mixit, Modern Bride, Monet, Okie Dokie, Royal Velvet, St John's Bay, Studio, Stafford, Total Girl, Worthington, Xersion	11,859
13	L Brands	US	Retail	Victoria's Secret, Bath & Body Works, PINK, La Senza, Henri Bendel	11,454
14	VF	US	Branded	7 for all mankind, Ella Moss, Bulwark'FR, Lee, Rustler, Majestic, Nautica, JanSport, Wrangler, Eagle Creek, The NorthFace, SmartWool, Reef, Kipling, Red Kap, Horacle Small, Splendid, Timberland, Lucy, Napapijri, Wrangler, EASTPACK, Vans	11,420
15	Ross Stores	US	Retail	Ross for Less, dd's DISCOUNTS	11,042
16	PVH	US	Branded	Calvin Klein, Tommy Hilfiger, Van Heusen, IZOD, ARROW, Speedo, Warner's and Olga	8,186
17	Ralph Lauren	US	Branded	Polo Ralph Lauren, Ralph Lauren Collection, etc., American Living, Chaps, Club Monaco	7,450
18	Associated British Foods	UK	Retail	Primark	7,448
19	C&A	Germany	Retail	Private-label brands: Angelo Litrico, Canda, Clockhouse, Here & There, Palomino, Rodeo, Westbury, Yessica, Yessica Pure, Your Sixth Sense	7,365 **
20	Next	UK	Retail	NEXT	6,151

* The company does not disclose detailed revenues from apparel sales
** In 2011/2012 revenues equalled €6.8 billion

and workplaces. According to the ILO, 168 million children are engaged in child labor with many making textiles and apparel. The Asian-Pacific region has the largest number of working children (77.7 million), followed by sub-Saharan Africa (59 million), Latin America and the Caribbean (12.5 million) and the Middle East and North Africa (9.2 million)[30].

WATER MANAGEMENT

The apparel industry uses and pollutes significant amounts of water across its supply chains. The World Bank estimates that almost 20% of global industrial water pollution comes from the treatment and dyeing of textiles. The greatest impact occurs in the cultivation of cotton, the most used fiber in the industry and washing at home. It can take more than 20,000 liters of water to produce 1kg of cotton; equivalent to a single T-shirt and pair of jeans[31]. Traditional dyeing techniques also require significant amounts of water and the effluent, if untreated, can pose a serious threat to drinking water, groundwater and local farmland.

HAZARDOUS CHEMICALS

A wide variety of chemicals are used in the manufacture and treatment of textiles. Pesticides and fertilizers are frequently used in natural fiber production. Cotton production alone consumes 15% of worldwide insecticides. Chemicals are also found in dyes, processing chemicals, water or stain repellents, performance-enhancing coatings or treatments, flame retardants etc. Some of these chemicals are designed to remain within the finished product while others are present as a carry-over from the manufacturing[32,33]. The use of these hazardous substances can lead to water pollution close to the manufacturing facilities but can also have broader impacts when garments are sold and washed[34]. A group of major apparel and footwear brands and retailers has made a shared commitment towards zero discharge of hazardous chemicals by 2020[35].

RELATIONSHIP WITH THE SDGS

IMPACT OF THE APPAREL INDUSTRY

STIMULATING ECONOMIC DEVELOPMENT

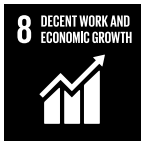
The apparel industry is a major global employer. In Asia alone, more than 15 million people are employed by the industry[28]. The majority of these are women who would otherwise have limited employment opportunities. Research shows that the textile and apparel industries are both economically and socially important, in the short run by providing incomes, jobs and foreign currency receipts, and in the long run by providing the opportunity for sustained economic development where appropriate policies and institutions are in place[36].

EMPLOYMENT OPPORTUNITIES FOR WOMEN AND EMPOWERMENT

Eighty percent of workers in the apparel industry are women. Research shows that the industry contributes significantly to the empowerment of women, particularly in countries where women have no income opportunities other than household jobs or the informal sector[36]. Although women employed in the apparel sector have increased opportunities for economic autonomy and improved livelihoods, including for their children, verbal and physical abuse, discrimination and maternity rights remain a problem. A gender bias also exists with regard to financial remuneration compared to men. Companies can take steps to e.g. make women aware of their rights, identify abuses, work with unions to ensure women are equally represented and participate in initiatives that aim to improve the position of women in the industry.

WATER CONSUMPTION IN PRODUCT LIFE CYCLE

Apparel products have a significant water impact, mainly in the areas of cotton cultivation and washing at home. Companies can undertake field-level efforts to improve water use at cotton fields to avoid water depletion and contamination by pesticides. Initiatives in this area include the Better Cotton Initiative (BCI) or Organic Exchange to promote the production and use of organic cotton that uses less water and no pesticides. In addition, companies can reduce the amounts of water used during the production process, for example by adjusting the wet-finishing processes. The widespread adoption of new waterless dyeing technologies could also sharply reduce pollution from the clothing industry.



WORKPLACE SAFETY

The collapse of the Rana Plaza factory in 2013 shows that workplace safety is still a major concern in the industry. Although encouraging steps have been taken to address this issue among first-tier suppliers in Bangladesh (notably through the introduction of the Accord and the Alliance), other countries remain outside these agreements as do subcontractors and second- and third-tier suppliers despite representing the greatest risk to workers[25].

LIVING WAGES AND REDUCED OVERTIME

Wages in the industry tend to be low. Brands and retailers have made progress in getting suppliers to pay their workers their statutory entitlements: a minimum wage plus any pension contributions, sickness or holiday pay[37]. However, research shows this is often barely enough to live on. Brands and retailers can do more to ensure that suppliers pay living wages (covering at least basic needs and some discretionary income). Furthermore, companies can advocate for minimum wages that are closer to living wages. It should be noted that there is currently no common standard for this. In addition, companies can plan their buying process differently in order to avoid peak stress and can enforce stricter standards at suppliers' facilities concerning overtime to prevent excessive (unpaid) working hours.

FREEDOM OF ASSOCIATION

Freedom of association, the right of workers to join and form trade unions to collectively bargain for their rights, is a universal human right. Through this mechanism workers can bargain for better wages, working conditions and safety measures. However, employers and governments often interfere with this right and only a small percentage of workers in the industry are actually unionized, of which a significant proportion is established by factory management to satisfy buyers' demands (yellow unions)[38]. For brands and retailers, it is challenging to identify whether freedom of association is respected at suppliers' facilities[39]. Companies can play a role in encouraging and helping suppliers to establish an open attitude towards unions and educating workers about their rights.

CHILD LABOR

Some progress has been made to reduce the incidence of child labor at first-tier and large second-tier suppliers. However, the problem persists, mainly at (unauthorized) subcontractor factories and workplaces. As these are not officially part of the buyer's supply chain, they often fall outside inspection schemes and influence over them is significantly weaker.

MIGRANT WORKERS

The industry employs migrant workers throughout the supply chain, often to fulfil the demand for cheap labor. Migrant workers are particularly vulnerable to discriminatory practices such as low pay, lack of freedom of association, risk of forced labor and labor trafficking.

FIRST STEP UP THE INDUSTRIALIZATION LADDER

Apparel is considered the typical 'starter' industry for countries engaged in export-oriented industrialization[40]. Textile and clothing production can be 'a first step up the value-added industrialization ladder' beyond agriculture but before many other manufacturing and services activities[36]. It offers a range of opportunities including entry-level jobs for unskilled labor and integration into the global economy. Several countries, e.g. Bangladesh, Sri Lanka, Vietnam and Mauritius, have benefitted from the industry and have experienced significant economic growth as a result of it[36].

USE OF HAZARDOUS CHEMICALS

By limiting the use of hazardous chemicals during the production process, companies can prevent harmful substances being released with wastewater and potentially polluting local water resources and farmland.

TEXTILE RECYCLING

Recent discussions on resource scarcity, the heavy use of resources by the industry and the fast-fashion model, have given rise to the first initiatives to recycle and re-use textiles. This is increasingly facilitated by government policies and legislation as waste reduction and environmental targets become more important. In the US alone, 11 billion kg of textile waste – equivalent to almost 40kg per person – is produced annually. According to the US Environmental Protection Agency (EPA), about 85% of textile waste ends up in landfills or incinerators while 95% of it is suitable for recycling. Companies can collect used garments from consumers to prevent them from ending up in landfills and can increase the amount of recycled materials in their products. Rethinking production in circular terms is an increasingly viable option that saves natural resources, raw materials and requires zero water, fertilizers or chemicals.

GHG EMISSIONS AND ENERGY USE

The apparel industry is a considerable producer of greenhouse gases due to its size and scope as well as the many processes and products that go into the manufacture of textiles and finished textile products[41]. It is estimated that textiles and apparel accounted for about one ton of the 19.8 tons of total CO_2 emissions produced by each person in the US in 2006[42]. The Carbon Trust calculates the yearly CO_2 emissions related to the production and use of clothing at 860 million tons: 330 million tons related to production and distribution and 530 million tons related to the use of the product (washing, drying, ironing). Energy use depends heavily on the type of fiber used. Polyester, made from non-renewable petroleum, requires high energy inputs to produce. Based on an annual production of 60 billion kg of fabric, an estimated 1,074 billion kWh of electricity (or 132 million metric tons of coal) is used. Companies can make smart choices in the design phase by e.g. increasing the amount of recycled materials. In addition, companies can work together with fabric mills to stimulate the efficient use of energy.

IMPACT OF COTTON CULTIVATION ON ECOSYSTEMS

Cotton monoculture and the irrigation of cotton plantations have severely impacted water and water sources. Central Asia's Aral Sea, for instance, once the fourth largest lake in the world, has almost completely dried up. In addition, the heavy use of pesticides and insecticides in the production of cotton and chemicals in the production of textiles and clothing negatively influences ecosystems.

PARTNERSHIPS ALONG THE SUPPLY CHAIN

The complexity of apparel supply chains and the wide-ranging sustainability issues at different stages of the supply chain, mean that improvements require multi-stakeholder partnerships. In addition, partnerships between industry players are necessary to address key sustainability issues and share knowledge, experiences and best practices.

THE INDUSTRY AS A DRIVER OF CHANGE

The apparel industry wields significant global power. Its size, fragmented value chain, social and environmental impact and strong presence in developing countries (with mostly female workers) pose a range of challenges. The industry is often one of the first means for developing countries to participate in global production networks and global value chains[36]. As history shows, this can have an important positive effect on economic development and growth through the creation of employment and trade. However, workers' rights and working conditions remain a concern as does the water-, energy- and chemical-intense nature of the industry.

The sector is under growing scrutiny from many stakeholders. Tragedies like the Rana Plaza collapse highlight the need to make the apparel supply chain more responsible and sustainable. There is a growing demand for transparency regarding their supplier base, supplier location and production volumes and more detailed insights into company structures, due diligence processes, audit outcomes and corrective action taken. Significant steps have been made to reduce the negative social and environmental impact of the sector, such as 'the Accord' and 'the Alliance' in Bangladesh that focus on worker safety. In several European countries, including Sweden, Germany and the UK, national action plans have been or are being developed for the apparel industry. These action plans are often initiated by the private sector but are implemented together with relevant stakeholders, among them governments, trade unions, knowledge institutes and NGOs. In addition, the Sustainable Apparel Coalition, comprising brands, retailers, manufacturers, governments, NGOs and academics, has developed a range of assessment tools that standardize the measurement of environmental and social impacts along the apparel/footwear life cycle (Higg Index).

Despite different initiatives in areas ranging from reducing water in cotton cultivation to addressing living wages, industry progress in many areas remains slow. It is also unclear which apparel retailers or brands are really leading the way in addressing these challenges. There is a need for companies to differentiate themselves given the backlash in the wake of scandals like the Rana Plaza factory collapse.

3 AUTOMOTIVE

INTRODUCTION

Since the introduction of the first mass-produced automobile – the iconic Ford Model T – at the beginning of the 20th century, cars have deeply influenced the way we live and work, shaping our landscapes and cities accordingly. Cars have become central to our mobility systems and a status symbol like no other. Yet change is afoot. McKinsey & Company calculates that whereas global consumer spending on mobility is steadily increasing, the percentage of consumer income spent on cars is declining[43]. For urban millennials (aged 18-34), cars appear to be less important as a status symbol than for previous generations. Combined with the rise of car-sharing concepts, tighter regulation and high unemployment, especially among the young, car ownership numbers are leveling off or even decreasing in most of the Western world.

Nevertheless, cars are expected to remain the dominant mode of transport for the foreseeable future[44]. The Institute for Mobility Research expects car ownership in emerging markets, particularly China, to increase dramatically over the coming decades. In 2011, there were 47 cars for every 1,000 Chinese citizens; in 20 years this will increase to 270[44].

Yet although cars facilitate mobility, their production and usage have negative side effects. The automotive industry consumes a tremendous amount of materials, including steel, plastic and aluminum, as well as more and more so-called 'rare earth metals' and 'conflict minerals' in an increasing number of electrical components. Cars also continue to present congestion problems in most urban areas. This leads to immediate health risks due to rising emission levels and lower productivity as a result of time spent sitting in traffic and finding a parking space. Besides improved public transport facilities, car manufacturers can help to ease the pressure on densely populated areas by introducing electric vehicles, smart technology and car-sharing concepts. This will be vital considering that half of the world's population now lives in cities and that number is set to rise.

INDUSTRY ANALYSIS

The automotive industry encompasses industries associated with the production, wholesale, retail and maintenance of motor vehicles. The global market for new cars grew by 9.1% in 2014, reaching a value of $1,793 billion[45]. If the sales of used cars and maintenance are included, the automotive industry becomes the world's largest economic sector by revenue. It is expected to exceed $9 trillion in 2015[46].

The biggest companies in the automotive industry are all involved in the design, development, manufacture and marketing of motor vehicles. Selling cars to consumers is in the hands of car dealers who also provide the majority of (maintenance) services. The main competition in the automotive sector can be observed between the different car manufacturers and at brand level. The barriers to entering the car manufacturing business are relatively high although there are some successful niche players with great potential. A case in point is Tesla Motors, which is currently valued at approximately $25 billon despite the limited number of cars sold.

TABLE 3

LARGEST AUTOMOTIVE COMPANIES BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($million)
1	Toyota Motor	Japan	248,955
2	Volkswagen	Germany	244,810
3	Daimler	Germany	157,040
4	General Motors	US	155,929
5	Ford Motor	US	144,077
6	Fiat Chrysler Automobiles	Italy	116,191
7	Honda Motor	Japan	114,753
8	BMW	Germany	104,476
9	Nissan Motor	Japan	101,576
10	Saic Motor	China	93,091
11	Hyundai Motor	South Korea	81,580
12	Audi	Germany	65,039
13	Peugeot	France	64,821
14	Renault	France	49,643
15	Kia Motors	Korea	43,047
16	Suzuki Motor	Japan	28,472
17	Mazda Motor	Japan	26,088
18	Fuji Heavy Industries	Japan	23,335
19	Mitsubishi Motors	Japan	20,285
20	Daihatsu Motor	Japan	18,539

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

CLIMATE CHANGE

The latest IPPC report – *Mitigation of Climate Change* – concludes that reducing global transport GHG emissions is a challenge as passenger and freight activity is expected to continue to increase. In 2010, the transport sector was responsible for approximately 23% of total energy-related CO_2 emissions[47]. Road transport, including passenger vehicles and heavy-duty trucks, is responsible for over 70% of all transport emissions. Without aggressive mitigation efforts, transport emissions could reach around 12GtCO_2eq per year by 2050, compared to the 7GtCO_2eq in 2010[47]. This emphasizes the need to decouple transport emissions from GDP growth. The automotive industry can contribute to decoupling by aggressively improving fuel efficiency and the mainstream introduction of zero-emission engines based on electricity or hydrogen fuel cells.

AIR POLLUTION AND HEALTH

The Union of Concerned Scientists considers passenger vehicles and heavy-duty trucks to be the main sources of air pollution in urban areas. This includes ozone, particulate matter and other smog-forming emissions[48]. The health risks of air pollution are extremely serious. Poor air quality increases respiratory ailments such as asthma and bronchitis, and heightens the risk of developing certain cancers. This puts a significant burden on health-care systems and can entail substantial medical costs. The majority of the cars on the roads today will still be driving ten years from now and will remain a major source of pollution. Car manufacturers can, however, help to improve air quality by introducing cars that are more fuel efficient, equipped with better filters or use clean energy sources like electricity or hydrogen fuel cells.

SAFETY

According to the WHO, 1.2 million people die in road traffic accidents every year. A further 50 million people are injured or left disabled by road accidents[49]. Governments can help to reduce those numbers by improving and enforcing safety policies such as speed limits and the compulsory use of seat belts. Car manufacturers can play their part too by making cars safer for passengers and developing smart technologies that help to avoid accidents. The latter is especially important as half of the victims are 'vulnerable' road users such as pedestrians and cyclists.

MATERIAL USE AND RECYCLING

The automotive industry uses a tremendous amount of materials in its manufacturing processes. The bulk of materials are made up of steel, plastic, aluminum, glass and rubber. Furthermore, more and more rare earth metals and potential conflict minerals are used in cars due to the increasing number of electrical components and batteries. Each of these materials has its own set of sustainability issues, ranging from the high amounts of energy required for extraction and production to the working conditions at mine sites. Car manufacturers can greatly reduce the social and environmental footprint of the vehicles they produce by maintaining stringent sourcing and control mechanisms throughout their supply chains and by reducing the use of virgin resources. More circular designs and the use of recycled materials can reduce dependency on primary resources.

The supply chain of the automotive industry is complex and is becoming more so with the increasing incorporation of advanced technologies. On average, raw materials pass through six to ten suppliers before reaching the car assembler. This poses an enormous challenge to the traceability of raw materials and improved transparency throughout the supply chain.

WORKING CONDITIONS

Hazardous and harmful labor practices in car manufacturing are relatively rare as the work is often highly automated and requires skilled staff. The risk of labor issues increases further down the supply chain where the production and processing of raw materials takes place. Labor issues are known to be associated with the production of rubber and textiles, processing of leather and extraction of metal ores at (artisanal) mine sites. Car manufacturers can help to prevent and resolve hazardous and harmful labor practices by implementing adequate due diligence procedures and engaging with second- and third-tier suppliers.

CITY CONGESTION AND MOBILITY

Istanbul, Mexico City and Rio de Janeiro rank among the world's most congested metropolises[50]. Estimates about the cost of traffic congestion vary widely, depending on whether they include the associated environmental and health-care costs, and account for lost productivity. Reliable global figures on the cost of traffic congestion do not exist but would likely be in the region of a trillion dollars. Car manufacturers can reduce the adverse environmental and health effects of traffic congestion by adopting cleaner technologies that lower emissions.

INCREASING IT SOLUTIONS

In the years to come, the exponential growth in technological innovations has the potential to disrupt the automotive sector. The main high-tech trends include self-driving cars and so-called 'connected cars' (fully autonomous vehicles equipped with advanced sensor and camera technology that can prevent accidents). On the one hand, this transition will pose challenges such as combining autonomous and

non-autonomous vehicles in traffic, regulations etc. On the other, it can greatly improve road safety by adding active road safety measures to passive ones (e.g. seat belts, air bags). It also presents enormous advantages for e.g. increased mobility of elderly people, fewer vehicle-related injuries and fatalities, and optimized time use[51].

CAR SHARING VERSUS OWNING

A shift from car ownership towards car accessibility is currently taking place. This shift is being driven by millennials (18-34 year olds) who appear to place less importance on car ownership than previous generations. The function of car as status symbol also seems to be dwindling for this group.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE AUTOMOTIVE INDUSTRY

ACTIVE AND PASSIVE SAFETY SYSTEMS

Car manufacturers can contribute to limiting the number of road traffic victims by developing better passive and active safety measures. Active measures include devices and systems that help to keep cars under control and prevent accidents. This is important as 95% of accidents are caused by human error[52]. Passive measures (seat belts, air bags) aim to protect the driver and passengers in the event that an accident does occur.

HEALTH EFFECTS FROM AIR POLLUTION

The transport industry is a major contributor to air pollution which has major impacts on human health. The WHO estimates that outdoor air pollution in cities and rural areas caused an estimated 3.7 million premature deaths in 2012[53]. In addition, air pollution increases the risk of stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases including asthma[53]. Introducing low- or zero-emissions cars can greatly contribute to improving air quality.

WORKING CONDITIONS IN THE SUPPLY CHAIN

Via their supply chains, car manufactures can influence employment and working conditions in a wide range of industries and countries. Leveraging this influence for good can help improve working conditions for millions of workers.

AIR POLLUTION IN CITIES

[See also SDG 3]. Personal vehicles are responsible for the majority of emissions in cities. Introducing cleaner, more fuel-efficient cars and increasing the rate at which zero-emissions vehicles are introduced can improve air quality in cities.

SUSTAINABLE DESIGN

Heavy dependency on raw materials and precious metals presents challenges for the industry. For example, the industry is the largest consumer of lead (60%), reserves of which may run out in 2030[54]. Companies can actively work to reduce the amount of rare minerals and primary materials necessary to produce cars and increase the use of recycled materials. Remanufacturing automobile parts and ensuring that cars are designed for recycling can contribute to decreased dependency on raw and rare materials.

EMISSIONS TO AIR

Eighty-five percent of the life-cycle emissions from a car occur during the use phase[55]. Substantial improvements to fuel efficiency and the introduction of zero-emission engines based on electric or hydrogen fuel cells can help to reduce this number. In addition, as car ownership is expected to increase, this can contribute to decoupling GDP growth from GHG emissions.

ACIDIFICATION OF OCEANS

Air emissions and pollution result in ocean acidification, negatively impacting the health of marine ecosystems.

ARTISANAL AND SMALL-SCALE MINING/ILLICIT MINING

Illicit mining of minerals can have negative effects on local ecosystems by polluting or destroying forests and streambeds. Extracted minerals themselves can also be toxic (e.g. coltan).

CONFLICT MINERALS

Profits from the extraction and trade of minerals from fragile regions can play a role in intensifying and perpetuating armed conflicts[56]. The industry has an important role to play in improving traceability and sourcing responsibly traded minerals.

MULTI-STAKEHOLDER PARTNERSHIPS

A number of the challenges faced by the automotive in transitioning towards a more circular model are systemic and depend on cooperation with for example chemical companies. Governments are crucial given the dominant role of regulation in making cars more fuel efficient. Partnerships could foster breakthroughs that would otherwise take much longer to materialize, like the electric infrastructure necessary to increase the share of electric vehicles.

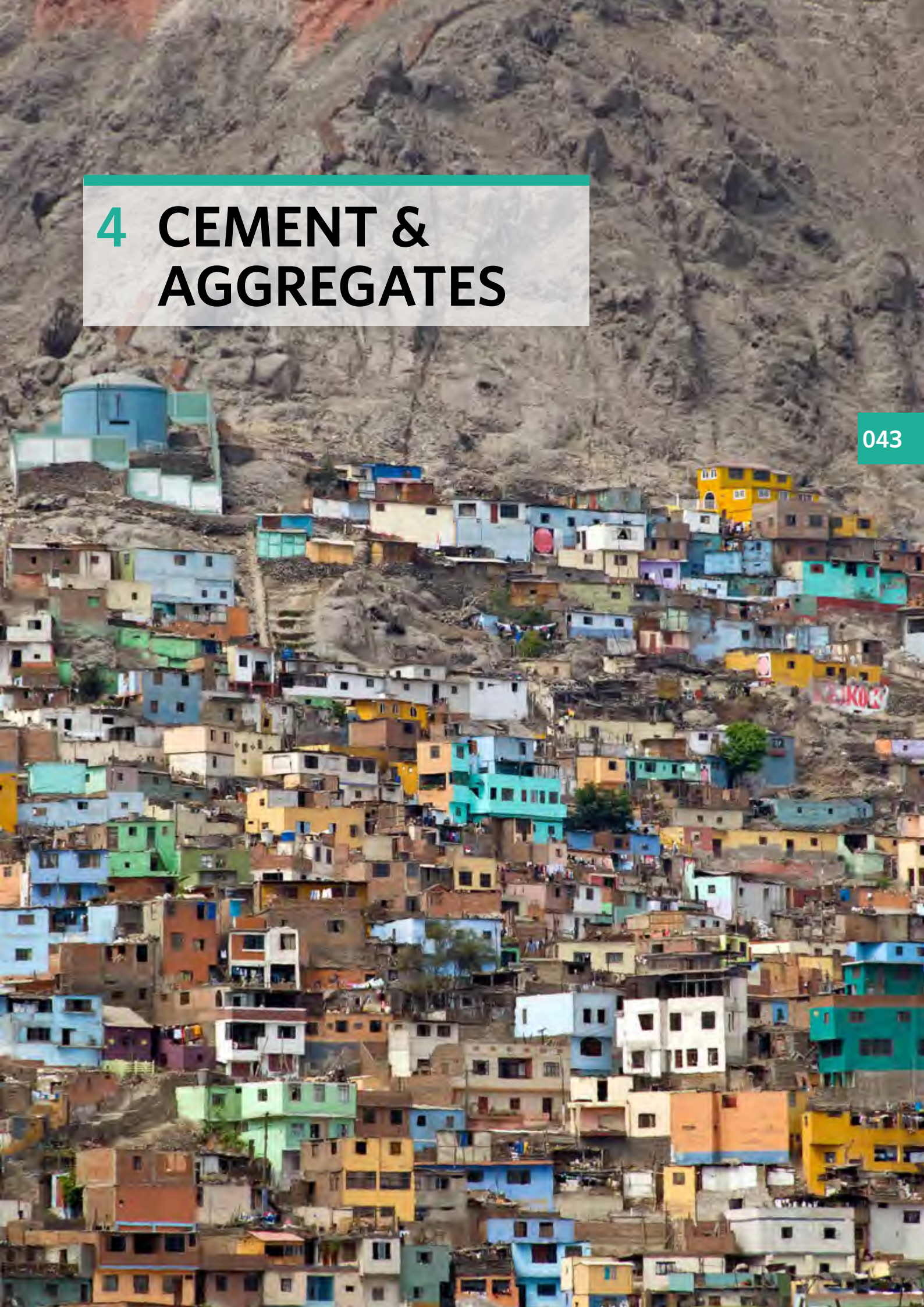
THE INDUSTRY AS A DRIVER OF CHANGE

The evolution of the automotive industry has always been influenced by innovations in fuels, vehicle components, societal infrastructure and manufacturing practices as well as changes in markets, suppliers and business structures. All of these elements will be dramatically affected in the coming decades by mega trends such as demographic and social changes, shifts in global economic power, rapid urbanization, climate change, resource scarcity and technological breakthroughs. However, the impact on the industry is often not direct but the result of government interventions in anticipation of these changes.

According to Transport & Environment, an NGO campaigning for smarter, cleaner transport in Europe, stricter government requirements for maximum emissions could 'save drivers money, combat climate change and create high-tech jobs'[57]. This view is echoed by McKinsey & Company, which talks about a triple-win situation when assessing the rise of new business models that revolve around car sharing: automotive companies can profit from capturing and locking in market share of the growing car-sharing market; cities and society can benefit from a lower need for parking infrastructure and the environment can benefit from reduced CO_2 emissions and a younger car fleet. Every shared car can replace on average three cars, creating enormous opportunities to limit the existing car fleet.

The logic regarding the potential benefits of more stringent requirements for maximum emissions increases the likelihood that governments around the world will start to take more progressive action to combat climate change and improve air quality, which may alter consumer behavior accordingly. The success of individual car manufacturers will greatly depend on how they succeed in anticipating and responding to these requirements as the market leaves little room for laggards.

4 CEMENT & AGGREGATES



VACLAV SMIL
Author of *Making the Modern World: Materials and Dematerialization*

"China has used more cement in the last three years than the US used in the entire 20th century."

INTRODUCTION

With rapid urbanization in developing countries, the demand for cement continues to rise. By 2050, the UN projects that 70% of the world's population will be living in urban areas. The cement & aggregates industry plays a major role in meeting the need for sustainable, durable housing and infrastructure, especially in developing countries. Concrete, a mixture of sand, crushed stone and gravel (aggregates), cement and water, is the single most widely used material in the world and is the second most consumed commodity by volume after water. Each person uses nearly three tons a year[58] or an equivalent of 450kg cement per capita per year[59]. Currently, there is no other material that can replace cement in terms of effectiveness, price and performance for many purposes[60].

Despite its positive contribution to development, the industry is also a major user of the world's resources. In addition, cement production is extremely energy and emission intensive: it accounts for around 5% of global man-made emissions of CO_2 [60]. So whereas the industry is a crucial provider of durable construction materials, it should also carefully balance its ecological and environmental impact.

INDUSTRY ANALYSIS

In 2013, the global cement market achieved total revenues of $267 billion, representing a compound annual growth rate of 8.1% between 2009 and 2013[61]. Cement consumption has increased significantly over the past 20 years. While cement consumption in Western Europe (excluding Mediterranean countries) and North America has been flat to declining, consumption is increasing in countries where demography, urbanization and economic growth drive demand for housing and infrastructure.

Cement consumption is closely related to construction activity and economic growth, and therefore exhibits strong cyclicality. Cement is produced in nearly every country and as it has low value and is expensive to transport (cement rarely travels more than 300km by road), companies often compete locally. Most of the larger cement companies are dominant in one or more region. Barriers to entry are high across the sector as companies are often subject to lengthy and stringent permit requirements and need large investments in plant and equipment. Another major barrier to entry is quarry ownership and development, both for lime and aggregates, as kilns have to be located close to quarry sites to limit transport costs.

Emerging markets currently represent 90% of the world market for cement. North America and Western Europe account for the remainder. Production capacity is highly concentrated in Asia, but capacity in the Middle East and Africa is also growing[62]. China and India are by far the largest cement producers (2300Mt and 280Mt respectively), followed by the US (77.8Mt). In general, Europe is home to the most efficient cement kilns which have the lowest heat consumption per ton of clinker, and some European companies are active in the development of lower impact types of cement.

The top 25 cement & aggregates companies, ranked by installed capacity, are listed below. Not all companies operate internationally, for example CNBM and Anhui Conch do not have any presence outside China.

TABLE 4

LARGEST CEMENT & AGGREGATES COMPANIES BY INSTALLED CAPACITY[62]

	COMPANY	COUNTRY	CAPACITY (Mt/yr)	PLANTS
1	Anhui Conch	China	219.70	33
2	Holcim	Switzerland	177.59	115
3	Lafarge	France	166.79	109
4	CNBM (Sinoma)	China	159.30	118
5	HeidelbergCement	Germany	91.99	58
6	Cemex	Mexico	82.91	60
7	Italcementi	Italy	79.95	45
8	Taiwan Cement	Taiwan	63.72	5
9	China Resources	China	62.92	16
10	Buzzi	Italy	53.17	33
11	InterCement	Brazil	51.70	28
12	EUROCEMENT	Russia	51.38	19
13	Votorantim	Brazil	47.89	42
14	Birla Group	India	47.85	19
15	Taiheiyo Cement	Japan	45.55	17
16	Semen Indonesia	Indonesia	38.02	10
17	Jidong Development	China	36.07	9
18	Siam Cement	Thailand	33.83	8
19	China Tianrui	China	33.08	11
20	Jiangsu Jinfeng	China	30.78	1
21	Shanshui (Sunnsy)	China	30.46	15
22	Asia Cement Corp.	Taiwan	27.95	7
23	Lafarge Shui On Cement	China	27.69	23
24	Vicat	France	27.64	14
25	VICEM	Vietnam	25.20	12

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

CO_2 EMISSIONS AND ENERGY MANAGEMENT

Concrete, the single most used building material, is composed of 10-15% cement and 60-75% aggregate. Cement production is extremely energy and emission intensive and accounts for about 5% of global man-made GHG emissions[63]. Roughly speaking, producing one ton of cement releases one ton of CO_2 into the atmosphere. Of this amount, 40% is due to the energy-intensive burning process of fuels to heat the cement kiln; 50% can be attributed to emissions from the chemical process of clinker production, the primary component of cement. When calcareous deposits (e.g. limestone) are heated, they break down into calcium oxide and CO_2 (calcination). Substituting a proportion of traditional clinker with mineral components (e.g. fly ash, metakaolin, silica fume, slag and calcined shale) can therefore significantly reduce CO_2 emissions. Transportation and the operation of machinery is responsible for 5-10% of total industry emissions[58].

RESPONSIBLE USE OF FUELS AND RAW MATERIALS

Depending on the type of cement and production process, one ton of clinker requires 3,500-3,700kJ/kg and on average 110kWh of electricity. While the production of Ordinary Portland Cement, the most common type of cement, can produce 1.05 tons of cement with 1 ton of clinker, partial substitution by more sustainable products –

(carbon-neutral, recovered) mineral components like granulated blast furnace slag or fly and bottom ash from the power industry – can significantly reduce the amount of clinker and thus energy necessary to produce the same amount of cement. In addition, the production of cement & aggregates requires significant amounts of raw materials like limestone, stone and gravel. Increasing the percentage of mineral components can therefore reduce the dependency on virgin resources.

WATER MANAGEMENT

The production of cement & aggregates requires water for e.g. cooling heavy equipment and exhaust gases, in emission-control systems, for preparing slurry in wet process kilns and for aggregate washing[64]. Discharged water can be altered in terms of temperature, acidity or suspended solids which can impact environments. Quarrying dewatering can also have an impact on groundwater levels.

LOCAL IMPACT ON LAND AND COMMUNITIES

The cement & aggregates industry has a large ecological footprint. For the production of cement, naturally occurring calcareous deposits such as limestone, marl or chalk are extracted from quarries close to the cement plant. The removal of soil and changes in topography have a negative impact on local ecosystems and watersheds[65]. Quarrying sites that are abandoned without proper rehabilitation can also have undesirable effects on local ecosystems, biodiversity and the livelihoods of surrounding communities as abandoned quarries often do not leave enough soil and nutrients to allow life to return to the area.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE CEMENT & AGGREGATES INDUSTRY

WATER CONSUMPTION

The production of cement & aggregates requires significant amounts of water. Companies should ensure responsible management and efficient use of water withdrawn as well as the quality of water released, particularly in water-stressed areas[64]. Companies can undertake efforts to recycle wastewater and install rainwater recovery systems as well as contribute to providing water to local communities.

ENERGY CONSUMPTION

Cement production is extremely energy intensive: significant amounts of fuel and electricity are consumed during the production process (raw mix preparation, clinker cooling and cement grinding). Companies can undertake efforts to reduce fossil fuel (mostly petcoke, a by-product of crude oil refinement and coal) consumption and increase the energy efficiency of their own operations. In addition, through the development of innovative materials, companies can contribute to the energy efficiency of buildings, which, according to the US Environmental Protection Agency, currently account for 39% of total energy use.

OCCUPATIONAL HEALTH & SAFETY

Injuries and fatalities are not uncommon in the sector. According to the Cement Sustainability Initiative (CSI), fatalities are most likely while driving or operating mobile plant equipment, and contractors are more at risk than employees or third parties. CSI indicates more attention should be devoted to these risks, e.g. through awareness campaigns and additional training programs.

RESILIENT AND SUSTAINABLE INFRASTRUCTURE

Cement & aggregates companies are key contributors to resilient and sustainable infrastructure. Through their products and innovations, they can contribute to meeting current and future development challenges.

NEW TECHNIQUES AND RETROFITS

Newer production techniques deliver significant energy and environmental benefits. Efficient technologies generally provide cost advantages to the producer due to lower energy costs. In addition, market and economic forces trigger the closure of inefficient facilities. However, retrofits require significant investment and are therefore limited[63].

SUSTAINABLE CITIES

Population growth and urbanization, predominantly in Asia and Africa, are increasing demand for sustainable buildings and infrastructure. Cement & aggregates companies can play an important role in sustainable urbanization by developing sustainable solutions, e.g. high-performance concrete for use in tall buildings, thereby limiting urban sprawl; self-healing concrete and other materials with high insulating capabilities.

ACCESS TO AFFORDABLE HOUSING

Companies can contribute to housing construction projects while ensuring good quality at affordable cost in developing countries. For example, several cement companies are collaborating with microfinance partners to stimulate the sale of their products to lower income populations while also offering technical assistance free of charge. In addition, companies can tailor their offerings to local needs and building practices.

NATURAL RESOURCE CONSUMPTION

The production of cement & aggregates requires significant amounts of natural resources, raw materials (e.g. limestone, rock, sand) and (fossil) fuels. As economic growth continues in developing countries, this will also increase demand for cement & aggregates. In order to decouple economic growth from natural resource depletion, companies can replace natural resources with waste and demolition waste (recycling), recycled minerals and increase the use of biofuels. For example, cement can be made with alternative cementitious materials like de-inking paper sludge containing metakaolin.

CO_2 EMISSIONS

CO_2 emissions are significant and can be compared to emissions by the aviation industry. There are three main routes for reducing CO_2 emissions in the cement-production process:

- Mineral components can be substituted for a proportion of traditional, carbon-intensive clinker[63]. This can reduce CO_2 emissions by up to 30% (and save natural resources and costs). In addition, selected waste and by-products that contain minerals such as calcium, silica, alumina and iron can be used to replace raw materials like clay, shale and limestone[59].
- Alternative fuels and raw materials (AFR), e.g. alternative fuels made from (hazardous) waste or by-products from other processes that can replace conventional fuels like coal, can be substituted for traditional fossil fuels. There are also materials that have both mineral content and can be used as alternative fuels, occasionally making the distinction between alternative fuels and raw materials unclear[59].
- Modern equipment requires less energy to produce clinker than wet kilns. Wet kilns need significant amounts of energy during the drying process.

ACIDIFICATION OF OCEANS

Air emissions and pollution result in ocean acidification, negatively impacting the health of marine ecosystems.

IMPACT ON ECOSYSTEMS AND WATERSHEDS THROUGH QUARRYING

Through limestone quarrying activities, companies can have an adverse impact on biodiversity and ecosystems. It is important that companies integrate biodiversity into company decision making and operations, and ensure responsibility for rehabilitating sites and the surrounding areas during and upon completion of operations. Companies can also reduce the amount of fresh aggregates by using alternatives like clean grit blast materials as a silica source. This reduces the need for quarrying and can therefore reduce the impact on local ecosystems.

SUSTAINABLE SOURCING

Sand is one of the major components of ready-mix concrete. Illegal sand mining has become rampant in developing countries, with particularly severe cases in India. The volumes extracted have a major impact on rivers, deltas, and coastal and marine ecosystems, resulting in loss of land through river and coastal erosion, lowering the water table and decreasing the amount of sediment supply[66].

MULTI-STAKEHOLDER PARTNERSHIPS

Partnerships with municipalities, governments, NGOS, and other companies can contribute to urban development and sustainable construction. As quarry sites can impact ecosystems and landscapes, companies should consult local stakeholders and environmental experts when planning and investing in afteruse.

THE INDUSTRY AS A DRIVER OF CHANGE

Cement is a vital commodity for fast-growing economies: it provides the building blocks for houses, roads and other types of infrastructure. Although significant progress has been made over the last decade in reducing CO_2 emissions, the industry remains a major polluter. If the world wants to limit the average global temperature increase to 2˚C, the cement & aggregates industry has to step up its efforts to limit CO_2 emissions. Increasing demand for cement poses significant challenges for the industry: on the one hand, the industry plays a major role in meeting the current and future need for sustainable housing and infrastructure. On the other, its environmental and ecological impact will only grow with increased production. The industry will therefore need to find ways to balance these environmental and developmental demands. Interestingly, contrary to other industries of this scale, cement & aggregates rarely attracts attention from the wider public.

An industry-led initiative, the Cement Sustainability Initiative (CSI), was launched by the World Business Council for Sustainable Development (WBCSD) to provide a platform for a shared understanding of sustainability issues. It brings together 24 major cement producers with operations in more than 100 countries[67]. Although these provide an important starting point, further transparency regarding the industry's performance can help governments, building companies and other users of the industry's products to make informed sourcing decisions and stimulate companies to innovate and scale up more efficient and sustainable production.

5 CHEMICALS

ADISA AZAPAGIC
Professor of *Sustainable Chemical Engineering* at the *University of Manchester*

"While chemical engineers cannot tackle all of the sustainability issues alone, we can help reverse some of the unsustainable trends and make key contributions in turning sustainable development from aspiration and patchy implementation into a genuine path to progress for this and future generations."

INTRODUCTION

The chemical industry is central to the global economy. Many of the chemical multinationals are over 100 years old and have been instrumental in the rapid increase of welfare in industrialized countries. The industry creates the building blocks for the globalized markets in energy, materials and food, and is of key strategic importance to the development of national economies[68]. According to the industry itself, 95% of all manufactured products rely on chemistry. With an expected increase in the world population and decreasing available resources, the knowledge of this industry will be essential for meeting future needs for materials, energy and food.

A potentially positive impact of the chemical industry is that it can be the driving force for sustainability in sectors like food, plastics, agriculture, energy, automotive, aviation, textiles, coatings, pharma and packaging. Initiatives to that end are emerging under the names of Green Chemistry, Product Stewardship and Life Cycle Assessment. They deal in different ways with concepts such as waste prevention, circular economy, renewables, eco-efficiency and health. Mainstream application of these principles would transform the industry.

The environmental impact of chemical production is significant as is the impact on workers and the safety of local communities. The industry has made progress and is expected to continue doing so under pressure from governments, buyers and NGOs. The introduction of simpler, safer, healthier and reusable materials could elevate the sustainability performance of many other industries.

INDUSTRY ANALYSIS

Worth over $4,233 billion[69], the chemical industry is one of the largest manufacturing sectors in the world. The top 50 companies account for nearly a third of total industry sales. Demand for chemical products is strong in Asia and other regions with a high concentration of manufacturing industries. Production takes place around the world but is often concentrated in areas of resource availability. The shale gas revolution in the US has given a huge boost to the chemical industry and the presence of many traditional oil & gas companies in the list of major chemical companies further illustrates this link.

Chemical companies differ in terms of the industries in which they are active and the distance to end markets. 'Basic chemicals' have commodity-like characteristics (also referred to as commodity chemicals) and are produced at relatively low cost and sold in large volumes. These include petrochemicals such as polymers used to make plastics and other synthetic fibers. Globally, basic chemicals make up the majority of revenue in the chemical industry, but their importance to the portfolio of an individual company can vary strongly. 'Specialty chemicals' are more performance critical and value adding, and are usually made to customer specifications. These include industrial gases, coatings and chemicals used in electronics manufacturing but also the life sciences segments such as animal health, crop protection, nutrition, biotechnology and pharmaceutical-related products.

TABLE 5

LARGEST CHEMICAL COMPANIES BY REVENUE

	COMPANY	COUNTRY	2014 CHEMICAL SALES ($billion)
1	BASF	Germany	78.6
2	Sinopec	China	60.8
3	Dow Chemical	US	57.0
4	SABIC	Saudi Arabia	43.6
5	Royal Dutch Shell	The Netherlands/UK	42.3
6	ExxonMobil	US	39.0
7	Formosa Plastics	Taiwan	37.6
8	LyondellBasell Industries	The Netherlands	33.4
9	DuPont	US	31.0
10	Ineos	Switzerland	26.8
11	Mitsubishi Chemical	Japan	26.6
12	Bayer	Germany	26.6
13	LG Chem	South Korea	21.1
14	AkzoNobel	The Netherlands	19.3
15	Air Liquide	France	19.1
16	Braskem	Brazil	18.9
17	Mitsui Chemicals	Japan	18.9
18	Linde	Germany	18.5
19	Sumitomo Chemical	Japan	18.1
20	Reliance Industries	India	17.7
21	Evonik Industries	Germany	17.0
22	Toray Industries	Japan	16.6
23	Lotte Chemical	South Korea	15.0
24	Yara	Norway	14.4
25	PPG Industries	US	14.0
26	Solvay	Belgium	13.7
27	Chevron Phillips	US	13.1
28	DSM	The Netherlands	12.7
29	Shin-Etsu Chemical	Japan	11.9
30	Praxair	US	11.9

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

PLANETARY BOUNDARIES

The Stockholm Resilience Centre, which researches the governance and resilience of socioecological systems, identified nine critical planetary boundaries[I] that define a safe operating space for humanity[70]. The chemical industry has both an impact on and is impacted by these boundaries. It is under increasing pressure to adapt in order not to transgress these boundaries, but at the same time this pressure presents opportunities for new products and solutions that can help humanity to stay within these boundaries.

HEALTH & SAFETY

Health & safety issues relate to the operations and supply chains of chemical companies as well as the products they bring to market. Various accidents throughout history have put health & safety high on chemical companies' agenda. Whereas all hazardous chemicals are subject to regulations like REACH in Europe, debates around this topic remain fierce. Understanding of the way in which these substances affect human health and ecosystems during the consumption and use phase as well as after they have served their purpose is still growing.

The societal pressure on the industry to reduce and eliminate the use of hazardous chemicals is likely to remain strong. This would encourage the scale-up of innovations for safer alternatives. Tighter regulations on restricted ingredients is one part of the solution. The other could very well be recognition of the companies that are ahead of the curve in substituting harmful but still widely applied material ingredients.

CIRCULAR ECONOMY

With an expected increase in demand for food, energy and materials, the world faces the challenge of getting more out of fewer virgin resources. The Ellen MacArthur Foundation captures the essence of the circular economy by describing what it means to move from a linear to a circular model: 'The linear "take, make, dispose" model relies on large quantities of easily accessible resources and energy, and as such is increasingly unfit for the reality in which it operates. (...) A circular economy is one that is restorative by design, and which aims to keep products, components and materials at their highest utility and value, at all times"[71].

The chemical industry could enable a circular economy by innovating and scaling up solutions for safe, renewable and easily reusable alternatives to complex, scarce and/or polluting resources. The objective should be twofold: firstly, to serve our needs longer with the products, materials or resources already in use, and secondly, to reduce the negative impact of waste (including emissions) on ecosystems that enable the regeneration of natural resources.

PRODUCT SIMPLICITY AND TRANSPARENCY

The industry creates products with complex chemical structures. This has resulted in materials which have extraordinary properties but are incredibly hard to recycle. As the need and demand for fully recyclable products increases, the challenge for the industry will be to create materials that meet this specification. This strikes at the heart of the industry's business model. 'Composition of matter' is one of the principle categories for filing a patent for new materials and a way for companies to differentiate themselves from their competitors and hence gain a competitive advantage.

ANIMAL WELFARE

Chemical companies make frequent use of animal testing, often required by law. Animal testing remains a controversial issue, with companies and governments facing strong social pressure to find alternatives.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE CHEMICAL INDUSTRY

FOOD AVAILABILITY

In order to feed the growing world population, agricultural production has to increase. Soil chemistry and applications can significantly contribute to improving agricultural yields, but products that prevent postharvest losses such as pest-control agents also contribute to the adequate supply of nutritious foods[7]. However, the industry also has an important role to play in ensuring that agrochemicals and chemical-based technologies do not push food production systems beyond our planetary boundaries.

NUTRITIONAL VALUE OF FOOD

An important segment of the chemical industry is life sciences. It is estimated that over 2 billion people, mainly women and children, suffer from micronutrient deficiencies[72,73]. Among other things, chemical companies engage in the manufacture of micronutrients that can enhance the nutritional value of food, also referred to as food fortification, or in other situations of severe malnutrition. Fortification is considered one of the most cost-effective means of overcoming undernutrition and micronutrient malnutrition and directly reducing poverty[74].

HAZARDOUS CHEMICALS

Avoidance and/or responsible use and disposal of hazardous chemicals is extremely important to prevent them from harming the people making and using them. According to the ILO, occupational exposure to hazardous chemicals is responsible for over 300,000 annual deaths worldwide[75]. The wider health effects of chemicals are even more serious: according to the WHO, chemicals caused around a million deaths in 2004 and 21 million disability-adjusted life years (DALYs)[76].

TREATMENT AND PREVENTION

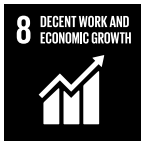
With regards to life sciences, innovations are targeting new treatments but can also aid in the prevention of non-communicable diseases like obesity and diabetes. With life expectancy increasing around the world (accompanied by rising health-care costs), the industry could play a major role in prevention instead of cure.

RELEASE OF TOXIC CHEMICALS IN WATERWAYS

Water quality can be severely affected if toxic chemicals are released into local waterways. Companies should maintain stringent internal standards and monitoring procedures to ensure responsible handling of chemicals and compliance with water quality standards. At the same time, the chemical industry can provide solutions that purify unsafe water and make it suitable to drink.

RENEWABLE ENERGY TECHNOLOGIES AND PROCESSES

Chemical products play an important role in many renewable energy technologies, ranging from turbine blades and solar panels to batteries for energy storage[77]. In addition, the chemical industry is heavily involved in the development of technologies and processes for the production of biofuels.



WORKING CONDITIONS IN THE SUPPLY CHAIN

The chemical industry employs more than 7 million people globally[77]. Due to the nature of the work and the substances involved, health & safety in operations will remain a critical issue. However, most gains in providing decent work lie in sustainable supply chain management. The raw materials (feedstock) for the chemical industry originate in the extractive and agriculture industries, both of which are known for their exposure to harmful labor practices. Implementing responsible sourcing practices is important to ensure environmental and social sustainability.

SUSTAINABLE AND INCLUSIVE INDUSTRIALIZATION

Based on its size, global coverage and position at the beginning of many value chains, the chemical industry can greatly influence the degree to which industrialization in developing countries is inclusive and sustainable.

SUSTAINABLE CHEMISTRY

Sustainable chemistry is a concept that seeks 'to improve the efficiency with which natural resources are used to meet human needs for chemical products and services'[78]. The concept includes the design, manufacture and use of efficient, safe and more environmentally sound chemical processes and products. Despite the concept's great potential, the OECD finds that there is still a lack of knowledge and awareness regarding sustainable chemistry[78]. If the concept were widely applied, it could significantly enhance the sustainability of product life cycles, reduce dependency on virgin resources and contribute to the production of products that can be reused or recycled.

ENERGY-EFFICIENT SOLUTIONS

Chemical production is energy intensive. This makes chemical companies large energy consumers, accounting for about 10% of global energy demand and 7% of GHG emissions[77].Besides enhancing the efficiency of their own operations, chemical companies can make a significant contribution to a low-carbon economy through their products and technologies. Examples include renewable energy solutions (e.g. solar panels, biofuels) or products that reduce the amount of energy required for traditionally energy-intensive processes like climate control (insulation materials, roof coatings), lighting and transport (fuel efficiency, lighter materials). According to a study commissioned by the International Council of Chemical Associations (ICCA) in 2009, the global chemicals sector delivers two tons of GHG savings for every ton emitted in the production process. This could rise to more than four tons by 2030[79].

CHEMICAL POLLUTION

Products produced by the chemical industry like fertilizers and plastics accumulate in the world's oceans via atmospheric transport, runoff into waterways or direct disposal into the ocean. This contributes to the degradation and destruction of marine ecosystems. Three categories of chemicals are of particular concern: toxic metals, oil and persistent organic pollutants[80]. The longer term effects of such accumulation are often poorly understood by both companies and regulators.

CHEMICAL POLLUTION

Chemical waste and runoff can accumulate in terrestrial ecosystems and contribute to their degradation and ability to provide ecosystem services.

MULTI-STAKEHOLDER PARTNERSHIPS

A number of the challenges faced by the chemical industry in transitioning towards a more circular economy are systemic. Many industries depend on solutions developed by chemical companies that likewise depend on cooperation with other industries. The role of governments is crucial given the dominant role of regulation on issues such as waste (classification). Partnerships could foster breakthroughs that would otherwise take much longer to materialize.

THE INDUSTRY AS A DRIVER OF CHANGE

The chemical industry is one of the largest manufacturing sectors in the world, serving a broad variety of end markets. For this reason, it is at the core of what we consume, from materials to food and from medicine to energy. This means that the sustainability challenges and efforts to mitigate them will vary strongly from one industry segment to another. The industry's ability to determine the building blocks of the world around us holds enormous potential for sustainable development. Steps in the direction of simpler, safer, healthier and reusable building blocks could elevate the sustainability performance of almost every other industry. The chemical industry is thus uniquely and prominently positioned to define our ability to stay within our planetary boundaries.

Despite increasing pressure from regulators and buyers to improve the sustainability of chemical processes and products, non-renewable-based and potentially harmful chemicals continue to be an essential part of the chemical industry today. As the world is coming to better understand the ways in which these chemicals affect our health and ecosystems, the industry should step up its efforts to accelerate innovations in this area.

I These planetary boundaries include: climate change, ocean acidification, stratospheric ozone depletion, interference with the global phosphorus and nitrogen cycles, rate of biodiversity loss, global freshwater use, land-system change, aerosol loading and chemical pollution.

6 CONSUMER ELECTRONICS

NIKOLA TESLA (1856-1943)
Physicist, mechanical and electrical engineer, inventor and futurist

"When wireless is perfectly applied the whole earth will be converted into a huge brain, which in fact it is, all things being particles of a real and rhythmic whole. We shall be able to communicate with one another instantly, irrespective of distance. Not only this, but through television and telephony we shall see and hear one another as perfectly as though we were face to face, despite intervening distances of thousands of miles; and the instruments through which we shall be able to do this will be amazingly simple compared with our present telephone. A man will be able to carry one in his vest pocket."

INTRODUCTION

Consumer electronics are devices that contain electronic circuit boards used by individuals in day-to-day life. They encompass a wide range of products, including smartphones, personal computers, televisions, DVDs, tablets, audio devices and MP3 players. In a short amount of time, new products like HDTVs, smartphones and tablets have reached millions of households and have become an essential part of our everyday life. As a result, the consumer electronics industry has grown rapidly since 2000 and will continue to grow as a result of rising demand, in particular for smartphones and mainly from developing countries. The resulting increased connectivity and access to information has enormous implications for economic growth and development.

However, the pace at which we purchase and discard electronic products raises questions about how these products are made and their environmental impact. In recent years, the consumer electronics industry has been under mounting pressure from civil society and the public sector. NGOs, governments and media have called attention to abuses at production facilities, environmental degradation caused by the industry, and the origin and scarcity of raw materials used in electronic products. Governments are stepping up their policy efforts to hold electronic companies accountable for their business conduct (for example through the US Dodd-Frank Act). Public interest has also been spurred by incidents at production locations for global brands, such as the use of toxic chemicals causing serious worker injuries and the use of child labour[81].

INDUSTRY ANALYSIS

The global consumer electronics market was valued at $1,225 billion in 2014 and is projected to grow at 15% CAGR to $2,976 billion in 2020[82]. This makes the industry one of the largest in the global economy, generating more revenue than many other goods-producing sectors.

The industry is highly competitive, innovative and subject to rapid change. Because electronic equipment is highly complex and consists of a wide range of diverse components, the manufacturing process is global. The sector's supply chain is vast and elaborate. Brands have multiple suppliers, who in turn have numerous suppliers themselves. The industry can largely be divided into three groups: brand firms, contract manufacturers and component suppliers. Brand firms subcontract and outsource a considerable number of their manufacturing activities and use a range of suppliers for parts and components. These contract manufacturers are skilled suppliers that manufacture, assemble and test parts and final products for other companies. They themselves

manage vast supply chains through the purchase and sourcing of parts and components from a large group of suppliers. These suppliers range from global players that design and manufacture advanced components to small firms that produce parts[83]. Further down the supply chain are the smelters, traders and mining companies. From the extraction phase through to the finished product, the consumer electronics' supply chain can include seven tiers or more[84].

East Asia has become both an important production location and a final market for electronic goods. Brand firms dominate Japan and South Korea whereas countries such as China and Taiwan specialize in contract manufacturing for American and Japanese brands. In addition to providing a low-cost location for outsourced manufacturing, China is also gaining market share with brands such as Lenovo and Huawei. The 20 largest consumer electronics companies by revenue can be found below.

TABLE 6

LARGEST CONSUMER ELECTRONIC COMPANIES BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($million)
1	Samsung Electronics	Korea	188,476
2	Apple	US	182,795
3	Hewlett Packard	US	111,454
4	Microsoft	US	86,833
5	Sony	Japan	75,265
6	Panasonic	Japan	74,967
7	Dell	US	56,940 *
8	LG Electronics	Korea	53,963
9	Toshiba	Japan	52,423
10	Huawei	China	46,515
11	Lenovo	China	38,700 *
12	Sharp	Japan	28,364
13	Ericsson	Sweden	27,662
14	TCL	China	16,238
15	Nokia	Finland	14,457
16	ASUSTeK	Taiwan	11,624 *
17	Acer	Taiwan	10,683
18	Sichuan Changhong Electric	China	9,709
19	Blackberry	Canada	6,813
20	Motorola Solutions	US	5,881

* 2013

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

Electronic products generally go through seven phases: raw material extraction, production, transportation, brand, retail, consumer (user phase) and waste (recycling). Each of these phases comes with challenges specific to the electronics industry. The most significant take place in the extraction phase, the production phase and the end-of-life phase.

RESOURCE SCARCITY AND CONFLICT MINERALS

Rare earth minerals contain 17 chemical elements that are critical for the electronics industry (and other industries, including automotive and renewables). The demand for these metals and minerals continues to rise, with China responsible for about 97% of production. Although the US, Japan and Germany are investing heavily in securing their own supply, new mining projects will take a decade to come on stream. As a result, supply shortages are predicted[85].

In addition, a number of metals – most notably tantalum (coltan), tin, tungsten and gold, collectively known as 3TG – which are extensively used in the electronics industry, are extracted in fragile regions such as the Democratic Republic of Congo and adjoining countries. Profits from the extraction and trade of these minerals can play a role in intensifying and perpetuating armed conflict. Conflict minerals are associated with human rights abuses, corruption and environmental degradation. The Dodd-Frank Act requires US companies to report whether they use conflict minerals. The OECD and EU have policies in place that focus on the same minerals but are not geographically specific.

As these minerals are essential in the production of a variety of consumer electronics like cell phones and laptops, the industry plays an important role in sourcing responsibly traded materials. By carrying out supply chain due diligence, companies can prevent the financing of armed groups through their sourcing of minerals. Smelters and refiners represent a key link in the supply chain because it is the last stage at which information is known about the origin of minerals[56]. Several initiatives, driven by governments, NGOs and the industry itself, have emerged to address this issue.

WORKING CONDITIONS

Electronics spend about 73% of the production phase in low-wage countries where costs are notably lower. In many of these countries, the guidelines for human rights and international labor conditions are not always enforced. In general, jobs in the electronics sector are characterized by low pay, substandard working conditions and excessive working hours. Workers, the majority young women, are usually only offered short-term contracts, often through employment agencies[86]. Exact figures on the number of workers in the industry are unknown. In a 2010 study, the ILO estimated it to be 18 million; in 2011, the Sustainable Trade Initiative estimated the number to be more than 15 million.

Based on a series of audits conducted by the EICC[II] in 27 countries, it emerged that excessive working hours are the top violation in production facilities, with some areas reporting work weeks of 60 hours. In the Philippines, Thailand and China, working days can run to 12 hours, without a day off. There is a relationship between overtime and low wages: the minimum wages are generally too low to sustain a decent livelihood, keeping workers in a 'poverty trap' which forces them to work overtime.

Health & safety of workers was the second most common violation. Issues include inadequate emergency exits, lack of an emergency preparedness plan and poor procedures for first aid[87]. Several processes in electronics manufacturing involve working with hazardous substances. Reportedly, between 500 and 1,000 different chemicals are used

in the semiconductor industry, including carcinogens such as solvents, arsenic-based substances and heavy metals. Health risks posed to workers in the industry range from respiratory problems to cancer.

Other violations related to working conditions include abuse of vulnerable worker groups such as women and immigrants, disrespecting union rights, human trafficking and issues of ethics and corruption.

E-WASTE AND RECYCLING

E-waste[III] is an emerging and fast-growing waste stream with complex and hazardous characteristics. Rapid technology innovations and ever-shortening product life spans are major contributors to the growing amount of e-waste produced every year[88].
In 2014, about 41.8 million metric tons (Mt) of e-waste was generated and this is expected to reach 50 million in 2018[88]. Estimates show that only 10-40% of e-waste is properly recycled and disposed of. It is not known whether the remaining amount is subject to illegal trade or simply dumped[89].

A driver for illegal waste shipments includes the profit generated from payments for safe disposal of waste and potential profits from recycling certain components. E-waste can contain precious resources like gold, copper, nickel and rare materials which can be recovered and recycled, and is therefore a potential 'urban mine'. Key destinations for illegal shipments of e-waste include Africa and Asia where they are often handled in socially and environmentally unsustainable ways, posing risks to human health and the environment[89].

Many governments and companies have adopted extended producer responsibility (EPR) to address the growing problem of e-waste. EPR 'is an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle'[90]. It aims to shift responsibility (physically and/or economically; fully or partially) upstream towards producers and to integrate environmental considerations into product design.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE CONSUMER ELECTRONICS INDUSTRY

IMPACT OF TOXIC MATERIALS DURING MANUFACTURING AND RECYCLING

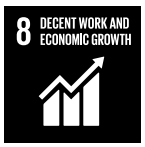
Common hazardous materials used include heavy metals (mercury, lead, cadmium etc.) and chemicals (CFCs/chlorofluorocarbon or various flame retardants). If improperly handled and recycled, these can pose health risks resulting from direct contact with harmful materials, inhalation of toxic fumes and from accumulation of chemicals in soil, water and food[91]. Recycling workers (including children) in developing countries are particularly vulnerable.
In addition, exposure to these toxic chemicals at manufacturing facilities can have negative health impacts for workers. These include cancer (carcinogens such as benzene), nerve damage (neurotoxins such as n-hexane) and birth defects or miscarriages caused by exposure to toxic materials[92]. Eliminating hazardous materials is an important step companies can take to decrease the health risks associated with their products.

EMPLOYMENT OPPORTUNITIES AND EMPOWERMENT

Globalization has led to the feminization of labor, especially in export sectors such as electronics. The majority of workers in electronics production are young women. Whereas employment can play an import role for the economic independence and empowerment of women, they are known to face workplace discrimination on several fronts. These include earning lower wages than men for the same or similar work, being more likely to be hired on short-term contracts and less likely to be employed after giving birth.

RELEASE OF TOXIC MATERIALS IN WATERWAYS

Water quality can be severely affected if toxic materials are released into local waterways during the manufacturing and disposal phase. Companies and their suppliers should maintain stringent internal standards and monitoring procedures to ensure compliance with water quality standards.



EXCESSIVE OVERTIME AND LIVING WAGE

Pressure on suppliers to deliver products within a very short timeframe can lead to excessive overtime at factories in low-wage countries like China. In addition, the minimum wages paid to workers in the sector are often too low to sustain a decent livelihood. This forces workers to work overtime so they can provide for themselves and their family.

HEALTH & SAFETY

Without proper protection, workers at manufacturing facilities can be exposed to toxic materials and fumes, which can adversely affect their health. Companies play an important role in phasing out toxic materials, and ensuring proper safety standards and trainings are in place at suppliers' facilities.

FREEDOM OF ASSOCIATION

Freedom of association and collective bargaining are basic rights laid down by the ILO. However, unionization in the electronics sector is generally very low and workers are often denied these rights, making it difficult for them to improve working conditions[93,94]. Companies can encourage their suppliers to adopt an open attitude towards the activities of unions and educating workers about their rights.

TEMPORARY CONTRACTS

Using temporary agency workers to fill previously permanent and direct positions has become a widespread practice in the industry[95]. These positions are less secure, offer less protection, are often paid less and ineligible for legal benefits like medical care, health insurance and maternity leave. In addition, the rights to freedom of association and collective bargaining can be undermined[95].

ACCESS TO ELECTRONIC EQUIPMENT

(Smart)phones and computers have become an essential part of everyday life. Access to modern communication devices and services are considered key drivers of growth and development. Some companies have developed smartphones that are being sold for less than $100, making these devices accessible to billions of people and enabling them to benefit from increased connectivity and access to information.

E-WASTE

Consumer electronics companies are directly responsible for the growing amount of e-waste. Devices are often unnecessarily replaced when software packages are out of date and cannot be updated, devices cannot be repaired or the costs are too high (e.g. no removable battery), and for maintenance reasons (e.g. dust blocking fans, damaged power cords). Both the industry and governments can step up efforts to establish eco-design programs and take-back systems that include proper control and monitoring of e-waste, enforcing regulation and embracing EPR.

ENERGY DEMAND RELATED TO CONSUMPTION

Consumer electronics have a large energy footprint throughout their life cycle: from resource extraction and manufacturing to electricity consumption during the use phase[96]. According to the IEA, online electronic devices waste around $80 billion annually due to inefficient energy technology[97]. This number is projected to increase to $120 billion by 2020. Using the best available technology can significantly reduce energy demand during the use phase. Although efforts are being undertaken to improve the energy efficiency of devices, increased global demand for consumer electronics will result in higher energy consumption during manufacturing, often the most energy-intensive phase.

GHG EMISSIONS

Production, use and disassembly of electronic products consume a great deal of energy and thus have an impact on climate change and the environment. The ICT sector is estimated to contribute 2-3% of worldwide GHGs and this number continues to rise. By reducing energy use in all phases of the product life cycle, companies can reduce their environmental impact. In addition, connected consumer electronics can contribute to reducing CO_2 footprints, e.g. by reducing the need to travel.

IMPACT OF TOXIC MATERIALS DURING MANUFACTURING AND RECYCLING

During the extraction phase, a significant amount of waste is produced that may contain high concentrations of toxic substances such as arsenic and lead. Hazardous chemicals and materials are also used in the manufacturing process. In addition, at the end of the life cycle, irresponsible waste management poses environmental risks as products are often not designed for recycling and are consigned to landfills. Toxic materials can seep into the soil and atmosphere, impacting nearby communities and ecosystems[86].

ARTISANAL AND SMALL-SCALE MINING/ILLICIT MINING

Illicit mining of minerals can have negative effects on local ecosystems. The mining process can pollute or destroy local forests and streambeds, but the minerals themselves can also be toxic (e.g. coltan).

CONFLICT MINERALS

The profits from the extraction and trade of minerals from fragile regions can play a role in intensifying and perpetuating armed conflicts[56]. The industry has an important role to play in improving traceability and sourcing responsibly traded minerals.

PARTNERSHIPS ALONG THE SUPPLY CHAIN

Throughout its supply chain, the consumer electronics sector has an influence on a number of SDGs. However, the direct influence on some of these goals is limited if companies do not cooperate with other direct and indirect stakeholders including suppliers, smelters, governments and NGOs.

THE INDUSTRY AS A DRIVER OF CHANGE

The consumer electronics industry is one of the fastest growing industries in the world. Consumer electronics can make our lives easier and more productive. Billions of people benefit from increased connectivity and access to information, which can be a key driver for growth and development. In addition, the electronics sector is an important employer and has significant influence in the supply chain. Choices made by the industry impact the environment and the availability of natural resources.

To address the growing interest in sustainability, electronics companies have started to organize in a number of initiatives. Most notable are the Electronic Industry Citizenship Coalition (EICC) and the Global e-Sustainability Initiative (GeSI). Both have developed a code of conduct for suppliers, and address several social and sustainability issues through specific working groups. The industry has taken significant steps towards improving traceability (i.e. knowing who makes its products), but more transparency and effort is necessary regarding issues such as working conditions and e-waste. Moving to new, innovative business models based on a circular economy would offer companies strategies to reduce their environmental impact and decrease dependence on scarce raw materials[98]. Through developing disruptive technologies and business models based on longevity, renewability, reuse, repair, upgrade, refurbishment, capacity sharing and dematerialization, companies can decouple growth from the use of scarce resources[99]. This offers opportunities to reduce costs and mitigate the industry's environmental impact.

II Electronic Industry Citizenship Coalition, a global industry coalition dedicated to electronics supply chain responsibility.

III E-waste is an overarching name for waste related to electrical and electronic equipment such as computers, cell phones, television sets and refrigerators[89].

7 ELECTRIC UTILITIES

BAN KI-MOON
Secretary-general
of the *United Nations*

"Energy transforms lives, businesses and economies. And it transforms our planet – its climate, natural resources and ecosystems. There can be no development without energy."

INTRODUCTION

Electric utilities are traditionally in the business of centralized power generation, and distribution over the grid to end users. This is still the dominant business model for the industry's largest companies, but it is being aggressively challenged. The rapid increase in renewable energy, driven by climate and energy policies, in combination with green technological innovations threaten the traditional, fossil fuel based business model of electric utilities. In addition, the industry is faced with an overall decline in demand in developed markets as a result of energy-saving measures taken by governments, citizens and companies.

New decentralized renewable energy technologies, combined with the expectation that energy storage technologies will soon be affordable and widely available, is forcing utility companies to rethink their role and business model. Ceres expects there to be 'a shift away from simply selling electrons as a commodity and toward a more service-oriented model that gives companies as well as customers greater and more efficient control over their use of grid-connected electric power resources'[100].

A major transformation of the landscape has already started and more change is expected during the coming decade. An example of this transformation is the German 'Energiewende', which aims to run the German economy on low-carbon mode, with 80% of its electricity generated by renewable energy in 2050[101]. This transition process poses significant challenges to the business model of electric utility companies.

In contrast to declining demand in Western markets, electricity demand in emerging regions is increasing rapidly due to growing economies, populations and rising income levels. Despite talk of a shift towards renewables, coal is still the dominant source of energy as it is abundant and cheap. Coal currently provides 40% of the world's electricity needs and this share is set to rise as energy production in developing countries increases. Coal-fired power plants are a major source of global CO_2 emissions and air pollution. This presents one of the great paradoxes of our time: while the world tries to combine an energy transition with increasing energy demand, 1.3 billion people still do not have any access to electricity.

INDUSTRY ANALYSIS

The global electricity market generated revenues in excess of $2.5 trillion in 2014. This represents a CAGR of 6.8% between 2010 and 2014. Electricity consumption reached a total of 18,808,571 GWh in 2014[102]. The industry is expected to grow at a CAGR of 7.6% for the period between 2014 and 2019. Growth is being driven by industrialization and urbanization, indicating strong demand for additional sustainable electricity generation capacity[103].

Historically, power markets have been delimited by national borders, markets were highly regulated and utilities were often owned by local or national governments. This is linked to the nature of the sector: electricity is bound to the grid and cannot, unlike gas or oil, be stored and transported easily. As a result, global competition is still limited. However, this might change according to analyses carried out by KPMG, EY and the Africa Progress Panel. Some markets are slowly opening up to foreign investors and decentralized off-grid power production is challenging the status quo.

In Western countries, power markets have been liberalized to varying degrees. As a result, state- owned companies have been privatized or had to compete with (foreign) competitors. Due to heavy consolidation in Western markets, most of the major power companies are from Europe or the US. Power sectors in most developing and emerging markets remain highly regulated and dominated by state-owned companies. India and China both have major electric utility companies, but the degree of market concentration and privatization is lower than in the US, Japan or the EU. Moreover, these utilities are often unprofitable because governments force them to keep electricity prices artificially low. In sub-Saharan Africa in particular, there is growing awareness that foreign investors and knowledge are needed to meet the demand for energy in general and electricity in particular[104]. As a result, foreign and private investments are rising. There are now some 130 independent power providers across the region[105].

TABLE 7

LARGEST ELECTRIC UTILITY COMPANIES BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($million)
1	E.ON	Germany	134,892
2	Enel Spa	Italy	106,124
3	ENGIE*	France	90,310
4	Électricité De France	France	88,119
5	Tokyo Electric Power Company	Japan	64,258
6	RWE	Germany	55,803
7	KEPCO (Korea Electric Power)	South Korea	51,174
8	SSE	UK	50,975
9	Iberdrola	Spain	36,315
10	The Kansai Electric Power Company	Japan	32,243
11	Vattenfall	Sweden	29,123
12	Chubu Electric Power	Japan	27,541
13	Exelon	US	27,429
14	Endesa	Spain	26,012
15	Enbw (Energie Baden-Wurttemberg)	Germany	25,396
16	National Grid	UK	24,682
17	Duke Energy	US	23,925
18	Russian Grids	Russia	23,097
19	Huaneng Power International	China	21,934
20	Tohoku Electric Power Company	Japan	19,757
21	The Southern Company	US	18,467
22	Kyushu Electric Power Company	Japan	17,356
23	The AES Corporation	US	17,141
24	PG & E Corp.	US	17,090
25	NextEra Energy	US	17,021
26	American Electric Power	US	17,020
27	NRG Energy	US	15,868
28	FirstEnergy	US	15,049
29	Edison	Italy	14,903
30	Origin Energy	Australia	13,696

* Formerly known as GDF-SUEZ

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

CLIMATE CHANGE

The IPCC is clear in its conclusions: scientists are 95% certain that humans are responsible for the 'unprecedented' warming experienced by the earth over the last few decades[47]. The power sector is of particular importance as, according to the IEA, electricity and heat production accounts for 42% of global CO_2 emissions[106]. Moreover, the direct CO_2 emissions from the energy supply sector are projected to double or even triple by 2050 compared to the 14.4GtCO_2 emitted per year in 2010. The main factors behind this increase are growing energy demand and the larger share of coal in the global fuel mix. This trend can only be reversed if investments in clean energy are stepped up and energy-efficiency improvements are significantly accelerated. Electric utility companies are well positioned to shoulder responsibility. By investing in both utility scale and small-scale, decentralized renewable energy production combined with energy storage, and in CCS for existing fossil-fueled power plants, utilities can lead the transition towards a low-carbon energy system.

ACCESS TO ELECTRICITY

According to the IEA, some 1.3 billion people have no access to electricity and a billion more only have access to aged and unreliable electricity networks. About 2.7 billion people rely on solid fuels (traditional biomass and coal) to meet their basic needs[107]. Moreover, this lack of access and low energy efficiency is an important cause of high energy prices. For example, a woman from a village in northern Nigeria pays around 60-80 times more per unit for her energy than a resident of New York City or London[108]. Access to modern energy services as well as effective measures to increase energy efficiency for cooking, heating, lighting, communications and mechanical uses thus represents a vast and untapped field.

The energy access challenge is particularly acute in the least developed countries in Asia and sub-Saharan Africa as 97% of all people without access to electricity live in these regions. According to the IEA, 622 million people in Africa do not have access to electricity, of which 621 million live in sub-Saharan Africa. In Asia, 620 million people do not have access to electricity. The largest populations without electricity are in India (304 million), Nigeria (93 million), Ethiopia (70 million), Bangladesh (62 million), Democratic Republic of Congo (60 million) and Indonesia (60 million). The vast majority (84%) of people that lack access to modern energy live in rural areas[107].

TABLE 8

ELECTRICITY ACCESS IN 2012 - REGIONAL AGGREGATES [107]

REGION	POPULATION WITHOUT ELECTRICITY (millions)	ELECTRIFICATION RATE (%)	URBAN ELECTRIFICATION RATE (%)	RURAL ELECTRIFICIATION RATE (%)
Developing Countries	**1,283**	**76%**	**91%**	**64%**
Africa	622	43%	68%	26%
North Africa	*1*	*99%*	*100%*	*99%*
Sub-Saharan Africa	*621*	*32%*	*59%*	*16%*
Developing Asia	620	83%	95%	74%
China	*3*	*100%*	*100%*	*100%*
India	*304*	*75%*	*94%*	*67%*
Latin America	23	95%	99%	82%
Middle East	18	92%	98%	78%
Transition economies and OECD	**1**	**100%**	**100%**	**100%**
World	**1,285**	**82%**	**94%**	**68%**

Whereas the situation is improving in large parts of developing Asia, progress in electrification in Africa is slow[109]. In this region, the expansion of the power sector, both generating capacity and the grid, cannot keep pace with the growing economy and population[105]. In turn, the lack of (reliable and affordable) energy hampers economic growth. The lost growth is estimated at 2-4% annually.

The private sector is a key partner in providing access to energy for all. Accenture, KPMG and others suggest that utilities could, for example, develop and experiment with (off-grid) power production applications and services that are clean, affordable and reliable but also scalable and can evolve into new profitable business models.

EMISSIONS FROM COAL-FIRED POWER PLANTS

According to the Union of Concerned Scientists, the use of coal in energy plants is the leading cause of smog, acid rain and toxic air pollution. Besides environmental impacts, it also has adverse health effects. Major emissions are sulfur dioxide, which contributes to the formation of small acidic particulates that can penetrate into human lungs and are absorbed by the bloodstream; nitrogen oxides, which cause ground-level ozone or smog, can burn lung tissue, exacerbate asthma and make people more susceptible to chronic respiratory diseases; particulate matter, which can cause chronic bronchitis, aggravated asthma and premature death as well as haze obstructing visibility; and mercury, which is a toxic heavy metal that causes brain damage and heart problems. These emissions can be significantly reduced with readily available – but unfortunately often not installed – pollution-control systems.

The indirect health-care cost of burning fossil fuels, especially coal, is enormous. The WHO estimates that the financial cost of air pollution in Europe stands at more than $1.6 trillion a year, equating to about a tenth of the GDP of the continent[110]. A study by the Harvard Medical School puts the additional health-care cost of using coal to generate electricity in America at between $330 and $500 billion annually[111]. The transition towards cleaner sources of energy would have a significant positive impact on health as well as on the cost associated with health care.

HOUSEHOLD AIR POLLUTION

The WHO estimates that 2.7 billion people cook and heat their homes using open fires and simple stoves burning biomass (wood, charcoal, animal dung and crop waste) and coal. This leads to millions of premature deaths annually[112]. More than 50% of premature deaths among children under five are due to pneumonia caused by particulate matter (soot) inhaled from household air pollution. In addition to the negative health effects, gathering wood for cooking and heating can put women in a position where they are vulnerable to (sexual) violence. Access to modern energy will therefore be particularly beneficial for women and children. Utilities can dramatically improve their situation by providing clean cooking options such as gas, electric or solar stoves.

SUPPLY CHAIN

Energy utilities have to manage extensive (international) supply chains to source fuels and equipment for power generation. The risk of human rights violations and environmental damage during the extraction and production of these materials is high. Examples of supply chain risk related to the extraction of coal and metals are misconducts at mining sites and processing plants. Deforestation or competition with food production can result when biofuels are used as alternative sources of energy. The impact of activities linked to the supply chain on the environment and communities is a (shared) responsibility of electric utilities.

NUCLEAR RISK

Nuclear energy is a mature low-carbon and emission-free energy solution but one that is strongly criticized for its impact on human health and the environment in the event of a meltdown or other disaster. Nuclear waste remains hazardous for generations to come. Although most Western countries have lost interest in nuclear energy, developing regions like China and India are still investing in it. Privately owned utilities could favor investments in renewable energy over nuclear energy. National utilities that are urged by their government to invest in nuclear energy should at least use the best available technology and uphold the highest international standards concerning nuclear safety and waste management.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE ELECTRIC UTILITIES INDUSTRY

ENABLE DEVELOPMENT

Eradicating extreme poverty will not be achieved if no substantial progress is made in improving access to energy. Access to energy facilitates socioeconomic development by providing more efficient and healthier means to undertake household and productive activities[113].

EMISSIONS WITH NEGATIVE HEALTH EFFECTS

The use of coal in energy plants has significant negative health effects. Electric utilities can have a major positive impact by shutting down coal-fired power plants, beginning with older facilities. Remaining coal-fired plants should fulfill the highest efficiency standards and be equipped with the best available pollution filter techniques. New investments in coal-fired power plants should be limited and directed towards cleaner options like utility scale and/or decentralized renewable power production.

INDOOR USE OF BIOMASS AND COAL

The health effects of indoor cooking and heating with solid fuels presents serious health risks, particularly for women and children. Access to modern and cleaner sources of energy can dramatically improve health across developing countries.

ENABLE EDUCATION

In underprivileged communities children spend a significant part of their day gathering fuelwood, fetching water and cooking. Improved access to cooking fuels or technologies can facilitate school attendance. In addition, electricity can improve communication and provide basic needs such as lighting[113].

RISKS ASSOCIATED WITH FIREWOOD COLLECTION

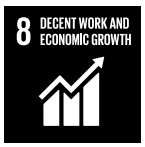
Women and children are most exposed to the negative health effects associated with indoor cooking. In addition, gathering wood can put girls and women in vulnerable situations. Access to modern energy reduces the need for and physical burden associated with collecting and carrying firewood. This can free up time for other activities including employment[113].

ACCESS TO CLEAN AND AFFORDABLE ENERGY

Worldwide, 1.3 billion people do not have access to energy and a billion more only have access to unreliable electricity networks. As key players in the energy market, utilities can develop scalable business models (both grid and off-grid) that are capable of serving people who currently do not have access to electricity. In addition, companies can partner with governments and local businesses to provide and scale up modern energy solutions.

RENEWABLE ENERGY

Although the share of renewables is increasing, more work needs to be done to stimulate the transition to a cleaner energy future[114]. Currently, only 15% of the world's total investment in energy is spent on renewable energy sources. It is estimated that $53 trillion in investment in energy supply and efficiency is required to steer the world onto a 2˚C path[115]. The electric utilities industry is essential to meeting these energy investment needs as it is the industry best positioned to install clean and cost-effective energy capacity at scale. However, research shows that government policies are often a key driver in utility clean energy investment[114], rather than the industry.



EMPLOYMENT OPPORTUNITIES

Access to reliable energy can create new opportunities for economic activities and support local industries.

ENERGY INFRASTRUCTURE

Electric utilities can contribute to developing stable, modern energy infrastructures that can foster economic competitiveness, new sources of energy such as renewables, energy security and innovation.

INEQUALITIES IN ACCESS TO ENERGY

Low-income countries and rural and disadvantaged areas within low- to middle-income countries suffer from a lack of access to reliable and affordable energy. Electric utilities can contribute by including these countries and populations in their energy networks.

AIR QUALITY

Electric utilities can prioritize switching to clean sources of energy for electricity generation in densely populated areas and so improve air quality.

IMPACT OF PRODUCTS AT END-USER LEVEL

Companies can promote energy savings by helping end users (consumers and industrial users) to better manage their energy needs.

GHG EMISSIONS

As a major producer of GHGs, and with direct emissions set to increase, the industry has an important role to play in curbing these emissions and is best positioned to make cost-effective investments in low-carbon energy. Transitioning to a low-carbon energy supply requires companies to install clean energy capacity at scale and to phase out (inefficient) coal-fired power plants. Additionally, companies can invest in carbon capture and storage.

ACIDIFICATION OF OCEANS

Installing clean energy capacity at scale and phasing out coal-fired power plants can reduce the speed of acidification of oceans due to lower CO_2 levels. Ocean acidification negatively impacts the health of marine ecosystems.

LOCAL ECOSYSTEMS

In order to limit the harmful impact on local ecosystems resulting from mining (e.g. coal or uranium) or agricultural production (biofuels), utility companies should apply responsible sourcing practices.

CONFLICTS

When engaging in energy extraction projects (this can include the mining of coal, hydro projects, palm oil projects etc.), which can have significant negative impacts on local communities, companies should carefully consult and engage stakeholders. In addition, companies should implement responsible sourcing practices and perform due diligence when sourcing coal, biofuel, uranium or machinery to ensure companies respect human rights and avoid contributing to conflict through their mineral-sourcing practices.

PUBLIC-PRIVATE PARTNERSHIPS

Improving access to energy worldwide requires public-private partnerships between utility companies and national and local governments that can scale up successful and innovative solutions.

THE INDUSTRY AS A DRIVER OF CHANGE

The power sector faces three major (global) challenges: curbing climate change, providing access to energy and preventing energy-related pollution that causes health problems and premature deaths. These problems affect the wellbeing of billions of people, especially the most vulnerable. As some of the problems can be partly attributed to the power sector, part of the solution can also be found in this sector. This presents a responsibility but also an opportunity for private and state-owned electric utilities to become a driver of change.

Electricity and heat production are responsible for 42% of global CO_2 emissions. Organizations like the IPCC therefore consider electric utilities to be ideally positioned to fight climate change. These companies can take cost-effective steps to drive the transition towards a low-carbon energy system, thereby helping the world to meet its ambition to limit the global temperature increase to 2°C. Investments should be steered towards utility scale and small-scale decentralized renewable energy production, combined with storage, energy-saving measures and CCS for existing fossil-fueled power plants. Implementing these measures will enable utilities to lead the transition towards a low-carbon future. Despite the potential of these investments, however, research shows that investments in clean energy are often driven by government policies. This frequently makes governments the pacesetters rather than electric utilities themselves.

Without reliable and affordable access to energy, development and poverty eradication will be impossible. Even though providing access to populations that currently lack access can be regarded as a primary responsibility of national utilities, companies that operate internationally can play a role as additional markets open up. This presents a potential opportunity for global utility companies to enter challenging but untapped markets in regions with rapidly growing economies and populations. Growing economies need power. Utilities can provide this by bringing knowledge, technology, capital and (off-grid) innovations that are clean, affordable and reliable but also scalable and profitable.

8 MEAT & POULTRY

INTRODUCTION

Dutch artist Christien Meindertsma has spent three years researching all the products made from a single pig. The majority of the pig is used as food for human consumption, but some of the more unexpected uses include ammunition, medicine, photo paper, heart valves, brakes, chewing gum, porcelain, cosmetics, cigarettes, conditioner and even biodiesel. Her work gives an interesting perspective on the degree to which animal products are part of our everyday lives, even for those with a vegetarian lifestyle. In modern agriculture, animals are increasingly produced and slaughtered by large, vertically integrated meat & poultry companies. These companies, together with their smaller peers and millions of smallholder farmers, make a large claim on the world's resources. Their impact is illustrated by the fact that livestock is responsible for 14.5% of the world's annual human-induced GHG emissions[116]. Three quarters of the emissions are caused by ruminants such as cattle, buffaloes, sheep and goats, the remaining quarter comes from pig and poultry production.

Although animal products can be part of a balanced diet, contributing valuable proteins, vitamins, minerals and micronutrients vital for growth and development[117], high meat consumption in many developed countries has resulted in excessive intake of fat, varying between different social classes. In developing countries, meat intake is generally low among the poor.

There is a dichotomy in the livestock sector. In industrialized and emerging countries, highly specialized, large-scale, industry-like systems are developing, mainly for the production of pigs and poultry. These systems are hardly connected to the local agricultural system (footloose) as they rely heavily on energy-intensive inputs and imports of feed. A significant part of the feed is human edible and hence competing with food. This specialized livestock sector is growing rapidly. Simultaneously, the number of smallholders in developing countries is growing due to population increases and the lack of alternative employment. Livestock is important for more reasons than just the production of meat, milk and eggs. In many instances, it is an asset and acts as 'capital on hooves', reflecting a financial reserve. In many regions, cattle and buffaloes are still important for their draft power. Most livestock in smallholder systems is kept in mixed-farming systems, utilizing residues, wastes and human-inedible products. The use of human-edible feed is limited[118]. Training and education of farmers and knowledge support is often poor. As a consequence of the low feed quality and poor management, animal productivity is often also low and emissions per unit of product are high[116].

INDUSTRY ANALYSIS

Meat production has increased rapidly over the last 20 years, growing from 191 million tons in 1993 to over 310 million tons in 2013[119]. In 2013, 13% was internationally traded. This percentage is limited as meat can only be exported if it meets strict quality standards set by the importing country[120]. Global meat production is estimated to rise by 1.6%, showing weaker growth rates compared to the last ten years. Developing countries will account for 78% of the global increase in meat *production* and will account for 83% of extra meat *consumed* in 2023[121] while meat consumption in the US and EU is relatively stable or declining[122]. The meat sector in developing countries is among the fastest growing agricultural sectors[121]. Important drivers of growth are population and wealth increases and urbanization (paired with changing lifestyles). This growth is expected to continue for the next decades[123].

By 2020, poultry will be the largest meat sector and will capture almost half of the increase in global meat production by 2023. This is largely a result of consumer preferences. In addition, poultry has some advantages over other meats as production does not require a large land base, does not emit methane and is often located close

to populated, growing and urban markets. Ruminants, although less efficient in feed conversion compared to monogastrics (mainly pigs and chicken), are able to utilize fibrous products such as grass, crop residues and other low-digestible by-products from the food and beverage industry[124]. This feed is human inedible whereas poultry rations consist almost entirely of human-edible products.

The specialized industrial livestock-production sector has experienced significant consolidation. As profit margins tighten, companies are looking to create economies of scale and are expanding across borders and species[125]. It is notable that Western players are being acquired by emerging-market producers.

The top ten meat processors by revenue are listed below. This list includes vertically integrated companies that are active in livestock production and raising through to slaughtering, processing, distributing and sales (e.g. JBS, Tyson Foods, WH Group, Nippon Meat Packers) or even feed production (e.g. Cargill), and companies focusing mostly on slaughtering, processing and distribution (e.g. Vion).

TABLE 9

LARGEST MEAT PROCESSORS BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($million)	CATTLE PROCESSED (000)	HOGS PROCESSED (000)	HOGS AND CATTLE PROCESSED (000)	BIRDS PROCESSED (000)	SMALL PROCESSED (000)
1	JBS	Germany	40,712	18,807	16,827		953,649	5,376
2	Tyson Foods	Italy	37,580					
3	WH Group*	France	22,243		47,170			
4	Cargill	France	18,000**					
5	BRF	Japan	9,803			9,621	1,664,000	
6	Nippon Meat Packers	Germany	9,441***					
7	Hormel Foods	South Korea	9,316					
8	Danish Crown AmbA	UK	8,671	600	21,100			
9	Vion	Spain	7,851***					
10	Marfrig	Brazil	7,122	5,000			406,000	3,000

* Formerly Shuanghui International
** Estimate
*** 2013

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

CLIMATE CHANGE

Annually, it is estimated that the livestock sector emits 7.1GtCO_2 equivalents[IV], representing 14.5% of human-induced GHGs[116]. This can to a large extent be attributed to (smallholder) cattle production. Livestock is responsible for a large share of some gases that have high potential to warm the atmosphere, e.g. the sector emits 37% of anthropogenic methane, 65% of anthropogenic nitrous oxide and is responsible for almost two thirds of anthropogenic ammonia emission, contributing to acid rain and acidification of ecosystems[126]. When looking at the overall industry, beef and dairy production account for the majority of emissions (41% and 20% respectively). Pork, poultry and eggs contribute 9% and 8% respectively to the total livestock emissions. Sustainable intensification of the smallholder production system provides large opportunities for combining the increase of productivity and food security with a reduction of emissions per unit of product[116]. Within livestock production systems, feed production and processing chain represent 45% of total emissions, of which 9% comes from land use change for cattle ranching and soy cultivation[116]. Another important source of emissions is the enteric fermentation from ruminants, contributing 39% of livestock sector emissions.

DEFORESTATION

Cattle ranching requires significant land and is therefore a major cause of deforestation in Amazon countries and accounts for up to 80% of current deforestation. In addition, as much of the meat and livestock production is located around rivers and riparian zones, grazing and trampling by livestock can have severe negative effects on these ecosystems resulting in soil erosion, salinization and contamination[127,128]. Brazil keeps almost two thirds of all cattle in South America, of which a substantial proportion are kept in the Legal Amazon region. Productivity in these areas tends to be low. Increases in productivity (sustainable intensification) have shown positive results with herd sizes growing and deforestation rates declining[116].

About three quarters of soy worldwide is used for animal feed, mainly for pigs and poultry. This is mainly as soybean cake whereas the oil is used for human purposes. Research indicates that demand for animal feed is a factor in the increase in soybean production[129]. To produce soybean, vast areas of forest, grassland and savannah have been converted to agriculture, predominantly in South America. Land devoted to soy has grown from 7 million hectares in 1990 to 46 million hectares in 2010[119], mainly on land converted from natural ecosystems and land that was previously used for cattle ranching, pushing this activity towards new pioneer areas[128].

WATER USAGE AND POLLUTION

Water usage for livestock production accounts for 8% of global human water use, mostly to irrigate feed crops[126]. In addition, disposal of manure without proper treatment (removing or recycling nutrients) can lead to pollution of water resources. According to the FAO, '[the livestock sector] is probably the largest sectoral source of water pollution, contributing to eutrophication zones in coastal areas, degradation of coral reefs, human health problems, antibiotic resistance and many others'[126]. Mismanagement of animal waste can lead to the eutrophication of surface water; leakage of nitrate and possible pathogens to groundwater from manure storage facilities or from fields on which high doses of manure have been applied; excessive accumulation of nutrients in soil when high doses of manure are applied; and pollution of natural areas such as wetlands and mangrove swamps, often leading to biodiversity loss[126]. In addition, water pollution can pose significant public health risks due to waterborne diseases. This is not only caused by large-scale footloose production systems but is in part also linked to poor manure management on many smallholder farms[130].

ANIMAL DISEASE OUTBREAKS

The sector faces two main risks related to the outbreak of animal diseases: those that affect herd capital and those that affect human health[121]. According to the FAO, the world is facing an increase in emerging and re-emerging animal diseases and zoonoses due to globalization and climate change[131].

ANTIMICROBIAL RESISTANCE

In a number of industrial production systems, it is a common practice to add antibiotics to water and feed to promote faster growth and to prevent, control and treat disease. The inappropriate use of antimicrobial drugs, including in animal husbandry, can lead to the emergence of resistant strains, posing significant risks to human health[132]. Although the EU prohibited the use of antibiotics to promote growth in 2006, this has not resulted in significant declines in antibiotic use on farms. In other parts of the world, the use of antimicrobial drugs is subject to few regulations or restrictions[125]. In the US, it is even estimated that over 80% of all antibiotics sold are used in the livestock industry.

ANIMAL WELFARE AND RIGHTS

The treatment of animals in industrialized, confined systems and slaughterhouses has drawn strong criticism. The European Welfare Quality® is an animal welfare assessment system that sets out standards for housing and feeding. Their criteria indicate that the greatest risks posed to livestock in extensive systems relate to feed and water shortage, thermal comfort and resting[133]. The OIE World Organization for Animal Health focuses on transport and slaughter[134]. Undercover videos made in slaughterhouses by civil society organizations have revealed shocking levels of animal cruelty, resulting in increased pressure on companies to improve practices and calls for consumer boycotts. Enforcement of regulations will contribute to the improvement of animal health and welfare.

WORKING CONDITIONS

Jobs in industrialized systems such as large-scale industrial farms and slaughterhouses are often low paid and workers, in particular immigrants, can come from vulnerable backgrounds. The increase in production speed has led to health & safety risks and injuries are not uncommon. In addition, the industry has come under scrutiny for preventing workers to unionize.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE MEAT & POULTRY INDUSTRY

INCOME GENERATION FOR RURAL POPULATIONS

In developing countries, a significant proportion of meat output comes from traditional forms of livestock raising. About 50-75% of the extreme poor (1.3 billion people) depend on agriculture as part of their livelihood and livestock products represent high-value agricultural produce, less vulnerable to harvesting timing than many crops[135]. In addition, although 40% of the world's land surface is too dry, too steep or insufficiently fertile to sustain crop production, these areas can support the growing herds of cattle, sheep and goats that can digest roughage and convert it into meat and milk[136,137].

CONTRIBUTION TO A NUTRITIOUS DIET

Although animal products are not essential, their inclusion makes it easier to ensure a good diet. A balanced vegan diet is easier to sustain in affluent countries with greater options for alternatives. In many food insecure countries, consumption of livestock products can ensure the intake of sufficient vitamins, minerals and micronutrients vital for human growth and development.

INCREASED PRODUCTIVITY

The rise of large-scale industrial producers in the meat industry has led to significant productivity gains. This has both positive and negative consequences. On the positive side, increased productivity means more output at lower cost, making animal proteins cheaper and therefore more widely accessible for lower income groups. Increased productivity also has a positive influence on lowering deforestation rates as it reduces the need for cattle pasture. On the negative side, the rise of intensive livestock production is believed to be behind issues such as nutrient accumulation in livestock-dense regions and depletion in other regions, a shift in welfare problems and health risks. Increased productivity via sustainable intensification can be an option for smallholders to improve food security and livelihoods while decreasing emissions per unit of product[116].

ANIMAL DISEASES AFFECTING HUMAN HEALTH

Zoonoses, animal diseases and infections that affect humans, can be transmitted directly or indirectly, for example by consuming contaminated food or through contact with infected animals. Food-borne zoonotic diseases are widespread and pose a significant public health threat[138]. The risks of contamination are present from farm to fork, and prevention and control is necessary to avoid the spread of diseases across the food supply chain. The top five food-borne diseases resulting in death in the US (2011) are salmonella, toxoplasma, listeria, norovirus and campylobacter, mainly originating from monogastrics[139].

ANTIMICROBIAL RESISTANCE

Antibiotic use is widespread in industrialized livestock production systems. This has contributed to the emergence of strains of bacteria resistant to antibiotics used to treat both animals and humans. According to the CDC, 'up to half of antibiotic use in humans and much of antibiotic use in animals is unnecessary and inappropriate and makes everyone less safe'[140]. Stopping even some of this use would greatly slow the spread of resistant bacteria. 'Antibiotic stewardship' – the commitment to use antibiotics appropriately and safely, only when they are needed to treat disease, and to choose the right antibiotics and administer them in the right way in every case[139] – is an important step the livestock sector can take in this direction.

EXCESSIVE CONSUMPTION OF ANIMAL PRODUCTS

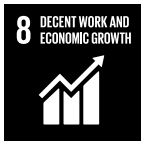
The excessive consumption of animal proteins and fats can lead to obesity and increase the chances of developing non-communicable diseases such as cardiovascular diseases, diabetes and hypertension.

OPPORTUNITIES FOR WOMEN

Livestock in developing countries can contribute to gender equality by creating employment opportunities for women. Much of the work on smallholder farms is done by women and women often have a prominent role in managing poultry[118].

WATER USAGE AND POLLUTION

Water usage for livestock production accounts for 8% of global human water use, mostly necessary to irrigate feed crops[126]. In addition, the disposal of manure without proper treatment (removing or recycling nutrients) can lead to pollution of water resources. This is a particular risk for areas with intensive livestock production.



WORKING CONDITIONS

Industrialization of the production process has significantly increased the demand for unskilled workers. Slaughterhouses hire cheap labor, often immigrants. Over the last 15 years, several reports and studies have found labor violations in the industry. This is closely linked to the increasing 'line speed' which in turn increases occupational health & safety risks, particularly injuries[141]. Unionization has dropped significantly since the 1970s, lowering the ability of workers to organize for collective bargaining. Meat & poultry companies should ensure proper recruitment, safe working environments, and workers should be able to raise issues and concerns.

NATURAL RESOURCE CONSUMPTION

The livestock sector is a significant user of natural resources such as land and water. As natural resources are often free or underpriced, this can lead to overuse and pollution. Perverse subsidies can encourage livestock producers to engage in environmentally damaging activities[126]. Responsible management of natural resources can ensure their proper use.

ANIMAL WASTE MANAGEMENT

Recycling livestock manure is difficult when production is concentrated in certain locations as this limits the opportunity to apply manure to cropland. Smallholders also face a number of problems relating to the proper utilization of manure[142,130], especially when they increase their livestock numbers without increasing their land area. Nutrient overloads mainly occur as a result of animal waste mismanagement and improper handling and can lead to water quality and soil degradation. When properly handled, recycled nutrients can be a substitute for mineral fertilizers.

GHG EMISSIONS

Livestock supply chains are an important contributor to climate change. According to the FAO, the sector can deliver a significant share of the necessary mitigation efforts to tackle climate change by improving current practices and technologies[116]. Solutions will vary across the sector as emission sources, intensities and levels differ between species, production systems and regions. The major potential lies within ruminant systems that operate at low-productivity levels (e.g. in South Asia, Latin America and Africa) through better feeding, animal health and herd management. In more affluent regions, where emission intensities (emission per unit of animal product) are relatively low, improvements can be made e.g. in manure management, energy use and the sourcing of feed with lower emission intensities[116]. Proper manure management can reduce methane emissions by anaerobic digestion and nitrous oxide, and reduce CO_2 emissions by proper use of manure as a fertilizer, lessening the need for the production of synthetic fertilizers[126].

DEGRADATION CAUSED BY LIVESTOCK PRODUCTION

Livestock production accounts for 70% of all agricultural land and 30% of the planet's land surface[126]. It is a key factor in deforestation, especially in Latin America. About 20% of the world's pastures and rangelands (and almost three quarters in dry areas), have been degraded to some extent, mostly through overgrazing, compaction and erosion caused by livestock action[126]. This can be halted by limiting overgrazing, soil conservation methods, better management of grazing systems and controlled exclusion from sensitive areas. Deforestation and land degradation often reflect weaknesses in institutions and policies[116], which can increase the role of companies to demonstrate leadership in this regard.

BIODIVERSITY LOSS

Many of livestock's threats to biodiversity arise from its impact on climate, air and water pollution, land degradation and deforestation. Conversely, extensive pastoral systems in Africa and Asia are considered important contributors to biodiversity. There is, however, a thin line between contributing to biodiversity and overgrazing.

PARTNERSHIPS ALONG THE LIVESTOCK VALUE CHAIN

In order to improve the sustainability of meat production, partnerships with actors along the livestock value chain, including civil society and governments, are important.

THE INDUSTRY AS A DRIVER OF CHANGE

The meat & poultry industry is important to global food security, livelihoods and health. Animal products can be part of a balanced diet and provide key nutrients for growth. However, the global increase in production to meet the growing demand of meat is taking place in an unsustainable way. Reducing consumption of animal products in industrialized countries will not be enough to counteract the demand for livestock products in emerging and developing countries.

Livestock production by both smallholder farmers and highly specialized, industrial systems are contributing to GHG emissions to water, soil and air. Adequate mitigation of the sector's environmental impact requires a strategy suitable for smallholder and industrialized livestock systems. These systems operate in very different conditions and the way in which they influence each other is limited, both in terms of operations and the markets they serve. Dealing with sustainability issues therefore requires two very different approaches.

Sustainable and modest intensification of many extensive systems operated by smallholders provides two important advantages: it improves food security and livelihoods while reducing emissions per unit of product. The relative and absolute gains are potentially substantial due to current inefficiencies and the large number of smallholder farmers. Large-scale industrialized systems should focus more on recycling nutrients, sustainable sourcing of animal feed and animal welfare. Gains in these areas are often incremental but, combined, could deliver a significant contribution due to the industry's size and impact.

Consumers, and through them supermarkets and (fast food) restaurants, are becoming more concerned with how food is raised and produced and where it comes from. There is growing demand for transparency around the way in which industrial livestock producers deal with health & safety, the environment, animal welfare and other sustainability themes. Despite important steps taken to improve the performance of the sector, such as the Global Roundtable for Sustainable Beef, the Global Agenda for Sustainable Livestock and the Livestock Environmental Assessment Partnership, transparency regarding actual improvements made by individual companies remains limited.

IV Nitrous oxide (N_2O), methane (CH_4) and carbon dioxide (CO_2) are the three main GHGs emitted by the sector.

9 MOBILE TELECOMMUNICATIONS SERVICES

JEFFREY SACHS
head of the Earth Institute at Columbia University and author of the 2005 book *The End of Poverty*

"The cell phone is the single most transformative technology for development."

INTRODUCTION

Cell phones have rapidly become the most popular and widespread form of personal technology, with 3.6 billion unique subscribers and a total of 7.2 billion connections worldwide[143]. The telecommunications services industry represents the pioneering success story for inclusive business models. Multinational companies have acknowledged the business case for mobile inclusion and have developed business models designed to include disadvantaged populations. Results show great success, both in terms of business results and wider socioeconomic benefits.

While global mobile penetration is considerably high and mobile-cellular subscriptions are slowing down as developed markets reach saturation point[144], broadband connections, now seen as a key driver of economic growth, significantly lag behind. There is growing concern that the digital divide between developed and less developed regions and countries will grow. Telecommunications service providers, consisting of those who provide the infrastructure as well as those who provide content and services or both, have an important role to play in ensuring equitable access to services worldwide, in particular for rural and disadvantaged regions and populations.

INDUSTRY ANALYSIS

Mobile telecommunications companies provide wireless voice, messaging and data communications for their subscribed mobile users. In addition, they can offer a wide range of other services such as (public) fixed-line telephony, cable television, wireless applications, broadcasting services, long-distance services, enterprise services and telecommunications equipment sales and rentals. The global telecommunications services market generated total revenues of $1,534 billion in 2014 and reached over 6.5 billion subscribers[145,V].

The industry is characterized by a highly competitive environment with many buyers (both individual and corporate) and the presence of large players, benefitting from economies of scale and diversification. The global wireless telecommunications services market has experienced strong growth in subscriber numbers and value in recent years. This is predicted to continue, although at decelerated pace[146]. Over the last decade, emerging markets have been driving the global telecommunications market, helping European telecoms operators to offset slower growth in Western markets[147]. From 2005 to 2010, cell phone use in the developing world tripled to nearly 4 billion subscriptions. This number has since risen to 5.4 billion, with over half of the subscriber base in the Asia-Pacific region (3.6 billion). Mobile penetration is estimated to be significant among BoP customers and will continue to grow[147]. Although penetration is high, this does not necessarily mean that everyone has a cell phone since many people have more than one subscription or SIM card. For a total overview of mobile-cellular subscriptions by level of development and region, see figure 2.

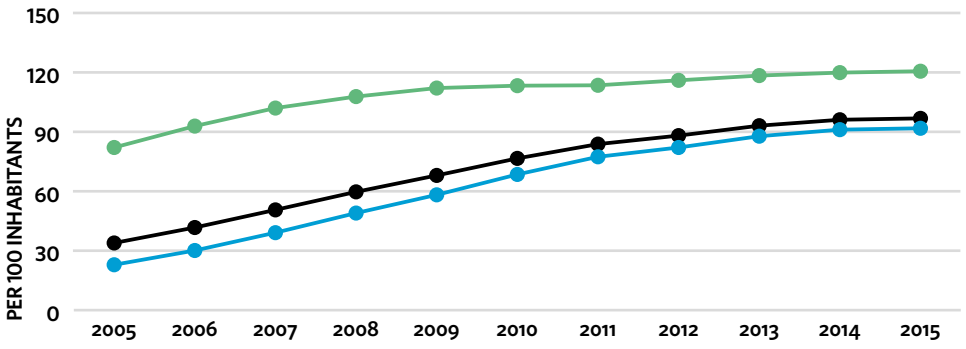
Mobile internet[VI] is the fastest growing market segment, with strongest growth rates in developing countries (26% growth in developing vs. 11% growth in developed countries)[144]. This is driven by the availability and uptake of more affordable devices (smartphones) and types of plans on offer[144]. For an overview of mobile-broadband subscription levels by levels of development, see figure 3.

FIGURE 2

MOBILE-CELLULAR SUBSCRIPTIONS[148]

Developed
World
Developing

BY LEVEL OF DEVELOPMENT, 2005-2015



BY REGION, 2015

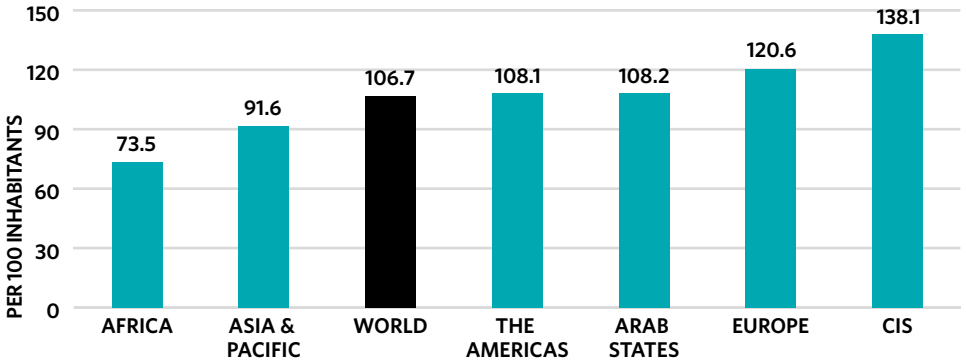
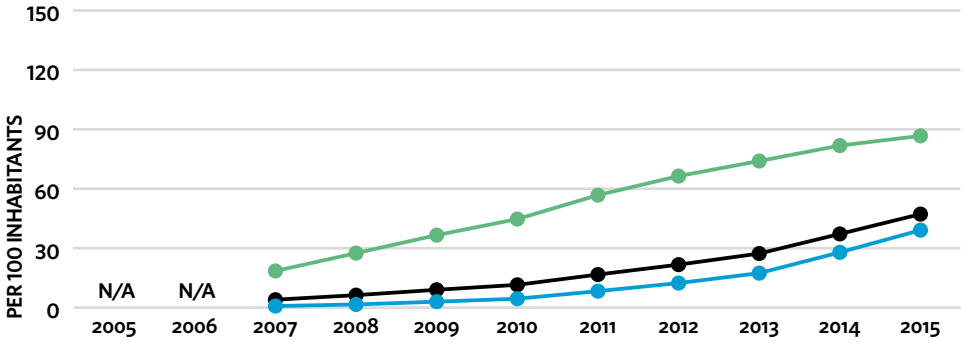


FIGURE 3

ACTIVE MOBILE-BROADBAND SUBSCRIPTIONS[148]

Developed
World
Developing

BY LEVEL OF DEVELOPMENT, 2005-2015



BY REGION, 2015

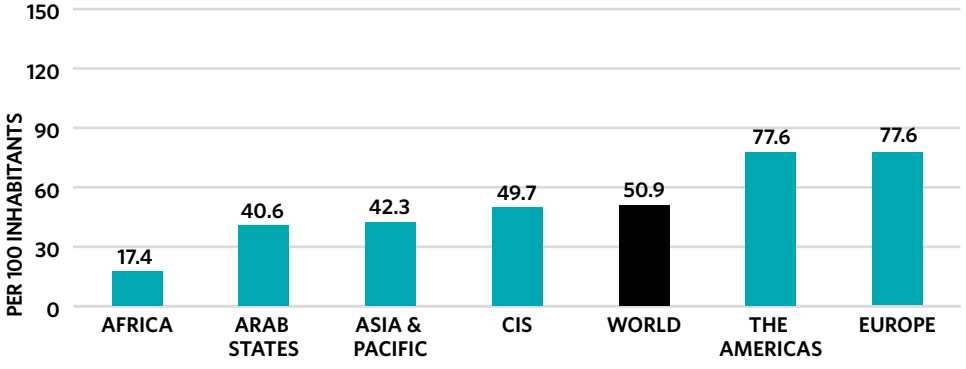


TABLE 10

LARGEST MOBILE TELECOMMUNICATION SERVICE COMPANIES BY NUMBER OF SUBSCRIBERS

	COMPANY	COUNTRY	NUMBER OF SUBSCRIBERS (million)	NUMBER OF COUNTRIES OF OPERATION	2014 SALES ($million)
1	China Mobile	China	807	1	103,383
2	China Unicom	China	450	1	45,549
3	Vodafone	UK	434	27	53,759*
4	América Móvil	Mexico	368	20	57,635
5	Telefonica	Spain	341	21	54,911
6	Bharti Airtel	India	313	20	17,148
7	Axiata	Malaysia	250	8	5,052
8	Orange	France	244	29	42,995
9	MTN Group	South Africa	223	23	12,277
10	VimpelCom	The Netherlands	222	13	19,627
11	Deutsche Telekom	Germany	198	38	68,343
12	China Telecom	China	186	1	51,903
13	Telenor	Norway	186	13	13,850
14	Etisalat	UAE	169	19	13,176
15	Saudi Telecom Company (STC)	Saudi Arabia	161	3	12,373
16	Idea Cellular	India	151	1	5,301**
17	Telkomsel	Indonesia	132	1	4,622
18	AT&T	US	121	2	132,400
19	Reliance Communications	India	118	1	3,725**
20	Verizon	US	108	1	127,079
21	TIM (Telecom Italia)	Italy	106	3	25,514
22	MTS/Sistema Shyam TeleServices Limited (SSTL)	Russia/India	100	6	12,488**
23	Ooredoo	Qatar	97	10	9,140**
24	Global Telecom Holding	Egypt	83	3	3,413
25	BSNL (Bharat Sanchar Nigam Limited)	India	80	1	N/A
26	Aircel	India	80	1	N/A
27	Oi Group	Brazil	75	2	9,095
28	TeliaSonera	Sweden	73	17	12,127
29	Turkcell	Turkey	71	7	5,513
30	MegaFon	Russia	70	2	5,666
31	Tata Teleservices/DoMoCo	India	66	1	530
32	NTT DoCoMo Group	Japan	65	2	43,346
33	Smart (Philippine Long Distance Telephone Company)	Philippines	54	1	3,797
34	Advanced Info Services	Thailand	44	1	4,538
35	Zain	Kuwait	44	8	4,300
36	au (KDDI)	Japan	42	1	42,107**
37	Maroc Telecom	Morocco	40	5	3,216
38	SoftBank Group	Japan	37	2	N/A
39	SK Telecom	South Korea	29	1	15,790
40	Hutchison Whampoa Group	China	27	10	54,035**

* Group service revenue
** 2013

The largest global telecoms operators by total subscriber base are listed on the previous page. Out of the 40 companies, only three are privately owned. A wide variety of home countries can be observed.

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

DIGITAL DIVIDE AND DIGITAL INCLUSION

The term digital divide refers to the gap between individuals, households, businesses and geographic areas at different socioeconomic levels with regard to both their opportunities to access information and communications technologies (ICTs) and their use of the internet for a wide variety of activities[149]. It is estimated that 450 million people still live out of reach of a mobile signal[VII,144]. In addition, 4.3 billion people are not online (>60% of world population), with 90% of these living in developing countries[144]. Sixty-four percent of offline individuals live in rural areas, where incomes are low and illiteracy high[150]. Broadband is now regarded as a crucial driver of economic growth and there is particular concern that less developed countries and regions will not be able to catch up, thereby widening the digital divide[151]. Statistical data show a link between countries with low internet access and low levels of education, health and income, indicating that there is a correlation between social inequality and the digital divide[152].

PRIVACY, AND PROTECTING AND RESPECTING FREEDOM OF EXPRESSION

Large amounts of personal data are transmitted over and stored by different networks. There is concern about how companies ensure consumer awareness of and education on these topics, and the actions companies take to protect data[153]. In addition, companies have to distinguish between legitimate and illegitimate demands from governments to access data that can impact freedom of expression and privacy.

ELECTRONIC WASTE

Electronic waste (e-waste) is a growing problem, mainly in the developing world. Although electronic manufacturers have been implicated, telecommunications service providers are also directly responsible for the increasing amount of e-waste. Providers spend significant marketing budgets on enlarging their subscriber base and accelerating product life cycles ('churn'). This is often achieved through subsidies on new phones or hardware upgrades, leading to more phones, turned over more often, creating more e-waste[154].

CO_2 EMISSIONS

It is estimated that the ICT industry accounts for 2% of global CO_2 emissions[155]. The main contributors are energy consumed by PCs and monitors (40%), data centers (23%), and fixed and mobile telecommunications (24%)[156]. At the same time, the telecoms industry is in a position to reduce GHG emissions by developing technologies that enable other industries to reduce their emissions, for example by substituting physical products with e-products and services[144,153]. According to research by the Global e-Sustainability Initiative, this substitution has the potential to reduce GHG emissions by 16.5%[157].

EXPOSURE TO ELECTROMAGNETIC FIELDS (EMF)

There are societal concerns about the link between exposure to EMF radiation from cell phones and a variety of health conditions, ranging from cardiovascular to neurodegenerative diseases such as cancer. Levels of EMF will continue to increase as technology advances[158].

RELATIONSHIP WITH THE SDGS

IMPACT OF THE TELECOMMUNICATIONS SERVICES INDUSTRY

ECONOMIC GROWTH

Several studies have focused on the increase in (basic) mobile penetration and the effect on GDP growth. Studies show positive results: e.g. Waverman et. al conclude that an increase of ten cell phones per 100 people would increase GDP per capita growth up to 0.6 percentage points, and in developing countries between 0.8 and 1.2 percentage points[159]. The effects of increasing access to internet appear to be even larger. Research by the World Bank finds that a 10% increase in broadband, internet and mobile penetration in developing countries increases GDP per capita growth rate by 1.38, 1.12 and 0.81 percentage points respectively[160]. Research by Deloitte shows that for a given level of mobile penetration, a 10% substitution from 2G to 3G penetration increases GDP per capita growth by 0.15 percentage points. In addition, a doubling of mobile data use leads to an increase in the GDP per capita growth rate of 0.5 percentage points[161]. In developing markets, a 10% expansion in mobile penetration increases productivity in the long run by 4.2 percentage points[161].

MOBILE SERVICES THAT HELP TO INCREASE AGRICULTURAL PRODUCTION

Mobile services can improve agricultural output, value and social impact by providing rural farmers with access to weather, crop selection, pest control and real-time market/price information[150]. Mobile technology can improve agricultural efficiency and productivity, thereby increasing the incomes of small-scale farmers.

All the elements below refer to mHealth: the practice of medicine and public health supported by mobile devices.

TELEMEDICINE

Provision of remote diagnosis, advice, treatment and health education can address 80% of the health issues of patients in rural clinics, which are often most poorly staffed. It can also promote health education and treatment adherence through e.g. text messages[150].

EFFICIENCY AND EFFECTIVENESS OF PUBLIC AND PRIVATE HEALTH SYSTEMS

Mobile health applications can help to streamline patient admission. For example, real-time information collection through cell phones can help to monitor disease rates and medication stock levels, allowing for improved tracking of disease outbreaks and allocation of health workers and medication[150].

EDUCATION FOR PRACTITIONERS

ICT can provide practitioners with information on e.g. outbreaks, vaccination programs, other preventative initiatives and online medical training[150].

ACCESS TO EDUCATION THROUGH MOBILE TECHNOLOGIES/REMOTE LEARNING

Especially in remote areas, telecommunications can facilitate access to educational materials and teachers.

TRAINING FOR TEACHERS

Offering online training and qualification tools for educators can improve training for teachers.

GENDER GAP

The GSMA Connected Women program estimates that 21% or 300 million fewer women than men own a cell phone in low- to middle-income countries. There are various reasons for this, including costs, awareness, illiteracy, culture and religion. In addition, fewer females are connected to the internet than men hindering social progress and widening the gender gap[143].

ACCESS TO FINANCIAL SERVICES FOR WOMEN

Mobile finance services can increase access to micro-loans for women. Financial inclusion can play a key role in advancing economic development and empowerment[162]

PRODUCTIVITY

Telecommunications services can enhance worker productivity, increase market reach and save costs through e.g. reducing the need for travel.

DIRECT AND INDIRECT LOCAL EMPLOYMENT OPPORTUNITIES

The telecoms sector stimulates the creation of local jobs. In Kenya, for instance, mobile-related employment rose by 67%[143].

NETWORK AND BROADBAND COVERAGE

Low-income countries, and rural and disadvantaged areas within low- to middle-income countries, suffer from a lack of network and particularly broadband coverage as cost-recovery for companies is more challenging in these areas. Telecommunications service providers can contribute to the expansion of coverage in these countries and regions.

FINANCIAL INCLUSION

Traditional banking models developed for Western markets are often not suitable for developing countries where rural populations can be far removed from the nearest bank branch or ATM[150]. Mobile technology has proven to be a breakthrough solution, and in Kenya, Tanzania and Uganda there are already more mobile money accounts than bank accounts. It is estimated that by 2025, more than 60% of Africans could enjoy access to banking services, and more than 90% could use phone-based wallets for daily transactions and remittances. Mobile service providers can play an important part in rolling out basic technology systems that work on any phone although financial service players still need to innovate in several key areas[150].

ACCESS TO TELECOMMUNICATIONS SERVICES

Mobile telephony and broadband are considered key drivers of growth and development. They often represent the first modern telecommunications infrastructure and can reduce communication costs significantly. This facilitates access to information on e.g. social, economic, health and political topics[163].

Although the coverage of 3G networks is increasing rapidly in developing countries, mobile broadband is six times more affordable in developed countries than in developing ones. High prices put broadband out of the reach of large segments of the world's population[144]. Ensuring equitable access for all will prevent countries and regions from falling behind and will help to bridge the digital divide between rich and poor, urban and rural.

REDUCING E-WASTE

Telecommunications companies are directly responsible for the growing amount of e-waste. The industry has a role to play in stimulating and facilitating the collection, handling and recycling of e-waste.

ENERGY-SAVING SOLUTIONS

The industry can play a significant role in helping other companies and individuals to reduce their carbon footprints by developing smart energy solutions.

ENERGY USE

The telecommunications industry is responsible for significant energy use and therefore CO_2 emissions. It can actively invest in measures that reduce energy usage.

PEACEFUL AND INCLUSIVE SOCIETIES AND ADVANCING HUMAN RIGHTS

The Tunis Commitment of the ITU underscores that ICTs are effective tools to promote peace, security and stability, to enhance democracy, social cohesion, good governance and the rule of law at national, regional and international levels[164]. Through telecoms services like telephony and internet, people can obtain relevant, critical and balanced information. They can facilitate freedom of speech, justice and equality and, according to Human Rights Watch, have enormous potential to advance human rights[165].

MULTI-STAKEHOLDER PARTNERSHIPS

Within the telecommunications value chain, mobile telecommunication service companies can partner with governments and providers of telecommunication infrastructure technology to create the necessary basic infrastructure. In addition, companies can engage in partnerships that stimulate the development of relevant and useful local content.

THE INDUSTRY AS A DRIVER OF CHANGE

The mobile telecommunications industry can be considered a frontrunner in terms of successful inclusive business models. Mobile penetration across all income groups worldwide is considerably high, mainly due to the development of innovative and affordable pricing options for low-income users[166]. Yet although mobile penetration is high, broadband penetration lags far behind, particularly in less developed countries and regions, creating digital divides between and within countries. As telecoms impact all development sectors, digital divides are liable to exacerbate gaps in development outcomes[151].

Mobile operators have an important role to play in expanding access to affordable mobile and, increasingly, broadband services. By doing so, companies can contribute to narrowing the digital divide nationally and internationally, thereby creating equal opportunities for progress. This can have a profound impact on social and economic development. In addition, companies can ensure meaningful access by introducing innovative services that stimulate sustainable development and improve lives. As telecommunications services have penetrated every sector of society, the potential positive impact of the industry is considerable.

V Total worldwide mobile-cellular subscriptions amount to 6.9 billion, according to ITU[144], and 7.2, according to GSMA[143].
VI Wireless access to the internet through a mobile phone, smartphone, USB wireless modem, tablet or other mobile device[143].
VII Mobile-internet services are increasingly becoming an alternative to fixed internet in developing countries due to a lack of fixed-broadband infrastructure and affordable service offerings.

10 OIL & GAS

JAMES SMITH
Chairman of the Carbon Trust and former chairman of Shell UK

"The transition over the coming decades for oil & gas companies is uncertain and risky. But defending the status quo would be more so."

INTRODUCTION

On August 28, 1859, George Bissell and Edwin L. Drake made the first successful use of a drilling rig on a well drilled especially to produce oil at a site on Oil Creek near Titusville, Pennsylvania. The Drake well marked the beginning of the era in which oil and later gas would literally fuel economic growth and globalization. Today, the oil & gas industry is one of the world's largest in terms of revenue, market capitalization and global presence. Despite increasing attention for the environmental impact of fossil fuels and the necessity to find cleaner alternatives, it is projected that fossil fuels will continue to supply nearly 80% of world energy needs through 2040[167]. Total energy consumption is forecast to increase by more than 50% by 2040, mainly driven by economic growth in developing countries[167].

This rising demand for energy is taking place in a world seeking to limit the average global temperature increase to 2°C. Consecutive IPCC reports make it very clear that economic growth based on fossil fuels and limiting global temperature increase to 2°C are incompatible. Although fossil fuels are predicted to dominate the energy landscape for the foreseeable future, the world needs to decarbonize its economy. This puts oil & gas companies under growing public pressure to provide tangible evidence of their support for and investments in a low-carbon future.

The effects of climate change will be most severely felt by the poor. The IPCC states that: "Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development"[47]. It is estimated that 90% of future oil & gas production will come from developing countries[168], with many of the industry's extraction activities encroaching the living environment of disadvantaged people and communities. These are places where poverty is widespread, low-income households have no access to modern energy and ecosystems are unprotected. Viewed through the lens of sustainable development, the question is how oil & gas companies can use their local presence to support the resilience of local communities and ecosystems as they progressively transition towards becoming providers of low-carbon energy.

INDUSTRY ANALYSIS

Oil & gas is one of the largest industries worldwide and generates revenues in excess of $3,073 billion in 2014[169]. The industry has experienced colossal growth but this is expected to level off. In late 2014, OPEC[VIII] failed to reach an agreement on cutting its own oil production, which resulted in plummeting oil prices. It is also expected that oil prices will remain low for a longer period. US domestic production has nearly doubled over the last six years, leading to increased oil supply and decreased US oil imports. In addition, demand from Europe and developing countries is weakening and vehicles are becoming more energy efficient[170].

The activities of the oil & gas industry can be divided into exploration, extraction, refining, transportation and retail. The industry consists of fully integrated companies and a wide variety of companies specialized in one or two of those activities. Ownership ranges from fully listed to 100% state owned. State-owned companies like Saudi Aramco, NIOC, KPC, Pemex, Pertamina, Qatar Petroleum, ADNOC, Sonatrach, NNPC,

PDVSA and Iraqi Oil Ministry are often substantially larger than many of their privately owned – and better known – peers. The other major characteristic that distinguishes the different oil & gas companies is the composition and location of their hydrocarbon reserves. Both these factors significantly influence the cost of extraction, CO_2 intensity and the materiality of different sustainability issues.

TABLE 11

LARGEST INTEGRATED OIL & GAS COMPANIES BY REVENUE AND CAPITAL EXPENDITURE

	COMPANY	COUNTRY	2014 SALES ($million)	CAPITAL EXPENDITURE (ttm, $million)
1	Sinopec	China	433,310	20,049
2	Royal Dutch Shell	The Netherlands/UK	385,635	29,192
3	PetroChina	China	372,997	50,232
4	Exxon Mobil	US	364,763	32,952
5	BP	UK	334,606	21,359
6	Total	France	194,159	24,120
7	Chevron	US	191,755	35,407
8	Gazprom	Russia	159,777	42,520
9	ENI	Italy	157,586	14,971
10	Petroleo Brasileiro Petrobras	Brazil	129,081	41,507
11	SK Holdings	Korea	101,099	5,152
12	Rosneft Oil	Russia	92,628	8,883
13	Oil Company Lukoil	Russia	81,537	9,347
14	Statoil	Norway	81,190	16,352
15	ConocoPhillips	US	52,464	17,085
16	OMV	Austria	43,425	4,639
17	Ecopetrol	Colombia	36,482	4,120
18	Suncor Energy	Canada	34,845	6,010
19	Imperial Oil	Canada	30,016	4,567
20	Surgutneftegaz	Russia	25,467	5,380

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

CLIMATE CHANGE

The burning of fossil fuels and the resulting increase in atmospheric CO_2 is the greatest contributor to global warming and climate change. Climate change affects regions differently, and the impact does not correlate with historic economic development and emissions. In order to mitigate the impact of climate change, at UN level countries have agreed to limit the global temperature increase to a maximum of 2°C by reducing emissions. This will require a major overhaul of the global energy supply system. Oil & gas companies can contribute to this transition by developing project portfolios with progressively lower CO_2 intensity, by diversifying their energy portfolio into renewables, developing and deploying technologies that provide the most efficient clean-energy conversion and investing in CCS facilities.

STRANDED ASSETS

The UK-based NGO Carbon Tracker developed the concept of carbon bubble and stranded assets. In its report *Unburnable carbon*, it demonstrates that the fossil fuel reserves of oil & gas companies already far exceed the carbon budget to avoid global warming above 2°C[171]. However, the industry continues to spend significant amounts ($674 billion in

2014) to find and develop new potentially stranded assets. Investors worry their investments will suffer as governments introduce serious policy measures (e.g. a global carbon tax) to combat climate change. This has contributed to the amount of traction gained by the divestment movement, a campaign led by 350.org that calls on (mainly) institutional investors to withdraw their investments from fossil fuel companies.

Oil & gas companies have challenged the theory of stranded assets, arguing that the expected increase in demand for oil & gas will consequentially allow them to utilize their assets fully. Investments in new oil & gas operations are justified on the grounds that they need to keep renewing their portfolios as a substitute for the 'natural' decline of production in oil & gas fields over time. Even in scenarios that predict an overall decline in demand for fossil fuels, it is expected that companies will continue to invest in new oil & gas operations for the foreseeable future.

SKILLS DEVELOPMENT AND CAPACITY BUILDING

Oil & gas field development extends well over 20 years and in many cases even longer. Skills development and local staff engagement practices differ significantly across the industry. In many cases, skills development is limited to mandatory vocational training. Companies are often hesitant to invest in developing local staff as the required skills are often highly specialized and fluctuate in demand during the different faces of a typical extraction project and setting up relevant local training programs can be challenging, time consuming and costly[172]. Instead, oil & gas companies generally rely to a large extent on imported company staff (expatriates) or third parties that operate globally to provide the required skills and supplies[173]. Currently, no strong relationship can be observed between the oil & gas industry and local education systems (ranging from vocational training to university) for talent development. Companies that actively invest in skills development and capacity building are better positioned to foster lasting professional business relationships, thereby creating opportunities for communities to benefit from activities by the sector.

COMMUNITY DEVELOPMENT

The significant amounts of spending and earning in a typical oil & gas project can deeply affect local communities and economies, possibly distorting socioeconomic structures and cohesion. Oil & gas companies should therefore ensure local communities have the opportunity to benefit equally from the economic activities that come with oil & gas operations.

ACCESS TO ENERGY

An estimated 1.3 billion people still do not have access to reliable and affordable electricity[107], and up to a billion more have access only to unreliable electricity networks[174]. About 2.7 billion people rely on the traditional use of biomass for cooking, causing harmful indoor pollution[107]. Oil & gas companies can help communities to access the energy they need, especially those neighboring their areas of operation. This requires (facilitating) investments in local and often decentralized energy infrastructure.

HEALTH & SAFETY

The industry devotes significant attention to its health & safety performance. Yet while long-term performance in terms of injuries and fatalities in operations has improved, performance is now stabilizing. At the same time, several independent investigations of major industry incidents highlight that insufficient focus is paid to removing high-risk exposure. Safety and occupational health performance relates to the extent to which companies take responsibility to include contractors and subcontractors in their supply chain, implying a wider range of social responsibilities.

ASSET INTEGRITY

Asset integrity is back on the agenda following several serious incidents culminating in the 2010 Macondo disaster in the Gulf of Mexico. Regulators became explicitly interested in containment in the early 2000s with a focus on small gas leaks. Reality dictates that the release of hydrocarbons with the associated risk of fire and explosion, spills and emissions is still pervasive across industry. The industry has formulated new expectations but the trend has yet to be reversed. Furthermore, the industry has started consolidated reporting on leaks, but no transparency is provided on failures that could lead to leaks.

ENVIRONMENT AND BIODIVERSITY

Oil & gas field developments invariably have an environmental impact. This can be direct and indirect impacts on land use, biodiversity and water resources. Companies have to minimize these effects and compensate where a negative impact is unavoidable. Operations in areas of high-conservation value should be avoided or accompanied by additional measures concerning asset integrity. As climate change is often considered a threat to local environments and biodiversity, oil & gas companies can indirectly contribute to their conservation by investing in low-carbon energy systems that mitigate climate change.

TRANSPARENCY AND CORRUPTION

Oil & gas companies frequently operate in weak states, increasing the risk of corruption, conflicts over (informal) land rights and unauthorized violence. Criticism of offshoring profits, a lack of clarity on payments to governments and the insufficient amount spent on local and regional reinvestment is mounting. Companies are increasingly expected to provide transparency regarding these money flows. Different initiatives in this area are under way: the Extractive Industries Transparency Initiative (EITI) has put in place a revenue transparency framework at governmental level. In 2013, the EU passed the Accounting Directive that requires EU-based extractive companies to report on payments to governments, setting a benchmark for companies worldwide.

ACQUIRING AND PROTECTING CONCESSIONS

Beside increased transparency on money flows, companies are expected to actively inform and consult all stakeholders when acquiring concessions in order to prevent conflicts over land rights with local communities. In addition, they should provide access to adequate remedy in the event of unresolved conflict. Companies often feel the need to physically secure their concessions, assets and operations. They should do so in recognition of internationally recognized human rights principles and again provide access to adequate remedy when misconduct occurs.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE OIL & GAS INDUSTRY

ECONOMIC DEVELOPMENT

Despite the economic output of the oil & gas industry and its widespread activity in developing countries, returns do not always translate into equal social and economic outcomes for local communities[175]. Increasing local procurement can contribute to greater socioeconomic benefits in terms of job creation and enterprise development[176]. Better aligning business interests with community needs can contribute to both business success and societal progress[175].

HEALTH EFFECTS FROM AIR POLLUTION

Climate change can be mainly attributed to the rise in GHG emissions resulting from the burning of fossil fuels. Air pollution has serious health impacts, increasing the risk of stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma[53]. Although the majority of emissions will be determined by the (combustion) technology applied, oil & gas companies can contribute to the development of cleaner transport fuels that reduce hazardous emissions in urban areas. In addition, they can enable the substitution of coal by natural gas in coal-fired power plants to reduce hazardous emissions.

HEALTH IMPACT FROM OPERATIONS

The activities of oil & gas companies can negatively impact human health. Examples include risks associated with oil spills, the use of complex and toxic chemicals, and gas flaring and venting processes. These result in potentially damaging emissions to air, soil and water.

PROFESSIONAL DEVELOPMENT

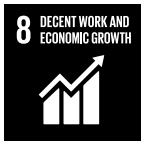
Oil & gas companies can create vocational/professional education programs to develop skills and create employment opportunities for local communities. In addition, they can support higher education and university programs to develop future leaders.

WATER MANAGEMENT

Water is important to the industry: it handles more water than it does oil[177]. Depending on the type of extraction, e.g. fracking, fresh water use can be significant. As a minimum, companies should ensure threshold levels remain available for local communities and other downstream use. Furthermore, companies should implement sound water management policies to prevent any type of groundwater and surface water contamination. This involves applying procedures to conserve, recycle and reuse water[178].

ACCESS TO ENERGY

In countries with limited access to reliable energy sources, companies can help neighboring communities to meet their energy demand by leveraging their presence, infrastructure and capacity in those communities. This could possibly extend beyond project scope.



LOCAL EMPLOYMENT

Oil & gas companies often operate in some of the most underdeveloped regions in the world. Contributing to building sustainable, long-term employment opportunities can have a significant impact on local development. Investing in and building human capital in host communities brings benefits not only to those communities but also to companies themselves by mitigating risk and improving operational efficiency[175].

WORKING CONDITIONS IN THE SUPPLY CHAIN

At all stages in the supply chain, companies should uphold stringent health & safety procedures.

INFRASTRUCTURE DEVELOPMENT

Oil & gas companies often operate in remote areas with limited infrastructure but need infrastructure to transport their products. Improved infrastructure can have wider benefits by providing access to remote villages for the delivery of goods and export of products. In addition, companies can invest in infrastructure to transport petroleum gas, a by-product of extraction that can be used as a source of energy for local communities[175]. This would also reduce the environmental impact as the gas would not need to burned off onsite.

HYDROCARBON PORTFOLIO DIFFERENTIATION

Companies could prioritize the exploitation of their HC portfolio in countries with a disproportionate number of low-income households as these nations potentially benefit most provided effective and sustainable resource management and governance are in place.

OPERATIONAL PERFORMANCE

Creating clean, efficient, low-waste operations should be a priority for oil & gas companies. Accidents in the industry can be prevented or reduced if constraints on safe behavior are better enforced and if effective safety control structures are in place[179].

LOW-CARBON PORTFOLIO

The industry continues to invest significant amounts in finding new reserves and in high-cost, high-carbon sources of production such as deepwater, oil sands and shale oil reserves. Analysis shows that international oil & gas majors dominate these sources of production and are therefore most at risk if global climate change policy were to tighten[180]. Companies can actively move to less carbon-intensive portfolios. Natural gas could play an important role as a bridge energy in the transition to renewable energy technologies[181]. In addition, companies can diversify their portfolios into renewables.

REDUCING GHG EMISSIONS

High-cost sources of production (deepwater, oil sands, light-tight oil) tend to be the most carbon intensive – and thus most polluting – due to higher energy demands during the extraction process[180]. In addition, gas flaring accounts for some 360 million tons of GHG emissions globally[182]. Oil & gas companies can steer their portfolio away from newly developing unconventional reserves with high carbon intensity. Furthermore, they can develop and deploy techniques that provide the most efficient and clean energy conversion as well as invest in technologies for CCS.

IMPACT ON MARINE ECOSYSTEMS

Offshore activities and spills can put oceans and marine ecosystems at risk. Companies can avoid or develop advanced operating practices in or near sensitive marine areas. In addition, creating a low-carbon project portfolio as well as clean technologies can help to reduce CO_2 levels and thus the acidification of oceans.

CONSERVATION

Drilling and extraction activities can have a negative impact on local ecosystems. In order to limit this, companies should implement operating practices that adequately protect ecosystems, monitor and report performance and remedy incidents. It is important that companies build a comprehensive understanding of relevant biodiversity through research, environmental and social impact assessments, and the creation of effective compensation for unavoidable impacts. In addition, companies should protect riverine and delta freshwater systems and ensure equitable continued use for local communities to safeguard agriculture and fisheries. Companies should also protect all potential surface and subsurface potable water resources through zero disposal and asset integrity.

TRANSPARENCY

Corruption hampers development and fuels conflict over resources. Open, accessible and reliable public information about royalties, taxes and other payments to governments by oil & gas companies enables the monitoring of these revenue flows. This transparency can help to hold both governments and companies to account.

SECURITY

Responsible business conduct by oil & gas companies is essential to prevent their operations from undermining justice. Companies frequently operate in fragile states, increasing the risk of corruption, conflicts over (informal) land rights and the use of violence in securing operations. It is important that companies adhere to the Voluntary Principles on Security and Human Rights, designed specifically for extractive sector companies, when securing operations.

MULTI-STAKEHOLDER PARTNERSHIPS

Multi-stakeholder partnerships are critical as companies can rarely tackle complex issues regarding local communities and ecosystems on their own. Cooperation and coordination with local and national policy makers and local communities is crucial.

THE INDUSTRY AS A DRIVER OF CHANGE

Different stakeholders, in particular investors, are increasingly demanding transparency regarding the strategies and concrete measures oil & gas majors are taking to prepare for a more carbon-constrained world. These demands will require oil & gas companies to develop energy solutions at scale that can lower the carbon intensity of their portfolios. Investments in energy research and new technologies and diversification into lower carbon sources of energy will significantly contribute to the transition towards a lower carbon energy system.

While the industry faces increased stakeholder pressure regarding climate change-related risks, global demand for energy continues to rise. This poses a significant challenge: while affordable energy is an important driver of economic growth reducing fossil fuel-related GHG emissions will be crucial for keeping global warming below 2°C. An estimated 1.3 billion people still do not have access to clean, reliable and affordable energy, stifling their social and economic development. Oil & gas companies can deploy their knowledge, local capacity and financial assets to support access to energy around their operations.

As oil & gas companies often operate in remote and underdeveloped areas, they can use their presence to stimulate economic and social development in the countries and communities where they operate. This requires companies to commit to and invest in building human capital as a means to establish sustainable business relationships with local communities. As country contexts vary widely, different approaches might be appropriate. This contribution cannot be seen separately from companies' human rights performance, health & safety practices and environmental preservation measures as irresponsible business conduct will undermine lasting community development.

VIII OPEC controls approximately 40% of the global market[69].

11 PUBLISHING

WORLD BANK POLICY RESEARCH BULLETIN
April/May 1992

"More than natural resources, more than cheap labour, more than financial capital, knowledge is becoming the key factor of production."

INTRODUCTION

Publishers are central to the dissemination of knowledge and can play an important role in the advancement of education and the protection and promotion of cultural content and diversity[147]. The industry was well established but conservative for a long time[183]. Due to the emergence of new technologies, the industry is experiencing a rapid shift towards the digitalization and electronic presentation of content[103]. In addition, while the industry has traditionally been subject to national and linguistic borders, globalization is further reinforcing digitalization and reach[183].

These developments are effecting publishers' business models. The classic models focused on selling books and other publications one at a time. New business models are based on recurring revenue streams through personalized, adaptive digital subscriptions. These open up interesting possibilities to reach target groups that previously could not be reached due to financial, political, physical and/or language barriers. Since the information traded by publishers is used in the economic, legal, medical, educational and advancement of individuals, regions and countries, the digitalization of the industry is widely seen as an important step for sustainable development.

However, the commercial and societal relevance of these new target groups might not be aligned. In other words, while a doctor in Mali can now be easily reached with the latest insights in medical research or a lawyer in rural India with the latest information on international property rights, the commercial relevance of these target groups might be limited due to their low purchasing power or lack of internet access. With increasing digitalization, there is concern that the knowledge gap between countries and regions is exacerbating development inequalities between and within countries as a result of lacking internet access (digital divide).

INDUSTRY ANALYSIS

Total revenues in the global publishing market amounted to $290.7 billion in 2013, with performance forecast to accelerate[184]. Over the last decades, the industry saw a wave of consolidations, creating large multinational, integrated publishing houses. While these publishing conglomerates keep on growing, they have also found their own niches within certain segments[183].

Companies in the industry are engaged in publishing newspapers, magazines, other periodicals and books as well as directories, mailing lists and software. In general, publishers issue copies of works for which they hold the copyright. These can be either works created by others but for which they have obtained the rights and/or works created in-house[185]. The sector is divided into three main segments: professional information and science, technical and medical (STM) publishing, educational publishing, and trade (or general literature) publishing. STM represents the largest segment (42%), followed by educational (35%) and trade (23%)[183].

The 20 largest publishing companies by revenue are listed in table 12. A growing number of publishers are consolidating around one of the aforementioned segments: educational (Pearson, Cengage, McGraw-Hill), professional information (Reed Elsevier, Wolters Kluwer, Thomson Reuters) or trade (Penguin Random House, Hachette Livre).

TABLE 12

LARGEST PUBLISHING COMPANIES BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($million)
1	Thomson Reuters	US	12,605
2	Reed Elsevier	UK/US/The Netherlands	8,828
3	Pearson	UK	7,453
4	Wolters Kluwer	The Netherlands	4,109
5	Penguin Random House	Germany	3,729
6	Hachette Livre	France	2,250
7	Holtzbrinck Publishing Group*	Germany	1,930
8	Scholastic	US	1,822
9	John Wiley & Sons	US	1,775
10	Grupo Planeta	Spain	1,763
11	Informa	UK	1,739
12	Cengage	US	1,678**
13	China Publishing Group	China	1,499**
14	Houghton Mifflin Harcourt	US	1,372
15	HarperCollins	US	1,369**
16	McGraw-Hill Education	US	1,291
17	De Agostini Editore	Italy	1,261
18	Shueisha	Japan	1,191**
19	Oxford University Press	UK	1,161
20	Springer Science+Business Media*	Germany	1,077

* On May 6 2015 the majority of Macmillan Science and Education formally merged with Springer Science+Business Media in its entirety to create Springer Nature

** 2013

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

COPYRIGHTS

The business model of publishers revolves around copyrights. Publishers have a professional interest in capitalizing on these intellectual property rights to the best advantage of their authors as well as themselves[186]. Copyrights allow publishers to take action against intellectual property infringements and can thereby protect authors as well as their investments and income. Although this mechanism allows for the protection of the authors and producers of content and, ultimately, the dissemination of knowledge and culture, it can also impede access to information as the copyright holder has full control (or a monopoly) over its dissemination. In addition, while much peer-reviewed scientific literature is funded by taxpayer-supported government grants and articles are made available to journals by the authors free of charge, the scientific publications in which they appear are often only accessible upon payment of hefty subscription or per-article fees[187,188]. As commercial publishers control about 40% of academic titles, the transfer of rights to these parties raises the problem of access to 'public' research findings by the wider public[188]. On the other hand, journals would not exist without publishers and editors. It has been argued that 'intellectual property right is not designed to legitimize measures of control over access', so companies should carefully balance protecting intellectual property rights with public and societal interests[189].

EQUITABLE ACCESS TO INFORMATION

The need for access to information and knowledge is particularly strong in developing countries. Information traded by the industry can be used, for example, in legal, medical and trade situations. Unequal access to this information often represents a direct unequal opportunity for trade, health and rights. The attractiveness and stability of emerging and developing markets can, with current business models, be limited for publishers.

CULTURAL CONTENT

As developers and disseminators of knowledge materials, publishing houses are central to the cultural, social, intellectual, legal, economic and educational life of a nation[190]. Despite their international and commercial character, multinational publishers play an important role in safeguarding and promoting cultural and indigenous content and diversity.

EDUCATION

Publishers have an important role to play in developing materials, software and curricula that promote learning for children and adults. Literacy is central to both a successful publishing industry and a thriving society. Publishers have the ability to ensure that the public can access, read and enjoy books and educational materials, thereby combating illiteracy and stimulating intellectual progress.

PAPER PROCUREMENT AND USAGE

Despite digitalization, significant amounts of paper are still used by the industry. Unsustainably sourced paper can have negative effects on forests and local ecosystems. Companies can take steps to ensure their paper comes either from responsible sources or is recycled. Twenty-two publishers are members of PREPS (the Publisher's Database for Responsible Environmental Paper Sourcing), a database that holds technical specifications and details of the pulps and forest sources of the papers publishers use as well as data on CO_2 emissions and water use at the paper mill level[191]. This can influence the actions of the pulp & paper industry and ensure sustainable sourcing.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE PUBLISHING INDUSTRY

HEALTH RESEARCH

Health research can provide important information about disease trends and risk factors, outcomes of treatment or public health interventions, functional abilities, patterns of care, and health-care costs and use[192]. Economists have found that medical research can have a significant impact on human health and longevity, thereby contributing to thriving societies and economies[192]. Widespread and equitable access to this information is therefore of high societal interest.

EDUCATIONAL MATERIALS

Published materials like textbooks and children's literature are key to education and access to knowledge. Books and other reading materials (either hardcopy or digital) can combat illiteracy, spread knowledge and widen people's horizons[188]. Basic education and literacy are in turn preconditions for universal access to the internet[188].

DIGITALIZATION

Publishers can help developing countries to overcome the problem of poor information, knowledge, education and publishing infrastructures by offering digital solutions that are easily accessible through (low-bandwidth) smartphones and tablets.

ACCESS TO INFORMATION AND KNOWLEDGE

While copyrights can protect the rights of authors and publishers, they can also impede the widespread dissemination of information. Other obstacles to information and knowledge access include a lack of (broadband) infrastructure, technical constraints and socioeconomic factors. Knowledge is considered the least expensive input for development as it empowers people to improve productivity, health, decision making, governance, education etc. Knowledge gaps can exist within countries (rich vs. poor; rural vs. urban) but also between countries (developed vs. developing). Different mechanisms can improve access to information, e.g. open access, licensing agreements and preferential pricing schemes can significantly open up academic content for developing countries.

RESEARCH FROM DEVELOPING COUNTRIES

Despite the term 'global research', research from developing countries is significantly underrepresented. In order to strengthen the cycle of knowledge worldwide and stimulate cross-regional collaborations, it is important that work from researchers from developing countries is visible and recognized[193].

SOURCING AND PAPER USE

Although more and more material is disseminated electronically, publishers are still a major user of paper. Companies can limit paper use by moving to digital solutions and reducing waste. In addition, they can implement policies that ensure the paper used comes from certified sources (e.g. Forest Stewardship Council).

FREEDOM OF EXPRESSION

Access to information and freedom of expression is central to political democratization efforts globally and within countries. Publishers play an important role in ensuring the freedom to read, write and publish through the distribution of information and advocacy activities.

ACCESS TO LEGAL INFORMATION

Publishers that offer legal publications and solutions can help justice systems, governments and businesses to function more effectively and efficiently by supporting transparent legal systems and ensuring the accessibility of law and regulation. Unequal access to legal information can result in information asymmetries and unfair advantages.

PARTNERSHIPS WITH PLAYERS OUTSIDE THE INDUSTRY

Changes and innovations in the sector will revolve around the formation of new partnerships and alliances with players outside industry, such as telecommunications and technology companies[183]. In addition, partnerships with governments, NGOs and other actors in the knowledge society are crucial for facilitating the widespread dissemination of knowledge.

THE INDUSTRY AS A DRIVER OF CHANGE

The publishing industry has undergone a digitalization transformation over the past ten years. Large multinationals have emerged, active in the dissemination of educational and professional information among e.g. doctors, lawyers, scientists, accountants and traders. Digitalization enables the industry to provide personalized and adaptive information to an ever-widening group of people.

Equal opportunities for development and the protection of basic rights are dependent on the information that is the commodity of trade for publishers. It is in the hands of the industry to develop new business models that enable broad access to information in a commercially viable way. This can have a direct effect on improving levels of health, education, development and literacy in countries and regions where these are lagging. Furthermore, access-oriented business models can leverage the potentially positive impact of often publically financed research.

12 PULP & PAPER

JOSÉ LUIS PENIDO
Chairman of Fibria and Riikka Joukio, senior vice president of Metsä Group, co-chair of the WBCSD Forest Solutions Group

"The forest industry has a long history of change and expansion, from papyrus to Gutenberg and modern paper machines to biorefineries. It now stands before another period of change and transition."

INTRODUCTION

The pulp & paper (P&P) industry inspires mixed emotions when discussed in the public forum. Visions of large, smelly factories consuming vast amounts of forest resource spring to mind. Connotations associated with the industry are almost always negative and yet the industry continues to grow and expand despite rapid digitalization.

While recycle rates have gone up, primarily in Europe and the US, wood still remains the major feedstock for the P&P industry to produce pulp, paper and packaging. The main source of this wood is from forested areas. Ideally these are planted, but in reality natural forest wood is still utilized in some parts of the world. WWF International estimates that 40% of all industrial wood traded globally is used for P&P[194]. P&P companies are regularly put under scrutiny because of the large volumes of the fiber supply (virgin wood) that remain untraceable to their original source. In developing countries, the industry has been linked to deforestation and violations of land rights for indigenous and local communities. In response, some P&P companies have started working with NGOs, governments and other stakeholders to implement new policies for responsible forestry and plantation management. Despite this progress, a 2013 assessment showed that major global players still disclose very little information about their operations on the ground[195]. Of concern to environmentalists and consumers alike is the fact that some of these companies have operations in natural forest areas classified as having high conservation value.

The P&P industry has a considerable impact on large tracts of land including tropical forests, and on local community rights and livelihoods. But it can also have a positive economic influence in poorer and more remote regions. As large areas are controlled by a relatively small number of companies, sustainability strategies in the P&P industry can have an immediate and widespread effect.

INDUSTRY ANALYSIS

The P&P industry reported revenues of $567 billion in 2014[196]. HSBC expects consumption to grow at an annual rate of 2.4% over the next five years (compared to an annual growth rate of 1.7% over the last decade), driven primarily by demand in emerging markets[197]. The FAO estimates that paper and paperboard production has increased from 371 million tons in 2009 to 398 million tons in 2013. Almost all of this growth has come from increased production in South America and Asia[198].

Large-scale P&P companies are normally vertically integrated: they obtain a substantial portion of their raw materials from their own plantations, forest concessions and recycling operations. Depending on the project scale and the capacity of their own resources, companies may supplement supply with fiber produced by third-party suppliers.

On a global scale, the P&P industry can be broadly divided between two regions. The older, well-established companies are based in Europe and North America whereas the relatively young companies operate in (sub)tropical areas such as Brazil, Southeast Asia and China. The first region is in constant or declining production as a result of supply constraints and high costs of production relative to the tropics. By contrast,

companies in the (sub)tropical regions are characterized by newer mills and access to fast-growing plantations which have been expanding rapidly during the last 20 years. By far the most contentious area of development (due to their high biodiversity value and controversy over land rights) has been in Southeast Asia, primarily within Indonesia but also within Malaysia and to a lesser extent the Philippines, Cambodia and Vietnam.

The industry can also be further divided into two levels of operation. The first is large-scale companies producing 100,000 tons or more of product per annum. They require large capital investments and large sources of fiber supply. These are the companies that have the most impact on a global scale and where most of the attention from buyers, environmentalists and NGOs is focused. The second level comprises small-scale producers that often utilize other fiber sources besides wood such as bamboo or hemp. They use simple technologies and their environmental footprint is significantly smaller.

The largest P&P companies, based on the volume of paper and packaging produced, are listed below. Companies whose production consists predominantly of 'market pulp' are listed in table 14 as they are also significant players with large forest concessions and plantations. Market pulp is any variety of pulp that is produced in one location, dried and shipped to another location for processing.

TABLE 13

LARGEST PULP & PAPER COMPANIES BY PAPER AND PACKAGING VOLUME

	COMPANY	COUNTRY	VOLUME X 1000T PAPER AND PACKAGING	2014 SALES ($million)
1	International Paper	US	21,215	29,080
2	APP/Sinar Mas	Indonesia/China	15,108	N/A
3	Nine Dragons	China	13,875	4,637
4	UPM	Finland	10,925	13,101
5	Stora Enso	Finland	10,665	12,769
6	Oji	Japan	9,382	11,618
7	Nippon Paper	US	8,550	8,689
8	Georgia-Pacific	US	8,420	N/A
9	RockTenn	US	8,404	9,077
10	Smurfit Kappa	Ireland	6,869	10,563
11	Lee & Man	Hong Kong	6,720	2,189
12	SCA	Sweden	6,094	N/A
13	Chenming Group	China	5,904	N/A
14	Sappi	South Africa	5,744	5,925
15	Mondi	UK/South Africa	5,590	8,597
16	PCA	US	4,175	N/A
17	Resolute Forest Products	US	4,039	4,258
18	Kimberly-Clark	US	3,734	9,960
19	Shanghai Taison Group	China	3,620	N/A
20	Domtar	Canada	3,357	5,321
21	Cascades	Canada	3,257	3,074
22	Verso Corporation	US	3,245	1,297
23	Norske Skog	Norway	3,233	2,199
24	Daio Paper	Japan	3,064	4,167
25	DS Smith	UK	3,022	5,259

TABLE 14

LARGEST PULP & PAPER COMPANIES BY MARKET PULP VOLUME

	COMPANY	COUNTRY	VOLUME X 1000T MARKET PULP	2014 SALES ($million)
1	Fibria	Brazil	5,430	2,206
2	RGE/APRIL	Indonesia	4,515	N/A
3	CMPC	Chile	3,890	4,846
4	Arauco	Chile	3,885	5,329
5	Suzano Pulp and Paper	Brazil	3,545	2,262

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

DEFORESTATION, BIODIVERSITY AND CARBON EMISSIONS

The use of natural forest wood (i.e. not plantation based) in P&P manufacturing leads to deforestation. In Europe and North America, natural forest is allowed to regenerate after cutting, meaning that the impact of harvesting is short. In other parts of the world, especially in tropical regions, natural forest is replanted with short rotation monoculture plantations, which inevitably leads to forest cover change, biodiversity loss and net carbon emissions. Within Indonesia alone, over 2.5 million hectares of natural forest have been converted into monoculture plantations by P&P companies. In the worst case, natural forest that is sourced from third-party suppliers and small-scale companies is not replanted at all, creating a net loss of forested area.

DEFORESTATION IN ASIA

The impact of deforestation on a large scale is clearly evident in Asia. The last 25 years have seen high demand for fiber brought on by a rapid expansion of production capacity. In some cases, mill capacity was constructed prior to plantation development meaning mills relied on natural forest wood until plantation wood was available. In Indonesia, the P&P industry, along with the palm oil industry, are the main drivers of industry-caused deforestation. Between 1985 and 2009, 49% of the natural forests on Sumatra were cleared. Competition between two large P&P companies, Asia Pulp & Paper (APP) and Asia Pacific Resources International Limited (APRIL), have had a negative impact on the condition of natural forests in Indonesia. This large-scale natural forest clearance has led to many high-profile attacks by major NGOs such as Greenpeace, RAN and WWF for the deforestation and habitat loss that ensued. This was exacerbated by the fact that over 50% of the expansion was onto carbon-rich peatlands resulting in major biodiversity loss and significant increases in GHG emissions. These have been instrumental in pushing Indonesia into third place in the world list of highest emitters. It is only recently that APP and APRIL have committed to cease deforestation of natural forest. The step has been welcomed by the entities that have been vocal critics in the past.

LAND RIGHTS AND LIVELIHOODS

Deforestation is often associated with the violation of land rights of indigenous people and local communities. This is especially problematic when communities depend on forest resources to support their livelihoods. The risk of social conflict is high when preparing and clearing forest areas without having received free, prior and informed consent (FPIC) from local stakeholders. This occurs most frequently in the tropics where land rights are often poorly documented and policed. Indonesia, for example, has experienced a massive increase in the number of land conflicts between companies and local communities since the transition in 1998 from the largely authoritarian old regime to a democratically elected government. The post-1998 governments have been unable to control land use rights issues and many companies have been in a state of constant conflict with local communities. In extreme cases, mills have been closed pending a resolution and violent confrontations have occurred. While deforestation for wood fiber production in the P&P industry may be ending, many social conflicts are far from resolved. This is leading to illegal encroachment, open confrontation and even the burning of company assets.

ENERGY AND EMISSIONS

Producing P&P requires vast amounts of energy. According to the IEA the P&P sector is the fourth largest industrial consumer of energy[199]. In 2006, the sector consumed 6.7 exajoules of energy, which represents 6% of global industrial energy use. It should be noted, however, that CO_2 emissions are relatively low due to the high percentage of biomass – mainly waste from the production process itself – used to produce this energy.

WATER USE

WWF International estimates that the P&P industry is the single largest consumer of fresh water for industrial activities in developed countries[200]. Production of paper also requires large amounts of chemicals whose negligent use can lead to hazardous working conditions. Insufficiently treated waste water can be a source of environmental pollution, which has become a high-profile issue around some pulp & paper plants.

PLANTATION PRODUCTIVITY

Wood plantations are highly efficient monocultures and although they are low in biodiversity, they do offer an effective alternative to the use of natural forests, especially in tropical countries. Typical rotation lengths in tropical countries range from five to seven years. In the cooler climates of Europe and North America, rotation lengths are anywhere between 30-70 years. Well-managed plantations can therefore significantly contribute to zero-deforestation targets set by both companies and governments. If fiber demand can be met through plantations alone, further deforestation will no longer be required. This remains a major issue in Southeast Asia, which lags behind Brazil in plantation productivity despite having a similar climate. Falling growth rates of plantations indicate that in order to supply their mills, companies will source from third-party suppliers who may in turn (illegally) source from natural forests.

RECYCLING

Today, 54% of the global paper industry's material comes from recovered paper and board, according to industry statistics[201]. Recycling is important as it reduces the need for raw materials although it is still a challenge to trace the sources of the original fiber. Improving recycling rates is a major opportunity for the industry, especially in areas where recycling rates remain low. By substituting recycled paper for raw material, the use of new wood fiber can be avoided. In addition, recycling can contribute to reduced waste and provide a direct source of income for local collectors and communities if wastepaper is collected within the immediate area.

RELATIONSHIP WITH THE SDGS

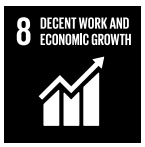
IMPACT OF THE PULP & PAPER INDUSTRY

WATER USE

As a major industrial user of water in developing countries, P&P companies have to use fresh water wisely and treat large amounts of wastewater. The degree to which they do so will greatly impact overall water quality in the surrounding area. Contaminated wastewater from P&P mills can damage aquatic ecosystems and threaten the health of communities near the mills[200]. Great improvements have been made thanks to the use of new technologies, but companies continue to play a major role in actively ensuring healthy water-related ecosystems.

ENERGY USE

The industry consumes 6% of global industrial energy. Given the predictability of its energy needs, P&P companies should gradually reduce energy intensity and increase the use of renewable energy sources (i.e. by using waste, wood pellets and biomass).



EMPLOYMENT OPPORTUNITIES

Pulp & paper projects are normally located in rural areas where opportunities for work are limited. Employment opportunities provided in plantation and manufacturing operations have a demonstrable impact on the alleviation of poverty. This relates to both unskilled work and the opportunities for young people to be trained and mentored for more technical tasks. Some P&P companies have established training and development programs.

INFRASTRUCTURE DEVELOPMENT

P&P companies require good-quality roads and infrastructure to move wood from the forest to the factory sites. These roads also provide access to remote villages for the delivery of goods and export of products.

RECYCLING

In a world where products are traded around the globe, packaging is essential for enhancing shelf life and reducing damage. Packaging can also add to a product's ecological footprint if materials are not recycled. The P&P industry should increase recycling rates and, together with manufacturers, develop solutions that lead to less wood fiber use from natural forest sources.

DELINK DEFORESTATION FROM SUPPLY

P&P companies should delink deforestation of natural forests from their supply chain, optimize their plantations and increase yields. These measures will reduce the pressure on natural forests as a source of fiber thus protecting biodiversity, local peoples' customary rights and carbon storage. This is especially relevant to those companies operating on peatland soils, which not only have high conservation value but also emit large volumes of carbon when drained and opened up for plantation development. P&P companies have a significant role to play in the protection of conservation areas within their forest boundaries.

HARVEST OF NATURAL FORESTS

Forests are among the most important terrestrial ecosystems on earth. P&P companies can protect and/or restore forests primarily by preventing the clearing of natural forests, preventing fire loss and combating illegal deforestation. They can also assist in the re-forestation of damaged ecosystems. Conserving specific parts of forests is essential for diversity of landscape and ecosystems and for the preservation of rare species[202].

PLANTATION PRODUCTIVITY

Improving plantation productivity can reduce the need for third-party suppliers who may source from natural forests. P&P companies can enhance productivity for example by using alternative species, improving genetics via intensive tree breeding, mechanical land cultivation, improved management practices and the control of pests and diseases.

LAND RIGHTS

Deforestation is often associated with the violation of land rights of indigenous people and local communities. Companies should fulfil the obligation to obtain FPIC, allowing communities to give or withhold their consent to proposed projects that may affect the lands they customarily own, occupy or otherwise use[203].

MULTI-STAKEHOLDER PARTNERSHIPS

P&P companies usually obtain their concession from governments. Working with these governments as well a local stakeholders is crucial in tackling the complex social and environmental issues related to land use planning and land rights.

THE INDUSTRY AS A DRIVER OF CHANGE

The P&P industry has earned a bad reputation for cutting down natural forests, poor social management and a poor track record on environmental protection issues. It is only now that major companies in the tropics are committing to real sustainability across all operations. However, more efforts are needed to make on-the-ground improvements. This comes at a time of continuing social conflict, low plantation productivity, weak governance and increasing threats from fire, pest and disease. An industry transition is crucial as the last remaining natural forests are under serious threat from further clearing.

While certification of operations is a standard practice in the P&P industry, there is no single means by which consumers, NGOs, governments, buyers or other institutions can immediately verify performance against wider sustainability criteria or against the performance of industry peers. Different interpretations of legal, environmental and cultural aspects further complicate the comparability between different certification standards. This confuses people at all levels of industry association and hinders progress for coordinated and successful application of sustainable management practices. The large footprint in terms of forests and plantation concessions of a relatively small number of companies makes this industry unique as in many other industries associated with deforestation such as soy, beef and palm oil, the ownership of concessions and impact is much more fragmented.

Stewardship of these concessions can make a significant contribution to a range of global issues, including deforestation, ecosystem restoration, and protection of civil rights.

13 RETAIL (FOOD)

UK SUSTAINABLE DEVELOPMENT COMMISSION
2008 report Green, *Healthy and Fair*

"Supermarket chains sit at the heart of the modern food system, shaping its workings, with influence on how products are grown, packaged, processed and manufactured, transported, marketed and consumed, and how waste is disposed of."

INTRODUCTION

Linked closely to globalization, the food retail sector began developing rapidly some 30 years ago. In that time, the presence of food retailers has expanded steadily almost everywhere in the world, including in developing countries. Food retail is the last step in the food value chain and includes supermarkets, superstores, hypermarkets and discount stores. In other words: the outlets that are becoming the main suppliers of food for consumers around the world[IX]. In the EU, for example, modern retail sales constitute on average 62% of the edible grocery market[204].

In the EU and North America in particular, a limited number of companies have become dominant players with considerable power in the food-retail market. Their strategic position in the food value chain, right between suppliers and consumers, gives these companies substantial influence over these two groups. Influence tools include retailers' product offerings, promotions and their direct relationship with consumers. They can influence consumers' buying choices and the way consumers use and dispose of products and packaging[205]. At the same time, food retailers can exercise significant influence over their suppliers due to their size and market concentration. This allows them to promote the fair and sustainable production of products but can also lead to unfavorable pressures on suppliers.

INDUSTRY ANALYSIS

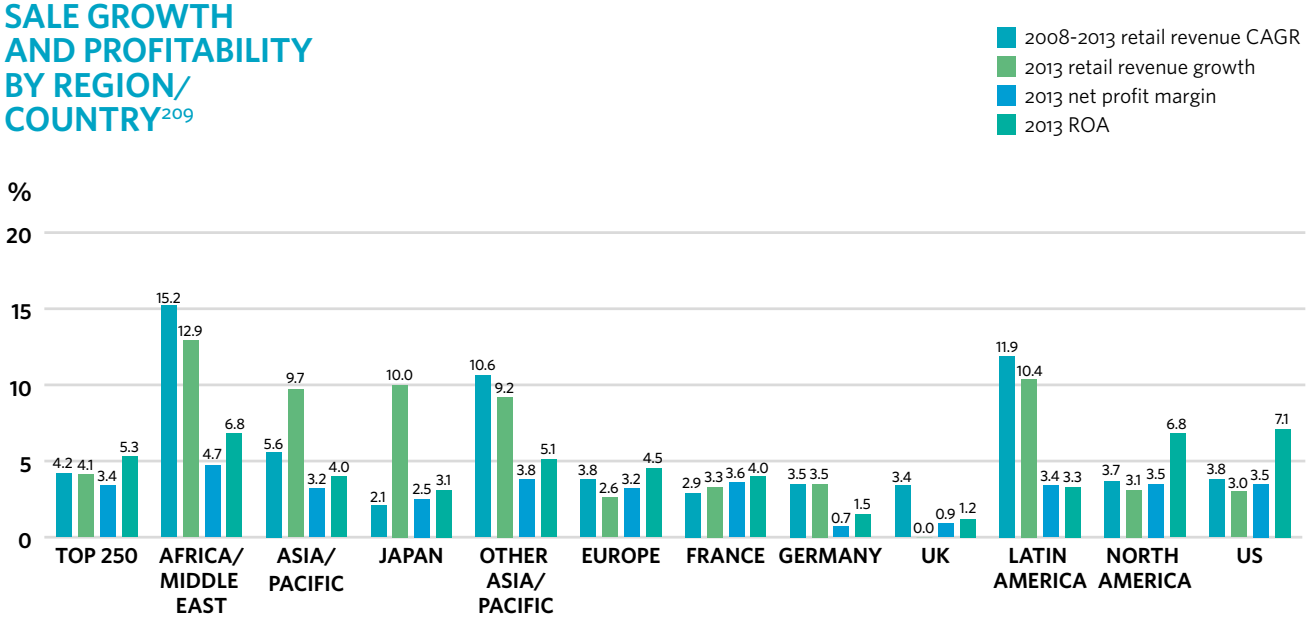
Over the last five years, the global food retail industry grew by 4.8% CAGR to a value in excess of $5.5 trillion[206]. However, growth is expected to slow due to increased competition and the effect of price wars which stifle sales growth in Western markets. The industry has experienced significant consolidation over the past few years, leading to the decline of SMEs. The majority of food retailers are now large, multinational corporations.

Driven by growing economies and retail environments, supermarkets are expanding into Asia and Latin America[207]. A similar expansion is expected to take place in many African countries[208]. As figure 4 shows, Africa, the Middle East and Latin America represent particularly strong growth markets for retailers.

In many Western countries, the food retail market is dominated by a limited number of companies. In Germany and the UK, for example, four companies control 85% and 76% of the market respectively, in Austria three retailers control 82% of the market, and in France and the Netherlands 65% of the market is controlled by only five companies[210]. The 25 largest global food retailers by retail revenue are listed in table 15. The market share of discounters is increasing rapidly and their sales volumes have tripled over the last ten years[211]. While food retailers typically sell a range of products and brands, own-brand products (private label) are of great importance to retailers and can contribute between 30% and 100% of their revenue[212].

FIGURE 4

SALE GROWTH AND PROFITABILITY BY REGION/ COUNTRY[209]



ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

RESPONSIBLE SOURCING

Thanks to their product offering and large advertising budgets, food retailers have a significant influence on consumer buying habits. This can result in unsustainable products at low prices, such as the infamous 'kiloknallers'[X] in Dutch supermarkets. However, retailers can also use this influence as a force for good by stocking and promoting (private-label) products that have a lower environmental/ecological impact or products with a more favorable social impact. Relevant themes in this area include animal welfare, sustainable seafood, sustainable forestry products, sustainable commodities, and Fairtrade/organic and local products. In addition, as food retailers source products globally, companies can face issues relating to violations at suppliers' facilities such as forced labor, child labor or poor working conditions.

BUYING POWER AND INFLUENCE OVER NATIONAL BRANDS AND PRIVATE-LABEL SUPPLIERS

The increase in retail concentration[XI] in many European markets has led to significant concerns about the negotiating power that retailers have over their suppliers, particularly with regard to private-label products. Large retailers are able to impose their own contractual terms on suppliers, which in some cases can be abusive or unfair. In addition, this buying power puts constant downward pressure on prices for suppliers. It has been argued that the traditional buyer-supplier relationship has been turned upside down due to the emergence of large retailers. The two most common abusive practices are imposing a variety of payments on suppliers, such as listing fees or charges for promotional leaflets, and passing on the costs of business risk to suppliers. The latter involves making retrospective changes to agreed prices based on how well the product has sold to consumers. Any differences compared with sales forecasts are transferred to the supplier. Retailers can do this by introducing a complicated system for establishing the final net price, which includes various types of return bonus. These two mechanisms distort the simple business formula by which production costs are borne by the producer while the commercial costs are borne by the seller, according to the European Economic and Social Committee[213].

In terms of sustainability, however, this buying power and influence over private-label and direct suppliers can also have a favorable effect. Typically, buyer/supplier relationships facilitate better communication and coordination and allow suppliers to be closely involved in the design and governance of standards and sustainability requirements.

WASTE MANAGEMENT

Food retailers have a significant impact on waste streams through transit and product packaging, point-of-sale packaging (including carrier bags), food waste from products past their sell-by date and promotions and price signals to consumers that can encourage food waste[214].

In developed countries, around 40% of food intended for human consumption ends up as waste, making food the second largest category of waste going into municipal landfills[215]. This contributes to significant energy waste, both in the production and recovery process. Research shows that for every $1,000 in revenue, grocery stores generate 4.5kg of food waste[216] or an equivalent of over 20kg per day per supermarket[217]. Best practices in this area are evolving, in particular with regard to collaborative agreements with supply chains partners, third-party suppliers and customers to understand how their actions and those of others can reduce food waste and spur action[218].

NUTRITION AND OBESITY

Changing food consumption patterns have major effects on public health. Worldwide, obesity has more than doubled since 1980 and, in 2014, more than 1.9 billion adults were overweight (39%), of which more than 600 million (13%) were obese[219]. This has led to a significant increase in the level of diet-related diseases like cardiovascular diseases, diabetes, musculoskeletal disorders and some forms of cancer. As food-purchasing decisions are often made in supermarkets and grocery stores, these settings significantly influence consumer buying behavior[220].

RELATIONSHIP WITH THE SDGS

IMPACT OF THE FOOD RETAIL INDUSTRY

ECONOMIC DEVELOPMENT

Trade with food retailers can play an important role in improving economies in developing countries. A small but significant amount of fresh food and vegetables in supermarkets comes from developing countries where agriculture as an important source of employment and income is central to poverty reduction[214]. Agricultural products such as green beans (Kenya) and oranges (Egypt) can represent significant export values for developing countries.

SUSTAINABLE AGRICULTURE

Food retailers can exercise significant control over how products are produced and can support suppliers in improving their own practices. Agriculture is the single largest food-related contributor to climate change[214]. Several food retailers have set targets to increase the percentage of sustainably produced and sourced agricultural commodities and products on their shelves. Examples include responsible soy, palm oil and forestry products that do not impact deforestation; certified coffee, cocoa and tea that encourage farmers to apply better and more sustainable farming methods while safeguarding proper working conditions; or the Sustainability Initiative Fruits and Vegetables (SIFAV) that aims to make imports of fruits and vegetables 100% sustainable by 2020.

TABLE 15

LARGEST GLOBAL FOOD RETAILERS BY RETAIL REVENUE[209]

	COMPANY	COUNTRY	2013 NET RETAIL REVENUE ($million)	2013 PARENT COMPANY/ GROUP REVENUE ($million)	DOMINANT OPERATION FORMAT	# OF COUNTRIES OF OPERATION (2013)
1	Wal-Mart Stores	US	476,294	476,294	Hypermarket/Supercenter/Superstore	28
2	Costco Wholesale	US	105,156	105,156	Cash & Carry/ Warehouse Club	9
3	Carrefour	France	98,688	101,844	Hypermarket/Supercenter/Superstore	33
4	Schwarz Uternehmens Treuhand	Germany	*98,662*	*98,662*	Discount Store	26
5	Tesco	UK	98,631	100,213	Hypermarket/Supercenter/Superstore	13
6	The Kroger Company	US	98,375	98,375	Supermarket	1
7	Metro	Germany	*86,393*	*86,393*	Cash & Carry/ Warehouse Club	32
8	Aldi Einkauf GmbH & Co	Germany	*81,090*	*81,090*	Discount Store	17
9	Casino Guichard-Perrachon	France	63,468*	64,613*	Hypermarket/Supercenter/Superstore	29
10	Groupe Auchan	France	62,444	63,859	Hypermarket/Supercenter/Superstore	13
11	Edeka Zentrale	Germany	59,704*	61,339*	Supermarket	1
12	Aeon	Japan	57,986*	64,271*	Hypermarket/Supercenter/Superstore	10
13	Woolsworth	Australia	54,457	55,974	Supermarket	2
14	Seven & I Holdings	Japan	54,258*	56,600*	Convenience/ Forecourt Store	18
15	REWE Combine	Germany	51,109*	55,745*	Supermarket	11
16	Wesfarmers	Australia	50,711	55,265	Supermarket	2
17	Centres Distributeurs E. Leclerc	France	*47,671**	60,569g/*	Hypermarket/Supercenter/Superstore	7
18	Koninklijke Ahold**	The Netherlands	43,321*	43,321*	Supermarket	7
19	J Sainsbury	UK	38,031	38,076	Supermarket	1
20	ITM Développement International (Intermarché)	France	*37,351**	52,998g/*	Supermarket	6
21	Safeway	US	35,011	36,139	Supermarket	3
22	Loblaw	Canada	30,697*	31,446*	Hypermarket/Supercenter/Superstore	2
23	Publix Super Markets	US	29,148	29,148	Supermarket	1
24	Delhaize Group**	Belgium	28,037*	28,037*	Supermarket	9
25	WM Morisson Supermarkets	UK	27,739	27,739	Supermarket	1

Numbers in italics are estimates

* Revenue includes wholesale and retail sales
** In June 2015 a merger between Koninklijke Ahold and Delhaize was announced
g Gross annual turnover as reported by the company

INCLUSIVENESS OF SUPPLY CHAINS

As a result of the 'supermarketization' of the global food supply chain, many smaller farmers have found themselves sidelined by a lack of skills or capital to comply with the stringent food safety standards of large retailers[221]. Some effort has been made to integrate these farmers into the supply chain. Certification programs such as Fairtrade, for example, focus on stimulating smallholder farmers to form larger cooperatives, and so enable them to compete in global markets.

FOOD SAFETY

Food safety is one of the biggest issues for retailers and suppliers are required to adhere to stringent (in-house) industry standards such as Global Food Safety Initiative (GFSI), in addition to government food safety regulations. Adherence can be monitored through third-party certification and/or audits. However, the complexity and global spread of retailers' supply chains makes this a challenge. Unsafe food poses a considerable public health risk and can cause more than 200 diseases, ranging from diarrhea to cancers[222].

HEALTHY LIFESTYLES AND PRODUCTS

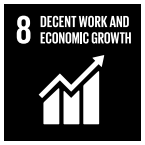
Food retailers have become the major suppliers of food in many countries. Through their marketing efforts, companies can promote the sale of healthy products (e.g. fresh fruit and vegetables) but also products that can be harmful (e.g. alcohol, high-fat and high-sugar products). A systematic review shows that food retailers can promote healthy consumption through interventions on the demand and supply side, whereby interventions combining both are most effective. These can include food demonstrations, point-of-sale information, (voluntary) labeling, signage and other printed materials highlighting healthy food choices, pricing (coupons, reduced prices for healthy food), greater availability of healthy products and reformulating unhealthy products[220].

RESPECTING AND PROMOTING WOMEN'S RIGHTS

Food retailers sell numerous products (tea, chocolate, fruits, vegetables, flowers, cashew nuts etc.) produced by smallholder farmers and/or plantations[223]. The percentage of female smallholders and plantation workers is high and their position in both cases can be vulnerable. The degree to and way in which retailers are able to ensure that women are treated equally depends on their sourcing relationships. This can be direct as is often the case with fresh fruit or vegetables or indirect with branded products like tea and chocolate.

WATER USE IN FOOD PRODUCTION

Global food production accounts for 70% of total water use. The amount of water used in the process of producing a product ('embedded water') is an important sustainability issue in the food system[214]. The most significant water-using products are meat, fruit and vegetables, diary and beverages. As calculation methods vary widely, this makes it difficult to implement and monitor water-saving initiatives at the supplier level.



WORKING CONDITIONS IN THE SUPPLY CHAIN

As internationally operating companies, food retailers play an important role in ensuring fair working conditions in the complex and extensive supply chains of their products. Issues include child and bonded labor, unsafe working conditions and living wages. Companies can screen and audit suppliers in order to make sure they meet retailer standards. In addition, food retailers are often criticized for their significant bargaining power over farmers and other suppliers, which can lead to unfair or abusive practices. Adhering to ethical purchasing practices can ensure a balanced relationship between retailers and suppliers.

STIMULATING LOCAL EMPLOYMENT

Food retail is a labor-intensive industry and thus creates significant employment opportunities. Furthermore, through direct local sourcing, food retailers can support local economies and stimulate local employment.

PROMOTING SUSTAINABLE CONSUMPTION

Food retailers can use their power and reach to promote more sustainable products to their customers, offer financial incentives for sustainable products and educate consumers about the environmental and social impacts of products[224].

WASTE

Companies can cut waste in two main areas: food waste and packaging. Packaging protects products as they move through the supply chain, and innovations in packaging material, design and labeling provide opportunities to improve efficiencies[215]. However, products are often over-packaged, creating significant amounts of unnecessary waste. Although substantial improvements have been made over the last decade, food retailers still also generate significant amounts of food waste. About 5% of this is generated at retail stores[225]. In-store strategies to reduce food waste include more efficient ordering and stock rotations, proper storage and presentation, and discounting blemished products or products with damaged packaging[215]. As a last resort, companies can also donate products to food aid organizations or reuse them as a beneficial source of livestock feed or fertilizer[215]. Food retailers have also proven to be successful in making consumers aware of food waste reduction at home. Since by far the greatest waste takes place at the 'fork' (consumption) stage, further awareness on this topic can have a significant impact on the amount of food that ends up in the trash.

ENVIRONMENTAL IMPACT

According to a study by the European Commission, food products have the greatest environmental impact throughout their life cycle compared to other consumption products[XII]. From farm to fork, these products can cause 20-30% of various environmental impacts of personal consumption, a number that increases to more than 50% for eutrophication[226]. Agriculture is the largest contributor. GHG emissions vary across foods, but 'hotspots' include meat and dairy production, glasshouse vegetables, air-freighted fresh produce, heavily processed foods and refrigeration (energy use and impact from refrigerant gases)[214]. Calculating the carbon footprints of products is an important but challenging step in understanding and mitigating impacts on climate change. The direct contribution of food retailers to GHG emissions is relatively limited, but measures to diminish their environmental impact include more efficient transportation, distribution and refrigeration.

SOURCING SUSTAINABLE SEAFOOD

Oceans continue to suffer from overfishing, destructive fishing and illegal fishing. Through sustainable seafood policies, participation in sustainable seafood initiatives and a better offering of sustainable seafood options to consumers, food retailers can have a positive impact on the conservation and sustainable use of oceans[227].

SUSTAINABLE FOOD PRODUCTION

Whether food is sustainably produced depends on the health of farmland, forests and fisheries ecosystems[214]. Agriculture's impact on ecosystems continues to grow and as procurers of agricultural products, retailers have an important role to play in ensuring suppliers adhere to sustainable production standards.

PARTNERSHIPS ALONG THE FOOD SUPPLY CHAIN

The direct impact of food retailers on many of the SDGs is limited. Due to their wide product offerings and corresponding complex supply chains, partnerships are necessary to improve environmental and social conditions throughout the supply chain.

THE INDUSTRY AS A DRIVER OF CHANGE

The pivotal position of retailers in the food supply chain allows them to exert significant influence on suppliers and consumers in the transition towards more sustainable production and consumption. Sustainability has become a strategic issue for retailers, one which is driven by a variety of factors. These include securing supplier bases, mitigating food safety or reputation risks and the changing consumer demand for more sustainable and fair products. In addition, although the buying power of food retailers over their direct and private-label suppliers is considered high, their power to change the system might be constrained in situations where suppliers are concentrated or purchasing volumes are low. Therefore, partnerships with suppliers, producers, peers and NGOs are vital for improving the sustainability of food supply chains. Several multi-stakeholder initiatives have been launched that include food retailers and aim to improve the sustainability of sourced products. However, which companies are more active in this domain and how companies perform relative to each other remains unclear.

IX In this analysis, retailers are discussed only with regard to the role they play in the area of food; non-food impacts are not considered.
X NGO-led campaign highlighting the very low price of meat (below €4.12 a kilo) in Dutch supermarkets.
XI The market share generally belonging to the top four or five retailers present in a regional market.
XII Other product categories include: clothing and footwear, housing, health, transport, communications, recreation, education, restaurants and miscellaneous.

14 SEAFOOD

SYLVIA EARLE
Marine biologist, explorer, author and lecturer

"We need to respect the oceans and take care of them as if our lives depended on it. Because they do."

INTRODUCTION

Fisheries are important for the food security and livelihoods of 200 million people, especially in developing countries. One in five people depend on fish as their primary source of protein[228]. Wild-caught (capture fisheries) and farmed seafood (aquaculture) jointly provide 17% of animal protein intake of the world's population[229]. In 'low-income food-deficit countries', fish contributes on average 25% to animal protein intake. This can exceed 50% in several small island developing nations and in Bangladesh, Cambodia, Gambia, Ghana, Indonesia, Sierra Leone and Sri Lanka. Globally, the consumption of seafood products is rising as a result of growing populations, rising incomes and increased health consciousness among consumers[230].

Demand from both developed and developing countries has resulted in overexploitation of natural resources. Overfishing is a textbook example of the tragedy of the commons and is generally considered to be the second biggest global threat to the oceans after climate change. In 2014, almost 30% of wild fish stocks were considered overfished, 60% were fully exploited and only 10% could be expected to allow further growth[231]. The proportion of fish stocks at levels that could be sustained declined from 90% in 1974 to 70% today. In addition, the worldwide increase in destructive fishing practices is destroying marine mammal populations and ecosystems[228]. This marine 'defaunation' and the overall effects of overfishing on marine ecosystems carry long-term risks[232]. Besides the negative ecological consequences of overfishing, it also reduces seafood production, further exacerbating socioeconomic consequences. Seafood companies play an important role in restoring overfished stocks and dealing sustainably with other fish stocks to ensure resource sustainability, food security and the well-being of coastal communities[231].

INDUSTRY ANALYSIS

The international seafood trade was valued at almost $130 billion in 2012. About 37% of fish production was exported[231]. Developing countries earned considerably more from seafood export than from any major food commodity like rubber, cocoa, coffee or sugar. The EU, US and Japan together account for 55% of global seafood imports. Seafood markets in the EU, US and Japan rely on imports for 63%, 60% and 54% respectively of their supply[231]. More than half of international trade originates in developing countries.

The seafood value chain is concentrated on processing and trade, which is mainly carried out by large, integrated seafood companies. Companies have varying portfolios, ranging from one dominant fish species (e.g. salmon or tuna) to a wide range of fish species. Some companies are primarily trading houses, while others integrate a number of activities ranging from fishing operations to branded consumer products. Companies are rapidly expanding their aquaculture portfolios to fulfil the growing demand for seafood. Global growth of seafood production is entirely attributed to aquaculture and in 2014, human consumption of farmed seafood exceeded that of wild-caught seafood[233].

The majority of the 20 largest seafood companies by revenue is publicly listed, although in several cases members of the founding family have considerable shares[234]. The industry is increasingly consolidating: the revenue of the 20 largest seafood companies is more than 50% of turnover of the global top 100[235]. Some companies have major shares in other companies in the top 20, making impacts even greater. For example, Maruha Nichiro (1) owned 14% of OUG Holdings (4) in 2015. Nissui (2) owned 11% of the shares

of Chuo Gyorui (13) and 50% of Sealord (80) in 2011, and Mitsubishi (7) owned 7.6% of the shares of Thai Union (3). Takeovers contribute to further industry consolidation. In addition, as some of these companies are large conglomerates, seafood forms only part of their business (e.g. Marubeni, Mitsubishi). A recent publication estimated the impact of seafood transnational companies (TNCs), indicating that 13 companies may control more than 11-16% of the global marine catch (9-13 million tons) and 19-40% of the largest and most valuable stocks, including species that play important roles in their respective ecosystems[236].

TABLE 16

LARGEST SEAFOOD COMPANIES BY REVENUE[235]

	COMPANY	COUNTRY	2012 SALES ($million)
1	Maruha Nichiro Holdings	Japan	8,600
2	Nippon Suisan Kaisha (Nissui)	Japan	6,020
3	Thai Union Frozen Products	Thailand	3,525
4	OUG Holdings	Japan	3,228
5	Dongwon Group	South Korea	2,999
6	Marine Harvest	Norway	2,789
7	Mitsubishi	Japan	2,500
8	Pescanova	Spain	1,735
9	Austevoll Seafood	Norway	2,119
10	Marubeni	Japan	2,000
11	Red Chamber Group	US	2,000
12	Pacific Andes International Holdings	Hong Kong	1,883
13	Chuo Gyorui	Japan	1,749
14	Charoen Pokphand Foods	Thailand	1,647
15	Kyokuyo	Japan	1,547
16	Sojitz	Japan	1,500
17	Daisui	Japan	1,431
18	Tri Marine International	US	1,400
19	Tohto Suisan	Japan	1,315
20	F.C.F. Fishery	Taiwan	1,300

VALUE VERSUS VOLUME

Analyzing the impact of the seafood industry requires looking at the volume of trade of seafood (rather than the value) and how this affects fish and marine ecosystems. Several factors distort the outcomes of such an analysis. Firstly, analyzing large seafood companies by value does not reflect their impact on natural resources. Shrimp, lobster and tuna are usually of high value while so-called small pelagic species (e.g. sardines, anchoveta, blue whiting and horse mackerel) are caught in enormous volumes but have low value. Secondly, while trade reports by authorities include the volume of the trade flow, these are often processed products, which require correction factors for the downward bias to determine the 'whole fish equivalent' of the original fish/shellfish volume. This has been done for selected product groups in Europe, but it is far from customary in seafood trade databases[231]. Thirdly, trade flows of the same product are recorded several times, with or without further processing of the product. When a batch is traded through several countries, each import/export is reflected in the databases, leading to an upward bias of the underlying product volume. Fourthly, the considerable volume of illegal and unreported fishing causes a marked downward bias of the total trade volumes in official records. Finally, country reports are known to be inaccurate, making the databases of UN Comtrade, Eurostat (EU), NMFS (US) and JFA (Japan) useful for detecting trends but not as a source of realistic volume/value statistics. It is unclear to what extent total trade volume figures in whole fish equivalent would either underestimate or overestimate the volume of extracted fish and shellfish.

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

ILLEGAL, UNREPORTED AND UNREGULATED FISHING

Global overfishing is aggravated by illegal activities. An estimated 20-32% of wild-caught seafood imported into the US comes from illegal, unreported or unregulated (IUU) fishing activities in the countries of origin[237]. A widely acknowledged study estimated that 13-31% of reported global catches, worth $10-$23.5 billion per year, is IUU[238]. IUU fishing puts additional stress on the world's fish stocks, and undermines fair pricing and competition as illegal products undercut the price on the market. Legal fisheries need to make investments to meet regulatory and sustainability requirements although this is likely to increase their costs compared to illegal products.

LOCAL FISHING COMMUNITIES

In developing coastal states, marine fisheries frequently suffer from a lack of regulation. Large foreign fleets can often fish with few limitations and the small-scale local fleets are generally too dispersed to be easily controlled. Large fisheries have a twofold effect on the livelihoods of coastal communities: depriving them of their fishing and thus economic opportunities and putting their direct dependence on seafood as a protein source at risk.

HUMAN TRAFFICKING AND SLAVERY

Human trafficking and slavery are known to occur in marine fisheries to an alarming degree. The literature provides comprehensive descriptions of how fishers are exploited on board fishing vessels. The severity of the abuse is striking[239]. Fishermen on board of vessels that are engaged in organized fisheries crime are particularly vulnerable.

AQUACULTURE

Aquaculture is a form of intensive livestock production and faces similar challenges: land-use rights, antibiotic use, dependence on feed conversion and pollution of water and related ecosystems. Aquaculture can take place in open waters (salmon, white-fish, tuna) or on land (shrimp, pangasius, trout). Fish farms affect oceans through the stocking of wild non-native species (mussels, shrimp), the release of effluents from coastal fish farms and destruction of mangroves for new farm sites. In addition, most farmed fish requires a feed component of wild fishmeal and fish oil. The Aquaculture Stewardship Council (ASC) has developed a sustainability standard for fish farming and the aquaculture market has been quick to respond.

SUSTAINABLE SEAFOOD MARKETS

The market for seafood certified as originating from sustainably managed fisheries has experienced substantial growth in Europe, the US and Japan. Consumer recognition of the Marine Stewardship Council (MSC) label is high in Europe (25-58%) and in the US (28%)[240]. Retailers have expanded their sustainability commitments and the food service is following suit. In the UK, Sainsbury's carries 165 MSC-certified products. In the Netherlands, 100% of the frozen wild fish sold by Albert Heijn is MSC certified and on June 9, 2015, the supermarket announced that all of its farmed salmon, which makes up 45% of its fresh assortment, will be sourced from ASC-certified farms.

Economic losses in marine fisheries resulting from poor management, inefficiencies and overfishing may amount to $50 billion per year, according to a World Bank/FAO report[241]. When oceans and fish stocks are allowed to recover, they have proven to be incredibly resilient. Despite these encouraging prospects, it is generally considered unlikely that by 2020 more than 15-20% of the total volume of captured fish will be MSC certifiable. It will be a challenge to introduce sustainable measures in the remaining 80% of fisheries that are under the public radar.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE SEAFOOD INDUSTRY

VALUE-ADDED ACTIVITIES IN LOW-INCOME COUNTRIES

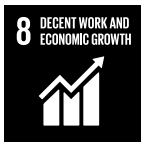
Developing countries earn considerably more from seafood export than from any major food commodity like rubber, cocoa, coffee or sugar, and more than half of all international seafood trade originates in developing countries. Seafood companies can enlarge and diversify their revenue streams by locating value-added activities in low-income countries.

CONTRIBUTION TO A NUTRITIOUS DIET

Fish is extremely nutritious and a vital source of protein and essential nutrients, especially for people living in poverty[231]. Over a billion people, mostly in developing countries, are dependent on seafood for their animal protein intake and livelihood. Seafood companies should avoid undermining the fishing activities of local fishing communities, which can deprive them of a traditionally cheap but highly nutritious food.

ROLE OF WOMEN IN COASTAL COMMUNITIES

Women play an important role in the handling, processing and marketing of fish products in most developing countries[242]. The percentage of women engaged in secondary activities (e.g. processing) can be up to 90%[231]. Seafood companies should be aware of the role of women in coastal communities as the primary trade is often in the hands of women although this role is gradually being eroded by the introduction of modern distribution and marketing systems[243]. In addition, most of the workers in fish processing plants are women. This work is often low paid and is very labor intensive.



DECENT WORK, HUMAN TRAFFICKING AND FORCED LABOR

In 2012, some 58.3 million people were engaged in the primary sector of capture fisheries and aquaculture[231]. According to the FAO, fisheries and aquaculture assure the livelihoods of 10-12% of the world's population[231]. The seafood industry can provide unskilled employment on vessels and fish farms, in canneries and other processing plants. As these activities are often located in low-cost labor countries and there is increasing pressure on profit margins, human rights and worker safety can be compromised. In addition, an alarming incidence of forced labor and human trafficking has been found in the industry. Seafood companies need to develop strong codes of conduct and ensure adherence to standards for decent work. Performing supply chain due diligence and regular audits can ensure better adherence to these standards.

BYCATCH AND DISCARDS

Bycatch and discards occur frequently but monitoring and mitigation measures are often lacking[231]. In order to limit or eliminate bycatch and discards, seafood companies should implement reduction measures and monitoring and control mechanisms.

SUSTAINABLE SEAFOOD

After global warming, fisheries have the biggest impact on the overall health of oceans. IUU fishing in particular is one of the main threats to marine ecosystems, undermining national and regional sustainability and marine biodiversity measures. Enforcement by (inter)national bodies is challenging, expensive and time consuming, placing greater responsibility on seafood companies to behave responsibly. Increasingly, stakeholders are calling for improved traceability. For seafood, this means data related to the species, catch location, catch date, gear type, vessel name, certification and any other information is linked to the fish at the time of harvest[244]. This requires significant investments from seafood companies in traceability technology. MSC and ASC apply the MSC Chain of Custody Standard, a traceability and segregation standard, to their full supply chain. This guarantees that MSC/ASC-labeled seafood products come from independently assessed and certified sustainable fisheries[245].

IMPACT OF AQUACULTURE ON ECOSYSTEMS

Aquaculture is one of the fastest growing food production industries but is criticized for its environmental impacts. For example, the impact of shrimp farming on coastal ecosystems can be severe. Seafood companies must ensure that aquaculture activities are developed in a way that does not threaten the functions and services of existing ecosystems.

CONFLICTS OVER LAND RIGHTS

Allocating productive resources such as land and water can lead to conflicts among competing users[231]. Consulting all stakeholders and ensuring that production activities are conducted in a sustainable manner can avoid conflict.

MULTI-STAKEHOLDER PARTNERSHIPS

The fishing industry operates in a complex environment and partnerships with governments, civil society, fishing communities and academics are necessary to deal effectively with global challenges.

THE INDUSTRY AS A DRIVER OF CHANGE

Many fishing operations literally take place behind the horizon without adequate monitoring or transparency. Most of the largest seafood companies are anonymous to the public and so far have not experienced strong pressure to be transparent about their operations. Even investors and lenders generally have limited insights into the particular risks that seafood companies, and therefore they, face.

International seafood companies are crucial for achieving sustainability in fisheries. The industry as a whole should transform into one that is capable of providing seafood for future generations. Its impact should remain within the carrying capacity of marine ecosystems and should allow depleted fish stocks to recover to healthy levels. A major step towards achieving these goals could be improving transparency and traceability. The traceability of wild-capture products can be split in two stages: pre-landing and post-landing. Many quality-control mechanisms are already in place that enable a seafood product to be traced from the shelf back to the point of landing. But the pre-landing phase, i.e. the fishing activities themselves or the transshipments and trade at sea, is much more opaque. Transparency about pre-landing activities could unlock the largely untapped data of the seafood industry. This could contribute to more accurate science for the management of fish stocks and better identification of any illegal practices.

Sustainable aquaculture has other aspects that will require improvements in sustainability, inter alia land-use rights, the exploitation of fish feed components (wild fish, soy, other) and the use of antibiotics and pesticides. Further down the product line, seafood companies could improve their involvement with the communities in which they operate, in terms of the conditions of sourcing, market access and processing.

Capture fisheries and aquaculture that improve on these issues would not only benefit the oceans and coasts and the people dependent on them; there is also a recognized market preference for sustainably sourced products. Raising company profiles by seeking more transparency will allow society to determine where the product originates and whether the sourcing was legal and sustainable. At the same time, it could help companies to better estimate true cost, waste and reduce risk, helping to secure seafood supply and ensuring sustainable supply in the long run.

15 WASTE MANAGEMENT

UN-HABITAT
2010 report
Solid Waste Management in the World's Cities

"A good solid waste management system is like good health: if you are lucky to have it, you don't notice it; it is just how things are, and you take it for granted. On the other hand, if things go wrong, it is a big and urgent problem and everything else seems less important."

INTRODUCTION

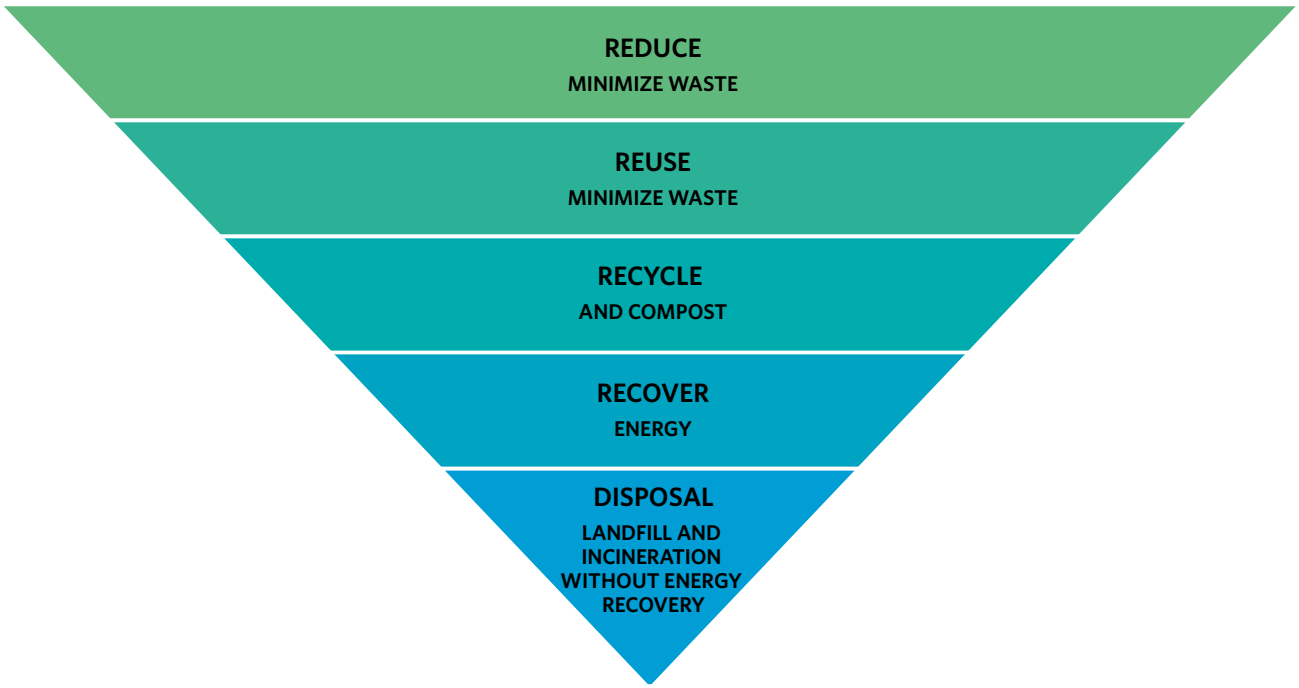
Until the emergence of the environmental movement in the 1960s, most waste disposal was uncontrolled: to land (open dumping), to air (burning or evaporation of volatile compounds) or to water (discharging solids and liquids to surface, groundwater or the ocean)[246]. Little attention was paid to the effects this could have on drinking water resources, health and the environment. Over the last 30-40 years, much has changed and countries and cities are increasingly seeking ways to control the growing amounts of waste produced. Whereas in Western countries waste management systems now focus heavily on reducing the amounts of waste generated and recycling, developing countries mainly focus on phasing out open dumps and establishing controlled disposal[246]. Recycling rates in developing countries are comparable with those in the West mainly due to numerous private players – individuals or micro-enterprises, often informal sector players – that offer waste collection services or pick up waste from streets and dumps and upgrade and trade it[246].

In general, the amount of solid waste[XIII] produced is determined by two main factors: the population in a specific area and consumption patterns linked to GDP. The global population is expected to grow to 9.2 billion in 2050, with cities absorbing almost all of the population growth[247]. Combined with rising GDP levels in developing countries, the amount of solid municipal waste is projected to double to 2.2 billion tons per year in 2025[248]. Sustainable waste management – reducing the volume of waste at source, improving sorting, and increasing recycling and waste recovery in the form of energy or materials – is necessary to handle waste in environmentally and socially acceptable ways. The waste hierarchy, the order of preference for action to reduce and manage waste, is depicted in figure 5.

It should be noted that local public authorities are responsible for the collection and disposal of municipal solid waste (MSW) (e.g. food waste, paper, textiles, garden waste, wood, rubber, plastics, metal and glass) although some large businesses are required to organize their own collection. Special waste producers are usually required by law to manage their own waste and hazardous waste requires dedicated collection and treatment to ensure safe handling and control[249]. So while waste management companies do not carry primary responsibility for collection, they play a crucial role in all stages of the waste hierarchy and in ensuring the safe disposal of waste.

FIGURE 5

WASTE HIERARCHY



INDUSTRY ANALYSIS

The industry was worth $250 billion in 2014, with industry growth of 2.8% CAGR between 2010 and 2014. The solid waste management segment represents over half (54.4%) of the industry's overall value. The Americas account for almost half of the global market[250]. The industry is fragmented, with many small and local companies. Many of the leading organizations are vertically integrated and thus present in all segments of the value chain: collection, transportation, processing, recycling or disposal and monitoring of waste material. The services offered by the industry are relatively homogeneous. Many of the players are only active in local markets.

The 25 largest waste management companies by revenue are listed in table 17. The market is dominated by companies from North America and Western Europe. As a result of the economic downturn, these companies have seen waste generation volumes drop. Many waste management companies have been left with overcapacity and margins are under pressure as bidding intensifies for municipal and business waste collection and processing contracts[251]. As a result, there is increased focus on scale and efficiency, with consolidation being driven by European and global waste companies in search of higher volumes.

TABLE 17

LARGEST WASTE MANAGEMENT COMPANIES BY REVENUE

	COMPANY	COUNTRY	2014 SALES ($million)
1	Waste Management	US	13,983
2	Veolia Waste Management	France	9,405
3	Republic Services	US	8,788
4	Suez Environnement Group	France	8,077
5	China Metal Recycling Holdings	China	6,865
6	Remondis	Germany	4,754
7	Clean Harbors	US	3,402
8	FCC	Spain	3,101
9	Schnitzer Steel Industries	US	2,544
10	Alba	Germany	2,341
11	Stericycle	US	2,143
12	Waste Connections	US	2,079
13	Progressive Waste Solutions	Canada	1,915
14	Tetra Tech	US	1,860
15	Urbaser	Spain	1,826
16	Covanta Holding	US	1,682
17	Transpacific Industries Group	Australia	1,341
18	Biffa	UK	1,331
19	Viridor	UK	1,294
20	Van Gansewinkel Group	The Netherlands	1,108
21	Shanks Group	UK	1,061
22	Chiho-Tiande Group	Hong Kong	931
23	Lassila & Tikanoja	Finland	774
24	Sound Environmental Resources Company Li	China	699
25	China Everbright International	Hong Kong	686

ISSUES, OPPORTUNITIES AND SOCIETAL DEBATE

CIRCULAR ECONOMY

Waste management companies play a vital role in the transition to a circular economy. In order to limit the extraction of natural resources, waste can be used as a valuable alternative, either as a form of energy or for reuse and recycling. Increasingly, there is political support for recycling and demand for secondary materials as a substitute for raw materials is on the rise, mainly driven by lower costs. However, only a quarter of all types of waste produced per year (4 billion tons) is currently diverted from disposal. The degree of source separation has a direct impact on the total amount of material that is recycled and the quality of these secondary materials[248]. MSW often contains valuable materials such as cardboards, plastics, glass and metals (up to 50% in developing countries), but recycling and waste valorization chains struggle due to the low price of secondary materials on the global market[249]. In developing countries, by contrast, most recycling activities are performed by the informal sector. Valuable products almost never enter the formal waste stream. There is significant untapped potential in these markets for the waste management sector. Composting, for instance, is a promising recycling chain in developing countries as around 50-80% of MSW consists of organic content[249].

In this context, urban mining – the extraction of minerals from existing, mainly electronic products that have reached their end-of-life stage (e-waste) – is an important concept. The worldwide demand for electronic goods is rising rapidly while product cycles are shortening. This is leading to growing amounts of e-waste which, if disposed of improperly, can have negative effects on human health and the environment. However, e-waste also contains valuable resources which can be recycled and thereby limit the need for virgin resources. For example, electronic goods contain 40-50 times the amount of gold and precious metals than ores mined from the ground[252].

MSW COLLECTION IN DEVELOPING COUNTRIES

According to UN-Habitat, the quality of waste management services is a good indicator of a city's governance[246]. If a local government cannot manage its waste properly, it is rarely able to manage other services like health, education or transport[248]. MSW collection is often the single largest budget item for local governments in developing countries whereas in high-income countries the main expenditure is on disposal[248]. MSW collection rates for cities in low- and middle-income countries differ widely, ranging from as low as 10% in peri-urban areas to 90% in commercial city centers. This means that many households receive no services at all and waste is dumped indiscriminately, increasing the risk of environmental pollution and disease. Collection rates for other types of waste tend to be higher as costs are lower and payment is more easily obtained[249].

For waste management companies, the volumes of waste generated in urban areas in countries like China, Brazil, Russia, India, South Korea and Indonesia represent interesting growth opportunities[251]. However, companies are highly dependent on (local) government policy because without supporting legislation, regulation and fiscal measures, larger companies are unlikely to step in. In addition, operating in developing countries requires a different business model due to a lack of infrastructure and the presence of extensive informal recycling, reuse and repair systems. Furthermore, the quality of waste from developing countries can be of very poor quality, making international technologies unsuitable.

DISPOSAL METHODS

In developing countries, open dumping remains the predominant means of disposal[249]. It is the most inexpensive disposal method but can have severe effects on public health, safety, ecosystems and water sources. Examples of environmental impacts include the contamination of water from direct contamination or leachate (liquids that pass through matter thereby accumulating dissolved or suspended contaminants) from dumps; long-term soil contamination (from e.g. heavy metals); the contribution of landfilled organic waste to GHG emissions (CO_2 and methane); the release of smoke and gaseous contaminants into the air as a result of uncontrolled burning (in particular plastics); and the damage to ecosystems surrounding the dump site[253]. Public health & safety impacts can include respiratory diseases, cancers and heart diseases attributable to smoke from burning solid waste; direct or indirect contact with polluted soil or water; potential spread of infections related to direct contact with waste or indirectly by vectors such as animals, flies and mosquitos, and accidents at dump sites, mainly involving scavengers[253]. Other types of disposal can also carry significant risks for human health and the environment if the right safety measures are not in place: for example, incineration can contribute to air pollution and ash disposal, and uncontrolled recycling of e-waste can lead to toxic chemicals being released into the air, water and the environment. Waste management companies have an important role to play in disposing of waste in ways that take into consideration the waste hierarchy, thereby preventing harm to the environment and public health.

RELATIONSHIP WITH THE SDGS

IMPACT OF THE WASTE MANAGEMENT INDUSTRY

PUBLIC HEALTH

Proper solid waste management is vital for maintaining public health. Uncollected solid waste provides a favorable habitat for insects, vermin and scavenging animals which proliferate and spread air- and waterborne diseases like the plague, dengue fever and diarrhea[249]. Research shows that rates of diarrhea and acute respiratory infections are significantly higher in areas were waste is not frequently collected[246]. Waste management companies can provide important collection services in the world's cities that can contribute to the protection of public health.

HAZARDOUS WASTE

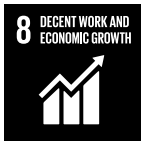
Hazardous waste is potentially harmful to public health and the environment and requires strict control regimes. Waste management companies provide important services that can prevent these harmful substances from ending up in the environment.

ENVIRONMENTAL IMPACT OF UNCOLLECTED WASTE AND OPEN DUMPS

When not disposed of properly, leachate accumulated in MSW can leak into the environment and contaminate surface and groundwater[249].

SOURCE OF RENEWABLE ENERGY

Incineration can reduce the volume of disposed waste by up to 90% and provide an alternative to the use of fossil fuels[248]. Incinerating waste with energy recovery is preferred over landfilling, provided the right air pollution control equipment is installed. Although this method is widely used in high-income countries, its use is limited in developing countries because of its high costs and stringent operating requirements. In addition, waste decomposing in landfills produces methane which can be extracted and used as an alternative energy source. Non-recyclable waste can serve as an alternative fuel in e.g. cement kilns.



INFORMAL JOBS IN URBAN AREAS IN DEVELOPING COUNTRIES

The solid waste market is one of the largest sources of employment in cities and provides up to 5% of urban jobs in low-income countries[249]. Over 2 million informal waste pickers work in the recycling industry in developing countries, providing a livelihood to a significant proportion of the urban poor[248]. However, these workers often face unsafe working conditions and low incomes, in particular when they are not supported by governments, not organized into cooperatives or not part of any formal waste management system.

DISADVANTAGED COMMUNITIES UNDERSERVED

The poor suffer disproportionally from a lack of waste collection services, particularly in informal urban settlements like slums[246]. For commercial waste collectors, serving rural areas is often unattractive from a cost-benefit perspective whereas poor areas in cities (e.g. slums and shantytowns) can be difficult to serve due to limited infrastructure, high population density and the difficulty of gathering collection fees. Companies can develop new, innovative business models that improve collection rates in underserved areas by for example, partnering with the informal sector.

SOLID WASTE COLLECTION IN CITIES

Solid waste is generally considered an 'urban' issue and is almost always in the top five of challenges facing cities[246]. Urban residents produce about twice as much waste as their rural counterparts. More than half of the world's population already lives in cities and urbanization is increasing rapidly. This will increase the need for sustainable waste management. Due to a lack of waste management services in many countries, it is still common practice to dispose of rubbish in unsafe landfills and illegal dumps or directly in rivers and sewers[254].

AMOUNT OF WASTE GENERATED

Various steps can be taken to prevent materials from ending up in the waste stream in the first place. Waste management companies' knowledge of materials and separation processes can help businesses to reduce their (primary) material use and improve the sustainability and recyclability of products (product design).

USE OF PRIMARY RESOURCES

Sustainable waste management and recycling systems can reduce the quantity of natural resources consumed by ensuring that resources already subtracted from nature are reused and that the amount of residual waste is minimized and treated in environmentally safe ways[254].

LANDFILLS

The vast majority of waste ends up in open dumps and landfills as it is the cheapest disposal method. Landfilling requires land availability and should be engineered and operated to protect the environment and public health. Landfills produce gases (including methane), which contribute to climate change when not recovered. Companies should invest in sustainable, low-impact disposal methods.

POSITIVE INFLUENCE OF RECYCLING ON ENERGY USE AND CO_2 EMISSIONS

Producing new products with secondary materials can save significant amounts of energy and CO_2. For example, the production of recycled aluminum requires 95% less energy than producing it from virgin materials[248]. Estimates by the European Commission show that the EU disposes of €5.25 billion worth of recyclables (e.g. paper, glass, plastics, aluminum, steel)[255]. If this were recycled, the equivalent of 148 million tons of CO_2 emissions could be avoided annually.

HAZARDOUS WASTE

Hazardous waste is dangerous and potentially harmful to public health and the environment and requires strict controls. Waste management companies provide important services that can prevent these harmful substances from ending up in the world's oceans.

LIMITING IMPACT ON LOCAL ECOSYSTEMS

Waste management companies have an important role to play in disposing of waste in ways that take into consideration the waste hierarchy. This can preserve and protect local ecosystems. Open dumping, landfilling and incineration without energy recovery are the least preferred options. Whereas in Europe landfilling is limited to the necessary minimum, other regions exhibit high landfill rates e.g. in North America, 91% of MSW is disposed of in sanitary landfills[248].

HAZARDOUS WASTE

Hazardous waste is dangerous and potentially harmful to public health and the environment and requires strict controls. Waste management companies provide important services that can prevent these harmful substances from ending up in the environment.

BRIDGING THE FORMAL AND INFORMAL SECTOR

Partnerships between formal partners, both public and private, are necessary to improve waste collection and disposal in developing countries. While local governments carry primary responsibility for waste collection, waste management companies can be valuable partners as they have important expertise and can achieve higher rates of efficiency than public sector players. However, the informal sector is an important component of the waste system in these countries, contributing to recycling rates and reducing the costs for solid waste management. Partnerships between public, private and informal sector players are therefore crucial for the improvement of waste management systems in developing countries.

THE INDUSTRY AS A DRIVER OF CHANGE

The waste management industry is of vital importance in the transition from a linear to a circular economy. The industry allows society to make better use of valuable resources, reduces dependency on primary resources and can lower CO_2 emissions. As the world continues to urbanize and develop economically, the importance of sustainable waste collection will increase. Poorly managed waste has an enormous impact on health, local and global ecosystems and the economy as it can result in high downstream costs[248]. However, waste collection and disposal, as well as legislation, monitoring and enforcement regarding waste, are often the primary responsibilities of local governments. This limits the direct influence waste management companies can have on improving collection rates and disposal methods.

Despite the (potentially) important role of waste management companies in developing countries, broad change in the industry is dependent on a shift in the role of (local) government institutions. Rather than providing waste services, these institutions would need to focus on regulation, delegation and monitoring of private sector players, and formulating clear roles and responsibilities. However, these institutions often lack the capabilities and capacity to manage such a transition. This limits the attractiveness for large waste management companies to step in despite the potential benefits of higher quality, more efficient service delivery for urban residents.

XIII Sources of solid waste: residential, industrial, commercial, institutional, construction and demolition, municipal services, process, medical, agricultural.

SUMMARY & CONCLUSION

SUMMARY OF THE FINDINGS

FIGURE 6

CONTRIBUTION TO THE SDGS BY INDUSTRY

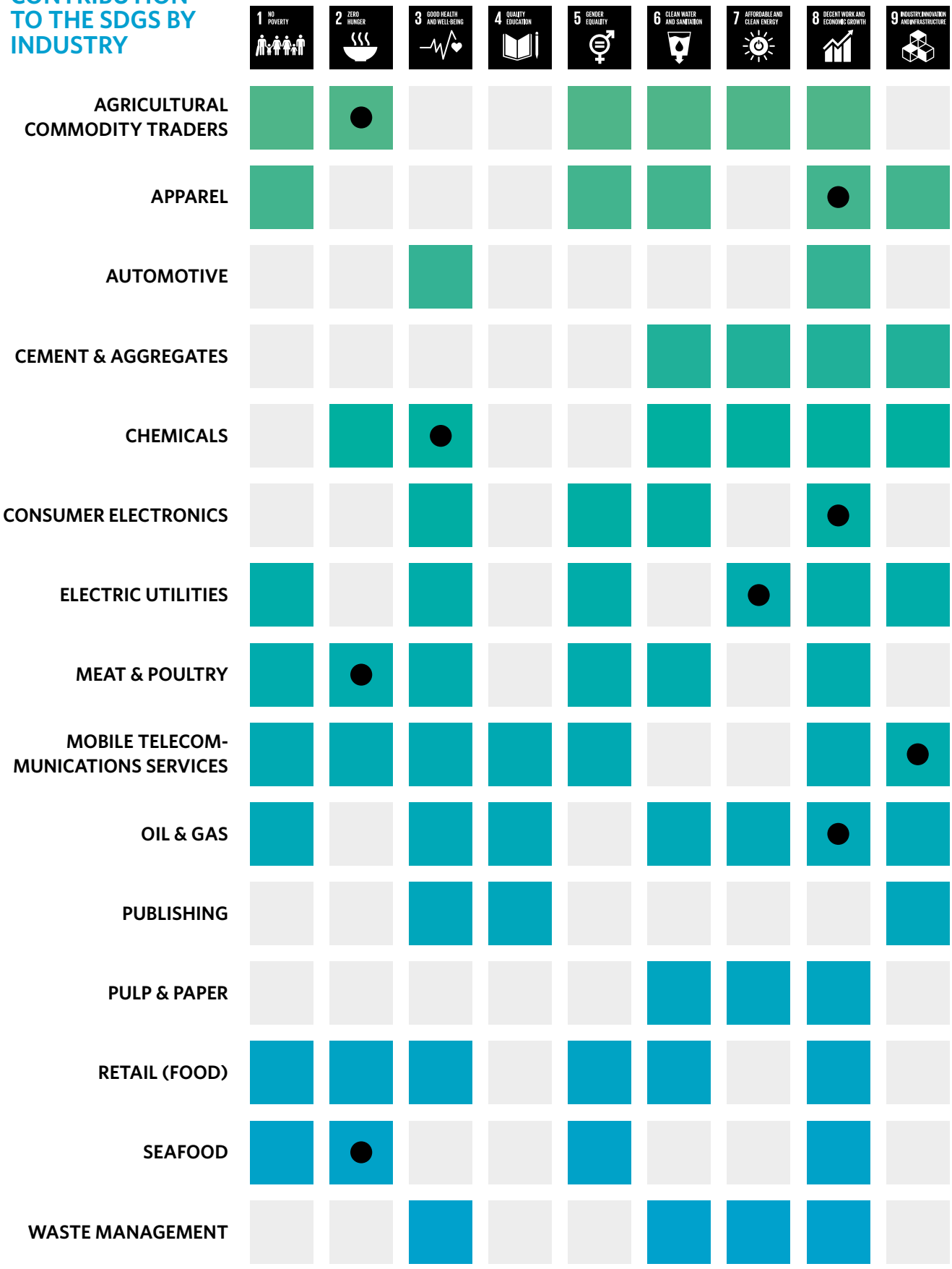
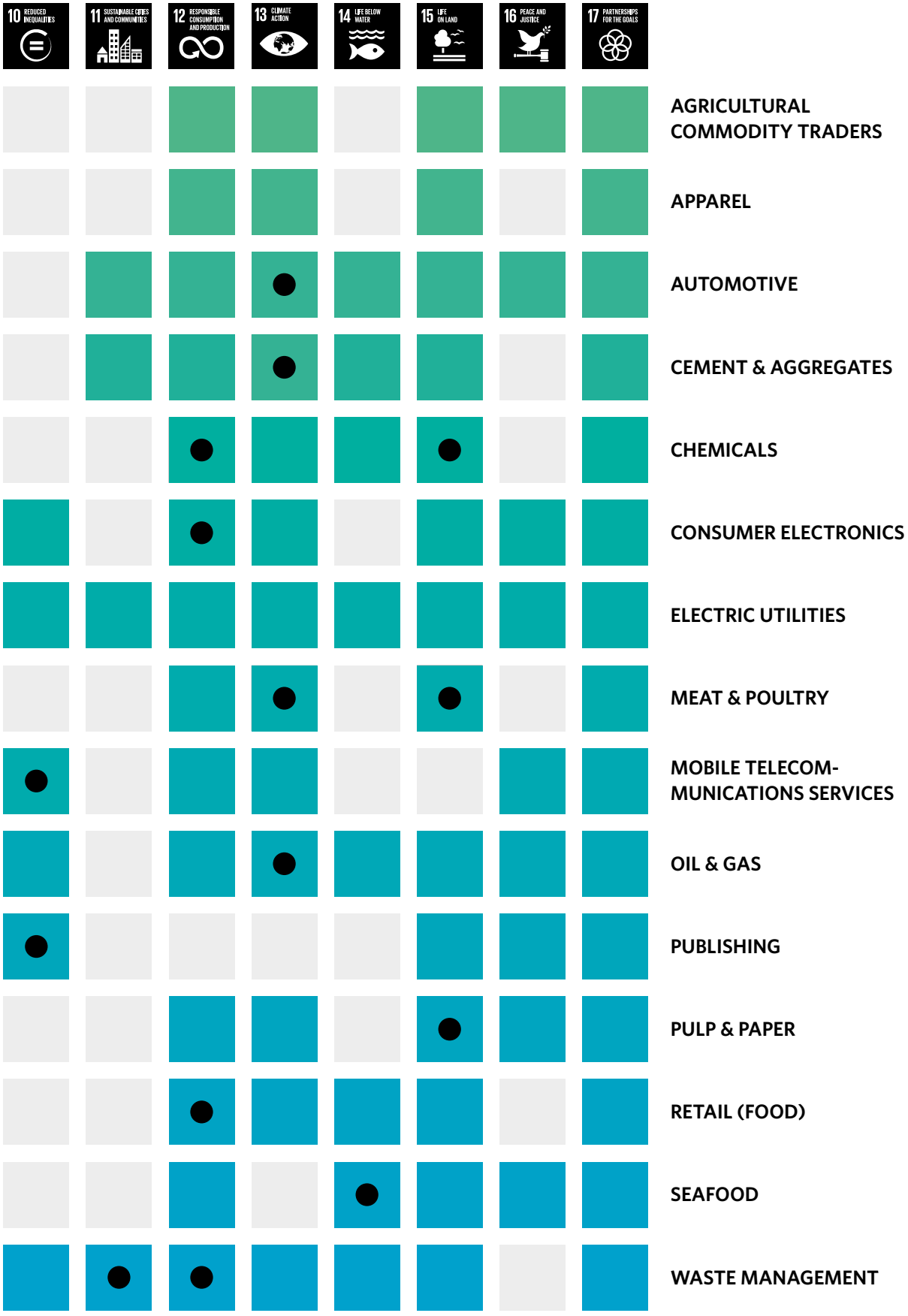


Figure 6 provides an overview of the (potential) contributions to the SDGs by industry. To support this table, a summary is provided of the impact of each industry on the identified SDGs on the next page.

- ● Most significant and actionable contribution
- Contribution
- Limited contribution



AGRICULTURAL COMMODITY TRADERS

Farmers producing commodity-like products mainly compete on price and volume. This dominant focus on price and volume risks further incentivizing farmers and governments to externalize the ecological and human cost of agricultural production in order to remain competitive. This mechanism creates a race to the bottom, potentially driving soil degradation, deforestation, hazardous labor conditions and water shortages. Agricultural commodity traders can facilitate the trade in sustainable products and leverage their relationships with farmers to help them adopt more sustainable production methods (SDG 2). Effectively promoting sustainable agriculture would reduce the pressure on water resources (SDG 6) and ecosystems (SDG 12 and 15), and reduce energy use and GHG emissions (SDG 7 and 13). The adoption of more inclusive trade relations would likely have a positive effect on poverty reduction (SDG 1), empowerment of female farmers (SDG 5) and working conditions throughout the supply chain (SDG 8), and could prevent the violation of (informal) land rights (SDG 16).

APPAREL

Outsourcing production to low-wage countries is a common practice in the apparel industry, which employs over 25 million garment workers in developing countries. As companies in the sector operate worldwide with a large variety and number of (sub) suppliers, adherence to and enforcement of codes of conduct and ethical standards are necessary to ensure proper and safe working conditions, living wages, freedom of association and collective bargaining, and decent working hours (SDG 8). This will especially benefit women, who make up 80% of the apparel industry's workforce (SDG 5). In addition, the industry contributes to the process of industrialization and creates economic opportunities (SDG 9) and employment (SDG 8), which can help lift people out of poverty (SDG 1). From a sustainability standpoint, the industry has significant potential to lower its water, energy and chemical footprint (SDG 6, 12, 13 and 15).

AUTOMOTIVE

Transportation is the single biggest source of CO_2 emissions. Without aggressive mitigation efforts this will only rise as demand from emerging and other developing countries increases (SDG 13). This emphasizes the need to decouple transport emissions from GDP growth to combat climate change (SDG 13) and ocean acidification (SDG 14). The automotive industry can contribute to this decoupling by enhancing fuel efficiency and the mainstream introduction of zero-emission engines such as electric and hydrogen. Lowering emissions will make a major contribution to improving public health (SDG 3), especially in cities (SDG 11). The other important sustainability issues faced by the automotive industry relate to its heavy reliance on raw materials and rare earth metals (and potentially conflict minerals) (SDG 12, 15 and 16) and working conditions in the supply chain (SDG 8).

CEMENT & AGGREGATES

Cement production is extremely energy, water, resource and emission intensive and accounts for 5% of global man-made GHG emissions (SDG 6 and 13). Companies can undertake efforts to limit emissions and dependency on natural resources by substituting traditional, carbon-intensive clinker for alternative fuels and raw materials, using modern equipment and improving recycling rates (SDG 6, 7, 12, 14 and 15). Finally, the cement industry can contribute to building sustainable infrastructure and cities (SDG 9 and 11). Working conditions (SDG 8) should remain a point of attention to eliminate injuries and fatalities.

CHEMICALS

Health & safety is a concern at both the production (SDG 8) and use phase of chemical products (SDG 3). Understanding of the way these ingredients affect human health and the environment during the use phase and after disposal is still growing. Chemical companies can make enormous progress by replacing harmful but still widely applied material ingredients with safer alternatives. On the life science front, the industry provides solutions that help to treat patients but can also aid in the prevention of non-communicable diseases like obesity and diabetes (SDG 3).

With an expected increase in demand for food (SDG 2), energy (SDG 7 and 13) and materials (SDG 12), society faces the challenge of creating more value with fewer (virgin) resources. Through its products and innovations, the chemical industry can contribute to food availability and the nutritional value of food (SDG 2), and enable a circular economy and sustainable industrialization (SDG 9) by introducing and scaling up solutions for renewable, safe and reusable alternatives to complex, scarce and/or polluting resources (SDG 6, 7 and 14).

Through its products, the chemical industry is uniquely positioned to influence humanity's ability to stay within the critical planetary boundaries that define the safe operating space for humanity. These boundaries put pressure on the industry to adapt but also offer opportunities for new products and solutions (SDG 13, 14 and 15).

CONSUMER ELECTRONICS

The supply chains of electronics companies are global, with production often outsourced to low-wage countries. As companies in the sector operate worldwide with a large variety and number of contract manufacturers, predominately young women (SDG 5), adherence to and enforcement of codes of conduct and ethical standards are important. This can ensure respect for workers' health & safety, living wages, union rights, decent working hours and the limited use of short-term contracts (SDG 8). Other social issues further down the supply chain revolve around the use of rare earth metals and potential conflict minerals (SDG 16).

In addition to the environmental and health issues related to the use of heavy metals, chemicals (SDG 3, 6 and 15) and energy in all stages of the life cycle of electronic equipment (SDG 13), e-waste is an emerging and fast-growing waste stream with complex and hazardous characteristics (SDG 12). Rapid technological innovations, ever-shortening life spans and the rise of low-cost mobile devices (SDG 10) are major contributors to the growing amount of e-waste. The industry has an important role to play in reducing the amount of e-waste by moving to more circular business models and taking greater responsibility for the collection, handling and recycling of e-waste, of which only 10-40% is properly recycled and disposed (SDG 12).

ELECTRIC UTILITIES

Electric utilities are ideally positioned to introduce cost-effective measures that drive the transition towards a low-carbon energy system (SDG 7). In addition, some 1.3 billion people have no access to electricity and a billion more only have access to aged, unreliable electricity networks. The industry can develop scalable business models, both grid and off-grid, to increase access to modern energy (SDG 7). Access to reliable energy is also an enabler of sustainable development (SDG 1, 3, 5, 8, 9, 10 and 11), and the transition to clean energy and energy savings (SDG 12) would make a major contribution to combating climate change and its negative effects on oceans and terrestrial ecosystems (SDG 13, 14 and 15). Consulting and engaging local communities and applying responsible sourcing principles can avoid contributing to conflicts over land and natural resources (SDG 16).

MEAT & POULTRY

With rising incomes in emerging markets and other developing countries, demand for meat is on the rise (SDG 12). Sustainable intensification can lower the negative environmental impacts of agriculture and, if managed properly, reduce the incidence of animal cruelty, poor working conditions (SDG 8) and overuse of antibiotics (SDG 3). Livestock raising outside large-scale farming systems creates economic opportunities for smallholder farmers, especially women (SDG 1 and 5).

The livestock sector is estimated to be responsible for 14.5% of man-made GHG emissions. The sector can deliver a significant share of the necessary mitigation efforts to tackle climate change within the existing system (SDG 13). Major potential lies with ruminant systems that operate at low productivity.

Livestock production accounts for 70% of all agricultural land and 30% of the land surface of the planet. It is a key factor in deforestation and land degradation. Companies can implement business practices that promote natural resource conservation (SDG 12 and 15) and prevent the depletion and contamination of freshwater reserves (SDG 6).

MOBILE TELECOMMUNICATIONS SERVICES

Some 450 million people still live out of reach of a mobile signal and 4.3 billion people are not online. Low-income countries and rural and disadvantaged areas in particular suffer from a lack of fixed and mobile broadband infrastructure (SDG 9). Telecommunications service providers can help to bridge the digital divide, creating new economic opportunities and facilitating access to agricultural, health, educational and financial applications and services (SDG 1, 2, 3, 4, 5, 8 and 9).

Mobile telephony and broadband are considered key drivers of growth and development. The industry can reduce communication costs and improve access to information on e.g. social, economic, health (SDG 3) and political topics (SDG 16). Ensuring equitable access for all will prevent countries and regions from falling behind (SDG 10).

Additionally, data centers supporting connectivity use vast amounts of energy. Ensuring these centers are efficient and progressively rely on clean energy will help to mitigate climate change (SDG 13). Actively reducing the amount of e-waste can contribute to more sustainable consumption patterns (SDG 12).

OIL & GAS

Oil & gas projects engender significant amounts of spending and earning in low-income regions. Oil & gas companies should ensure inclusive operations that allow local communities to reap long-term benefits from their activities (SDG 1, 4, 6, 9 and 10). Improving transparency on payments by oil & gas companies to governments can help to hold both governments and companies to account (SDG 16).

Burning fossil fuels is the major cause of climate change (SDG 13) and has serious health impacts (SDG 3). Caps on CO_2 emissions will require a major overhaul of the global energy supply system. Oil & gas companies can enable this transition by developing portfolios with progressively lower CO_2 intensity (SDG 7 and 13). Efficient, clean and low-waste operations (SDG 12) that limit negative effects on freshwater reserves (SDG 6), oceans (SDG 14) and ecosystems (SDG 15) will continue to play a key role in the industry.

PUBLISHING

The business model of publishers revolves around copyrights. While these protect the rights of authors and publishers, they can also impede the widespread dissemination of information. As knowledge is considered the least expensive input for development, publishers are uniquely positioned to help close the knowledge gap between and within countries (SDG 10), potentially impacting health (SDG 3), education (SDG 4) and the freedom of expression (SDG 16). Digitalization can overcome the lack of information, knowledge, education and publishing infrastructures (SDG 9).

Despite digitalization, print is still an important medium requiring vast amounts of paper that need to be sourced responsibly (SDG 15).

PULP & PAPER

Virgin wood remains the major feedstock for the pulp & paper industry. Natural forests will not be able to sustainably support the growing demand (SDG 12) for paper and packaging but are still under threat from further clearing as the industry tries to fulfil global demand. As the largest private owners of natural forest concessions, pulp & paper companies have a major role to play in protecting these natural forests and thereby contributing to zero-deforestation targets (SDG 13 and 15). In addition to improved stewardship of forest and plantation concessions, the industry can contribute to the creation of employment opportunities and better working conditions (SDG 8), protect (informal) land rights of indigenous people and local communities (SDG 16), and limit energy and water usage (SDG 6 and 7).

RETAIL (FOOD)

Food retailers can use their strategic position in the value chain to influence both consumers and suppliers. As food retail outlets have become the main suppliers of food for consumers around the world, they can use their power to promote the uptake of more sustainable products and educate consumers about healthy food (SDG 3), the environmental and social impact of products (SDG 12) and food waste (SDG 12). In addition, retailers can stimulate suppliers to adopt more sustainable, inclusive and sustainable production methods (SDG 1, 2, 5, 6, 8, 13, 14 and 15) and reduce waste at their own facilities (SDG 12).

SEAFOOD

Fisheries and aquaculture contribute to global food security as they provide an essential source of animal protein (SDG 2). In addition, seafood is a main source of income for many coastal communities and one of the most important export products for many developing countries (SDG 1). Large seafood companies can often fish with few limitations, depriving fishing communities, especially women, of their livelihood (SDG 5, 8 and 16) and source of protein (SDG 2). Labor conditions within commercial fisheries and aquaculture remain problematic as slavery, human trafficking and forced labor are still known to occur (SDG 8).

Overfishing is the second biggest threat to our oceans after climate change and the biggest threat to the seafood industry itself. Significant volumes of fish on the global market come from illegal, unreported or unregulated (IUU) fishing activities, putting additional stress on the world's fish stocks (SDG 14). Sustainable fishing quotas, stewardship of both marine and terrestrial ecosystems (SDG 14 and 15) and improved monitoring and traceability (SDG 12) will be increasingly important to prevent fish stocks from collapsing and to allow overfished stocks to recover.

WASTE MANAGEMENT

Solid waste is considered an urban issue. With rapid urbanization, the need for sustainable waste management services is increasing, especially in poor urban areas (SDG 10 and 11). Adequate waste management prevents harmful substances from being released into the environment (SDG 6, 14 and 15) and thereby helps to protect public health (SDG 3). The informal waste collection sector is currently an important source of income for many of the urban poor in developing countries yet working conditions are often substandard. Incorporating informal waste collectors into the formal waste management system can increase collection and recycling rates in cities and improve working conditions (SDG 8).

Waste management companies are important enablers of a circular economy. Sustainable waste management and recycling and reuse systems can reduce the amount of primary resources consumed (SDG 12) and the impact on local ecosystems (SDG 15). Waste that cannot be recycled can still be used to generate energy instead of being consigned to landfills (SDG 7 and 13).

IMPLICATIONS OF THE FINDINGS

NATURE OF THE CONTRIBUTION

The findings of this landscape study demonstrate that all the industries featured have the potential to make a significant contribution to achieving the SDGs. The findings also show that the nature of this contribution varies greatly from industry to industry as does the number of SDGs to which an industry can be linked. In other words, companies that address the issues or challenges on which they can have an impact are likely to contribute to the potential achievement of multiple SDGs. The issues addressed by these SDGs will therefore have to be the central themes of future industry indices. The nature of the issues and challenges can be categorized as follows:

- *Transition*
  Move away from traditional to more sustainable business models that enable a low-carbon and circular economy. Companies can do this by reducing their dependency on fossil fuels and non-renewable resources and focusing more on renewables and a circular use of materials. This applies most to the automotive, chemical, electric utilities and oil & gas industries. Transitions in these industries will significantly contribute to the SDGs on energy (7), sustainable production and consumption (12) and climate change (13).

- *Compliance*
  Ensure operations comply with stringent national and international labor, health & safety and environmental standards throughout the supply chain. This is particularly relevant to the apparel, consumer electronics, food retail and oil & gas industries as significant parts of production take place in low-wage countries. Improved compliance will contribute to the SDGs on productive employment and decent work (8) and sustainable production and consumption (12).

- *Stewardship*
  Responsible use and protection of natural resources and ecosystems through conservation and sustainable practices to ensure availability for future generations. This is most applicable to agricultural commodity traders, pulp & paper and seafood. Stewardship by these industries will contribute to the SDGs on food security and sustainable agriculture (2), oceans (14) and terrestrial ecosystems (15).

- *Access*
  Provide access to products and services that have become issues of equity. This is most relevant for electric utilities, mobile telecommunications services, publishing and waste-management services. More equitable access will contribute to the SDGs on inclusive industrialization (9) and inequality (10).

- *Environmental footprint*
  Improve and implement more sustainable production methods to progressively lower environmental footprints. This particularly relevant for industries where the impact can be made through incremental enhancements within the existing system, when deployed at scale. This applies to cement & aggregates, food retailers and meat & poultry, and will impact the SDGs on sustainable agriculture (2), sustainable production and consumption (12), climate change (13) and terrestrial ecosystems (15).

SELECTION CRITERIA

Based on the industry studies and the general Theory of Change (see Appendix 1), Index Initiative identified a number of criteria for selecting industries subject to a feasibility study. These criteria can be categorized as *qualifying* and *conditional*. Qualifying criteria relate to the potential impact of an industry on sustainable development. These criteria must be fulfilled if an index is to be justified. Conditional criteria, while not essential, give an indication of the applicability and usability of an index as a means for change. Combined, these sets of criteria support the selection of industries for which indices have the highest potential added value.

QUALIFYING CRITERIA

Unique

The degree to which the contribution of an industry is unique to and pivotal for achieving one or more SDGs. This partly determines the necessity to engage and stimulate a particular industry to contribute to achieving the SDGs. Seafood is an example of an industry with a unique impact on a specific SDG (oceans) as, besides climate change, overfishing is the biggest threat to our oceans.

Actionable

The industry can meaningfully influence its contribution through (enhancing) its products, services, supply chains and operations, i.e. the SDG is close to the industry's core business. The chemicals industry, for instance, can greatly impact the 'circularity' of materials through its products. The landscape study shows that the ability of an industry to act can be limited as a result of its position in the value chain or its dependency on government regulation. Waste management is an example of an industry whose contribution is conditioned by (local) governments.

Significant

The role of the industry in achieving the SDG is significant, i.e. the contribution of the industry is direct and its impact on the SDG is considerable. For example, nearly all industries directly impact climate change, but the oil & gas and electric utilities industries have the greatest impact.

CONDITIONAL CRITERIA

Peer recognition

The extent to which global players within an industry can be meaningfully compared depends on the level of peer recognition. Peer recognition is determined by the degree of direct competition and comparability in terms of size (based on revenue, volume, customer base etc.) and business model. E.g. automotive is an industry with a high level of peer recognition as nearly all major brands compete globally in multiple market segments.

Market concentration

An index is most (cost) effective when a limited number of companies control a significant global market share. Assessing and comparing a large number of companies to reach a significant share of the market is costly and may diminish the value companies attach to their position in an index. Agricultural commodity traders, for example, have a high level of market concentration as only a handful of companies dominate the market for the world's most traded agricultural commodities.

Stakeholder interest

The interest in an industry index from key stakeholders depends on the priority given to the issues at stake for society at large (e.g. by civil society) and/or their relevance to the future of the industry (e.g. by investors). The apparel industry, for example, has faced intense stakeholder scrutiny since the Rana Plaza factory tragedy in Bangladesh.

Stakeholder influence

This is determined by the degree to which key stakeholders use the insights created by an index to influence strategic decisions and challenge the existing business models of individual companies. For example, in the pulp & paper industry, insights into company-level performance on forest stewardship can directly influence the sourcing decisions of buyers seeking to minimize exposure to reputational risk.

CONCLUSION

The main objective of this study was to identify the areas where industries are best positioned to serve society's most pressing needs. Our findings show that many industries have a wide-ranging impact and that the contribution of particular industries to achieving one or more SDGs is unique and crucial. As the aim of Index Initiative is to introduce new indices that encourage and inspire companies to initiate positive change, we have outlined below the most significant potential and notable limitations of an index for each industry based on the results of this landscape study.

INDEX POTENTIAL AND LIMITATIONS

AGRICULTURAL COMMODITY TRADERS

An index for this industry could leverage the influence of traders in promoting sustainable and inclusive agriculture. The potential impact is substantial given the millions of farmers around the globe who can be reached through traders' sourcing activities. Traders are increasingly integrating their supply chains, thereby enlarging their sphere of influence and potential impact. However, as these traders continue to operate predominantly as intermediaries – buying high volumes with low margins – it has to be assessed to what degree their actual influence corresponds with their size and level of market concentration.

APPAREL

The apparel industry indirectly employs over 25 million garment workers (of which 80% are women) in developing countries. This puts it in a unique position to improve the working conditions of millions of people. However, the dominant business model in the sector, also referred to as 'fast fashion', limits sustainable, long-term relationships with suppliers. As brands and retailers aim to anticipate changes in the market with incredible speed, they employ flexible sourcing practices which prioritize price and delivery time. More focus on durability, coupled with longer term relationships with suppliers, would allow for significant improvements in social and environmental issues in the supply chain. It is uncertain how effective an index could be in promoting the progressive adoption of more sustainable business models due to the commercial success of the current model and the low degree of market concentration within the industry.

AUTOMOTIVE

The automotive industry can contribute to decoupling GDP growth and urbanization from increases in GHG and toxic emissions through enhanced fuel efficiency and the large-scale introduction of zero-emissions engines such as electric and hydrogen. Given the emergence of more stringent government regulations around these issues and strong consumer demand for fuel-efficient vehicles, the market leaves little room for laggards. As a result, nearly all automotive companies are engaged in developing cleaner vehicles. The situation is less clear cut further down the supply chain where both sustainability issues and performance are more diverse. However, most of these issues are already high on the industry's agenda and considerable consensus has been achieved on necessary actions. This limits the added value of an index.

CEMENT & AGGREGATES

Improving the environmental footprint of cement is one of the most cost-effective ways to make construction more sustainable. Considering the rapid rate of urbanization and the corresponding demand for cement, this is an important and obvious area to tackle. However, the cement industry is relatively anonymous. It faces limited stakeholder scrutiny and is an infrequent topic of public debate. These factors make it less likely that stakeholders would use the index outcomes to engage with individual companies. In addition, companies often compete regionally as cement is expensive to transport. The industry's main contribution lies in lowering GHG emissions, but although the potential for reduction is substantial, it is significantly less than e.g. the oil & gas or electric utilities industries.

CHEMICALS

The chemical industry is uniquely positioned to develop solutions that influence humanity's ability to stay within the limits of the planetary boundaries. Many of these solutions will be based on the use of bio-based feedstock, the avoidance of toxic chemicals and the application of 'circular principles'. Widespread application of these principles could elevate the sustainability performance of almost every industry but would require a significant transition in the chemical industry itself. This transition will be difficult but crucial for the overall competitiveness of individual companies in the long run. An index could therefore offer valuable predictive indicators for future competiveness and (sustainability) performance of individual companies. However, developing indicators that can be applied to a wide range of chemical companies with differing portfolios will be challenging.

CONSUMER ELECTRONICS

An index could focus on improvements in environmental and working conditions in the supply chain and/or the durability and after-use of electronic equipment ('circular electronics'). In response to stakeholder scrutiny, the industry has responded with a broad range of measures often leading to tangible improvements in supply chain transparency (traceability). However, more transparency is needed around working conditions and a more responsible approach to e-waste, which is a growing and global problem. While governments are introducing stricter regulation and enforcement mechanisms regarding the management and handling of e-waste, the industry can move to a more circular business model. As the issues are diffuse and several (industry) initiatives have emerged that already address these issues, this limits the added value of an index for this industry.

ELECTRIC UTILITIES

Electric utilities can accelerate the introduction of cleaner and more inclusive energy systems. The industry is well positioned to take cost-effective measures to drive the transition towards a low-carbon energy system. In addition, it could invest in infrastructure to reach the 1.3 billion people that currently have no access to electricity. As access to electricity is an enabler of development, electric utilities are crucial for achieving the SDGs. However, an index might not be an effective instrument to bring about change. Electric utilities are, even when formally privatized, very much guided by government policies and regulations and often compete regionally. This has a significant impact on the pace at which different companies are transitioning to lower carbon sources of energy. As a result, regulations and target setting by governments are probably more effective means to steer the industry to more sustainable and inclusive operations.

MEAT & POULTRY

As meat consumption continues to increase, so will the importance and impact of the meat & poultry sector through their substantial claims on natural resources such as land and water. The influence of an index that focuses on diminishing the industry's environmental footprint would be limited because most of the efficiency gains are with smallholder farmers, who generally raise animals in suboptimal conditions. In addition, an index does not tackle one of the core problems, which is the large share of animal proteins in the diet of consumers in developed and emerging economies.

MOBILE TELECOMMUNICATIONS SERVICES

Mobile telecommunications providers can help to bridge the digital divide by connecting the more than 4 billion people that currently lack access to broadband internet. This is of crucial importance in a world where access to broadband internet is vital for economic and social inclusion. Mobile telecommunications providers are in the unique position to provide this connectivity. However, their role and contribution should be determined and assessed in relation to the role of governments and other ICT companies.

OIL & GAS

Oil & gas companies can support local communities by enabling them to benefit more and longer from the economic activities that come with the extraction of oil & gas. In addition, they have to do so in a world where they are expected to progressively transition towards lower carbon energy sources. This is an enormous challenge and the stakes are high as reducing GHG emissions will be crucial to limit the average global temperature increase to 2˚C. The industry is therefore under close scrutiny from a wide range of stakeholders. An index could add value by clarifying societal expectations and tracking the positions, performance and transition of individual companies accordingly.

PUBLISHING

Opportunities for development and the protection of basic rights are dependent on the information that is the commodity of trade for the publishing industry. Publishing companies can contribute to the SDGs by providing better and more equal access to this information. The industry's impact on various goals around education, health, justice and equality will nevertheless remain relatively low compared to the positive and widespread potential of the public sector, making the case for an index less appealing.

PULP & PAPER

The considerable forest footprints of a relatively small number of companies makes the pulp & paper industry unique. Other industries/crops that have been linked to deforestation like palm oil and soy are mostly managed by individual farmers. Based on this footprint and concentration, the industry can make a significant contribution to issues such as deforestation and ecosystem restoration. Pulp & paper is a globally traded commodity but production operations are mainly regional and concentrated around company's forest concessions. Stewardship practices differ from one region to another, which can complicate meaningful comparison between companies operating in different regions.

RETAIL (FOOD)

The key position of retailers in the food supply chain allows them to influence sustainable production on the one hand and sustainable consumption on the other. However, this potential impact, although significant, is diffuse and influence over suppliers diminishes further down the supply chain where suppliers are concentrated or purchase volumes are low. Influence also differs per product and supplier (private label vs. brand) making it hard to assess company performance accurately. In addition, several issues (like unethical purchasing practices) will be hard to measure because they tend to take place under the radar. In other words, the sustainability issues faced by the industry are too diverse and the direct impact of retailers on some of these issues is expected to be too limited to capture them accurately and fairly in an index.

SEAFOOD

Companies can help to ensure access to seafood for local communities and future generations by conserving marine resources and ecosystems. While much effort has been made to improve and certify regional fisheries, little is known about the corporate performance of the largest seafood companies as they are opaque about their policies and practices. An index could potentially fill this gap but would need to overcome a considerable lack of transparency in the industry to be effective.

WASTE MANAGEMENT

As the world continues to urbanize and develop economically, the importance of sustainable waste collection will increase. This is particularly the case in developing countries where urbanization rates are high and the level of waste management is low. Adequate waste management can have significant positive effects on public health, the environment and the economy. However, waste collection is often the primary responsibility of local governments and companies frequently operate in one region or country. This limits the direct influence of waste management companies on improving collection rates and disposal methods globally and in countries where needs are greatest. An index that assesses company performance will thus have little added value, despite the (potentially) important role of waste management companies in developing countries.

INDUSTRIES SELECTED FOR A FEASIBILITY STUDY

Index Initiative is constrained to select a five industries for a future feasibility study. This makes the final selection to some extent arbitrary as this study demonstrates that multiple industries would be suitable for further assessment. In addition to the impact on the SDGs and the selection criteria, additional weight has been given to industries where there is relatively little clarity on the role and responsibility of companies. Industries like apparel, consumer electronics and pulp & paper have not been selected as there is currently significant momentum around the issues most relevant to them.

Index Initiative will start the respective feasibility studies in 2015. The first results are expected to be published during the course of 2016. The five industries that have been selected are:

AGRICULTURAL COMMODITY TRADERS

The potential impact of this industry on our global food system is enormous, yet its role remains poorly understood and is a topic of constant debate. The feasibility study will further assess the influence of traders on improving the sustainability of agricultural practices, the inclusion of smallholder farmers in their supply chains and agricultural commodity traders' potential to contribute to food security.

CHEMICALS

As nearly all manufactured products rely on chemistry, the systemic importance of the industry in making the global economy more sustainable is high. An index that assesses and compares the ability of individual chemical companies to enable other industries to become more sustainable can potentially add great value. The feasibility study will assess how chemical companies can accelerate sustainable chemistry and how the performance of companies with widely differing product portfolios can be meaningfully compared.

MOBILE TELECOMMUNICATIONS SERVICES

Access to the internet has rapidly become an issue of equity for people all over the world. Bridging the digital divide is of vital importance for creating more equitable and inclusive societies and economies, and stimulating development. The providers of mobile telecommunications services appear well positioned to help to bridge this divide, offering the main justification for further investigating the added value of an index. The feasibility study will focus on the specific role of telecom companies vis-à-vis stakeholders such as governments and other ICT-related industries.

OIL & GAS

The oil & gas industry has a direct and significant impact on the communities and ecosystems in which it operates. In addition, climate change – caused by burning fossil fuels – is already having a measurable effect on the planet. The feasibly study should demonstrate whether an index can clarify the role and responsibilities of the industry in a world committed to limiting the average global temperature increase to 2˚C, while ensuring host countries and communities can benefit from the industry's extraction activities.

SEAFOOD

Millions of people rely on seafood as a source of protein and income, making fisheries of vital importance to global food and economic security. After global warming, fisheries have the second biggest impact on the overall health of oceans. Given this impact, the level of transparency in the industry is notably low. The feasibility study will have to demonstrate whether an index can support improved stewardship of marine ecosystems by promoting transparency and accountability throughout the industry.

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APPENDIX 1

THEORY OF CHANGE FOR INDUSTRY INDICES FOR SUSTAINABLE DEVELOPMENT

The process of developing and publishing an industry index helps to clarify societal expectations of the contribution companies can make to sustainable development, and the extent to which companies meet those expectations. This general Theory of Change, a method used to define the building blocks required to achieve a given long-term outcome, describes how an index seeks to influence companies' impact on society. Integral to this method is the articulation of the assumptions stakeholders make to explain the change process and the expectations about how and why the proposed interventions will bring this change about. The way in which key internal and external stakeholders use and perceive the index is critical in the Theory of Change.

There are a number of potentially relevant stakeholder groups that can influence companies' impact on society, including:

- Civil society organizations
- Governmental organizations (local, national and international)
- Investors and banks
- Academia and knowledge institutes
- Company boards and senior management
- Employees
- Worker representatives/organizations
- Customers
- Consumers
- Industry peers
- Citizens
- Media

THEORY OF CHANGE BUILDING BLOCKS

The Theory of Change differs from index to index as it is adapted to a specific industry and its key stakeholders. Each index identifies the stakeholders most relevant to the industry and the SDGs at stake, seeking to engage these stakeholders in the index development process. The following elements will be addressed in each industry-specific Theory of Change:

Sustainable development impact

Companies are in a unique position to contribute to specific SDGs. Stimulating companies to best utilize their position is the main justification for an index. An industry's potential impact on particular SDGs therefore needs to be significant and actionable.

Public debate

Industries that have a substantial impact on society are increasingly subject to public scrutiny and debate. Yet key stakeholders often do not have shared and articulated views on what companies should do to achieve specific SDGs. An index can help stakeholders to articulate their expectations, in a way that is operational to companies.

Clarification of societal expectations

An index assesses and compares company performance against societal expectations. Clarifying and reaching consensus on these expectations through extensive multi-stakeholder dialogue is essential to the credibility of and value created by an index. The broader the support for this consensus, the harder it is to ignore and the more likely insights generated by the index will indeed be used by internal and external stakeholders.

Company assessment and comparison

An index provides clarity by assessing and comparing company performance. This:

- *shows how companies perform against societal expectations*
  An index establishes practical indicators that measure corporate performance. By creating straightforward metrics and points of comparison, an index shows where and how individual companies contribute to specific SDGs.

- *stimulates the disclosure of non-financial information*
  Decisions taken by company stakeholders (e.g. investors, banks, customers, peers, governments) are based on the information available to them. Lack of reliable and comparable data is one of the biggest obstacles to the integration of sustainability targets in decision-making processes. An index collects and publishes information that would not otherwise be disclosed or in some cases even produced.

- *recognizes the contribution of the industry and individual companies to sustainable development*
  Companies can be encouraged to adapt their policies and practices through positive or negative enticements. An index triggers a socialization process that recognizes good practice but also shows where industries or individual companies are lagging behind and where improvements are required.

- *identifies and disseminates good practice*
  Good practice is an excellent way to illustrate how companies can contribute and where others can improve. In addition, identifying and highlighting innovative business practices can stimulate their scale-up and widespread adoption.

Stakeholder engagement

The insights that are created by developing and publishing an index can be used by internal and external stakeholders as they seek to influence the strategy and business models of a company. The results of an index:

- *enable evidence-based engagement by external stakeholders*
  Stakeholders have distinct relationships with companies. This puts them in a unique position to push companies to enhance their contribution to global sustainable development targets. However, stakeholders often lack the tailored information needed to do this. An index produces detailed data on the strengths and weaknesses of individual companies, providing an important basis for meaningful stakeholder engagement

- *empower and motivate internal stakeholders*
  Within companies, different forces and opinions compete for attention and resources. An index can be a powerful tool to drive internal change and engage different parts of the business, including senior management. It can also help a company to identify strengths and areas for improvement as well as gauge its position relative to its peers.

- *inform the wider public about company performance*
  Index analyses and rankings are publicly available, allowing wide access to and dissemination of outcomes. In addition, (social) media coverage and advocacy campaigns by NGOs have a significant influence on public opinion and contribute strongly to companies' corporate reputation. Public pressure and reputational considerations can be an important driver of corporate change.

- *promote business accountability on sustainable development*
  Achieving the SDGs set out by the UN member states requires active private-sector participation. An index can bridge the gap by collecting information on sustainable development targets at the corporate level. Without company-focused data, it is impossible to track the contribution of the sector or commitments made by individual companies.

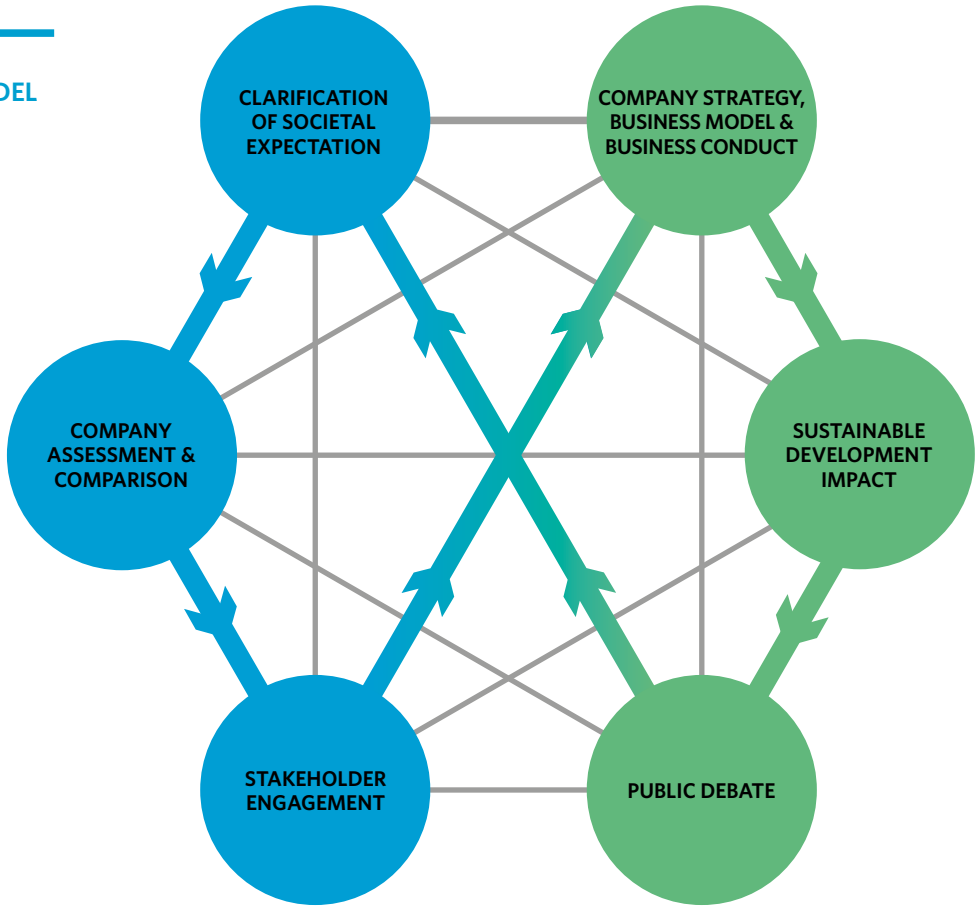
Company strategy, business model and responsible business conduct

Indices will have a longer term effect if the direction in which stakeholders want to see the industry progress ultimately makes business sense. An index seeks to become an important point of reference for companies and their stakeholders in measuring policy, innovation and performance. Depending on the industry and the nature of its social or environmental impact, the focus of the index is balanced between company strategy, business models and/or responsible business conduct.

The relationships between the different building blocks in the Theory of Change for Industry Indices for Sustainable Development is visualized in the model below.

FIGURE 7

THEORY OF CHANGE MODEL



APPENDIX 2

DESIGN PRINCIPLES FOR INDUSTRY INDICES FOR SUSTAINABLE DEVELOPMENT

INDUSTRY SPECIFIC
Maintaining a strict industry focus ensures that an index offers meaningful guidance and comparison. As a result, the scope of an index is limited not only to companies in the same industry but also to companies that are considered industry peers in that they share some basic features (e.g. size, business model and markets).

FOCUS ON CONTRIBUTION
An index clarifies and assesses the unique contributions that companies can make to achieving specific sustainable development outcomes. These desired outcomes are based on societal expectations, building upon the notion that companies can and should demonstrate responsible business conduct.

STAKEHOLDER CONSULTATION AND EXPERT REVIEW
The influence of an index rests in its legitimacy and credibility. Index methodologies are developed in cooperation with a wide range of stakeholders, including companies themselves. A thorough review by a team of recognized experts is an integral part of the process.

INCLUSION BASED ON SCOPE
An index includes all the companies that fall within its scope. Companies that choose not to participate actively in the data collection phase are scored on the basis of publicly available information.

RELATIVE COMPARISON
An index is a relative ranking, which compares companies with each other rather than against an absolute, ideal state. The highest attainable scores do not reflect an optimal characteristic of industry behavior, but the degree to which a company compares to the best or leading practice in the industry.

INDEPENDENT AND IMPARTIAL
Sustainability issues are often highly politicized and the polarization of opinions is one of the undesirable side effects. An index can only play a pivotal role in bringing together stakeholders with divergent views if it is independent itself. An index needs to be equally responsive to all stakeholders in order to remain impartial.

TRANSPARENT
An index is transparent about its methodology, development process and outcomes. It is vital that companies understand how and why they are measured in order to drive change and engage different parts of the business.

CLEAR AND COMPLEMENTARY
As an index aims to provide clarity, it builds upon the work done by others and adds value to existing initiatives and mechanisms.

ITERATIVE
Continuous improvement is an iterative process. The cyclical nature of an index provides companies with an incentive to improve and show progress and accountability over time.

RESPONSIVE
Societal expectations of the role of businesses evolve. An index responds by updating its methodology at each successive iteration. Boundaries are set, however, in order to maintain comparability of information across iterations.

APPENDIX 3

PRELIMINARY SUSTAINABLE DEVELOPMENT GOALS

GOAL 1
End poverty in all its forms everywhere.

GOAL 2
End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

GOAL 3
Ensure healthy lives and promote well-being for all at all ages.

GOAL 4
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

GOAL 5
Achieve gender equality and empower all women and girls.

GOAL 6
Ensure availability and sustainable management of water and sanitation for all.

GOAL 7
Ensure access to affordable, reliable, sustainable and modern energy for all.

GOAL 8
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

GOAL 9
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

GOAL 10
Reduce inequality within and among countries.

GOAL 11
Make cities and human settlements inclusive, safe, resilient and sustainable.

GOAL 12
Ensure sustainable consumption and production patterns.

GOAL 13
Take urgent action to combat climate change and its impacts.

GOAL 14
Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

GOAL 15
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

GOAL 16
Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

GOAL 17
Strengthen the means of implementation and revitalize the global partnership for sustainable development.

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