AUTOMOBILES
Research Brief

Sustainable Industry Classification System™ (SICS™) # TR0101
Research Briefing Prepared by the
Sustainability Accounting Standards Board®
SASB's Industry Brief provides evidence for the material sustainability issues in the Automobiles industry. The brief opens with a summary of the industry, including relevant legislative and regulatory trends and sustainability risks and opportunities. Following this, evidence for each material sustainability issue (in the categories of Environment, Social Capital, Human Capital, Business Model and Innovation, and Leadership and Governance) is presented. SASB's Industry Brief can be used to understand the data underlying SASB Sustainability Accounting Standards. For accounting metrics and disclosure guidance, please see SASB's Sustainability Accounting Standards. For information about the legal basis for SASB and SASB's standards development process, please see the Conceptual Framework.

SASB identifies the minimum set of sustainability issues likely to be material for companies within a given industry. However, the final determination of materiality is the onus of the company.

Related Documents

- Automobiles Sustainability Accounting Standards
- Industry Working Group Participants
- SASB Conceptual Framework

INDUSTRY LEAD

Nashat Moin

CONTRIBUTORS

Andrew Collins
Henrik Cotran
Anton Gorodniuk
Jerome Lavigne-Delville
Himani Phadke
Arturo Rodriguez
Jean Rogers
Gabriella Vozza

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INTRODUCTION

The automobile has become one of the most popular solutions for personal mobility worldwide. Vehicle ownership is a source of personal independence and social status. Developed countries like the United States, Australia, New Zealand, and Luxembourg have high rates of vehicle ownership at over 700 motor vehicles per 1,000 people.\(^1\) The rate of vehicle ownership is much lower in developing economies, but the rate is growing with GDP, creating significant new markets for automakers. As a producer of a high value-added goods, the automotive industry is one of the most important economic sectors. It is global in nature, with sourcing and distribution spread across the world. The industry employs over 2 million people and produces almost 90 million vehicles annually.\(^2\) Vehicle ownership is rising globally, which is creating new challenges for public infrastructure. It also magnifies environmental externalities associated with tail pipe emissions and end-of-life disposal.

Additionally, intensifying traffic worldwide increases the risk of car accidents, which are among the leading causes of accidents with unintentional injuries. Moreover, materials intensive manufacturing and constant innovation-driven fleet upgrades exacerbate global resource constraint.

Within the Transportation sector, emission from personal vehicles is one of the main contributors of greenhouse gases. Therefore, the Automobile industry is a target of global regulations establishing fuel-efficiency and emission standards. While the industry has made significant strides to improve fuel efficiency of vehicles and lower emissions by introducing hybrids and electric-powered cars, increasing production and an evolving regulatory environment indicate that companies will need to continue to reduce environmental externalities.

Today, the traditional auto model is challenged by quickly emerging companies, such as Tesla, that provide high-quality products and help to limit greenhouse gas emissions. Moreover, safety of drivers and passengers is a paramount goal of automobile manufacturers. Higher customer expectations, as well as increasingly stringent safety regulations, are driving the innovation to produce safe and defect-free vehicles.

Therefore, management (or mismanagement) of material sustainability issues has the potential to affect company valuation through impacts on profits, assets, liabilities, and cost of capital.

To ensure that investors are able to evaluate these factors, automobile companies should report on the material sustainability risks and opportunities that are likely to affect value in the near and long term. Enhanced reporting will provide investors with a more holistic (and comparable) view of performance that includes both positive and negative externalities, and of the non-financial forms of

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capital that firms in this industry rely on to create long term value.

Specifically, performance on the following sustainability issues will drive competitiveness within the Automobiles industry:

- Improving materials efficiency through managing manufacturing waste and end-of-life vehicles;
- Ensuring the highest standards of automobile safety;
- Managing labor relations and ensuring fair employee treatment;
- Minimizing the environmental footprint of vehicles by improving fleet fuel efficiency; and
- Sourcing of key inputs that reduce externalities while lowering risks to company value.

INDUSTRY SUMMARY

The Automobiles industry includes companies that manufacture passenger vehicles, light trucks, and motorcycles. Industry players design, build, and sell automobiles that run on a range of traditional and alternative fuels. Auto makers sell vehicles to dealers for consumer retail sales and directly to fleet customers, including car rental and leasing companies, commercial fleet customers, and governments. Both retail and fleet customers can obtain a wide range of aftersales services through the dealer network, including, but not limited to, maintenance, collision repairs, and extended service warranties. While companies in the industry do not sell cars directly to retail consumers, they are involved in the marketing and advertising of their products. Companies also provide automotive financing services to and through dealerships. The financial arm of automobile companies provides various options for new and used vehicles purchased by retail and fleet consumers. The financing function is key to maintaining sales of vehicles, as the typical borrower is unable to obtain financing from more traditional sources.

Automobile, light truck, and motorcycle manufacturers are known as the original equipment manufacturers (OEMs). They buy parts from many suppliers to assemble a final product for sale under their brand. Tier 1 suppliers are those that supply parts directly to OEMs, and therefore are most closely connected to the OEMs. Tier 2 suppliers are those that provide inputs for Tier 1 suppliers, Tier 3 suppliers usually provide inputs to Tier 2, and so on. A number of Tier 1 suppliers, also known as captive suppliers, are owned and operated by OEMs. These suppliers include engine and stamping facilities, although some of the largest are now independent again (e.g., Delphi Automotive, Denso Corporation, and Visteon Corporation).

The global automobiles manufacturing market is valued at about $2 trillion in revenues. Companies listed on the U.S. exchanges generate over $680 billion from the industry. According to Bloomberg, in 2013, the global sales of automobiles were about 76.3 million units. The largest market was Asia-Pacific, accounting for 47.6 percent of unit sales. China accounted for 60 percent of Asia-Pacific sales. The U.S. accounted for approximately 20 percent of the global vehicle sales.

Due to the global nature of this industry, nearly all market players have manufacturing facilities, assembly plants, and service locations in several countries across the world. Political pressure in countries with domestic car manufacturers has forced industry players to locate final assembly plants in these countries rather than export assembled cars. For cars produced in the U.S. (excluding SUVs and light trucks), 52.6 percent are exported to Canada, Germany, China, and Saudi Arabia.

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1 Industry composition is based on the mapping of the Sustainable Industry Classification System (SICSTM) to the Bloomberg Industry Classification System (BICS). A list of representative companies appears in Appendix I.

2 Sport Utility Vehicles
Arabia. The rest is sold domestically and split somewhat equally between dealerships (14.2 percent of total sales by revenue), wholesalers (12.6 percent), rental companies (12.1 percent), and the government (8.5 percent). For SUVs and light trucks, the demand is lower abroad with exports only representing 18.8 percent of industry revenue. A majority of SUVs (61 percent) is sold through wholesalers and dealerships. The remaining 20.2 percent is sold to government and leasing companies.

The Automobiles industry is oligopolistic, with a few large manufacturers and a large number of auto parts manufacturers feeding the supply chain. In 2013, there were only six car manufacturers and one motorcycle manufacturer listed on U.S. exchanges. It is a mature industry with slow revenue growth and generally low profit margins. In 2013, the median operating margin for companies traded in the U.S., including those traded primarily over-the-counter, was 5.6 percent. Meanwhile, the median net income margin was 4.9 percent, which has been relatively flat compared to the year before.

The 2008 financial crisis had a significant impact on the Automobiles industry in the U.S. Sales plunged, and balance sheets loaded with liabilities put some companies on a line of bankruptcy. According to a report by the World Bank, "[h]uge debt loads, high fixed-capital costs, high labor costs, and immense pension and health care commitments to retirees added to the immediacy of the damage." The impact was felt along the value chain among both dealerships and suppliers. In the U.S., already declining dealership numbers fell more drastically, from 20,770 in 2008 to 17,635 in 2013, a 15 percent decrease. While the recession had a dramatic effect on parts imports, which declined at an average annual rate of 20.2 percent from 2008 to 2009, the impact on U.S. auto parts plants was even more severe.

As the automation of automobile manufacturing process increases, the industry becomes more capital intensive, while labor intensive components are outsourced and purchased in modules. Mostly, automobile manufacturers are involved in the design and assembly of the final product and source components from suppliers. Purchases of auto parts and raw materials are the largest cost component, at 78.1 percent of revenue for cars and 72.8 percent for SUVs and light trucks. Wages, the second largest expense, accounted for just over six percent of revenue. Notably, marketing costs for cars, SUVs, and light trucks are around four percent of revenue. Lower passenger car densities in China (34 vehicles per 1,000 inhabitants as of 2013) and India (15 vehicles per 1,000 inhabitants) compared to developed markets demonstrate the growth potential in emerging markets. According to Goldman Sachs, BRIC markets (Brazil, Russia, India, and China) are expected to account for three-quarters of growth in automotive sales between 2011 and 2020. At the same time, the market is reaching saturation in developed economies. According to the World Bank, the U.S. and Australia had 797 and 695 vehicles per 1,000 people in 2010, respectively.

Due to growing demand from emerging markets and increasing fuel prices, the market is shifting towards smaller, lighter, more fuel-efficient vehicles. Therefore, consumer preference and environmental regulations are driving demand for alternative fuel and high-efficiency vehicles. From 2012 to 2013, the U.S. sales of electric vehicles increased by 228 percent, and sales of plug-in hybrids increased by almost 27 percent—for sales of 46,148 and 48,951 cars respectively.

Moreover, the amount of electronic content in vehicles is increasing. Automobile manufacturers invest in research and development of ‘smarter’ vehicles that are also safer to drive. At the same time, it exposes companies in the industry to the risks associated with reliance on critical and conflict...
materials that are used to a greater extent in automobile manufacturing.

LEGISLATIVE AND REGULATORY TRENDS IN THE AUTOMOBILES INDUSTRY

In the U.S., the Automobiles industry is subject to multiple federal regulatory standards, including those related to safety, fuel economy, emissions control, use of substances of concern, vehicle damage, and theft prevention. In addition, the industry must comply with local regulations related to the use and disposal of end-of-life vehicles (ELV). The following section provides a brief summary of key regulations and legislative efforts related to this industry.11

On the environmental side, the industry is subject to a number of regulations and standards including fuel efficiency, use of chemicals, waste management, and end-of-life management. The large and growing number of vehicles on roads is creating environmental and social concerns. Regulatory responses to these concerns may affect long-term sales of automobiles, particularly those with low fuel efficiency or higher emissions. For example, cities like London, Singapore, Oslo, and Stockholm are imposing congestion charges and other measures to limit the number of vehicles on city roads.19

Regulations on car emissions and fuel efficiency are growing more stringent across the globe. For example, in October 2013, the governors of eight states pledged to work together to create charging stations and fueling infrastructure to facilitate getting 3.3 million vehicles on the roads by 2025.20 In the U.S., a sales-weighted average fuel economy of 54.5 miles per gallon (mpg) is mandated by the 2025.21 In California, 4.5 percent of manufacturers’ state sales in 2018 must be zero emission vehicles (ZEV), or a mixture of ZEV and plug-in hybrid.22 Auto OEMs, and to a lesser extent particular auto parts manufacturers, have an important role to play in increasing the uptake of alternative vehicles through investments in infrastructure (such as stations to charge plug-in electric vehicles) that support these new technologies.

E.U. regulations are more rigorous and based on tail pipe emissions. By 2020, vehicles sold in the region will be allowed to emit no more than 95 grams of carbon dioxide per kilometer (g CO₂/km), using a sliding scale based on vehicle weight.45 Non-E.U. countries like Canada, Mexico, and many countries in Asia-Pacific are adopting fuel economy and emissions standards with specific regulations around disclosure of vehicle fuel economy at point of sale.

In addition, many countries have introduced incentives to support the commercialization of electric vehicles (EV) through subsidies, tax rebates and fee waivers. The U.S. offers a fixed amount federal tax rebate for electric and hybrid vehicles.23, 24 In the U.K., a subsidy is available as a percentage of the cost of the vehicle: 20 to 25 percent off the cost of plug-in cars and vans.25 China, the world’s largest automobile market, is encouraging development and sales of alternative fuel vehicles as a means of reducing pollution and dependence on foreign oil. At least 30 percent of government vehicle purchases must be electric cars by 2016. Additionally, there is an exemption on purchase tax for new energy vehicles from September 2014 until the end of 2017.26

The E.U. End-of-life Vehicles Directive is built on the concept of extended producer responsibility. It is designed to encourage auto manufacturers to “limit the use of hazardous substances in their new vehicles; design and produce vehicles which facilitate re-use and recycling; [and] develop the integration

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11 This section does not purport to contain a comprehensive review of all regulations related to this industry, but is intended to highlight some ways in which regulatory trends are impacting the industry.

45 95 g/km is roughly equivalent to 57 mpg.
of recycled materials.”  

According to the directive, 95 percent of a vehicle by weight must be recoverable, and 85 percent recyclable by 2015. Since July 2003, the E.U. has banned the use of mercury, hexavalent chromium, cadmium, and lead in the components of vehicles placed on the market. 

The industry is also subject to regulations that aim to limit social externalities. Motor vehicle safety is regulated by the U.S. National Traffic and Motor Vehicle Safety Act of 1966. Vehicles must be recalled if any safety standard is not met. Meeting safety standards can conflict with emissions and fuel economy standards, since additional safety measures can add weight to a vehicle and reduce its fuel economy. Countries have safety regulations that are likely to become more stringent in the future, specifically in the E.U., where the focus has been on active features, such as stability control and automatic brake assistance.

The National Highway Traffic Safety Administration (NHTSA) is a federal agency and a part of the Department of Transportation. NHTSA was established to carry out safety programs under the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966. The goal of these programs is to reduce deaths, injuries, and economic losses resulting from motor vehicle crashes. The NHTSA sets and enforces safety performance standards for motor vehicles and motor vehicle equipment. It has the authority to order the recall of automobiles and automotive products, including tires that have safety-related defects. Vehicles must be recalled if any safety standard is not met. The Transportation Recall Enhancement, Accountability, and Documentation Act, or TREAD Act, enacted on November 1, 2000, imposes numerous requirements on OEMs and auto parts manufacturers with respect to early-warning reporting of warranty claims, property damage claims, and bodily injury and fatality claims. To provide consumers with information about the crash protection and rollover safety of new vehicles beyond what is required by Federal law, in 1978 the NHTSA created the first New Car Assessment Program (NCAP) - 5-Star Safety Ratings. The safest cars are ranked with five stars. In Europe, the NCAP was founded in 1997.

Furthermore, companies in the industry are specifically impacted by the Dodd-Frank Act of 2010 and subsequent rules adopted by the U.S. Securities and Exchange Commission (SEC). Under the Dodd-Frank Act companies are required to publicly disclose their use of “conflict minerals” if those materials are “necessary to the functionality or production of a product” that the company manufactures, or contracts to be manufactured. These minerals include tantalum, tin, gold, or tungsten originating in the Democratic Republic of Congo or neighboring countries.

### SUSTAINABILITY-RELATED RISKS AND OPPORTUNITIES

Industry drivers and recent regulations suggest that traditional value drivers will continue to impact financial performance. However, intangible assets such as social, human, and environmental capitals, company leadership and governance, and the company’s ability to innovate to address these issues are likely to increasingly contribute to financial and business value.

Broad industry trends and characteristics are driving the importance of sustainability performance in the Automobiles industry:

- **Use-phase environmental and social externalities**: The most significant environmental and social impacts of OEMs occurs at the use-phase of automobile rather than during assembly. Design decisions and other innovation can significantly reduce the lifecycle environmental impacts of...
automobiles, while allowing companies to meet growing market demand for more energy efficient and clean vehicles. Similarly, the Automobiles industry faces increasingly stringent regulations on passenger safety, creating incentives to constantly improve car safety features.

- **End-of-life management.** The large and growing number of vehicles on roads is putting pressure on OEMs to manage environmental externalities at end-of-life of vehicles. They can do this by improving recyclability and recycling of vehicles, as well as minimizing the use of hazardous substance.

- **Resource scarcity:** Car manufacturing is a material-intensive process that is impacted by growing resource scarcity and increasing prices on critical materials.

As described above, the regulatory and legislative environment surrounding the Automobiles industry emphasizes the importance of sustainability management and performance. Specifically, recent trends suggest a regulatory emphasis on reduction of environmental impacts and high safety standards, which will serve to align the interests of society with those of investors.

The following section provides a brief description of each sustainability issue that is likely to have material implications for companies in the Automobiles industry. This includes an explanation of how the issue could impact valuation and evidence of actual financial impact. Further information on the nature of the value impact, based on SASB’s research and analysis, is provided in Appendix IIA and IIB. Appendix IIA also provides a summary of the evidence of investor interest in the issues. This is based on a systematic analysis of companies’ 10-K and 20-F filings, shareholder resolutions, and other public documents. It is also based on the results of consultation with experts participating in an industry-working group convened by SASB.

A summary of the recommended disclosure framework and accounting metrics appears in Appendix III. The complete SASB standards for the industry, including technical protocols, can be downloaded from www.sasb.org. Finally, Appendix IV provides an analysis of the quality of current disclosure on these issues in SEC filings by the leading companies in the industry.

### ENVIRONMENT

The environmental dimension of sustainability includes corporate impacts on the environment. This could be through the use of natural resources as inputs to the factors of production (e.g., water, minerals, ecosystems, and biodiversity) or environmental externalities and harmful releases in the environment, such as air and water pollution, waste disposal, and greenhouse gas (GHG) emissions.

In the Automobiles industry, advances in manufacturing process can serve to reduce the lifecycle environmental impacts of automobiles. From an economic standpoint, reducing manufacturing waste improves operational efficiency as the costs of inputs tend to increase over time. Management of end-of-life vehicles provides auto manufacturers with a reliable source of cheaper materials while significantly reducing the amount of landfilled waste.

Most of the GHG emissions generated during a lifecycle of a vehicle occur at its use-phase. Use-phase emissions and fuel efficiency are discussed in the "Business Model and Innovation” section of the brief.
Materials Efficiency & Recycling

The lifecycle environmental impacts of automobiles include impacts during the manufacturing process, the use-phase, and the end-of-life phase. Automobile companies can use design innovation as well as process and technological improvements to mitigate these impacts, and achieve material financial benefits. The automobile manufacturing process involves the use of significant amounts of materials, (including steel, iron, aluminum, and plastics among others) and can generate substantial amounts of solid waste (including scrap metal, paint sludge or shipping materials).

In addition, every year, millions of vehicles reach the end of their useful lives globally. At the same time, the rate of vehicle ownership is expanding globally, and leading to higher numbers of end-of-life vehicles (ELV). Recycling rates and amounts recovered per vehicle vary by country; in the U.S., about 95 percent of vehicles that reached end-of-life were disassembled for recycling. Industry efforts have led to roughly 80 percent of a vehicle by weight being recovered and recycled in the U.S. Manufacturers strive to recover and recycle the most valuable materials, such as aluminum, which represents less than 10 percent of weight, but accounts for almost a half of a vehicles’ value as a scrap. The remaining 20 percent, known as auto shredder residue (ASR), which includes plastics, rubber, wood, paper, fabric, glass, and metal parts, is usually landfilled. Landfilled waste generated during manufacturing processes, as well as from ELV, can contain harmful substances that affect human health and the environment.

For automobile companies, there are both risks and opportunities associated with materials efficiency and recycling. Cost of purchases, which includes the cost of auto parts as well as raw materials, is a significant expense item for auto manufacturers. In a resource-constrained world, prices on materials with limited a supply, such as aluminum, are likely to increase going forward. Therefore, process innovation aimed at improving resource efficiency, both in manufacturing and in utilizing ELV, is likely to help OEM companies reduce their operating expenses. It will also help OEM companies protect themselves from price or supply volatility for virgin input materials.

Several countries, including E.U. countries, Japan, and South Korea, have regulations in place requiring a certain percentage of vehicles by weight to be recyclable and reusable. These laws also set targets for the proportion of each vehicle that must be recycled, and require companies to take back cars, often at no cost to the consumer. These regulations pose increasing compliance costs for companies, but are also an added incentive to recover and recycle materials that can then be monetized through sales or reduced manufacturing costs. ELV regulations are also prompt innovation to recycle ASR, which is typically sent to landfills, as it is difficult to recycle. They also require a significant percentage of a vehicle to be recycled.

Companies innovating and continuing to improve materials efficiency—including reducing waste, reusing or recycling of waste and scrapped vehicles in their production processes through vehicle take-back and recycling programs—can contribute to lowering the lifecycle environmental impacts of vehicles. They can also reduce the strain on natural resources from the production of new materials. Furthermore, they can achieve cost savings, generate additional revenues, and protect themselves from regulatory risk and materials supply risks.

Therefore, company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):
• Amount of total waste from manufacturing, percentage recycled;
• Weight of end-of-life material recovered, percentage recycled; and
• Average recyclability of vehicles sold, by weight.

Evidence

As mentioned in the Industry Summary, cost of purchases, which includes auto parts and raw materials inputs, accounts for a majority of costs for the industry, at 80 percent of revenue. Automobiles contain significant amounts of ferrous metals, base metals, and plastics. Steel represents almost half of vehicle composition by weight, followed by iron. However, aluminum continues to gain popularity among car manufacturers due to its lightweight qualities. With the industry trend towards improving fuel efficiency of vehicles, aluminum content in vehicles is currently growing at about five percent a year, and the growth is expected to accelerate in the next decade.

Sourcing virgin materials, particularly aluminum, can create supply risks for auto manufacturers. Morgan Stanley estimates a 29 percent increase in aluminum prices by 2018 as demand from the industry is likely to outstrip supply. Therefore, automobile manufacturers able to retract, remanufacture, and recycle materials (both from the waste generated in their manufacturing processes and also from end-of-life vehicles) will better protect themselves from increasing materials prices, as well as ensure their supply. At the same time, such recycling can provide significant environmental benefits. Recycling aluminum requires 95 percent less energy than making it from scratch.

Diverting waste from landfills, recycling, and reuse of materials also present an area of opportunity for the Automobiles industry. In the U.S., industrial facilities, such as those used by auto manufacturers, generate and dispose of 7.6 billion tons of nonhazardous industrial waste annually. Between 2007 and 2010, GM generated $2.5 billion in revenue by selling reprocessed byproducts from its facilities. The company also uses byproducts from manufacturing operations in components for new vehicles. Byproduct recycling and reuse generated about $1 billion in revenue for the company in 2012 alone.

GM has 111 landfill-free facilities, including 83 landfill-free manufacturing facilities, and the company recycles or reuses 84 percent of its global manufacturing waste. The company recycled 2.2 million tons of waste in 2013. These efforts helped to reduce total waste generated per vehicle by 10 percent, or more than 45 kg/vehicle, from 2010 to 2013. In its 10-K Form for the fiscal year 2013, GM stated the following: “our landfill-free program and total waste reduction commitments generate revenue from the sale of production byproducts, reduce our energy costs, and help to reduce the risks and financial liabilities associated with waste disposal.” Ford also recognizes opportunities related to materials reuse and recycling. In 2012, the company recycled 568,000 tons of scrap metal from manufacturing worth $225 million.

Subaru’s Indiana plant pioneered the concept of “zero landfill” car manufacturing facilities by recycling 99 percent of waste from the plant and producing electricity from the remaining 1 percent. In 2006, the plant recycled 11,000 tons of steel. While some processes like the paint solvent recovery system were more expensive than others, the company expects the systems to take at most seven years to payback.

Several other automakers are moving towards zero-waste-to-landfill goals attracted by the cost-saving and revenue generating opportunities, including Toyota with its European facilities. In its Form 20-F for FY 2013, the company states that it expects to “improve profitability and enhance operating efficiency by continuing to pursue aggressive cost reduction programs.” This includes activity aimed at the elimination of waste in all processes from design to production. Moreover, the company identifies
regional environmental regulations with which it must comply, and risks associated with failing to do so.  

The U.S. automotive industry generates over 75 million pounds of paint sludge annually. Leading companies in the industry are investing in improving the efficiency of paint application, thereby reducing paint sludge. Honda invested in a new paint line that reduces paint sludge by about 25 percent. Chrysler Group uses an exterior basecoat application process at several of its paint shops that deposits 85 percent of paint on the vehicle surface (compared to 55 percent using a conventional paint-gun system). In addition to reducing paint waste, this method saved Chrysler nearly $900,000 annually. By utilizing paint recycling systems, companies are able to turn waste into useful inputs and ultimately save costs.

Apart from recycling waste generated in manufacturing, auto companies can also benefit from taking back and recycling vehicles when they reach the end of their useful lives. According to the EPA, each year, nearly 27 million cars worldwide reach the end of their useful lives and most are recovered for recycling. Nevertheless, the EPA reports that five million tons of ASR are disposed of in landfills every year. If diverted from landfills, much of the material from vehicles can be recycled or repurposed for use, enabling cost savings and revenue generation opportunities. At the same time, new regulations related to vehicle end-of-life could create regulatory compliance costs or lead to penalties for auto companies.

To reduce environmental externalities related to the limited availability of landfill space, the E.U. created the ELV Directive, which established a minimum of 95 percent of ELVs (by weight) must be reused or recovered. It also established that 85 percent be reused and recycled by January 1, 2015. Furthermore, under the E.U. ELV Directive, car manufacturers and ELV treatment facilities are required to take back vehicles free of charge. However, public authorities or car manufacturers have the option to cover the cost of free take-back programs through an additional charge on the sale of new cars. Nonetheless, such a charge, if significant, could impact sales of automobiles. In Japan, individual vehicle owners pay a recycling fee in advance; however, car manufacturers are physically and financially responsible for auto-shredder residues, ozone-depleting chlorofluorocarbons (CFCs), and airbags.

Companies that are able to implement effective and efficient take-back and recycling programs can therefore lower the impacts on their costs or sales from such laws compared to their peers, and even make profits on the recycling and reuse of materials. In 2006, the first year that Japan’s ELV directive went into effect, Toyota, Mazda, and Mitsubishi reported combined losses of ¥79.5 million as their spending for recycling exceeded receipts from fee deposits, while Honda and Nissan reported a combined profit of ¥255.9 million from the recovery and recycling activities.

Some companies not only meet the local ELV laws, but also substantially exceed required recovery and recycling rates, often due to the cost savings that can be achieved. In 2013, Nissan achieved a recovery ratio of 97.2 percent by recovering 112,507.2 tons of ASR from 533,836 vehicles in Japan. The company also recovered over 1.6 million airbag-related products from almost 450,000 vehicles, by which it significantly surpassed the required recycling ratio. Overall, the Nissan recycling initiatives helped the company to save more than $29 million, or $5 per vehicle, throughout the 2004 to 2013 period. Moreover, the company works closely with business partners to collect and recycle aluminum wheel rims. In 2013, Nissan recovered 2,700 tons of wheel rims.

Nissan carries out experimental studies to optimize processing and improve the recovery rate for ELVs. Feedback from the studies helped the company to
improve its dismantling techniques. It also helped gear the designing process towards the use of suitable materials and vehicle design that is easy to dismantle. According to the company, the recoverability rate for its ELVs in Japan has been at least 95 percent since 2006 and 99.5 percent in 2013.61

To ensure that most of their vehicles are recycled, auto manufacturers may have to establish relationships with third parties for take-back programs. In their SEC filings, the top companies in the industry link the existence of such relationships to increased recycling rates. For example, by coordinating with “relevant parties,” Toyota established a vehicle take-back and recycling system throughout Japan, which helped the company to achieve a recycling rate of 96 percent.62 Tesla has an agreement with a third party battery recycling company to recycle its battery packs. Moreover, if a customer wishes to dispose of a battery pack from a Tesla vehicle, the company will accept it for no cost to the customer.63

Value Impact

Companies that are able to limit the waste of metals and plastics used in production and recycle the waste generated can achieve significant savings in operating costs. This is particularly important as prices of certain raw materials, such as aluminum, are expected to increase in the future. Through investments (including R&D) in materials efficiency and recycling, companies can improve operational efficiency and can lower their cost structure over time, and they will be better positioned to mitigate the impacts of scarcity and price increases of raw materials. Selling by-products from the manufacturing process can also be a source of revenue for auto manufacturers.

Stricter regulations around end-of-life management require higher recyclability rates of manufactured vehicles as well as actual recycling rates of disposed cars. These regulations can increase compliance costs for companies, and in some cases could lower sales if costs of recycling are passed on to consumers. Noncompliance with regulations may lead to civil penalties, resulting in extraordinary expenses. Conversely, car manufacturers can achieve significant cost savings by remanufacturing ELVs, and can protect themselves from input price increases or volatility.

The percentage of waste recycled, together with amount of recycled materials used in the manufacturing process, indicates how well the company is maximizing resource efficiency in the face of resource scarcity.

SOCIAL CAPITAL

Social capital relates to the perceived role of business in society, or the expectation of business contribution to society in return for its license to operate. It addresses the management of relationships with key outside stakeholders, such as customers, local communities, the public, and the government.

In the Automobiles industry, social capital issues revolve around the safety of vehicles manufactured and social externalities that may result from a failure to ensure driver and passenger safety. The ability of companies to manage product quality and safety is critical to protecting their reputation and license to operate, and therefore their brand value.

Product Safety

Driving is a risky activity, as distracted driving, speeding, drunk driving, dangerous weather conditions, and sometimes vehicle defects, among other factors, can lead to accidents exposing drivers, passengers and bystanders to possible injuries and deaths. The Center for Disease Control and Prevention (CDC) cites motor vehicle crashes as one of the leading causes of death in the U.S. According
to the World Health Organization, traffic injuries are the leading cause of death worldwide for those between ages 10 and 24. The total number of road traffic deaths is 1.24 million per year globally. Public safety policies and regulations around the world are driving innovations in automobile design and production, including the use of information technology to continuously improve the safety of passenger vehicles. While safety features such as seat belts, air bags, and crumple zones have improved occupant safety in the event of a crash, technologies are now being applied towards prevention of accidents. Furthermore, in low-income countries, pedestrians constitute the greatest percentage of road traffic deaths. Vehicle design can reduce the risk and severity of pedestrian impact.

Defective vehicles can also cause accidents. Failure to detect these defects before the vehicles are sold can have significant financial repercussions for auto manufacturers. For example, vehicles sold in the U.S. must meet safety requirements or else they must be recalled and the feature repaired or replaced at the manufacturer’s cost. In addition, manufacturers must provide warranties to insure customers against the risk of purchasing a defective vehicle. Growing automobile ownership in developing countries like China and India has led to increased traffic accidents. Vehicle safety regulations in these countries are becoming more stringent, creating potential liabilities for companies with defective products.

Automobiles that meet safety regulatory requirements, as well as those automobiles that feature crash avoidance technologies, are likely to be in greater demand from consumers. Companies that fail to produce defect-free vehicles may open themselves to lawsuits leading to significant compensations.

Company performance in this area can be analyzed internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Percentage of models rated by NCAP programs with overall 5-star safety rating, by region;
- Number of safety-related defect complaints, percentage investigated; and
- Number of vehicles recalled.

**Evidence**

Ensuring vehicle safety and responding in a timely manner when defects are identified can protect companies from regulatory action or customer lawsuits, which can affect company profitability through one-time costs and contingent liabilities. Through effective management of the issue, companies can enhance reputation and brand value and drive higher sales over the long term.

In addition to the federal laws mentioned earlier regarding recalls and warranties, all U.S. states have some form of “lemon law,” which protects customers who purchase products that repeatedly fail to meet quality and performance standards. For example, under the Song-Beverly Consumer Warranty Act, cars purchased or leased in California that are under warranty and have been taken to an authorized dealer for addressing the same problem four times or more are entitled to benefits. Customers can choose either a refund or a replacement vehicle at the manufacturer’s cost. Product recalls represent a significant cost for companies and have a negative impact on brand value. From 1990 through September 2013, there were 3,303 recalls in the U.S. that affected nearly 385 million vehicles. The U.S. “Detroit 3” (General Motors (GM), Ford, and Chrysler) alone accounted for 1,530 recalls and 260 million recalled vehicles. Fuel systems and service brakes were the most common reasons accounting for 290 and 315 recalls respectively, followed by airbags and seatbelts, with 267 and 252 recalls respectively. According to data from the National Highway Traffic Safety
Administration (NHTSA), the number of light-vehicle recalls has doubled in the last 20 years. In the period from 2012 to 2013, there was an average of one recall every two to three days. This shows the potential for significant safety improvements in automobiles. Seventy-eight percent of the 3,303 recalls were initiated by manufacturers.68

Automobile manufacturers able to recognize safety issues in their vehicles in a timely manner and initiate voluntary recalls may minimize costs. They can minimize costs by avoiding regulatory intervention and potential penalties, as well as contingent liabilities for failure to promptly address safety issues. In 2012, Volvo agreed to settle a case wherein the company was allegedly delaying seven recalls related to incorrect tire pressure labeling. The payment amounted to $1.5 million and was to be paid to the federal government. NHTSA may fine a single automaker up to $17.35 million. In 2010, the agency fined Toyota $16.4 million for failure to promptly initiate correction of sticky accelerator pedals on 2.3 million vehicles.69

Costs associated with recalling vehicles are significant and are likely to have a negative impact on a company’s financial results and market valuation. In 2014, a four-year criminal investigation into Toyota’s reporting of problems related to unintended acceleration resulted in a record $1.2 billion settlement with the U.S. government. NHTSA may fine a single automaker up to $17.35 million. In 2010, the agency fined Toyota $16.4 million for failure to promptly initiate correction of sticky accelerator pedals on 2.3 million vehicles.69

Companies in the industry recognize the material impacts of recalls on their operations in their SEC filings. In its Form 10-K for FY 2012, GM states that it has accrued $7.39 million in contractual obligations for policy, product warranty, and recall campaigns liability from 2013 onwards.66 In its FY 2012 filings, Ford reported that it recorded $2.25 million for warranty cost accruals. These are estimated future costs for basic warranty coverage and field service actions (e.g., product recalls and owner notification programs) on products sold,77 based on historical warranty claim experience. While these amounts are relatively small compared to other expenses, they are recurring, and product safety-related incidents can quickly rise to significant amounts. In the form 20-F filed with the SEC, Toyota states its “Liabilities for recalls and other safety measures” for the year ending March 31, 2014 were at ¥680,475 million (approx. $6.34 billion). That is a rise from ¥566,406 million the year before, a 20 percent increase.78 Between 2009 and 2012, Harley-Davidson initiated 12 voluntary recalls, which cost the company a total of $17.2 million.79

In extreme cases, OEMs may be required to buy back vehicles that do not meet safety requirements. For example, American electric vehicle producer ZAP reported a $2.1 million increase in accrued recall expenditure in 2012 due to estimated recall costs for the Model-Year 2008 XEBRA sedan.80 The U.S. Department of Transportation ordered ZAP to buy
back the vehicles that did not meet braking requirements for instances when the vehicles are operating at maximum speed.

In addition to expensive fines, product liability lawsuits by consumers can be a significant expense. The 2012 Dykema Automotive Survey reaffirmed the importance of this issue. In the survey of 100 OEMs and automotive suppliers, 22 percent of the respondents reported an increase in class-action lawsuits. Additionally, 78.6 percent of OEM respondents identified ‘product liability’ as the single type of class action that is the biggest threat to their company.81

With technology advances, vehicles feature increasing amount of electronics. Many of the features are aimed at reducing risks of crashes. According to the NHTSA Crash Causation Survey, distractive driving is the main cause of car accidents.82 The NHTSA further estimates that electronic stability control (ESC), a computerized technology that detects and reduces loss of traction and improves a vehicle’s stability, saved 1,144 lives of passenger car and light truck occupants. The number of lives saved has been increasing since 2008, since more cars being manufactured are equipped with ESC. In 2012, 100 percent of light trucks and passenger cars manufactured included ESC.83

Major safety incidents may occur with low probability, but they have high-magnitude impacts on company value, increasing operational risks and ultimately the cost of capital. More frequent but smaller incidents may lead to a higher cost structure, including through warranty costs. Safety concerns or incidents can also lead to voluntary or mandated recalls with material impact on a company’s profitability and its liabilities. Recall expenses can be significant and can include business interruption, product disposal costs, costs of supplying replacements, customer payments, transportation costs, investigation costs, regulatory fees, and fines. The period of a recall is likely to be characterized by lower sales and increased extraordinary expenses. Recalls can also cause consumers to question the safety and reliability of products, leading to reputational damage and loss of brand value, with long-term loss of market share and impact on revenue growth.

The percent of vehicles sold that have a high safety rating is an indicator of how well auto makers are responding to increasing consumer demand for safe vehicles and safety features that help prevent accidents. The number of safety complaints and communication protocols, a collision warning system. Such technology would enable vehicles to warn drivers of traffic hazards, thus improving road safety. In 2016, GM is planning to release a Cadillac model that would “feature ‘Super Cruise’ technology that takes control of steering, acceleration and braking at highway speeds of 70 miles per hour or in stop-and-go congested traffic.”85

**Value Impact**

Inherent safety of vehicles can be a driver of competitiveness and can therefore impact market share and revenue. Longer-term, performance on safety—either positive or negative—is an important factor in OEMs’ brand value and long-term revenue growth prospects.

Companies continue to innovate. GM is working with NHTSA to develop vehicle-to-vehicle communication protocols, a collision warning system.
percentage of those that are investigated provide a sense of actual safety performance beyond model safety rating, and indicate companies’ proactive approach to safety management for their existing fleet. The number of vehicles recalled provides a measure of past performance on vehicle safety beyond high-publicity events, as well as an indication of the probability and magnitude of safety-related incidents. Percentage of recalls voluntarily issued also provides indication of a company’s proactive approach to managing safety in existing fleets.

**HUMAN CAPITAL**

Human capital addresses the management of a company’s human resources (employees and individual contractors), as a key asset to delivering long-term value. It includes factors that affect the productivity of employees, such as employee engagement, diversity, and incentives and compensation, as well as the attraction and retention of employees in highly competitive or constrained markets for specific talent, skills, or education. It also addresses the management of labor relations in industries that rely on economies of scale and compete on the price of products and services. Lastly, it includes the management of the health and safety of employees and the ability to create a safety culture for companies that operate in dangerous working environments.

In the Automobiles industry, human capital issues revolve around the dependence on a large number of factory workers who are often unionized and have a strong bargaining power. Even though manufacturing processes have become increasingly automated over time, automakers still employ a large number of employees from management executives and engineers to factory workers. Moreover, American auto companies have greater burdens from legacy pensions than some of their foreign counterparts who started production in the U.S. more recently. Therefore, ensuring reliable and low-cost manufacturing requires an active management of labor relations with assembly and other factory workers.

**Labor Relations**

Labor relations play an important role in the Automobiles industry, in which wages account for the second largest expense item. Many auto workers belong to unions with strong bargaining powers. Labor unions are prevalent in industries where there are complete labor contracts, in which the conditions of the contract are explicitly stated when it is signed. For example, complete contracts exist in assembly line manufacturing—either a worker keeps up with the line or not. Under incomplete labor contracts, higher performance can be reciprocated with higher wages. In contrast, such characteristics are not present in complete labor contracts and so wages tend to be low. Therefore, unions play an important role in protecting worker rights and negotiating higher wages.  

In countries with strong labor laws or union representation, wages tend to be higher than in countries without strong worker laws and enforcement, representing, to an extent, better protection of worker rights. In the U.S., automobile factory workers have historically been well paid, with generous pensions and other benefits. Nonetheless, costs of poor labor relations and unsatisfactory treatment of workers can be higher in such countries. Poor labor management can affect companies’ ability to negotiate with unions and can lead to expensive work stoppages. At the same time, without early engagement, unions may limit the ability of companies to quickly adjust labor expenses and the size of their workforce in response to competitive pressures or adverse economic conditions. When faced with bankruptcy and potential mass layoffs during the 2008-09 financial crisis, partly due to untenable pension liabilities and competition from foreign auto makers, management
of U.S. auto companies and labor unions agreed to renegotiate contracts and curtail benefits as a way to reduce costs and liabilities. 88

Companies with newer operations in the U.S. have lower unionization rates and pension liabilities. For companies with low unionization rates in an industry characterized by otherwise high union participation, a short-term view on worker compensation, contract terms, and working conditions could create a potential for disruption if workers begin to demand better standards through increasing unionization or other actions.

Due to the global nature of the industry, auto companies may also operate in countries where worker rights are not adequately protected. In the absence of clear rules or enforcement of labor rights in such countries, auto makers, in their efforts to reduce costs, may find themselves failing to meet basic worker rights or, in extreme cases, exploiting workers. This can disrupt operations or affect company reputation. In this context, auto makers have an interest in protecting their workers’ rights and preventing off-shored facilities from violating labor standards applicable in their home country.

Ultimately, the nuances of both domestic and international worker concerns make management of labor relations critical for automobile companies. Proper management of, and communication around, issues such as worker pay and working conditions can prevent conflicts with workers that could lead to extended periods of strikes, which can slow or shut down operations and create reputational risk. Auto companies need a long-term perspective on managing workers, including their pay and benefits, in a way that protects worker rights and enhances their productivity while ensuring the financial sustainability of a company’s operations.

Company performance in this area can therefore be analyzed, internally and externally, through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Percentage of workers covered under collective-bargaining agreements; and
- Number and duration of strikes and lockouts.

Evidence

Labor unions play a critical role in the global Automobiles industry. Nearly one-fifth of all workers in the “motor vehicles and motor vehicle equipment manufacturing” industry in the U.S. are unionized: in 2013, 18.2 percent of workers were union members and 19.4 percent were covered by collective bargaining agreements. 89 Some automobile companies traded over the counter in the U.S., such as Peugeot and Fiat, report extremely high rates of unionization, with rates of around 90 percent. 90 In contrast, only 7.5 percent of all U.S. private sector workers were covered by unions in 2013. The average for “durable goods manufacturing,” a traditional union stronghold, fell from 32.1 percent in 1983 to 10.9 percent in 2013. 91 An analysis of annual SEC filings reveals that OEMs are unionized to some degree, both at their U.S. and international operations.

Globally, wages are 6.3 percent of revenue for automobile manufacturers, 92 however pension liabilities are high for more established companies. Managing worker benefits with a long-term perspective, in a way that protects worker rights and enhances their productivity but does not jeopardize company operations, becomes important in this context. For example, all three major American car manufacturers, Ford, General Motors, and Chrysler, have greater pension liabilities than their foreign counterparts that have plants in the U.S. These “big three” auto manufacturers have more retirees than active employees. In their respective 10-Ks, all three reported that their defined benefit pension plans are currently underfunded. Ford, for instance, states that its U.S. and worldwide defined benefit pension plans were underfunded by a total of $9.7 billion and $18.7 billion, respectively. 93
Companies with more recent operations in the U.S. do not have the same pension liabilities as their predecessors. When Japanese automakers first opened plants in the U.S., they offered matched wages to those of union workers to avoid unionization.\textsuperscript{94} Three decades later, new entrant Tesla reports in its 10-K filings that none of its employees are “currently represented by labor unions or are covered by a collective bargaining agreement with respect to their employment.” The company adds, “To date, we have not experienced any work stoppages, and we consider our relationship with our employees to be good.”\textsuperscript{95} Companies with such low or nonexistent unionization levels will need to ensure that workers are well compensated, worker rights are well protected, and communication lines between workers and management are open. If labor relations are hampered, the risk of work stoppages in the future due to increasing worker unionization or other actions to ensure fair pay and working conditions could have a material impact on companies.

Poor labor relations can result in work stoppages that can affect company cash flows and profitability. In cases of unionized labor, unions have more bargaining power to demand better wages and working conditions; therefore, in such cases, costs of labor disputes could be higher. In their annual filings, several auto makers cite the high percentage of unionized workers and labor disputes as having a material impact on their operations. In its 2012 Form 10-K, Ford Motor Company states that all of its hourly workers around the globe are represented by unions.\textsuperscript{96} The company cites both work stoppages as a result of labor disputes and limitations on the company’s ability to close plants and divest businesses as material risk factors resulting from employing unionized workers.\textsuperscript{97} Similarly, TATA Motors, an Indian auto manufacturer, cites in its 2012 20-F filing that it is vulnerable to labor unrest due to most of its employees being union members.\textsuperscript{98} In 2014, GM workers in Kentucky voted to allow strikes if necessary. Workers say they have been concerned about safety issues, alleging a high number of “near misses” that could have serious implications for assembly line workers. The two sides are hoping to resolve their differences without a worker walk-out.\textsuperscript{99}

Often, such votes may result in actual strikes with significant cost implications. Hyundai, a Korean automaker, has experienced union strikes in all but four years since 1987.\textsuperscript{100} Union representation at Hyundai is powerful and job assignments have to be pre-approved by the union. It is estimated that worker strikes at Hyundai plants in 2012 resulted in a seven percent shortfall in production, with estimated lost sales of 2.7 trillion won.\textsuperscript{101} Workers have been trying to improve working hours, and in 2005, after the company agreed in principle to eliminate night shifts, unions demanded an end to the round-the-clock shift system that had been in place since 1967. The 2012 labor union negotiations resulted in shortening two 10-hour night shifts to eight- and nine-hour shifts ending by one o’clock AM. The union also wanted permanent positions for 13,000 contract workers; Hyundai countered, promising positions for 3,000 by 2015.\textsuperscript{102} More recently, Reuters reported that Hyundai lost $1.1 billion of its market value in the week following the collapse of wage talks with unions on August 6, 2013.\textsuperscript{103} These examples emphasize the importance of a company’s management recognizing and addressing worker concerns in a timely manner and maintaining good communication with employees.

**Value Impact**

Labor-intensive industries with well-defined occupations are prone to high rates of unionization, as employees with similar skills and compensation have an incentive to resort to collective bargaining in their negotiations with management. The bargaining power that comes with unionization leads to higher wages and other compensation costs, including pensions. It can also lead to labor disputes and production disruptions, with short-term impact on
New entrants or disruptors in highly unionized industries often have a short-term competitive advantage from low unionization rates and lack of pension liabilities. However, these companies incur the risk of a medium-term shift in cost structure as growth tapers and cost-cutting initiatives drive employees to collective bargaining. The number of work stoppages provides a measure of past performance on labor practices, while the percentage of employees unionized provides an indication of companies’ exposure to wage cost increase and possible future labor disputes.

### BUSINESS MODEL AND INNOVATION

This dimension of sustainability is concerned with the impact of environmental and social factors on innovation and business models. It addresses the integration of environmental and social factors in the value creation process of companies, including resource efficiency and other innovation in the production process. It also includes product innovation, efficiency, and responsibility in the design, use-phase, and disposal of products. It includes management of environmental and social impacts on tangible and financial assets—either a company’s own or those it manages as the fiduciary for others.

In the Automobiles industry, advances in business models and innovation can serve to reduce the lifecycle environmental impacts of automobiles. From an economic standpoint, such innovation directly impacts the total cost of ownership of a vehicle, which takes into account the purchase price, taxes, insurance, operating costs (fuel, maintenance, or repair), and resale value. Fuel efficiency and use of alternative energy may reduce owners’ operating costs. The longevity of a vehicle can also reduce costs by delaying purchase of replacement vehicles, lowering maintenance costs, and improving resale value. Such innovation therefore becomes attractive to consumers of auto companies, while lowering the industry’s lifecycle environmental impacts.

Emerging environmental and social trends are creating new innovation and business opportunities for companies. These trends include changing customer preferences, higher regulatory requirements, and heightened scrutiny for the Automobiles industry. Those companies that are able to harness intellectual capital to address significant environmental and social challenges will also be able to improve operational and financial performance.

### Fuel Economy & Use-phase Emissions

Transportation accounts for a significant share of global GHG emissions. The cumulative use of motor vehicles through combustion of petroleum-based fuels generates significant, direct GHG emissions and contributes to global climate change. Automobile usage is also associated with local air pollutants that threaten human health and the environment. In this context, vehicle emissions of GHGs, nitrogen oxides, volatile organic compounds, and particulate matter are increasingly a concern of consumers and regulators. While these impacts are further downstream from auto companies (most of the emissions occur at the use-phase of vehicles rather than during their manufacturing), regulations are focusing on auto manufacturers to address some of these issues: for example, by imposing fuel economy standards.

Fuel types and efficiency of vehicles directly impact GHG and other emissions. It also affects dependence on oil (for internal combustion engines) and the total cost of ownership. The regulations on fuel efficiency, as well as customers' demand for vehicles with lower environmental impacts and lower total cost of ownership, are driving auto manufacturers to lower use-phase emissions.
More stringent emissions standards around the world are fueling rapidly expanding markets for electric vehicles and hybrids, as well as conventional vehicles high fuel efficiency. Moreover, manufacturers are also designing vehicles with lightweight materials to improve fuel efficiency by reducing the weight of vehicles.

Companies that are able to meet current fuel efficiency and emissions standards, and continue to innovate in order to meet or exceed future regulatory standards in different markets, are likely to strengthen their competitive position and expand market share. Meanwhile, they are also mitigating the risk of lower demand for conventional products.

Company performance in this area can be analyzed internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Sales-weighted average passenger fleet fuel economy, consumption, or emissions, by region; and
- Number of (1) zero emission vehicles (ZEV) sold, (2) hybrid vehicles sold, and (3) plug-in hybrid vehicles sold.

Evidence

Transportation activities, which include “movement of people and goods by cars, trucks, trains, ships, airplanes, and other vehicles,” is a significant source of greenhouse gases, accounting for 28 percent of U.S. GHG emissions in 2011. According to the International Energy Agency, global transportation emitted 6.8 million metric tons of carbon dioxide (CO₂), or 22 percent of global CO₂ emissions, from fuel combustion in 2010. Road transport alone accounted for 74 percent of transport emissions. Furthermore, in 2013, researchers at the Massachusetts Institute of Technology found that air pollution causes about 200,000 early deaths in the U.S. each year. Road transportation, the most significant contributor, caused 53,000 premature deaths, with California being the most affected state. This highlights the magnitude of the impact of air emissions from the use-phase of automobiles, which is prompting regulators globally to take action.

In order to reduce emissions from automobiles, several countries have set emission and fuel efficiency targets for vehicles sold within their borders. They are also providing incentives to consumers to buy low-emission vehicles, often subsidizing the purchase cost. These actions are affecting both the demand for and supply of automobiles, with an impact on automobile company revenues and costs. It explains the relative success of electric vehicles for commercial and industrial uses, with 2013 sales expected to exceed $30 billion, compared to $28 billion in the consumer segment.

Vehicle emission standards continue to evolve and become more stringent in various countries, i.e. CAFÉ Standards in the U.S., which may help to increase a market share of alternative fuel vehicles. Non-compliance with emissions standards in different regions and countries can lead to significant regulatory penalties for auto manufacturers in certain markets. For example, as of 2012, German automakers Daimler, Audi, and BMW all had vehicles that fell short of the E.U.’s 2015 standards that set the average CO₂ emissions from new cars sold in Europe. If they are unable to meet the required reductions in emissions by 2015, they will face fines of 95 euros for every excess gram over the target, multiplied by the total number of vehicles sold.

Markets with regulatory efforts to internalize the price of carbon in fuel use are likely to experience

\footnote{Transportation covers emissions from all transport activity (in mobile engines), regardless of the economic sector to which it is contributing. Road includes the emissions arising from fuel use in road vehicles, including the use of agricultural vehicles on highways.}

\footnote{Refer to the Legislative and Regulatory Trends section for specific targets.}
increased demand for fuel-efficient or alternative fuel vehicles. The cap-and-trade rules under California’s Global Warming Solutions Act that went into effect on January 1, 2013 currently apply to large electric power plants and large industrial plants. However, starting January 1, 2015, the regulations will extend to cover distributors of heating and transportation fuels. Under the program, such companies will be required to buy enough emission allowances to cover their emissions. The price of an allowance, which covers one ton of CO₂ emissions, is currently around $12, and is expected to remain at that level at the beginning of 2015. At that price, the new rules are expected to increase the marginal cost of selling gasoline in California by 9 to 10 cents per gallon. These higher costs are expected to be passed through directly to consumers, and are likely to increase customers’ demand for more fuel-efficient or alternative fuel vehicles.

Similarly, regulatory incentives to promote fuel-efficient and alternative energy vehicles will drive demand and create new market opportunities for automakers. Since 1990, the state of California requires large automakers to sell zero-emission vehicles (ZEV) in proportion to their sales in the state. By 2025, California and nine other states will require that plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), or fuel cell vehicles (FCVs) account for 15.4 percent of total sales in those states. In the meantime, automakers can comply with rising requirements directly or through purchase of ZEV credits. While this requirement can be expensive for companies lagging in sales of ZEV, some companies like Tesla and Nissan have been able to generate revenues from sales of their excess ZEV credits. For example, during the first half of 2012, Tesla received $119 million, or 12 percent of revenue, from ZEV credit sales. In July 2013, Nissan-Renault announced that it sold its one hundred thousandth zero-emissions car, putting it ahead in EV sales of all other auto manufacturers combined.

China is the largest and fastest-growing automobile market in the world, with 22 million new vehicles sold, representing 29 percent of global automobiles sales in 2013. Striving to reduce pollution, the country set a goal of having 500,000 electric vehicles on the road by 2015. However, as of August 2014, only 70,000 ZEVs were in use. To stimulate demand, electric vehicles have been exempt from a 10 percent purchase tax through 2017. OEMs able to satisfy the expected increase in demand for ZEVs could improve their competitive positioning and expand their market share in China.

In addition to regulatory drivers, cost considerations are shifting consumer preferences to more fuel-efficient and alternative fuel vehicles. The total cost of ownership of an automobile, which affects use-phase cost and resale value, is highly dependent on fuel savings. A recent study found that among vehicles with lifespans exceeding 120,000 miles, mid-sized hybrids and EVs have a much cheaper total cost of ownership than similar sized gas-powered cars. GM has incorporated a new technology in the 2014 Chevy Malibu, which improves the car’s fuel economy by 12 percent for an increase in price of $160 per vehicle. The company estimates that the feature will pay for itself within nine months, and will save over $2,000 over the life of the vehicle, compared to the 2013 model of the same car.

In 2008, the DOE study estimated that by 2050 the share of plug-in hybrid vehicle will reach 20 to 80 percent, based on a various penetration scenarios. Currently, the growing demand for fuel-efficient vehicles indicates that manufacturers need to be positioned to address this market. However, more efficient vehicles may have higher up-front costs for consumers, so the total cost of ownership over the lifespan may be lower, especially in the environment of increasing oil prices. Increasing fuel prices shift customer preferences towards smaller, more efficient cars.
Generally, automakers are responding to stringent fuel efficiency regulations and changing consumer demands by reducing fuel consumption and emissions of vehicles. In 1997, Toyota introduced the Prius hybrid model in Japan, and Audi introduced the Audi duo, also a hybrid, to the European market. In the following years, Honda, GM, and Ford joined the electric vehicle market. The popularity of alternative fuel vehicles is growing steadily, although several infrastructure challenges, such as charging stations for electric and plug-in hybrid vehicles, remain.

Tesla Motors was established in 2003 with a focus on high-performance all-electric vehicles. After 10 years of operation, the company had a market capitalization of $20 billion. The company is challenging the traditional large auto companies in satisfying a growing demand for high-efficiency vehicles. To be competitive, every major auto manufacturer now offers hybrid vehicles (e.g., Nissan Leaf, Ford Focus Electric, BMW Electron, and Chevrolet Spark EV) or has such models in the pipeline.

One way automakers are improving fuel efficiency is by reducing the weight of vehicles. According to Bloomberg, the share of steel and iron as a percent of the “curb weight” of a vehicle has been steadily declining over the past seven years, while the share of lighter materials such as aluminum and plastics has steadily increased. In an average modern vehicle, plastics account for about 50 percent of materials by volume. Reducing the weight of a car by one kilogram may result in a 20 kilograms reduction of CO₂ emissions over the lifecycle of the vehicle. The new Ford F-150 truck’s body contains 95 percent aluminum-alloy, and 77 percent of its frame is high-strength steel. These weight reduction measures helped lower the weight of the vehicle by 700 pounds.

Automakers’ investment in research and development (R&D) further illustrates the importance of innovation in the area of fuel efficiency and emissions standards. According to the Boston Consulting Group, nine out of the top 20 most innovative companies are automakers. In 2013, the industry spent $100 billion on R&D, which is a third of the total R&D spending in the U.S. Innovation, including in the area of fuel economy and alternative fuel vehicles, is tied to industry leadership. For example, in its Form 20-F, Toyota states that “its long-term success depends on its ability to secure a leadership position with respect to vehicle research and development.” The company spent ¥910.5 billion on R&D in 2014, which is over ¥100 billion more than a year before. The main areas of focus for the company’s R&D efforts included improvements in hybrid technologies and fuel efficiency of gasoline engines, as well as development of alternative fuel vehicles.

**Value Impact**

Strengthening regulations around GHG emissions, local air quality, and fuel economy, together with rising fuel costs, are driving demand for more fuel-efficient or alternative fuel vehicles with lower air emissions. The market for the Automobiles industry is changing, and companies that invest in research and development (R&D) to meet regulatory requirements and evolving consumer demands are likely to improve their revenue and market share. In addition, companies that produce ZEVs over regulatory quotas can generate additional revenue and are likely to improve their reputation and brand value, further contributing to long-term market share and revenue growth. Conversely, regulations can lead to sizable regulatory compliance costs as well as loss of market share and revenue for those manufacturers that fail to reach quotas. Laws and regulations governing the fuel efficiency of vehicles are likely to become stricter over time, which would increase the probability and magnitude of financial impact in the future.

Fleet fuel economy and the number of ZEV and PZEVs sold provide an indication of how well
Automakers are positioned to serve increasing consumer demand for fuel-efficient or alternative fuel vehicles, as well as their ability to leverage or mitigate the effect of regulatory quotas.

**LEADERSHIP AND GOVERNANCE**

As applied to sustainability, governance involves the management of issues that are inherent to the business model or common practice in the industry and are in potential conflict with the interest of broader stakeholder groups (government, community, customers, and employees). They create a potential liability, or worse, a limitation or removal of license to operate. This includes regulatory compliance, lobbying, and political contributions. It also includes risk management, safety management, supply chain and resource management, conflict of interest, anti-competitive behavior, and corruption and bribery.

Automobile companies rely on increasingly complex and geographically diverse supply chains for critical material inputs, magnifying the risks of supply disruptions. Effective materials sourcing that is able to mitigate supply risks will play an increasingly important role on shareholder value in the industry as the supply chain and regulatory environments are constantly shifting.

**Materials Sourcing**

Automobile companies are exposed to risk of supply chain disruptions, input price increases or volatility, and damage to brand reputation. This is particularly true when rare earth or “conflict” minerals and metals are used in their products. The use of minerals that originate from certain zones of conflict also exposes automobiles companies to regulatory risks associated with the Dodd-Frank Act.

Rare earth metals, also known as rare earth elements (REEs), and other critical materials play a crucial role in clean energy technologies. Electric and hybrid vehicles use substantial amounts of critical materials. With global regulations aimed at reducing emissions and increasing fuel efficiency of vehicles, the share of hybrids and ZEVs produced by the Automobiles industry is likely to continue to increase in the future. Furthermore, more electronic components are being used in automobiles, and these also can contain critical materials. These factors make the sourcing of REEs important to the Automobiles industry.

Despite the name, some rare earth elements are actually abundant. However, they are difficult to extract and refine because they tend to be lumped together in rocks along with radioactive thorium and uranium. There are material sourcing risks related to rare earth minerals and metals due to a low substitution ratio, concentration of deposits in only a few countries, and geopolitical considerations. Automobile companies also face competition from increasing global demand for these minerals from other sectors, including Technology, Renewable Energy and Infrastructure, which, along with supply constraints, can result in significant price increase and supply chain risks.

Moreover, the industry also faces supply chain challenges related to conflict minerals. Companies face pressure to track and eliminate the use of minerals responsible for conflict in the Democratic Republic of Congo (DRC) from legislation, actions by non-governmental organizations (NGOs), input price risks, and leadership from peers. To the extent that an auto manufacturer uses the aforementioned minerals in their production processes, the company is required to provide disclosures around the origin of such minerals in accordance with the Conflict Minerals provision of the Dodd-Frank Act (see Regulatory Trends section above). This requires an active monitoring of the supply chain.

Automobile companies with strong supply chain standards and the ability to adapt to increasing resource scarcity will be better positioned to protect
shareholder value. Innovations at the design phase to reduce dependence on some of these materials also contributes to lower risk. Companies that are able to limit the use of critical and conflict materials, as well as secure their supply, would not only minimize environmental and social externalities related to extraction, but also protect themselves from supply disruptions and volatile input prices. Conflict minerals also represent reputational risks, so OEMs need to ensure that their supply chain is “conflict-free.”

Company performance in this area can be analyzed in a cost-beneficial way internally and externally through the following direct or indirect performance metrics (see Appendix III for metrics with their full detail):

- Percentage of materials costs for items containing critical materials;
- Percentage of tungsten, tin, tantalum, and gold smelters and refiners within the supply chain that are verified conflict-free; and
- Discussion of the management of risks associated with the use of critical materials and conflict minerals

Evidence

According to the U.S. Department of Energy (DOE), electric vehicle (EV) technology is one of the most dependent on the availability of rare earth metals. Such materials as lanthanum, cerium, praseodymium, neodymium, nickel, manganese, cobalt, and lithium are used in the manufacturing of EV batteries. A current-generation hybrid vehicle battery contains several kilograms of rare earth elements. The DOE study concluded that, over the short and medium term (by 2025), dysprosium and neodymium were the elements with the highest importance to clean energy and the highest supply risk. 128

Automobile companies may face shortages of critical materials used in the expanding EV segment of the industry and in automobile electronics, not just due to physical constraints of recovering materials, but also due to the concentration of deposits in only a few countries and their low substitution ratio. Shortages of critical materials can also result in price spikes. In 2011, China was producing 97 percent of the world’s supply of REEs as a byproduct of the country’s iron ore mining activities. Furthermore, the British Geological Survey estimates that China is the top producer of 27 out of 52 critical minerals and metals. 129 In 2010, China restricted the export of rare earth elements supposedly due to environmental concerns. This led to a five-fold increase in the price of such materials, while Chinese companies were able to obtain the same materials at lower cost. 130 As China increases development of its own clean energy technologies, the country could significantly limit exports of critical materials in the future. 131

Deposits in some other countries also create supply risks. Lithium is one such material that may experience supply shortages, as more than half of the global reserves of lithium are found in Bolivia alone. The country’s reserves of lithium amount to 73 million metric tons, which Bolivian President Evo Morales claims to be nationalized. The political situation in the country further exacerbates the risk of sourcing the metal from Bolivia. 132

The U.S. government recognizes supply risks and price increases of REEs. In 2011, it announced that it would allocate $30 million in grants towards the development of alternatives that do not depend on the environmentally hazardous and increasingly costly minerals. 133

A 2011 study by PricewaterhouseCoopers (PwC) also demonstrated the materiality of mineral and metal scarcity for the industry. The survey was conducted with 69 senior executives from companies in different sectors, including 11 companies in the automotive sector. The survey found that 73 percent of respondents in the automotive sector perceived minerals and metal scarcity as a pressing issue for
their companies. Moreover, among automotive sector respondents, 73 percent thought that their company may experience an unstable supply of these inputs within the next five years, with 55 percent of respondents rating the severity as ‘high’ or ‘very high.’ The level of engagement and concern for the issue in the automotive industry is further reflected by 64 percent of respondents. These respondents indicated that their companies were already well prepared to mitigate the impact of scarce minerals and metals.134

Companies in the industry can manage the risks of supply shortages and price volatility of critical materials through various strategies, including: diversifying suppliers, improving materials efficiency at the manufacturing stage, increasing recovery of critical materials from ELVs, and investing in R&D to minimize the need for these materials. In a statement to the Congress Committee on Energy and Natural Resources, Jennifer Thomas, the Director of Federal Affairs of the Alliance of Automobile Manufacturers, stated that “[a]utomakers support the Department of Energy (DOE) R&D programs… that would facilitate the efficient production, use, and recycling of critical minerals and identify and develop alternative materials that can be used to reduce the demand for critical minerals.” 135

Some companies actively implement these strategies to lower their dependence on critical materials. For example, Toyota is a downstream user of REEs, which, as discussed earlier, are an integral component of the permanent magnets used in electric motors and generators. In order to reduce demand for rare earths, the company is investing in R&D of induction motors that will not use REEs.136 Automobile manufacturers such as Tesla and BMW do not use REEs in their Roadster and Mini-E EV models. 137

Moreover, Toyota is also striving to ensure a stable supply of rare earth materials, and in recent years, has made several strategic acquisitions. The company established a joint venture with the state-run Vietnamese Coal and Mineral Industries Group (Vinacomin) to develop the Dong Pao rare earth mine with an estimated production of 3,000 tons by 2015. Toyota also bought a company that owns an Indian exporter of REEs with roughly 4,000 tons of annual exports. Finally, the company has made a long-term supply deal with the Great Western Minerals Group subsidiary to provide alloys for battery and magnet production.138

Ford is also taking a proactive approach to understanding and minimizing the issues associated with REEs in their vehicles. The company estimated that a typical HEV sedan with a nickel-metal-hydride battery uses approximately 4.5 kg of rare earth metals. Additionally, HEVs with lithium-ion batteries contain approximately 1 kg of the materials. Ford is focused on reducing the amount of REEs used in electrified vehicle battery systems, and was able to reduce the use of dysprosium in the electric machine permanent motor magnets used in a hybrid system by approximately 50 percent. Minimizing the use of such an expensive element as dysprosium from electric motor magnets helped the company to lower the cost of hybrid systems by 30 percent. Moreover, the new system is also 50 percent lighter and 25 to 30 percent smaller than previous-generation hybrid batteries, which improved the fuel efficiency of Ford’s hybrids. Overall, the company expects the innovation to save up to 500,000 pounds of rare earth metals annually. 139

In certain regions of the world, such as the DRC, the mining and sale of conflict minerals, such as tantalum, tin, tungsten, and gold (3TG), provide funding for armed conflicts. Also, their mining is carried out under conditions that do not respect human rights. Electronic components used in modern automobiles use a substantial amount of tin, tantalum, and tungsten, exposing automobile companies not only to regulatory risk associated with the Conflict Minerals rule of the Dodd-Frank
Act, but also to input price volatility and reputational risks.

The DRC accounts for six to eight percent of global tin production, 15 to 20 percent (or 8.6 percent in 2009, according to the U.S. Geological Survey) of tantalum, and two to four percent of the global tungsten supply. Global input prices of 3TG have shown high volatility, sometimes related to the conflict in the DRC. A 31 percent increase in tin prices in 2008 coincided with a rebel offensive against the DRC’s primary tin trading center. Tantalum is a rare metal used in the production of automotive, medical, and aircraft equipment, as well as semiconductors. It is also a conflict mineral. Its price rose from $110 in 2011 to nearly $300 in 2012 due to supply constraints and rising demand. As the use of electronic components becomes more prevalent in automobiles, the industry may become more exposed to the conflict minerals risk.

Compliance with the Conflict Minerals provision of the Dodd-Frank Act is likely to be costly. The SEC estimates that it will cost affected companies a total of $3 to $4 billion in the first year and at least $200 million each year afterward to comply. This cost will be spread across roughly 6,000 companies, including companies in the aerospace and automotive industries.

Among auto manufacturers, there appears to be consensus around the necessity to eliminate the use of conflict minerals in the production of auto parts and automobiles. According to a statement released by the Automotive Industry Action Group (AIAG), an industry group of major auto manufacturers, “(t)he Automotive Industry fully supports this direction and is investigating ways to ensure that the parts and assemblies in our vehicles and products, regardless of where they are assembled or sold, do not contain Conflict Minerals, which have contributed to the armed conflict in Central Africa.”

Value Impact
Failure to effectively manage the sourcing of critical materials can result in higher input costs and lost revenue due to production disruptions. Companies may also face regulatory compliance costs associated with the sourcing of conflict minerals. If companies do not verify or avoid the use of conflict minerals, they may face significant reputational risk that could result in lower sales. The increasing scarcity or unavailability of certain key materials used by auto parts companies, as well as the price volatility of such materials, can increase companies’ risk profile and cost of capital if these companies rely heavily on such materials and are unable to source them effectively. Increasing demand for EVs and use of electronic components in automobiles, together with an expanding demand-supply gap for critical materials, suggests that the probability and magnitude of these impacts will increase in the future.

The percentage of a company’s products that contain critical materials indicates a company’s exposure to the risk of supply disruption and price volatility for key components, as well as its ability to use alternative materials. The percentage of tungsten, tin, tantalum, and gold smelters within the supply chain that are verified conflict-free indicates the extent of a company’s exposure to conflict minerals, in terms of both supply and regulatory risk.
APPENDIX I
FIVE REPRESENTATIVE AUTOMOBILE COMPANIES

This list includes five companies representative of the Automobiles industry and its activities. This includes only companies for which the Automobiles industry is the primary industry, companies that are U.S.-listed but are not primarily traded Over-the-Counter, and for which at least 20 percent of revenue is generated by activities in this industry, according to the latest information available on Bloomberg Professional Services. Retrieved on July 9, 2014.

<table>
<thead>
<tr>
<th>COMPANY NAME (TICKER SYMBOL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford Motor Company (F)</td>
</tr>
<tr>
<td>General Motors (GM)</td>
</tr>
<tr>
<td>Honda (HMC)</td>
</tr>
<tr>
<td>Tata Motors (TTM)</td>
</tr>
<tr>
<td>Toyota (TM)</td>
</tr>
</tbody>
</table>
### APPENDIX IIA

**EVIDENCE FOR SUSTAINABILITY DISCLOSURE TOPICS**

<table>
<thead>
<tr>
<th>Sustainability Disclosure Topics</th>
<th>EVIDENCE OF INTEREST</th>
<th>EVIDENCE OF FINANCIAL IMPACT</th>
<th>FORWARD-LOOKING IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HM (1-100)</td>
<td>IWGs</td>
<td>%</td>
</tr>
<tr>
<td>Materials Efficiency &amp; Recycling</td>
<td>73*</td>
<td>83</td>
<td>4</td>
</tr>
<tr>
<td>Product Safety</td>
<td>77*</td>
<td>93</td>
<td>1</td>
</tr>
<tr>
<td>Labor Relations</td>
<td>55*</td>
<td>81</td>
<td>5</td>
</tr>
<tr>
<td>Fuel Economy &amp; Use-phase Emissions</td>
<td>98*</td>
<td>89</td>
<td>2</td>
</tr>
<tr>
<td>Materials Sourcing</td>
<td>50</td>
<td>89</td>
<td>3</td>
</tr>
</tbody>
</table>

**HM:** Heat Map, a score out of 100 indicating the relative importance of the topic among SASB’s initial list of 43 generic sustainability issues; asterisks indicate “top issues.” The score is based on the frequency of relevant keywords in documents (i.e., 10-Ks, shareholder resolutions, legal news, news articles, and corporate sustainability reports) that are available on the Bloomberg terminal for the industry’s publicly-listed companies; issues for which keyword frequency is in the top quartile are “top issues.”

**IWGs:** SASB Industry Working Groups

**%:** The percentage of IWG participants that found the disclosure topic to likely constitute material information for companies in the industry. (-) denotes that the issue was added after the IWG was convened.

**Priority:** Average ranking of the issue in terms of importance. One denotes the most important issue. (-) denotes that the issue was added after the IWG was convened.

**EI:** Evidence of Interest, a subjective assessment based on quantitative and qualitative findings.

**EFI:** Evidence of Financial Impact, a subjective assessment based on quantitative and qualitative findings.

**FLI:** Forward Looking Impact, a subjective assessment on the presence of a material forward-looking impact.
## APPENDIX IIB
### EVIDENCE OF FINANCIAL IMPACT FOR SUSTAINABILITY DISCLOSURE TOPICS

<table>
<thead>
<tr>
<th>Evidence of Financial Impact</th>
<th>REVENUE &amp; EXPENSES</th>
<th>ASSETS &amp; LIABILITIES</th>
<th>RISK PROFILE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Revenue</td>
<td>Operating Expenses</td>
<td>Non-operating Expenses</td>
</tr>
<tr>
<td></td>
<td>Market Size</td>
<td>New Markets</td>
<td>Pricing Power</td>
</tr>
<tr>
<td>Materials Efficiency &amp; Recycling</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Product Safety</td>
<td>•</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Labor Relations</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Fuel Economy &amp; Use-phase Emissions</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Materials Sourcing</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

**Note:**
- **MEDIUM IMPACT**
- **HIGH IMPACT**
# APPENDIX III

## SUSTAINABILITY ACCOUNTING METRICS – AUTOMOBILES

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>ACCOUNTING METRIC</th>
<th>CATEGORY</th>
<th>UNIT OF MEASURE</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Materials Efficiency &amp;</td>
<td>Amount of total waste from manufacturing, percentage recycled</td>
<td>Quantitative</td>
<td>Metric tons (t), Percentage (%)</td>
<td>TR0101-01</td>
</tr>
<tr>
<td>Recycling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of end-of-life</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>material recovered,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>percentage recycled</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Average recyclability of</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vehicles sold, by weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Product Safety</strong></td>
<td>Percentage of models rated by NCAP programs with overall 5-star safety rating, by</td>
<td>Quantitative</td>
<td>Percentage (%) of rated vehicles</td>
<td>TR0101-04</td>
</tr>
<tr>
<td></td>
<td>region</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Number of safety-related</td>
<td></td>
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<td></td>
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<tr>
<td>defect complaints,</td>
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<td></td>
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<tr>
<td>percentage investigated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of vehicles recalled</td>
<td></td>
<td></td>
<td></td>
<td>TR0101-06</td>
</tr>
<tr>
<td><strong>Labor Relations</strong></td>
<td>Percentage of active workforce covered under collective-bargaining agreements,</td>
<td>Quantitative</td>
<td>Percentage (%)</td>
<td>TR0101-07</td>
</tr>
<tr>
<td></td>
<td>broken down by U.S. and foreign employees</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Number and duration of</td>
<td></td>
<td></td>
<td></td>
<td>TR0101-08</td>
</tr>
<tr>
<td>strikes and lockouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**Fuel Economy &amp; Use-phase</td>
<td>Sales-weighted average passenger fleet fuel economy, consumption, or emissions,</td>
<td>Quantitative</td>
<td>Mpg, L/km, gCO$_2$/km, km/L</td>
<td>TR0101-09</td>
</tr>
<tr>
<td>Emissions</td>
<td>by region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of (1) zero</td>
<td></td>
<td></td>
<td></td>
<td>TR0101-10</td>
</tr>
<tr>
<td>emission vehicles (ZEV)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>sold, (2) hybrid vehicles</td>
<td></td>
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<tr>
<td>sold, and (3) plug-in</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>hybrid vehicles sold</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Materials Sourcing</strong></td>
<td>Percentage of materials costs for items containing critical materials</td>
<td>Quantitative</td>
<td>Percentage (%)</td>
<td>TR0101-11</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Percentage of tungsten,</td>
<td></td>
<td></td>
<td></td>
<td>TR0101-12</td>
</tr>
<tr>
<td>tin, tantalum, and gold</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>smelters and refiners</td>
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<tr>
<td>within the supply chain</td>
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<tr>
<td>that are verified conflict-free</td>
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<tr>
<td>Discussion of the</td>
<td></td>
<td></td>
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<td>TR0101-13</td>
</tr>
<tr>
<td>management of risks</td>
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<tr>
<td>associated with the use</td>
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<tr>
<td>of critical materials and</td>
<td></td>
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<tr>
<td>conflict minerals</td>
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</tbody>
</table>

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8 Note to TR0101-03 - Disclosure shall include a discussion of the registrant’s approach to optimizing vehicle recycling and recovery rates, including participation in mandatory end-of-life of vehicle programs.

9 Note to TR0101-06 - Disclosure shall include a discussion of notable recalls, such as those that affected a significant number of vehicles of one model or those related to a serious injury or fatality.

10 Note to TR0101-08 - Disclosure shall include a description of the root cause of the stoppage, impact on production, and corrective actions taken.
APPENDIX IV: Analysis of SEC Disclosures
Automobiles

The following graph demonstrates an aggregate assessment of how the top ten U.S.-listed Automobiles companies by revenue are currently reporting on sustainability topics in the SEC Disclosures.

*Percentage of IWG participants that agreed topic was likely to constitute material information for companies in the industry.
References


3 Data from Bloomberg Professional service accessed on August 25, 2014, using the BICS <GO> command. The data represents global revenues of companies listed on global exchanges and traded over-the-counter (OTC) from the Automobiles industry, using Level 3 of the Bloomberg Industry Classification System.


7 Danova, Antonio. “SUV & Light Truck Manufacturing in the US.” IBISWorld, April 2013.

8 Author’s calculation based on data from Bloomberg Professional service, accessed on August 25, 2014 using Equity Screens (EQS) for U.S. listed companies (and those traded primarily OTC) generating at least 20 percent of revenue from the Automobiles segment.


http://www.nhtsa.gov/About+NHTSA/Who+We+Are+and+What+We+Do.


http://www.safercar.gov/Vehicle+Shoppers/5-Star+FAQ.


55 "Chrysler Invests $35m In Emissions Cuts, Conservation." Environmental Leader, October 28, 2011.


90 Data on the percent of employees unionized is from Bloomberg Professional service, accessed July 9, 2014 using EQS screen for U.S.-listed companies (including those traded primarily OTC) and generating at least 20 percent of revenue from the Automobiles segment.


97 Ibid.


103 Jin, “Hyundai’s South Korea labor woes strike again.”


142 Craven, Chelsea, "Why US Tantalum Imports – And Prices – Are Skyrocketing," *Metal Miner*, April 2013: Web 
