Adapting to Climate Change: A Guide for the Transportation Industry

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This guide is part of a BSR industry series. For additional climate adaptation briefs, please visit www.bsr.org/adaptation.

Contents and Methodology

This brief covers:

Reporting on Risks and Opportunities: Based on reporting of climate risk in 2009 by 79 Transportation companies to the Carbon Disclosure Project (CDP).

Current Practices: An outline of actions related to climate change adaptation based on reporting from the CDP, interviews, and other publications.

Emerging Practices: Synthesis of company disclosures, literature, reviews, and input from climate change professionals through interviews.

This primer on climate change adaptation in the transportation industry summarizes how transportation companies are reporting on climate change risks and opportunities. It outlines current and emerging best practice, provides guidance for transportation companies on how to develop a proactive approach to climate change adaptation, and makes recommendations for next steps.

In this brief, transportation refers to a broad range of companies, including those from aerospace and defense logistics, air freight and logistics, airlines, airports, surface transport, trading transport, and general transportation industries.

Introduction

Climate change's warmer temperatures and more frequent and severe extreme weather events, as well as the decreased availability of natural resources, will increase pressure on transportation companies to adapt to changing regulations and customer concerns, along with threats to assets and infrastructure.[1] The sources of this pressure are variable; ranging from those suffering immediate threats from climate change to those pushing for proactive management of assets and key components of global supply chains.

Within these supply chains, the transportation sector plays a critical role in enabling and guiding climate change adaptation strategies worldwide. Both in terms of assets (such as ocean freighters and railcars) and locations (such as airports and seaports), the transportation sector is highly vulnerable to the physical impacts of climate change across its supply chain. Its major vulnerabilities include rising sea levels, changes in temperature, and extreme weather events, all of which can affect destinations and operations.[2] The sector has an opportunity to more wholly play a strategic role in improving the majority of sectors' supply chain impacts through transportation adaptation measures. Yet this ability is often dependent on existing transportation infrastructure, making strategic infrastructure investments a key priority.

Proactive and responsible adaptation should concern the transportation industry for the following reasons:

» Rising sea levels, extreme weather events, and changes to weather patterns pose severe and immediate threats to transportation company supply chains, which will result in business disruptions. Therefore, companies with supply chains in coastal areas, flood zones, or high-risk

[1] Government of Canada, "The Vulnerability and Adaptation of the Transportation Sector to Climate Change Transport, Infrastructure and Communities," 2003. http://www.transportation.alberta.ca/Content/docType57/Production/Adaptation.pdf

[2] Intergovernmental Panel on Climate, Change, "Climate Change 2007 Impacts, Adaptation, and Vulnerability," Cambridge University Press, 2007. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm

storm locations may experience increased rates of interruption and delay.

» The physical risks of climate change will disrupt transportation operations, including facilities and assets. For example, rising sea levels will flood seaports that have not implemented adequate adaptation measures, temporarily or permanently shutting down operations.

» Increases in external pressure from regulators, customers, and shareholders for immediate review and action on climate risks are driving rapid change within the sector. At the same time, the sector is tied to highly vulnerable infrastructure systems, often owned by government, that will require long-term planning and coordination for effective climate-ready systems.

"Increases in extreme heat [due to climate change] are likely to result in payload restrictions, flight cancellations, and service disruptions at affected airports.

[For the Denver and Phoenix airports, there is an] estimated summer cargo loss for a single Boeing 747 of about 17 to 9 percent, respectively, by 2030 because of the effects of increased temperature and water vapor."

Source: National Research Council

Against this backdrop, this brief examines ways that climate change is affecting the transportation industry and how companies are responding. We also propose priority areas for further exploration. Our analysis shows that while there is growing understanding of climate-related risks, there are far fewer examples of adaptive measures, especially in light of the transportation sector's extensive and interrelated supply chain. This means that there is ample room for innovation and leadership to guide the sector toward safer and more comprehensive climate change adaptation. Based on company reporting, this brief will help transportation companies identify material climate risks and opportunities and develop practical approaches to preparing for climate change.

Reporting on Risks and Opportunities

Mitigation refers to actions taken to reduce greenhouse gas emissions, which are primarily driven by energy use.

Adaptation refers to activities that reduce harm or risk of harm, or realize benefits associated with climate variability and climate change.

The following is an analysis of transportation company disclosures in 2009 to the Carbon Disclosure Project (CDP), one of the largest repositories of company reporting on climate change,[3] along with company interviews and annual reports. Companies reported to the CDP on climate change risks and opportunities, and our review of those responses revealed common trends, which are grouped and summarized in the three areas below, and accompanied by examples of companies that provided those responses.

Note that while company names are provided as examples, they do not constitute a comprehensive list of all companies that provided similar responses.

Key:
Risks
Opportunities

1. DISRUPTIONS TO SERVICE OPERATIONS

Supply chain disruptions due to extreme weather events, rising sea levels, and changes in temperature can harm a supplier's assets, leading to service delays or temporary shutdowns. This can result in loss of business, contracts, and customers.[4]

Impacts	Companies
Suppliers of key manufacturing facilities near locations with high risks of the physical impacts of climate change, including rising sea levels and extreme weather events, may experience significant supply chain disruptions.	ITT Corp, Rockwell Collins, BBA Aviation, Mitsubishi Corp., America Latina Logistica
Consistent disruptions in service due to supply chain issues, operations issues, and extreme weather may result in loss of customers.	Copenhagen Airports, British Airways, FirstGroup, Fraport AG, Panalpina, Raytheon Co.

[3] For more information on the Carbon Disclosure Project, see www.cdproject.net.
[4] S. Changnon, "Record Flood-Producing Rainstorms of 17–18 July 1996 in the Chicago Metropolitan Area. Part III: Impacts and Responses to the Flash Flooding," 1999, Journal of Applied Meteorology, Vol. 38, No. 3, March, pp. 273–280.

Carbon Disclosure Project Highlight: Of 79 company disclosures in 2009, 67 percent indicated that climate change represents physical risk to the company, and 48 percent noted that physical impacts of climate change present opportunity.

Source: BSR Analysis

2. THREATS TO ASSETS AND INFRASTRUCTURE

The locations, equipment, and infrastructure that the transportation sector is reliant upon require adaptive investments to not only safeguard against climate change, but also to improve upon existing networks. Since transportation infrastructure is used over a span of 10 years or more, strategic investments are critical to make transportation systems secure and climate resilient.[5]

Impacts	Companies
Airplanes, modules, rail lines and other equipment prone to weather impacts have an increased risk of malfunctioning and/or being damaged.	Air Canada, Cathay Pacific, Canadian National Railway
Rail lines, seaports, airports, and other infrastructure that is part of a network were not built to withstand increased sea levels, storms, or other extreme weather events, requiring significant levels of investment and multi-sector planning. To strengthen entire transportation networks.[6]	Saab, Hafen Hamburg, Deutsche Post, Qantas
Facilities such as coastal airports face specific site risks, including severe storms, which require immediate assessment, strategic planning, and safeguarding to protect operations from future events, such as an increase in hurricanes.	Northrop Grumman, Raytheon Co., Rockwell Collins, VT, FirstGroup

99 percent of all marine facilities* are vulnerable to temporary and permanent impacts resulting from a seven-meter storm surge.

72 percent of all freight port facilities* are vulnerable to a 122 cm rise in relative sea level.

Almost 50 percent of intermodal connector miles,* and 10 percent of its rail miles are vulnerable to rising sea level.

Source: Transportation Research Board of the National Academies

*Facilities assessed by study.

3. CHANGES TO UNDERLYING MARKETS

Transportation companies' reliance upon multiple industries directly impacted by climate change, including insurance, energy, and tourism, increases the sector's vulnerability while also providing new potential service offerings.[7]

Impacts	Companies
Since transportation companies and assets tend to be located in highly vulnerable locations, companies are experiencing a loss of insurance coverage.	Cobham, Burlington Northern Santa Fe Corp., Cintra
The rise in fuel and energy prices will lead to service disruptions, further compounded by increasing emissions regulations and the need for alternate fuel types.	SAS, UAL, Auckland Airport, Hong Kong Aircraft Engineering Co., Boeing, Arriva
Companies tied to tourism may see a decline in demand as the physical damage due to climate change increases, particularly in coastal regions.	Air France-KLM, Macquarie Airports, Nippon Yusen Kaisha (NYK Line), Stagecoach Group, Canadian Pacific
Customers are increasingly seeking more sustainable service offerings, presenting new business opportunities.	A.P. Moller-Maersk, MTR Corp., easyJet

The responses indicate a broad awareness of the risks that climate change poses to a company's owned operations and its supply chain. There was less recognition of opportunities for the sector to play a critical role in adaptation measures across sectors and societies, including disaster response. The

[5] T.R. Karl and D. M. Anderson, "Emerging Issues in Abrupt Climate Change," 2007.
[6] National Research Council of the National Academies, "Potential Impacts of Climate Change on U.S. Transportation," 2008. http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf
[7] Transportation Research Board of the National Academies, "Adapting Transportation to the Impacts of Climate Change: State of the Practice," 2011. http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf

"[T]he impact of sea level rise is limited to coastal areas, but the effect of intense precipitation on land transportation infrastructure and operations is not.

A record-breaking 24-hour rainstorm in July 1996 resulted in flash flooding in Chicago and its suburbs, with major impacts on the urban area.

Extensive travel delays occurred on metropolitan highways and railroads, and streets and bridges were damaged.

Commuters were unable to reach Chicago for up to three days, and more than 300 freight trains were delayed or rerouted."

Source: S. Changnon

transportation sector faces distinct vulnerability due to its scale and the need for long-term planning despite uncertain events. For example, the site-specific nature of physical threats, such as sea level rise, compounded by the range of projected sea levels make infrastructure investments in levees and dams difficult. Investing in levee reinforcements for a three-meter rise is quite different from investing in an infrastructure overhaul for a nine-meter rise. Yet the sector's ability to use "intermodal downshift," in which different modes of transportation can be substituted for one another, such as an airplane in place of a flooded rail line, has provided it some protection against uncertain changes to the sector's extensive network.

It is important to note that the above list is not a perfect representation of all real risks and opportunities. Climate reporting is new; reporting standards are coalescing, detailed guidance is scant, and reporting is uneven among companies. In addition, since attributing distinct weather events directly to climate change can be difficult, identifying and acting upon risks and opportunities specific to climate change can be challenging. Finally, the distinction between risk and opportunity is not always clear—the difference might be how a company is poised to handle a given disruption or risk, especially relative to its competitors.

Current Practices

In response to these risks and opportunities, companies are pursuing a range of adaptive practices to stay ahead of current and expected disruptions. In some cases, these practices are intended to ***protect value*** of existing assets and systems. In others, practices are aimed more at ***creating value*** through innovation and meeting new needs that stem from climate change effects.

The following examples of practices and innovations are drawn primarily from the 2009 CDP responses, and supplemented by conversations with a few companies.

VALUE *PROTECTION*
These practices provide examples of how companies are promoting resilience of physical assets and improving system responses to effectively execute on existing plans and expectations and maintain business as usual.

1 **Climate change risk assessment and management:** Physical risks en route and at site locations in key regions are regularly assessed. Climate-related risks are typically evaluated as part of routine risk assessments, and subsequent actions are included in business continuity planning.

- » **Cobham** conducted risk assessments of sites, including in-depth assessments of sites with high levels of potential risk, to identify and act upon necessary climate adaptation measures to equipment and infrastructure.
- » **National Express Group** conducted specific climate change risk assessments utilizing U.K. Climate Impacts Programme modeling to identify and better understand future risks.

2 **Product design investments:** Companies are investing in equipment upgrades and new technology to protect their assets from climate change.

- » **America Latina Logistica** developed the ultrasound wave, which detects cracks along railway networks caused primarily by changes in

temperature associated with climate change. This helps the company protect its rail lines and rail assets.

» **Rolls-Royce** has integrated climate change risk into product design through efficiency measures, vehicles that can accept alternative fuels, and a fuel cell.

3 **Insurance coverage:** Companies are leveraging their insurance policies to account for the physical risks climate change poses to their supply chains, locations, and ability to deliver services without delays.

» **Cintra** has integrated trends on global climate change into how the company shapes its insurance policies, coverage, and premium costs.

» **Electrocomponents** has purchased business interruption insurance to help safeguard its supply chain and operational risks from delays due to disruptions attributed to climate change.

VALUE *CREATION*

These practices offer examples of how companies are creating solutions that support the pursuit of new revenue-generating opportunities by helping suppliers, stakeholders, and customers adapt to a changing climate.

About Adaptive Practices
Based on the identified risks and opportunities, companies report pursuing a range of adaptive responses, which are included in this section.

Adaptive practices are grouped by two types:

- **Value Protection**: Ensuring resilience of physical assets and planning responses to maintain business as usual.
- **Value Creation:** Devising solutions that contribute to the ability to pursue new revenue-generating opportunities and help suppliers, stakeholders, and customers adapt to a changing climate.

1 **Climate strategy integration:** Companies are increasingly investing in comprehensive strategies to align their current CSR efforts with their specific climate adaptation goals, leading to higher internal efficiencies and alignment as well as increased preparedness for a low-carbon world.

» **Auckland International Airport** has developed an integrated sustainability policy with an action plan that incorporates climate change issues throughout the value chain, framing sustainable business practices as the way forward. This plan was designed to complement the potential climate change adaptation requirements for New Zealand.

» **Boeing** developed extensive strategic measures and methodologies to propel the company's efforts toward climate change adaptation. Through a defined internal governance system, the company has established and is actively working toward reduction targets and efficiency goals that will result in cost savings, a reduced carbon footprint, and potential positive brand benefits. The company has focused extensively on biofuels and improving efficiency within the aviation sector.

2 **New technologies:** Through strategic investments, companies are creating the next generation of transportation and logistics technology that facilitates sustainable behavior, leading to reduced greenhouse gas (GHG) emissions.

» **Deutsche Post DHL** has developed a suite of green logistics solutions and carbon neutral products for their customers to not only share information on climate change, but to also provide them resources for decision-making. One project piloted by businesses integrates CO2 into supply chain design, so leaders are able to choose the carbon reduction scenario that best suits their operational, cost, and carbon requirements. The green product portfolio is part of Deutsche Post DHL's GoGreen environmental protection program, aimed at minimizing the company's impact on the environment and improving its carbon efficiency.

» **MTU Aero Engines** is focusing on reducing fuel consumption, as well as CO_2 and NO_x emissions, through research and development projects, including their geared turbofan technology and intercooled

recuperative aero-engine, which may strategically position the company as a supplier for the shift toward a more sustainable airline industry.

3 **Logistics and Efficiency Planning:** As logistics and planning companies, the transportation sector has found unique opportunities in creating and deploying better logistics and efficiency tools both internally and externally.

- **Ryder System Inc.** and other companies have found opportunities for improving logistics for disaster-relief efforts. The need for such efforts is expected to increase due to climate change.
- **United Parcel Service Inc.** has developed several leading logistics strategies to reduce GHG emissions and transform industry leadership toward future adaptation. Key UPS achievements include a Package Flow Technologies program that eliminated more than 100 million miles of travel, and the company's fuel reduction systems and technology for airlines. UPS has also shifted toward a high utilization rate of intermodal downshift, where the company is able to transport the same goods through different methods of transport to reduce emissions.

Recommendations

This paper has cited a range of responses that are readily observable, and many of them will be familiar to those managing climate change or business risk more generally. According to our analysis, responses to climate change vary significantly based on a transportation company's role in the supply chain and whether proactive climate management is a priority. The public sees the industry as instrumental to reducing emissions and providing leadership in adaptation in both private-sector and government supply chains. This provides transportation companies with three key drivers—supply chain leadership, reputation, and physical threats to operations—for taking proactive steps toward climate and energy management and adaptation throughout their own supply chains.

For these reasons, BSR recommends that transportation companies establish climate change adaptation strategies that contain the following key components.

1. Leverage logistics knowledge. Transportation companies are not only positioned to aid their industry in improved logistics and innovation in transportation, but also to have a distinct multiplier effect throughout the supply chain. As energy reporting, including to the CDP, increases, companies with leading logistics practices *and* external solutions in terms of sustainability will have a key competitive advantage. Companies may also consider creating proprietary or public tools and sustainable logistics solutions for clients as a new service offering. Lastly, as many companies have already discovered due to catastrophic events like Hurricane Katrina, the heat waves in Europe, and increased tsunami activity worldwide, disaster response is a key opportunity to leverage industry expertise. Transportation networks may completely shut down in severely damaged regions, requiring other networks to assist in immediate disaster response efforts as well as cleanup and redevelopment work. As the need for disaster relief increases worldwide, the transportation sector can play a key role in improving responsiveness.

2. Review insurance coverage and plan for gaps. With highly vulnerable assets, transportation companies are already experiencing retractions of insurance coverage. Being proactive in assessing climate risks to operations and wholly integrating them into insurance policies will better safeguard companies from future financial risks.

"*Investment choices made today about the location, retrofitting, and rehabilitation of transportation infrastructure will have far-reaching consequences for the ability of transportation infrastructure to accommodate climate change and for the costs of any necessary adaptation."*

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Source: National Research Council of the National Academies.

3. Incorporate climate change risks into new technology. The diversity within the transportation sector, and within several transportation companies, provides a great opportunity for innovation. Companies leveraging internal knowledge, as well as strategic partnerships for technology development, are already seeing greater returns and diversity within their client base. By integrating not only reduction tactics but also awareness of climate change risks into product development, new technology can provide solutions for the industry. Technologies, such as America Latina Logistica's rail line detector for cracks due to temperature changes, provide opportunities for both safeguarding current assets and creating new services and products for the industry as a whole.

4. Engage active climate change risk assessments and improvements at seaports. Seaport CDP disclosures were disproportionately low, representing larger industry trends of low levels of identification of climate change risk and even lower rates of proactive management. Seaports are a critical juncture in major supply chains, so poor preparation for rising sea levels is a direct threat to the shipping and rail industries, along with such sectors as tourism and retail.[8] The lack of direct authority over seaports and the large variations in predictions for the rise of sea levels have been framed as barriers to industry progress toward climate-resilient seaports. Therefore, strategic planning for safeguarding against climate change has an immediate need and place within climate adaptation for the transportation sector.

5. Report, and increase transparency, on adaptation-specific efforts. As the media and such reporting organizations as the CDP give greater attention to climate change mitigation efforts, adaptation initiatives will also become increasingly important. By actively communicating adaptation efforts through external reporting mechanisms like the CDP, as well as through CSR reports and online communications, companies are able to demonstrate their proactive efforts. This also indicates the importance of adaptation and the recognition of responsibility within the company to act on the issue. Due to the long lifespan of transportation infrastructure, companies and government agencies alike are finding it necessary to demonstrate climate change adaptation thinking in their long-term planning and investments. The EPA's Smartway program is a forward-thinking example of how transportation companies can improve efficiency and reduce emissions while gaining recognition for their work via the rating system. Companies are increasingly sourcing based on Smartway ratings to improve their own supply chain footprints.

It is especially important for transportation companies to view these recommendations through the lens of their specific roles in the transportation network. An airport's climate adaptation strategy will be different from that of a railroad company. Regardless, transportation companies are well-positioned to adapt and create climate strategies and solutions that will ripple throughout a diverse set of supply chains.

For more tools on managing climate change adaptation, visit: www.bsr.org/adaptation.

[8] A. Becker, S. Inoue, M. Fischer, B. Schwegler, "Considering Climate Change: A Survey of Global Seaport Administrators" Center for Integrated Facility Engineering, Stanford University, 2011. http://www.stanford.edu/group/CIFE/online.publications/WP128.pdf