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Mitigating and Adapting to Climate Change in the Auto Industry: Proposed Benefits & Monetization Methods

November 2025



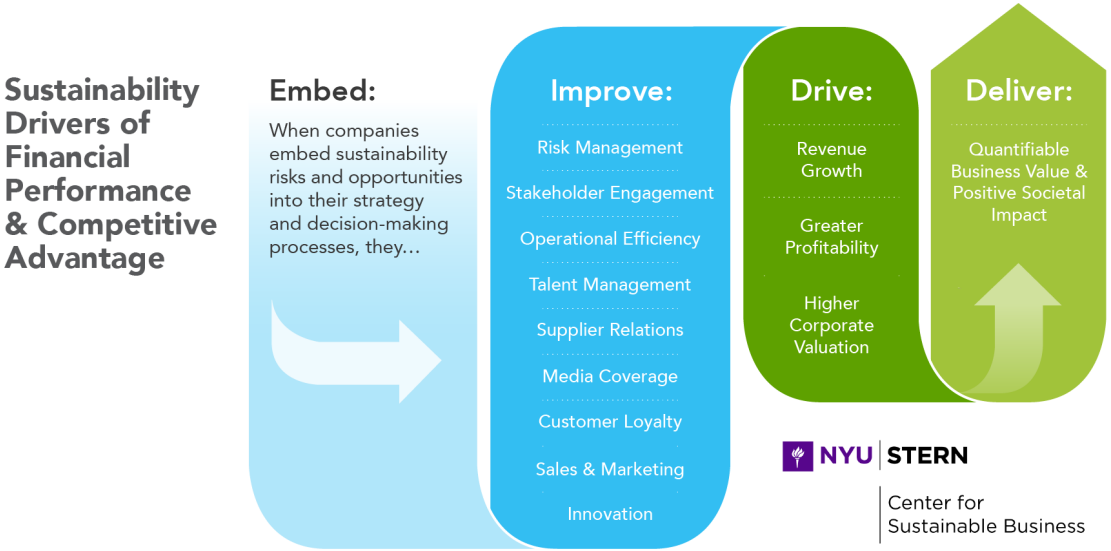
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ROSI™ Framework

Return on Sustainability Investment (ROSI™) Framework



By embedding ESG risk and opportunities within core business strategy, the return on sustainable investment can be quantified, delivering the possibility of both financial value and positive societal impact.

Overview of Auto Industry Framework

NYU Stern CSB is developing a ROSI™ framework for the auto industry with publicly available monetization tools to help the industry understand where and how sustainability can unlock financial value.

Based on research, experience, and engagement with industry leaders, we have identified the following sustainability strategies* used by the industry to include in the framework:

- Mitigate & Adapt to Climate Change
- Waste Management
- Water Management
- Chemical Management
- Support Electrification Ecosystem
- Circularity
- Cybersecurity
- Sustainable Sourcing
- Driver Safety
- Supplier and Employee Well-Being

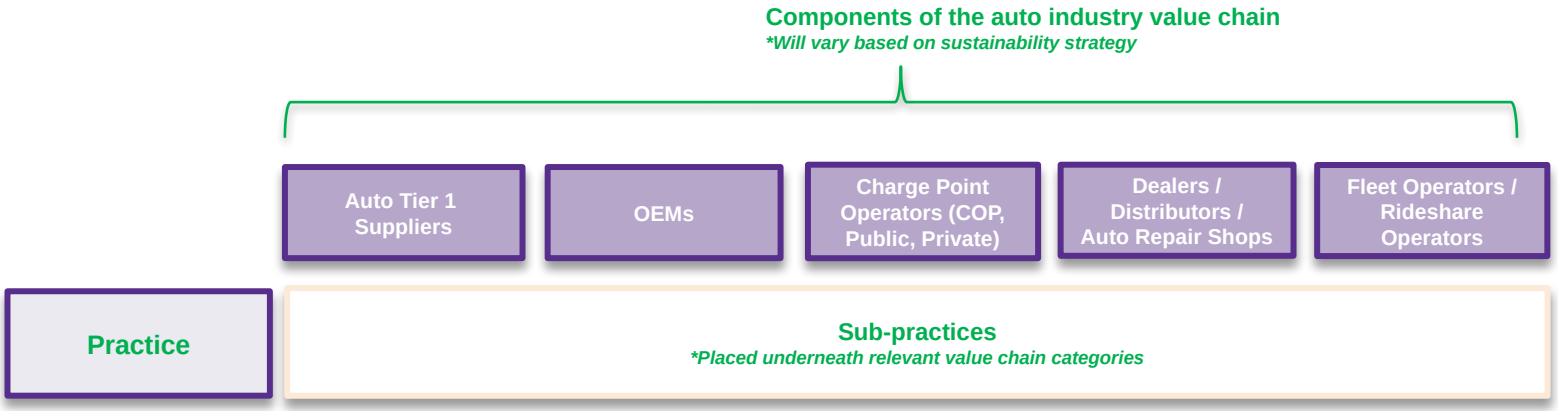
Identified Sustainability Practices and Sub-Practices

Framework Layout

Through our research, we identified key sustainability practices and sub-practices that auto industry value chains are using to achieve their sustainability goals.

- **Each practice is broken into sub-practices, which are mapped to the relevant components of the value chain (and excluded where not applicable).**
- **Benefits are mapped to sub practices, with some benefits appearing across multiple practices.**
- **Specific compliance or enforcement policies are not listed in this framework, except for the new Cross Border Adjustment Mechanism regulations.**

The diagram below illustrates the framework applied for each strategy in the following slides



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Mitigating and Adapting to Climate Change

Investing in Mitigating and Adapting to Climate Change

	Auto Tier 1 Suppliers	OEMs	Charge Point Operators	Dealers / Distributors / Auto Repair Shops	Fleet Operators / Rideshare Operators
Improve Energy Management	Design and/or install new energy efficient equipment				
	Implement energy efficient manufacturing processes				
	Increase use of renewable energy (such as solar panels, wind turbines, etc.)				
	Invest in energy agreements and contracts (such as EACs, PPAs, and VPPAs)				
	Develop on-site energy sources				
	Partner across the supply chain on energy reduction strategies (such as equipment, process improvement)				
Phase Out Internal Combustion Engine (ICE) Vehicles	Promote alternative ice vehicles including plug-in hybrid electric vehicles (PHEVs), fully battery-powered electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and hydrogen fuel cell and hydrogen combustion vehicles			Promote alternative ice vehicles including plug-in hybrid electric vehicles (PHEVs), fully battery-powered electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and hydrogen fuel cell and hydrogen combustion vehicles	
	Innovate in the development of new fuel technologies (hydrogen, biofuels, etc.)				

Investing in Mitigating and Adapting to Climate Change (continued)

	Auto Tier 1 Suppliers	OEMs	Charge Point Operators	Dealers / Distributors / Auto Repair Shops	Fleet Operators / Rideshare Operators
Promote Additional Decarbonization Investments	Improve fuel efficiency of ice vehicles (such as lightweight vehicles, improved technologies, etc.)				
	Improve logistics planning and increase the use of lower-emission transport options to reduce emissions from the transportation of raw materials, components, and finished vehicles			Improve logistics planning and increase the use of lower-emission transport options to reduce emissions from the transportation of raw materials, components, and finished vehicles	
	Source from low carbon suppliers				
	Install new equipment or change processes to reduce embodied carbon (in owned infrastructure)				
	New equipment and/or processes to reduce other GHG emissions (i.e. VOC)				
	Automate emissions data from external (such as emissions factor databases, esg data providers, lca and epd databases, supplier data, etc.) and internal (such as ERP systems, lot sensors, facility-management systems, etc.) sources				
		Invest in alternative mobility solutions (such as ridesharing, carsharing)		Invest in alternative mobility solutions (such as ridesharing, carsharing, etc.)	

Investing in Mitigating and Adapting to Climate Change (continued)

	Auto Tier 1 Suppliers	OEMs	Charge Point Operators	Dealers / Distributors / Auto Repair Shops	Fleet Operators / Rideshare Operators
Build Resilience to Climate Change	Protect owned facilities from extreme weather-related impacts by retrofitting existing buildings, adding advanced drainage systems, and climate-resilient new construction architecture, etc.				
	Diversify suppliers and logistics routes				
	Partner with suppliers on resilience efforts (such as shared best practices, circularity programs, joint emergency planning, and capacity building)				

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Monetization Approach

Investing in Mitigating and Adapting to Climate Change

Overview of Sustainability Strategy and Value Drivers

Sustainability Strategy Definition

Mitigate & Adapt to Climate Change

Automotive value chain participants are investing in strategies to adapt to and mitigate the impacts of climate change, including actions to reduce GHG emissions in their operations through better energy management, transitioning to EVs, and a variety of investments to decarbonize products and processes

The following slides focus on the benefits and relevant value drivers derived from the Mitigating & Adapting to *Climate Change* strategy

Relevant Value Drivers	**Benefits that…**
Operational Efficiency (OE)	Optimize corporate and supply chain efficiencies to lower cost and increase profits
Risk Management (RM)	Encourage risk mitigation and resilience within the value chain
Sales and Marketing (SM)	Increase volume of sales through brand and marketing policies
Supplier Relations (SR)	Improve upon the relationships between the company and its suppliers

Investing in Mitigating and Adapting to Climate Change

Overview of Sustainability Strategy and Value Drivers (continued)

The following slides focus on the benefits and relevant value drivers derived from the *Mitigating and Adapting to Climate Change* strategy.

Relevant Value Drivers	**Benefits that…**
Customer Loyalty (CL)	Attract an increasing community of conscious buyers & consumers, while reducing retention costs
Innovation (IN)	Attract and retain high-quality internal talent
Talent Management (TM)	Improve goodwill among the broader stakeholder community (i.e. NGOs)

Value Drivers not captured in this Strategy

Stakeholder Engagement (SE)	Create new revenue streams using sustainable business models
Media Coverage (MC)	Increase a company's media presence with the development of traditional and social media content

Investing in Improved Energy Management

Overview of Benefits and Monetization Methods

OE	RM	SR
SM	SE	MC
CL	TM	IN

Value Drivers based on color coding illustrated on previous slides

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Improve Energy Management	Design and/or install new energy efficient equipment ——— Implement energy efficient processes	Reduced **energy costs** due to new energy efficient products and processes	OE	Compare the per unit energy cost before and after new equipment or process implementation. Multiply the difference by units produced or serviced and subtract any costs to quantify the benefit
		Reduced **GHG emissions** due to new energy efficient products and processes	RM	Forecast baseline company energy use. Adjust the forecast for the expected improvement in energy efficiency. Convert the reduction in energy into a reduction in emissions using a energy emissions factor (such as EPA GHG Emission Factors). Multiply the reduction amount by an associated cost (e.g. internal cost of carbon or cost of carbon offset) to quantify the benefit
		Reduced **operating cost** (such as lower labor, water use, maintenance and repairs, and tax rebates) due to new energy efficient products and processes	OE	Calculate the savings in other costs (i.e labor, maintenance & repairs, employee related health and safety expenses such as lower workers comp claims and health related absenteeism) related to identified new equipment and/or process change implementation including available tax credits to quantify the benefit
		New equipment and/or processes lower the probability of current or future risk of **non compliance and sanctions**	RM	Forecast baseline company's emissions based on current mix of energy sources and calculate the taxes, fines or penalties on excess emissions (based on current and potential future regulations). Calculate the reduced emissions and related taxes, fines and/or penalties related to increased renewables and compare to the baseline to quantify the benefit
		Increased **consumer demand** due to improved carbon footprint and increased sales of more energy efficient equipment by suppliers	SM	Forecast baseline sales. Estimate the impact of the design change on new and existing customer sales to calculate the incremental sales potential

*Each Sub-Practice has the potential to drive all benefits.

Investing in Improved Energy Management (continued)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Improve Energy Management	Increase use of renewable energy (such as solar panels, wind turbines, etc.) Invest in energy agreements and contracts (such as EACs, PPAs, and VPPAs) Develop on-site energy sources	Reduced **costs** for lower energy usage/consumption	OE	Compare the per unit energy cost before and after investment in reduced energy use and/or renewable or on-site energy sources. Multiply the difference by units produced and subtract any costs to quantify the benefit
		Reduced **GHG emissions** due to reduced energy usage and/or lower emissions sources	OE, RM	Forecast baseline company emissions (including estimates around grid decarbonization). Adjust the emission forecast for reduced energy usage and/or the increase in renewables and/or on-site energy. Calculate the reduction in emissions and multiply by an associated cost (e.g. internal cost of carbon or cost of carbon offset) to quantify the benefit
		Reduced exposure to grid **supply disruption** due to reduced energy, renewables and/or on-site energy sources	RM	Estimate the probability of a grid interruption before and after reduced energy usage, increase in renewables and/or on-site energy. Estimate the associated average costs of a disruption (delay in production - hours, days, weeks, admin and legal expenses). Multiply the change in probability of occurrence by the associated average costs to quantify the benefit
		Reduced exposure to current or future **regulatory or compliance** costs due to new purchases/agreements of carbon offsets, new equipment and/or processes	RM	Forecast baseline emissions based on current mix of energy sources and calculate the taxes, fines or penalties on excess emissions (based on current and potential future regulations). Calculate the reduced emissions and related taxes, fines and/or penalties associated with increased renewables and compare to the baseline to quantify the benefit.
	Partner across the supply chain on energy reduction strategies**	Increased collaboration with suppliers on improved energy management (equipment, process improvement) supports improved **supplier relations**	SR	Measure the impact of the energy practice implementation on vendor management and contract administration costs (legal costs, accounts payables, staffing), working capital, and inventory management (improved delivery times, lower buffer stock)

*Each Sub-Practice has the potential to drive all benefits. **Associated benefits of outcomes (equipment and process design) are captured above

Investing in Alternatives to ICE Vehicles (EVs, PHEVs, BEVs, FCEVs)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Phase Out Internal Combustion Engine (ICE) Vehicles	Promote Alternative ICE Vehicles including plug-in hybrid electric vehicles (PHEVs), fully battery-powered electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and hydrogen fuel cell and hydrogen combustion vehicles Innovate in the development of new fuel technologies (hydrogen, biofuels, etc.)	Improves **operational efficiency** from simplified **manufacturing** process vs. ICE vehicles over time	OE	Forecast sales of vehicles by type (ICE and zero-low emissions). Forecast average COGS and average SG&A as percentage of sales (incorporating declines in battery prices overtime) for each vehicle type and calculate profit for each. Compare net profits to quantify the benefit
		Increases or protects **sales** through better price and/or volume by offering an alternative to ICE vehicles	SM	Calculate the additional volumes of business that can be earned from existing and/or new customers driven by improvements in fuel efficiency. Multiply by an average sales price to calculate the total $ value and apply an average margin % (including the impact of higher prices and any additional costs) to quantify the benefit
		Engineering improvements for fuel economy (like lightweighting, better aerodynamics, and more efficient engines/transmissions) reduces material use, streamlines supply chains, standardizes parts, and cut shipping costs—together drives **operational efficiency**	IN, OE	Identify and calculate any resource efficiencies related to actions to improve fuel efficiency and reduce by any incremental costs

*Each Sub-Practice has the potential to drive all benefits.

Investing in Alternatives to ICE Vehicles (EVs, PHEVs, BEVs, FCEVs) (continued)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Phase Out Internal Combustion Engine (ICE) Vehicles	Promote Alternative ICE Vehicles including plug-in hybrid electric vehicles (PHEVs), fully battery-powered electric vehicles (BEVs), fuel cell electric vehicles (FCEVs) and hydrogen fuel cell and hydrogen combustion vehicles Innovate in the development of new fuel technologies (hydrogen, biofuels, etc.)	Reduced reliance on fossil fuel use lowers the probability of current or future risk of non **compliance and sanctions** related to regulated emissions	OE, RM	Forecast total emissions before and after changes to achieve greater fuel efficiency and calculate excess emissions for each (based on current and potential future regulations). Multiply reduction in excess emissions by the average cost of taxes, fines or penalties to quantify the benefit
		Investment in EVs product offerings can lead to favorable trends in **customer loyalty** and greater sales or reduced risk of sales loss	CL	Calculate current customer loyalty rate (CLR) by dividing the number of new company models purchased after trade-ins by the total company model trade-ins. Estimate the expected improvement (or reduced decline) in CLR due to EV investments and apply it to anticipated trade-ins to determine incremental or avoided lost sales. Multiply these sales by the average vehicle price to estimate revenue impact, then apply the average profit margin to calculate the profit contribution.
		Increased access to **government incentives and favorable financing** terms	OE	Identify the type of government incentive that applies and/or the borrowing rate differential and tenure of the favorable financing available. Calculate the credit amount available. and/or multiply the favorable rate by the loan amount to quantify the benefit

*Each Sub-Practice has the potential to drive all benefits.

Investing in Alternative Decarbonization Initiatives

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Promote Additional Decarbonization Investments	Improve fuel efficiency of ice vehicles (such as lightweight vehicles, improved technologies, etc.) ——— Improve logistics planning and increase the use of lower-emission transport options to reduce emissions from the transportation of raw materials, components, and finished vehicles ——— Source from low carbon suppliers	Reduced reliance on fossil fuels and lowers **GHG emissions** due to improved efficiency of ICE vehicles	RM	Calculate the average annual per unit GHG emissions before (baseline year) and after fuel efficiency changes have been made. Multiply the GHG emissions with an associated cost per unit (e.g. internal price of carbon or carbon offset costs) to quantify the benefit
		Improved fuel efficiency creates **demand from customers** for lower carbon cars and may enable price premiums	SM	Calculate the additional volumes of business that can be earned from existing and/or new customers driven by improvements in fuel efficiency. Multiply by an average sales price to calculate the total $ value and apply an average margin % (including the impact of higher prices and any additional costs) to quantify the benefit
		Engineering improvements for fuel economy (like lightweighting, better aerodynamics, and more efficient engines/transmissions) reduce material use, streamline supply chains, standardize parts, and cut shipping costs—together driving **operational efficiency**	OE	Identify and calculate any resource efficiencies related to actions to improve fuel efficiency and reduce by any incremental costs
		Reduced reliance on fossil fuel use lowers the probability of current or future risk of **non compliance and sanctions** due to Improved fuel efficiency	RM	Forecast total emissions before and after changes to achieve greater fuel efficiency and calculate excess emissions for each (based on current and potential future regulations). Multiply reduction in excess emissions by the average cost of taxes, fines or penalties to quantify the benefit

*Each Sub-Practice has the potential to drive all benefits.

Investing in Alternative Decarbonization Initiatives (continued)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Promote Additional Decarbonization Investments	Install new equipment or change processes to reduce embodied carbon (in owned infrastructure) New equipment and/or processes to reduced emissions (i.e. VOC)	Increased **customer sales** related to lower emission equipment	OE	Calculate the additional volumes of business that can be earned from existing and/or new customers driven by reduced embodied carbon and/or lower emissions. Multiply by an average sales price to calculate the total $ value and apply an average margin % (including the impact of higher prices and any additional costs) to quantify the benefit
		Reduced **embodied carbon in infrastructure and/or emissions** in **operations** from new energy equipment and processes	RM	Calculate the average per unit GHG emissions (for example VOC emissions in paint shop) per number of cars produced before and after changes are implemented. Multiply the differential by the number of cars produced and an associated GHG cost per unit (e.g. internal price of carbon or carbon offset costs) to quantify the benefit. Emissions for infrastructure are captured in life cycle assessment and need to be updated for less carbon intensive material use and compared to prior assessments to quantify the benefit
		Reduced emissions lowers **permitting, monitoring and reporting** costs	OE	Calculate the costs of permitting, monitoring and reporting before and after the change in equipment and/or processes to quantify the benefit

*Each Sub-Practice has the potential to drive all benefits.

Investing in Alternative Decarbonization Initiatives (continued)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Promote Additional Decarbonization Investments	Install new equipment or change processes to reduce embodied carbon (in owned infrastructure) New equipment and/or processes to reduced emissions (i.e. VOC)	Reduced VOC emissions improves **working environments** increasing **employee safety**	TM, OE	Calculate the savings in employee related health and safety expenses (lower workers comp claims and health related absenteeism) before and after the change in equipment and/or processes to quantify the benefit
		Reduced VOC emissions lowers **treatment costs**	OE	Calculate VOC treatment costs per unit of production before and after taking action and multiply by the # of vehicles produced and subtract costs associated with the investment to quantify the benefit
		Reduced **regulatory compliance** risk by lowering emissions to within allowable thresholds, thereby minimizing the likelihood of fines, penalties, or legal action tied to employee safety and environmental regulation	RM	Identify allowable emission limits in relevant jurisdictions (current and anticipated future standards). Measure baseline emissions relative to these thresholds. Calculate avoided excess emissions after new equipment/process changes. Quantify avoided regulatory costs by multiplying avoided excess emissions by average per-unit fines, penalties, or compliance taxes. Subtract investment costs (equipment, installation, process changes) to quantify the benefit

*Each Sub-Practice has the potential to drive all benefits.

Investing in Alternative Decarbonization Initiatives (continued)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Promote Additional Decarbonization Investments	Automate emissions data from external (such as emissions factor databases, esg data providers, lca and epd databases, supplier data, etc.) and internal (such as ERP systems, lot sensors, facility-management systems, etc.) sources	**Reduced compliance and labor costs**, improved reporting accuracy, and strengthened operational efficiency due to streamlined data management	OE	Calculate baseline administrative costs tied to manual reporting (legal, compliance staff, audit prep, data entry, consulting). Estimate reduced costs after automation (fewer staff hours, lower external advisory costs, faster reporting cycles). Quantify the difference in direct cost savings and subtract automation investment and maintenance costs (software, integration, training) to quantify the benefit
		Improved transparency and accuracy of emissions reporting, increases organizational awareness of sustainability practices and reduces the probability of **non-compliance, regulatory sanctions,** and **reputational risks**	RM	Estimate baseline probability of incurring non-compliance fines or sanctions due to incomplete or inaccurate reporting. Estimate reduced probability of fines after implementing automated emissions tracking. Multiple the probability reduction by the average fine/penalty to quantify the benefit
	Invest in alternative mobility solutions (such as ridesharing, carsharing, etc.)	Generates **new revenue streams** from mobility services while diversifying the business model beyond traditional vehicle sales	SM	Calculate annual revenues from new mobility services (ridesharing fees, subscriptions, partnerships, fleet utilization). Subtract operating and investment expenses directly attributable to delivering these services to quantify the benefit from alternative mobility offerings

Investing in Resilience to Climate Change

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers		Suggested Monetization Methods
Build Resilience to Climate Change	Protect owned facilities from extreme weather-related impacts Diversify suppliers and logistics routes Partner with suppliers on resilience efforts (such as shared best practices, joint emergency planning, and capacity building)	Avoided **business interruption** costs (production or supply chain delays and lost sales) caused by severe weather events due to retrofitting existing buildings, adding advanced drainage systems, and climate-resilient new construction architecture, etc.	OE	RM	Assess baseline probability of business interruption from a climate event and calculate the average disruption cost (lost revenue, idle labor, contractual penalties, recovery expenses). Estimate reduced probability of disruption after resilience measures and/or supplier actions. Quantify avoided cost by multiplying reduced probability by average disruption cost. Subtract mitigation investment costs to quantify the benefit
		Reduce exposure to **property damage**, stabilized **insurance** costs, and preserved long-term **asset value** due to resilience investments (e.g., retrofitting existing buildings, advanced drainage, climate-resilient new construction, supplier collaboration for joint planning and capacity building)	OE	RM	Assess baseline risk of property damage from intensified weather-related impacts (frequency, severity, expected loss). Estimate avoided costs from property damage avoidance (repair, replacement, downtime, business continuity), insurance-related savings (premium stabilization, reduced deductibles, continued access to coverage), and asset value preservation (avoid climate-related devaluation). Subtract mitigation investment costs (retrofits, drainage, supplier capacity building) to determine net benefit.

*Each Sub-Practice has the potential to drive all benefits.

Investing in Resilience to Climate Change (continued)

Overview of Benefits and Monetization Methods

Practice	Sub-Practice*	Proposed Benefits	Value Drivers	Suggested Monetization Methods
Build Resilience to Climate Change	Protect owned facilities from extreme weather-related impacts Diversify suppliers and logistics routes Partner with suppliers on resilience efforts (such as shared best practices, joint emergency planning, and capacity building)	Investment in property resilience strategies unlocks financial upside through mitigation tax incentives (e.g., stormwater credits, grants) while reducing exposure to **regulatory sanctions and compliance penalties**	RM	Assess baseline risk of property damage from intensified weather-related impacts (frequency, severity, expected loss). Estimate avoided costs from property damage avoidance (repair, replacement, downtime, business continuity), insurance-related savings (premium stabilization, reduced deductibles, continued access to coverage), and asset value preservation (avoid climate-related devaluation). Subtract mitigation investment costs (retrofits, drainage, supplier capacity building) to quantify the
		Collaboration with new and diverse suppliers on logistics, practice improvements, planning, and capacity building strengthens **supplier relationships**, driving **efficiencies** in vendor management, contract administration, and inventory control	SR	Measure reductions in vendor management and contract administration costs (legal fees, accounts payable processing, staffing). Estimate working capital improvements from faster delivery times and lower buffer stock requirements. Quantify avoided costs or savings from improved supply reliability and reduced inventory carrying costs. Subtract collaboration and capacity-building investment costs to quantify the benefit

*Each Sub-Practice has the potential to drive all benefits.



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