

# The price of unprepared



# Content overview

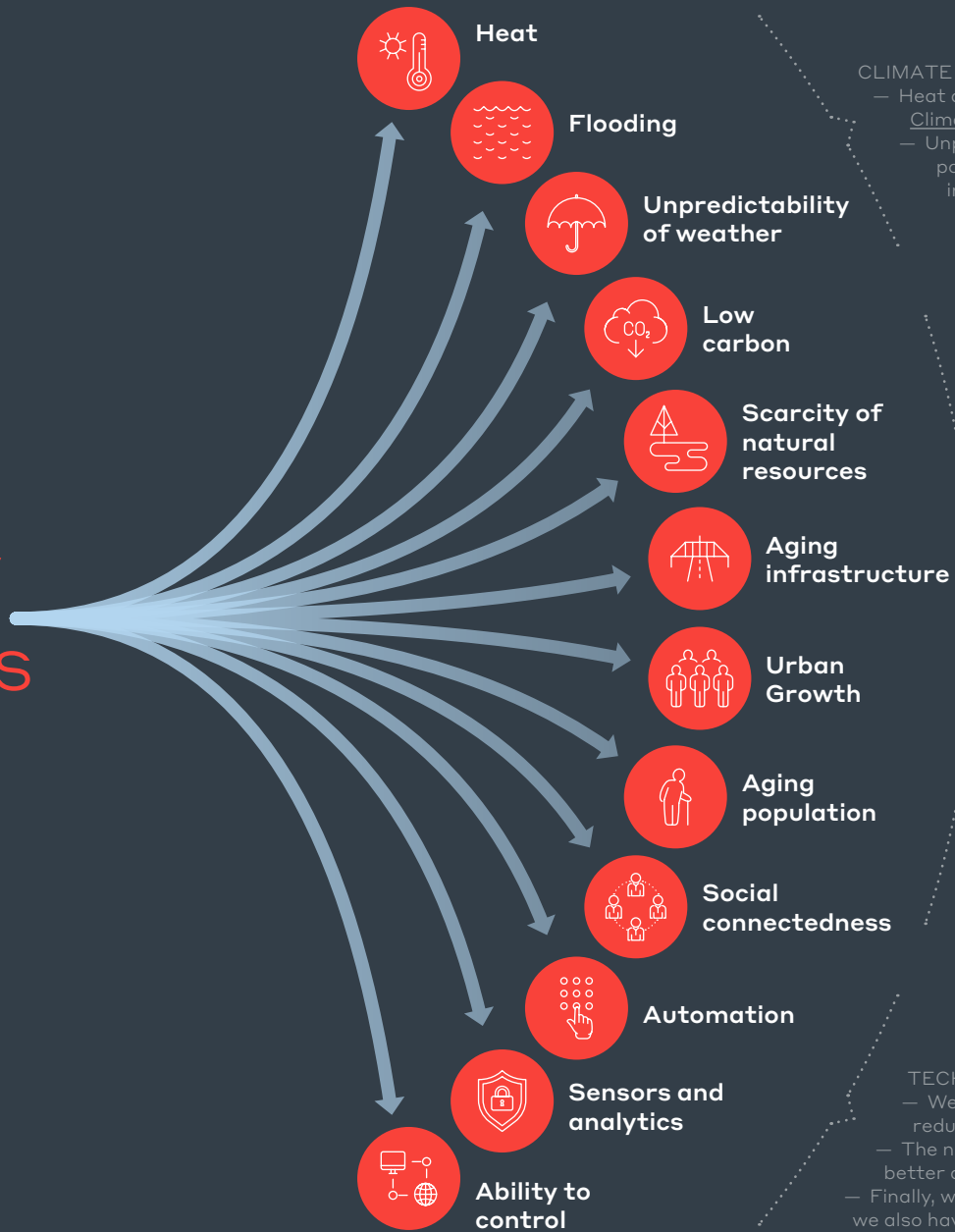
12 key trends	— 04
Cost implications	— 05
Hidden costs, potential savings	— 06
Proactive investment, preventative measures	— 07
How can you lower the price tag?	— 09
Contributors	— 11
Appendix	— 12

In the next 10 years alone, disruptive trends in climate, resources, society and technology are projected to cost Canadians an **extra \$25,000 per household, per year**. How can we act now to mitigate these impacts — and lower the price tag on disruptive change?

COVID-19 has had a significant impact on our economy, and organizations have learned important lessons about how to adapt in a crisis environment. But these lessons aren't limited to public health challenges; much of what we've learned can be applied to other future challenges, too. Disruptive change like extreme weather events and unexpected black swan events are two such examples that could. But there are other major trends to plan for over the next decade. And if we're not prepared, change will come at a steep cost. Here's our experts' line-item breakdown of how future trends may tally up financially.

Beyond the COVID-19 experience, we took a step back and considered trends in climate, resources, society and technology. In each of these categories, we identified three **major trends that our advisors believe will be both impactful and are frequently overlooked**.

# 12 key trends



## CLIMATE

- Heat and flooding are two of the trends identified in [Canada's Changing Climate Report](#) [1].
- Unpredictable weather is one that our teams identified as having large potential risk and operational costs that would be transferred through insurance and contracted works.

## RESOURCES

- Canada's GHG emissions are reducing, and Canada has strong targets to halve GHG emissions by 2030 and become carbon neutral by 2050.
- With increasing urban growth, pollution and climate change, natural resources will become scarcer.
- Our infrastructure is aging, which is imposing both costs and risks.

## SOCIETY

- We focus on the global population increase because its impacts on Canada are fascinating: by 2030, our population increase will be due entirely to newcomers. Diversity will increase, and so too will our opportunities for innovation. Further, increasing global population will result in increasing urban growth, which will increase demand for infrastructure and services.
- The number of older adults is expected to increase by about 40% between 2020 and 2030.
- Finally, we chose connectedness – not in the technology sense, but in the sense of “the way we work and feel”. Here, we identified that Canadians’ mental health is projected to suffer. However, another important consideration is that of collaboration: there are opportunities for entities with similar interests to come together to co-fund important initiatives that will improve mental health, safety and security, and physical health.

## TECHNOLOGY

- We identified increasing automation as one with significant opportunity to reduce costs and improve efficiencies.
- The next step was to consider the power of sensors and analytics to make better decisions.
- Finally, we recognized that sensors and analytics are virtually meaningless unless we also have the ability to do something with the information.

# Cost implications

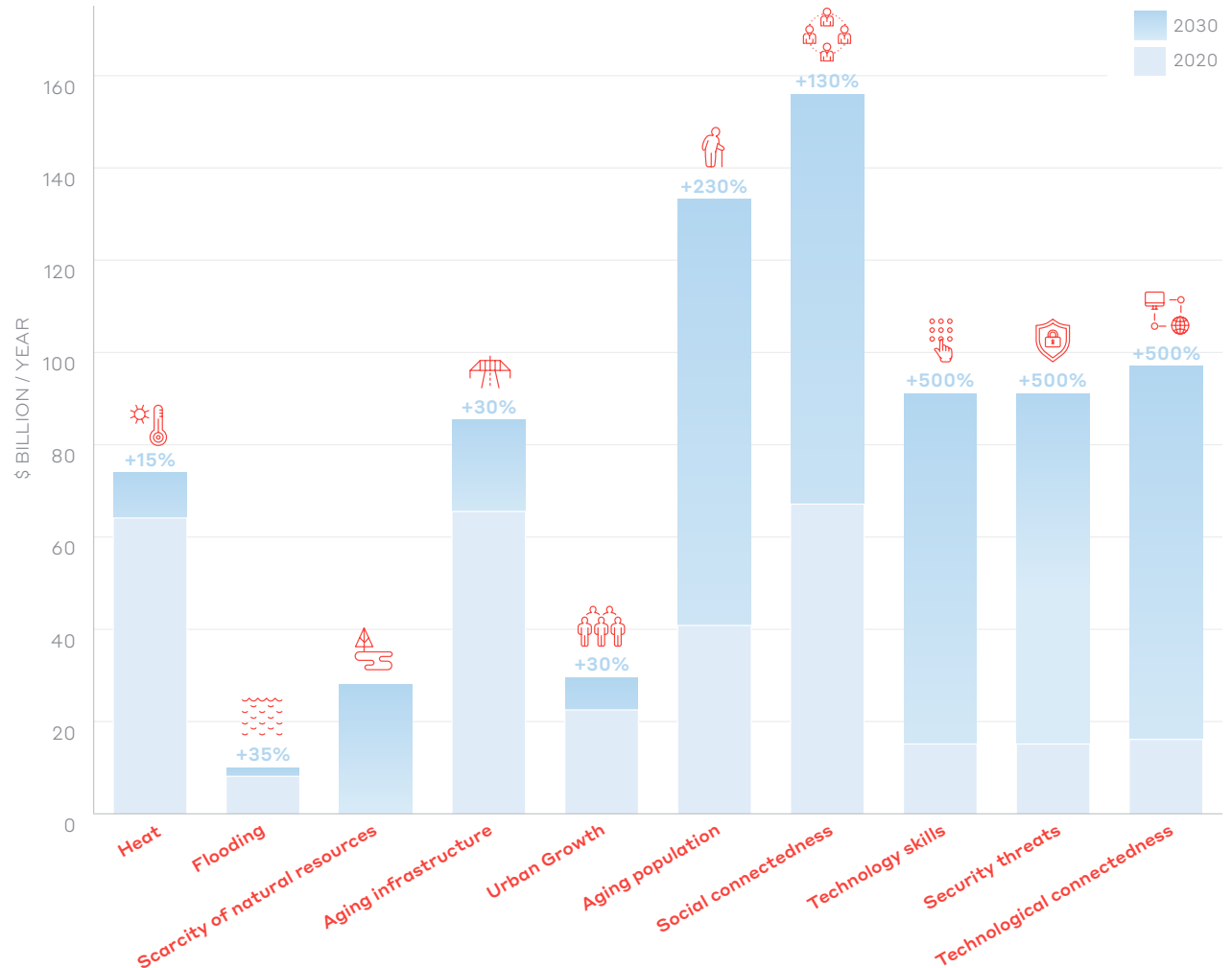
**For each of these trends, we examined the impacts — and the economic implications.**

From the available information, acknowledging many gaps and extrapolations, these 12 trends will cost the Canadian economy roughly \$480 billion per year, as shown in the figure below. That's an increase of \$25,000 per household in just the next 10 years. The impacts of each trend were based on our experts' input and a detailed literature review. Economic implications were obtained from academic literature and industry reports. Most of the available data was specific to Canada. In a few instances, we interpolated based on global or G20 GDP estimates.

We did not find data on the cost implications of increasingly unpredictable weather or scarcer natural resources". Further, we found that the implications of the key technology trends would result in three main types of impacts which overlapped significantly. We have therefore represented the increased costs of technology in terms of the impacts of technology skills, security threats and technological connectedness.

*By 2030, twelve key trends will cost Canadians an additional \$25,000 per household per year.*

INCREASED COSTS DUE TO ALL TRENDS



Refer to the [Appendix](#) for more information about the impacts included in the cost estimate for each trend

# Hidden costs, potential savings

This cost analysis of the existing literature gives us a pretty good idea of what we might expect the financial burden to be — but we don't have a complete picture yet. There are two striking gaps in what has been monetized:

1

The impacts on **infrastructure costs** due to heat (e.g., shorter asset lives), technology (e.g., upgrades to leverage new technology), and urban growth (e.g., upgrades to infrastructure to support denser populations).

2

The impacts on the **costs of materials and construction** due to increasingly unpredictable weather (e.g., disruptions to construction and operations) and heat (e.g., invasive species degrading timber sources).

These costs will impact municipalities, utilities, developers, and provincial and federal governments, among others. They could apply in many different scenarios, but consider construction as just one illustration. Here are a few examples of how the costs of construction will increase for everyone:



## Labour costs

Employees will rapidly require more training to work with new technologies and low-carbon materials. And with more people caring for aging parents combined with a projected increase in mental health challenges, employees in all sectors will need more benefits support.



## Cost of materials

Increasing heat will affect the timber supply through forest fires and invasive species. Increasing heat and flooding will disrupt transport of materials, adding to supply chain costs.



## Volume of materials

More materials will be required to service smart infrastructure, to protect electrical devices from cables, and to provide ample space to accommodate smart equipment.



## Insurance and risk costs

More unpredictable weather and flooding will increase the risks of damage at construction sites, and will be factored into insurance.

It's not all costs; these trends can bring benefits too. For example, increasing diversity can bring enhanced innovation and creativity, and an aging population can provide more mentors and their work can bring a greater sense of community. However, just as we need to leverage the potential benefits of these trends, we also need to mitigate or reverse the costs.

# Proactive investment, preventative measures

All these cost increases can seem overwhelming. The great news is that there is a lot of evidence about the kinds of proactive and preventative investments that can be made now to reduce long-term costs.

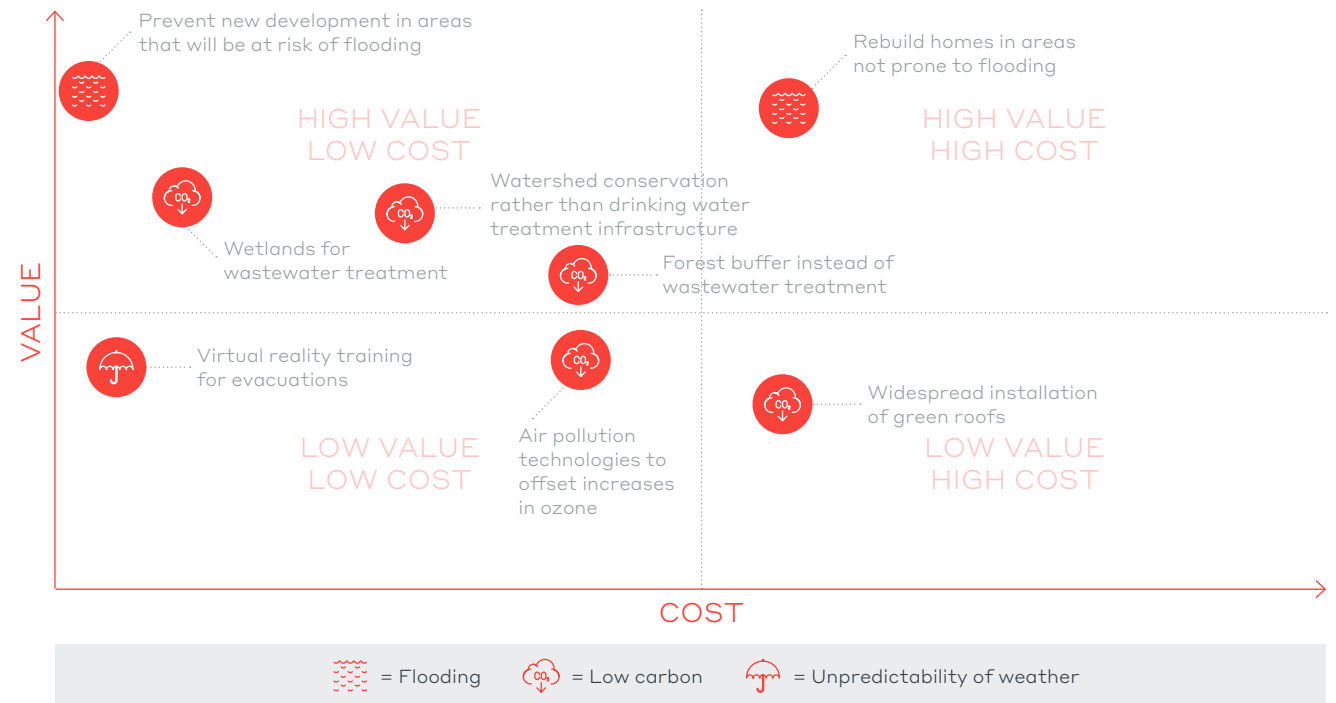
For example, many flood protection measures have been shown to have benefits that far outweigh costs.

So where to start? There are two main considerations:

## 1. WHAT'S WITHIN YOUR IMMEDIATE CONTROL?

Within your immediate control, there are solutions that provide greater benefits than costs. Prioritize the set of projects that has the highest value for your budget.

The chart below shows how a set of solutions for green and low carbon infrastructure would plot out:



This matrix oversimplifies the approaches somewhat, and the added complexity is important. One measure might have a low capital cost, but require changes in your own policies or even industry regulations. This can add a level of difficulty, which you need a strategy to address.

# Proactive investment, preventative measures

As one tangible example, the Ministry of Transportation in Ontario recently released a [report](#) on connected and automated vehicles (CAVs) that transportation authorities can use to evaluate their readiness for a future of CAVs. Their framework for considering the different levels of change required for CAV readiness is useful for our overall readiness purposes:

## 1. Infrastructure readiness

Do we have the right infrastructure to support these solutions? Do we need new technology to gather data and analyse the effectiveness of these solutions?

## 2. Operational readiness

Do we have the skills in our organisation – to design and make decisions? Are we structured to procure and manage this type of solution? Do we have the culture to take on a preventive, smart, resilient mindset? Have we piloted some solutions?

## 3. Institutional readiness

Are the right skills being taught and available? Has industry developed and are they promoting the right standards?

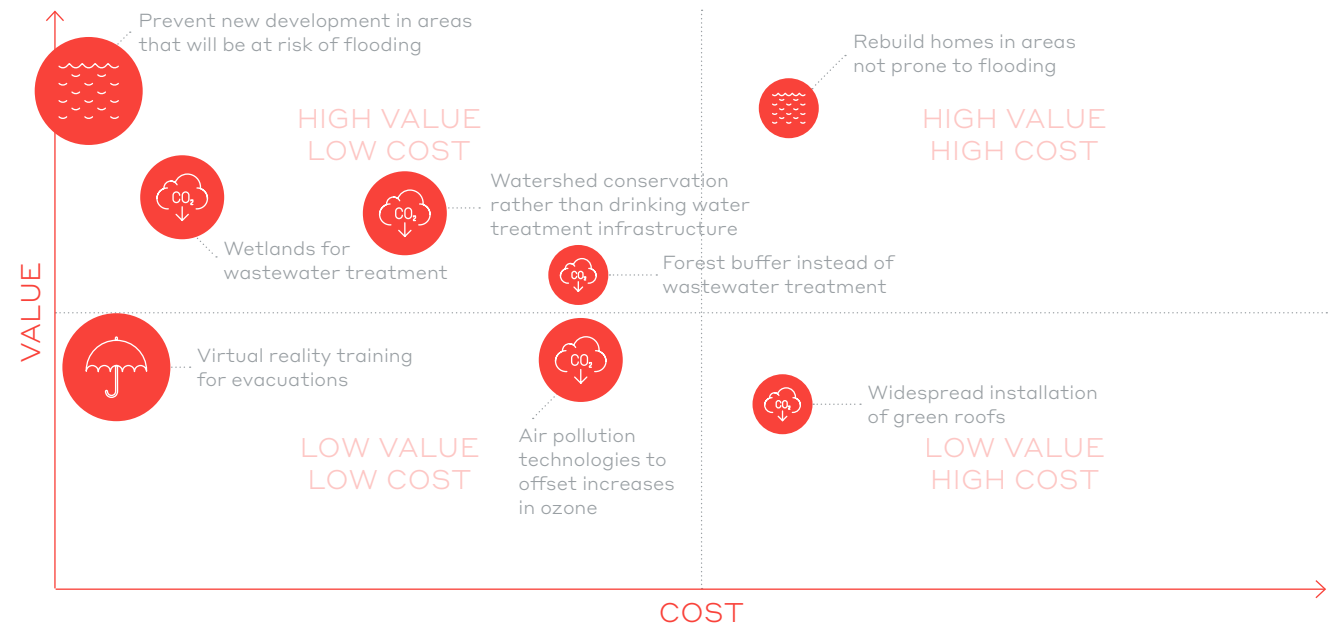
## 4. Policy

Are the regulations and incentives in place to promote these solutions?

## 2. WHAT REQUIRES DEEPER CHANGE OR MORE EFFORT TO MAKE IT A REALITY?

There are systemic cost increases that will affect other organizations like yours. For these, the best way forward is to collaborate with your industry and advocate for change.

Pulling in this third dimension of systemic costs, the size of the bubbles below reflects the ease of implementing each initiative. Initiatives that are “ready” to implement will deliver change more quickly, while initiatives that require more widescale change (“not ready”) will require collaboration with other departments or wider industry.



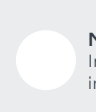
= Flooding    
 = Low carbon    
 = Unpredictability of weather



**Ready to implement**  
no additional infrastructure or operational changes required



**Moderately ready to implement**  
additional infrastructure or operational changes required but we can do this



**Not ready to implement**  
Institutional changes or new industry standards required



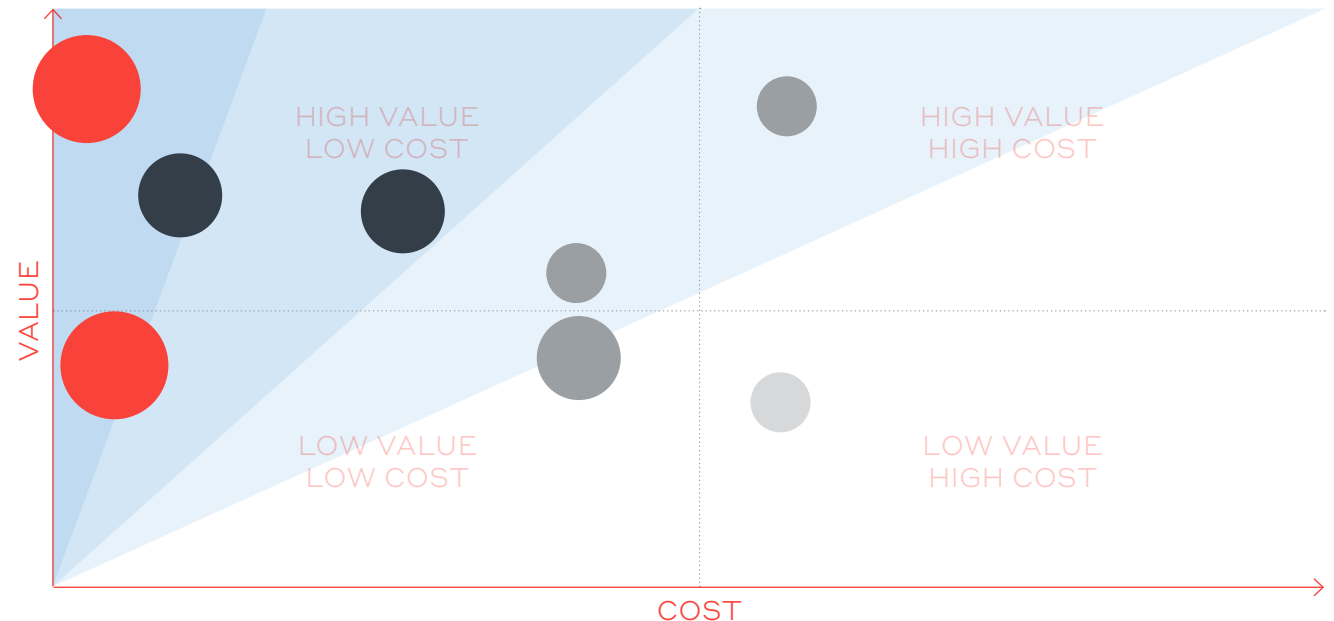
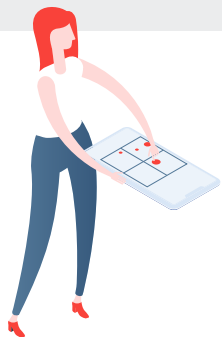
# How can you lower the price tag?

You can consider three timeframes into which you can plan different initiatives; first to gain momentum, and then to initiate widespread, sustainable change.

- 1 Do now**  
 These projects provide high value at relatively low cost and have few real barriers to getting them moving and seeing results.  
 ↳ Low cost, Positive value, Easy to implement (Can get results quickly)
- 2 Plan for a 5-year horizon**  
 These projects provide high value and relatively low cost with greater difficulty. Because of their high benefit/cost ratio, it is worth putting change in place, by building supporting infrastructure or preparing your operations.  
 ↳ Low-med cost, Positive value, Moderate change required to implement (Require additional supporting infrastructure or operational changes)
- 3 Plan for a 10-year horizon**  
 These projects may have higher costs, or they require more fundamental change in industry. Because of their high benefit/cost ratio, it is worth collaborating with industry for change.  
 ↳ Low-high cost, Positive value, Wide-scale change required to implement (Institutional or policy change required)

Download our **WSP Value / Cost / Readiness template** to start prioritizing your Smart Resilient investments

[Download](#)



*When it comes to your own operations, we suggest starting with the smaller investments that have demonstrated benefits greater than the costs, and implementing pilots for larger initiatives. You can start today to implement both small changes and support large movements to offset the coming cost your communities.*

ABOUT THE AUTHOR

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Discover the rest of our *Costing the Chasm* series on [wsp.com](http://wsp.com), and stay tuned for our WSP Smart™ campaign launching September 2020. In the meantime, follow the links to learn more about [Future Ready®](#) and [Resilience at WSP](#).



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# Appendix

## CLIMATE

### Heat

#### \$42 billion/year

- Reduced worker productivity \$11 billion (based on 2-4% of GDP per trillion tonnes of carbon emitted. \$0.59/tonne CO<sub>2</sub>. Source: Chavaillaz, Y; Roy, P; Partanen, A; et al, 2019, "Exposure to excessive heat and impacts on labour productivity linked to cumulative CO<sub>2</sub> emissions", Sci Rep 9, 13711. Available <https://www.nature.com/articles/s41598-019-50047-w#Sec12> ). Further from Chavaillaz: today we are at 0.6 tera tonnes Carbon, so annual loss would be 0.6\*0.5=0.3% of GDP; the 1 tera-tonne threshold will be passed around 2045
- 2030 expected GDP=\$2876 billion (based on 2020 GDP of 2340 Billion CAD and 1.7% annual increase <https://www.conferenceboard.ca/e-library/abstract.aspx?did=10522> )
- 2030 expected carbon emissions= 0.76 tera tonnes Carbon (Chavaillaz)
- 2030 expected losses due to worker productivity=2030 GDP x expected carbon emissions x 0.38% = \$10.9 billion
- Suicide and violent crime \$45.5 billion
  - 1% increase in suicide and violent crime due to 1C increase in temperature: M. Burke, F. Gonzalez, P. Baylis, S. Heft-Neal, C. Baysan, S. Basu and S. Hsiang, «Higher temperatures increase suicide rates in the United States and Mexico.» Nature Climate Change, 2018.
  - Expected temperature increase in Canada by 2030 1C ref <https://changingclimate.ca/CCCR2019/chapter/4-0/>
  - 3811 suicides in Canada 2018 <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039201>. Estimated cost of suicide death \$850,000 in New Brunswick (1996) <https://www.suicideinfo.ca/resource/economicsofsuicide/>. Convert to 2020 dollars=\$5 billion/yr
  - Homicides cost \$3 billion (life value only) in 2012. \$35.2 billion for pain and suffering for other violent offences. \$1.8 billion for personal security measures. Total min \$40 billion
  - 1190 violent crime cases per 100,000 people <https://www.fraserinstitute.org/sites/default/files/cost-of-crime-in-canada.pdf>
  - Assuming number of crimes otherwise stays constant, and only 1C temp increase from 2012
- Forest fire damage and suppression \$2.5 billion
  - 50-300% Increase in frequency of forest fire-causing weather conditions and double the average area burned by 2100. Use conservative 100% increase. Interpolate to 2030. Forest fire suppression costs in 2018 were \$0.75 billion. Forest fire damage in 2018 was \$1.4 billion. <http://nrt-trn.ca/wp-content/uploads/2011/09/paying-the-price.pdf>
  - Wider and more dense spread of destructive pests and therefore disease
- Mortality and treatment due to heat and air quality (based on estimates in four cities only. \$10 billion min:
  - Estimated 25-400% increase in heat-related deaths over the next 30 years <https://nationalpost.com/news/canada/new-research-predicts-heat-waves-in-canada-could-become-more-frequent-and-five-times-more-deadly-and> <http://nrt-trn.ca/wp-content/uploads/2011/09/paying-the-price.pdf>. \$3-5 Bn/ year in 2018 for four cities. Interpolate for 2030: \$4-14 Bn/yr
  - Fatalities \$3.8-4.2 Bn/yr in 2018 to \$4.7-6.2 Bn for four cities in 2030 <http://nrt-trn.ca/wp-content/uploads/2011/09/paying-the-price.pdf>

*! Important "heat" aspects not valued: Decreased infrastructure life due to heat effects; business continuity losses (e.g., airports as planes can't fly during extreme heat); other business losses (people less likely to go outside when it's very hot); food chain losses*

## RESOURCES

### Low carbon

#### \$ No value identified

*! Important aspects not valued: The cost of materials and training required to meet low carbon requirements*

### Scarcity of natural resources

#### \$28 billion/year

Supply chain interruptions and waste disposal

Price volatilities and supply chain interruptions due to resource use in production and consumption estimated at \$4.5 trillion globally by 2030 (CAD \$6.1 billion). Prorate from global (8.5 billion) to Canadian (41 million) population in 2030. <https://institute.smartprosperity.ca/sites/default/files/spipolicybrief-circulareconomy>

### Aging infrastructure

#### \$83 billion/year

Increased maintenance costs for aging infrastructure.

Source: <http://www.chamber.ca/media/blog/131218-The-Foundations-of-a-Competitive-Canada/>

### Flooding

#### \$12 billion/year

Based on insurance claims for property damage and injury and estimate for 2100 (increasing from \$1.8 billion in 2018 to \$7.2 billion in 2100), straight-line interpolated for 2030 (\$2.6 billion), and insurance industry's estimate of infrastructure damage at "three times" property and injury claims (\$7.8 billion).

Source: Insurance Bureau of Canada, 2015. "The financial management of flood risk". Available [http://assets.ibc.ca/Documents/Natural%20Disasters/The\\_Financial\\_Management\\_of\\_Flood\\_Risk.pdf](http://assets.ibc.ca/Documents/Natural%20Disasters/The_Financial_Management_of_Flood_Risk.pdf)

*! Important "flooding" aspects not valued: Mental health impacts; averting behaviours; out of pocket costs; decreased infrastructure life due to more frequent and more widespread water ingress and attack; costs to fortify, strengthen and strategically retreat; impact on price of hydroelectricity.*

### Unpredictability of weather

#### \$ No value identified

*! Important "more unpredictable weather" aspects not valued: Rise of insurance costs due to additional damage; risk of price of physical works / construction and operation of infrastructure as higher risk is priced into contracts, PPPs, etc due to increasing uncertainty of weather events and how they will affect construction site, supply chains and infrastructure operations*

# Appendix

## SOCIETY

### Urban growth

#### \$30 billion/year

Increased costs in diabetes, cancer and heart disease.

Source: WSP Canada, 2019. Available [https://www.wsp.com/-/media/Insights/Canada/Documents/2019/Whitepaper\\_Health\\_and\\_the\\_Built\\_Environment\\_EN.pdf](https://www.wsp.com/-/media/Insights/Canada/Documents/2019/Whitepaper_Health_and_the_Built_Environment_EN.pdf)

*! Important "urbanization" aspects not valued: Infrastructure capacity increases; new infrastructure investments.*

### Aging population

#### \$93 billion/year

Increased costs of health care for the aging population generally (\$93 billion). These components may or may not overlap: dementia (\$23.2 billion) and injuries from falls (\$17 billion: extrapolated from expected number of older adults in 2030 using same injury rate of 1.2%).

Sources:

- Dementia: Alzheimer Society 2016, "Prevalence and monetary costs of dementia in Canada: a preort by the Alzheimer Society of Canada". Available <https://www.canada.ca/en/public-health/services/reports-publications/health-promotion-chronic-disease-prevention-canada-research-policy-practice/vol-36-no-10-2016/report-summary-prevalence-monetary-costs-dementia-canada-2016-report-alzheimer-society-canada.html>
- Other illnesses and health care: The Conference Board of Canada, 2018, "Meeting the care needs of Canada's aging population", Available <http://live-cma-ca.pantheonsite.io/sites/default/files/pdf/Activities/Conference%20Board%20of%20Canada%20-%20Meeting%20the%20Care%20Needs%20of%20Canada's%20Aging%20Population.PDF>
- Injuries: SmartRisk, «The economic burden of injury in Canada,» SmartRisk, Toronto, ON, 2009. Reference available <https://www.canada.ca/en/public-health/services/injury-prevention/cost-injury-canada.html>

*! Important "aging" aspects not valued: investments to modify homes, neighbourhoods and public buildings for greater accessibility and health; skills and knowledge "losses" out of formal workforce; contributions of aging population to community wellbeing through volunteering and mentoring.*

### Social connectedness

#### \$1.4 trillion cumulative; \$156 billion/year

The direct cost of mental illness in Canada (does not include losses due to productivity).

Source: Mental Health Commission of Canada, 2013, "Making the case for investing in mental health in Canada". Available [https://www.mentalhealthcommission.ca/sites/default/files/Investing\\_in\\_Mental\\_Health\\_FINAL\\_Version\\_ENG\\_0.pdf](https://www.mentalhealthcommission.ca/sites/default/files/Investing_in_Mental_Health_FINAL_Version_ENG_0.pdf)

*! Important "connectedness" aspect not valued: the benefits of coordinating resources across government departments, ministries, organisations, and companies. For example, municipalities' investments in the built environment to improve health outcomes.*

## TECHNOLOGY

### Skills adapted to technology

#### \$162 billion cumulative; est \$20 billion/year

Unattained GDP growth 2018-2028 if skills are not adapted to meet the needs of the new technological era. Accenture's estimate converted from \$US119 billion cum.

Source: Accenture, 2018: Accenture (2018), "Bridging the skills gap in the future workforce". Available <https://www.accenture.com/acnmedia/Thought-Leadership-Assets/PDF/Accenture-Education-and-Technology-Skills-Research.pdf#zoom=50>

### Security threats

#### \$90 billion cumulative; \$10 billion/year

The combined cost of cyber-crime and cyber-espionage to Canada: 0.2% of GDP. Based on CSIS estimate for Canada.

Source: Hughes, Bohl, Irfan, Margolese-Malin & Solorzano, 2016, "ICT/Cyber benefits and costs: Reconciling competing perspectives on the current and future balance", Technological Forecasting and Social Change, 115, 117-130. doi: <https://doi.org/10.1016/j.techfore.2016.09.027> Available <https://www.sciencedirect.com/science/article/pii/S0040162516303560>

### Technological connectedness

#### \$890 billion cumulative; \$140 billion/year

Benefits if we maximise Information and communications technology of the future. Pro-rated from global estimate of US\$130 trillion cum and US\$20 trillion/year by 2030, using a simple per capita basis for Canada, based on 2030 populations, and converted to CAD. Global population projected to be 8.5 billion. Canada's projected to be 41 million.

Source: Hughes, Bohl, Irfan, Margolese-Malin & Solorzano, 2016, "ICT/Cyber benefits and costs: Reconciling competing perspectives on the current and future balance", Technological Forecasting and Social Change, 115, 117-130. doi: <https://doi.org/10.1016/j.techfore.2016.09.027> Available <https://www.sciencedirect.com/science/article/pii/S0040162516303560>

