Deconstructing project costs

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Over the coming decades, construction projects will likely represent an ever-growing proportion of our spending. These projects are already pricey, accounting for **$1.3 trillion** in spending in 2019 alone. What happens to that price tag when the number of projects climbs, in tandem with their individual costs? And how can smart solutions both mitigate and prevent sticker shock?

As infrastructure investment races to rebuild some of the economic damage from COVID-19, construction spending in Canada has taken centre stage. Our construction projects have long been a major investment industry — we spent $1.3 trillion on construction in 2019 alone. Over the coming decades, we expect to see a steady increase in construction projects, and our research suggests that the costs of construction will also rise significantly.

With more projects and greater expenses creating a double-edged challenge, left unchecked, construction costs could soar unsustainably high. But integrating smart technology throughout the construction lifecycle could play an important role in mitigating and even reversing those costs.

More projects

A boost in construction investment isn't just a COVID thing.

We can expect more construction for at least the next 10 years due to the impact of climate on asset lifecycles; an aging infrastructure stock; increasing urban growth; an aging population (and a need to meet their needs for aging in place); and changes in technology. Here's how these trends will drive more construction:

Increasing heat

- Replace and repair infrastructure that fails early due to increased heat
  Higher temperatures and humidity are expected to reduce the "repair-free" lifespan of a concrete structure by 15-20 years.
- Upgrade buildings to increase insulation and replace windows
  Replacing windows is one of three primary measures the Canadian Government identified to reduce energy use in residential homes

Increasing floods

- Increased stormwater infrastructure to accommodate flooding in new areas, and more frequent and intense flooding in existing flood-prone areas
  WSP climate change specialist Dr. Yann Chavaillaz identified the capacity of our stormwater infrastructure as the largest vulnerability that arises the most frequently in climate lens assessments
- Upgrades to strengthen and protect existing infrastructure against flood damage
- Relocation of buildings or communities
- Replace and repair infrastructure that fails early due to water damage
  Increased moisture and inadequate drainage increase the deterioration rate of infrastructure

Scarce natural resources

- Increased infrastructure to extract increasingly scarce resources, transport them from farther away or, conversely, to decentralise and distribute
- Increased infrastructure to store resources
- Increased smart interventions to manage demand and optimize resources (e.g., power, water, materials use through 3D printing)

Aging infrastructure

- Increased repairs and replacements of a large part of our existing infrastructure stock
  The Canadian Infrastructure Report Card shows that the average condition of our infrastructure is decreasing — which means there is catching up to do.

Urban growth

- Upgrade existing infrastructure to accommodate increased demand
  Our population will have increased by 11 per cent in 2030, with a larger proportion headed to urban areas.

Aging population

- Upgrades to infrastructure and additional features to new infrastructure so that older adults have homes, transit systems and public assets that accommodate their needs (e.g., accessibility features, social connectedness)
  By 2040, Canada is planning to be a country without barriers. Our aging population gives us the extra impetus to build new and upgrade infrastructure. The marginal costs of these additions are significant, at an average of over $300 per accessibility feature for a single home.

Technology

- Upgrade existing infrastructure or build new to accommodate new technology, such as electric vehicles, sensors and controls

Rising costs

Not only is the volume of construction set to increase, but the costs are too. Here's why:

COST IMPACT

LABOUR

Worker productivity will decrease as these trends create stress on our workforce

- More construction workers will become caregivers for their aging parents; 25 per cent of Canadians are already caregivers for older adults. If this burden increases proportionally to the number of older adults, 37 per cent of Canadians will be caregivers by 2030.
- Older workers may be less productive if their training is not kept up to date. And as they retire, new workforce entrants will need time to learn the industry and be effective in their roles.
- We'll see flooding in areas that have never been in flood zones before, and existing flood zones will be affected more drastically and more frequently. Employees will be burdened though property damage, injury, lost time and other losses.
- Worker productivity will suffer due to increased heat. Hotter days exacerbate health issues, dramatically slow job site progress, and create significant safety risks.
- The cost of mental health is expected to more than double in just the next 10 years, and this will affect worker productivity significantly.
- Employees will need new skills in technology and low carbon construction, from decision makers through to trades people. Training and upskilling workers in these emerging areas could be costly.

MATERIALS AND EQUIPMENT + TIME

The cost of materials, equipment and scheduling will increase in step with these trends

- More smart technologies will add to materials requirements, as will the additional space and infrastructure required to house and support them.
- Increased heat, flooding and unpredictable storms will affect both production of raw materials, and the supply chains that get them to site. Heat will increase forest fires, which will reduce timber supplies and increase the cost of timber. Flooding will shut down mining sites, which will push up the cost of raw materials.
- Low carbon legislation will require new materials that may cost more.
- Equipment will need to be protected from more frequent extreme weather events and hotter temperatures.
- Flooding and unpredictable weather will stall construction projects, increasing their costs.
- Heat will break the work day into smaller chunks — or require increased infrastructure and protective equipment to keep workers cooler. Heat also increases the curing time for concrete.

OTHER COSTS

Property and insurance costs will rise accordingly, as we see these trends manifest

- Flooding will increase flood zone setbacks and the amount of stormwater infrastructure required, thereby increasing the cost of land and property taxes.
- Flooding and unpredictable weather will also increase the cost of insuring new construction.

Smart solutions vs. sticker shock

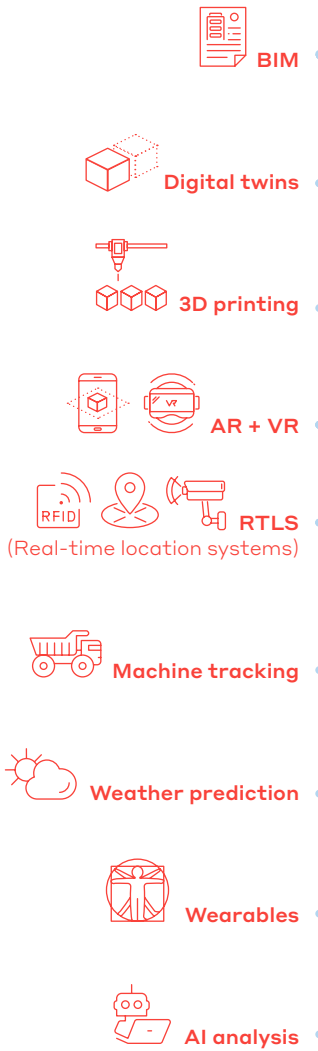
These cost increases can be overwhelming — but smart solutions can help significantly mitigate, and even prevent, many of these soaring costs.

Smart tech has changed the relationship between elements in the traditional project management triangle. It was once assumed that reduced cost or a tighter schedule would inarguably result in reduced quality — but that is no longer the case. The World Economic Forum's report Shaping the Future of Construction identified that "new technologies in the digital space will not only improve productivity and reduce project delays, but can also enhance the quality of buildings and improve safety, working conditions and environmental compatibility."

These technologies are not ideal for every construction situation. As an example, BIM is often promoted as a way of improving productivity and collaboration, but it requires the disparate organizations involved to all have and contribute to BIM in the same way — and this is a challenge, particularly for smaller companies. Further, while BIM can be used to support innovative and trusting collaborations, other important factors include the individuals involved in the contracts.

Smart solutions vs. sticker shock

Here's how smart technologies can help to reduce costs through the entire lifecycle of a construction project.



PROCUREMENT

— An average construction dispute can cost $51 million and last 13 months. Some forms of contract aim to establish trust and mutual respect among the participants, thus avoiding such disputes. Early planning, gathering thorough knowledge and laying the foundations for good relationships and trust between all parties is critical to keeping costs down and quality up. Build in requirements to use technology and philosophies like BIM, digital twins, AR and VR to support a common vision — literally and philosophically.

— Information sharing through approaches such as BIM can be central to collaboration — but at least as important are the individuals involved and the interaction they have with one another. Contract methods such as Integrated Project Delivery (IPDs) that have used BIM have shown a 200% return on investment.

DESIGN

— BIM was a key factor in the success of an Integrated project delivery models with shared risk/reward pools that demonstrated a 200% return on investment.

— Digital twins saved Bergen Light Rail Extension in the Netherlands 25% of design review costs, and saved the multidisciplinary design team as estimated 300 hours per week through the design.

CONSTRUCTION

— 3D printing can cut two-thirds of the construction cost of complex structures. It can also reduce the weight of steel by 75%, with important implications for transport costs and carbon performance. Combining it with BIM or robotics can further improve designs and reduce costs.

— BIM + AR + personal cameras and Chatbots allow staff to consult subject matter experts to troubleshoot problems that arise on site

— Real-time location systems (RTLS: RFID, GPS, 360 cameras) can save up to 64% of labor costs for a 24-month construction project, or 10% in overall construction costs, by enabling just-in-time materials supply, and provide geofencing for security.

— When RTLS are used to support a comprehensive Lean approach, and in conjunction with AR and VR, construction time can be reduced by up to 30% and costs by up to 15%.

— GPS fleet-tracking software alone has reduced fuel consumption by up to 30%, by avoiding unauthorized vehicle use

— Machine tracking information systems can identify problems before they occur, improving equipment uptime

— Weather prediction allows resources to be protected and diverted at the optimal time.

— Delays due to injury and fatigue can be reduced through real-time monitoring using vision-based motion detection technologies, smart insoles, and 3D ergonomic modelling of workers' motions.

— BIM can reduce project time by 20% and costs by 16%.

TRAINING*

— AI analysis of experienced construction workers offers training materials for less experienced staff. *Researchers at the University of Waterloo used AI to analyze videos of construction workers to uncover experienced construction workers' implicit knowledge about how to reduce chronic injury.*

— AR and VR provide near hands-on experience at an earlier stage of training.

— Microlearning keeps costs down and can be more impactful.

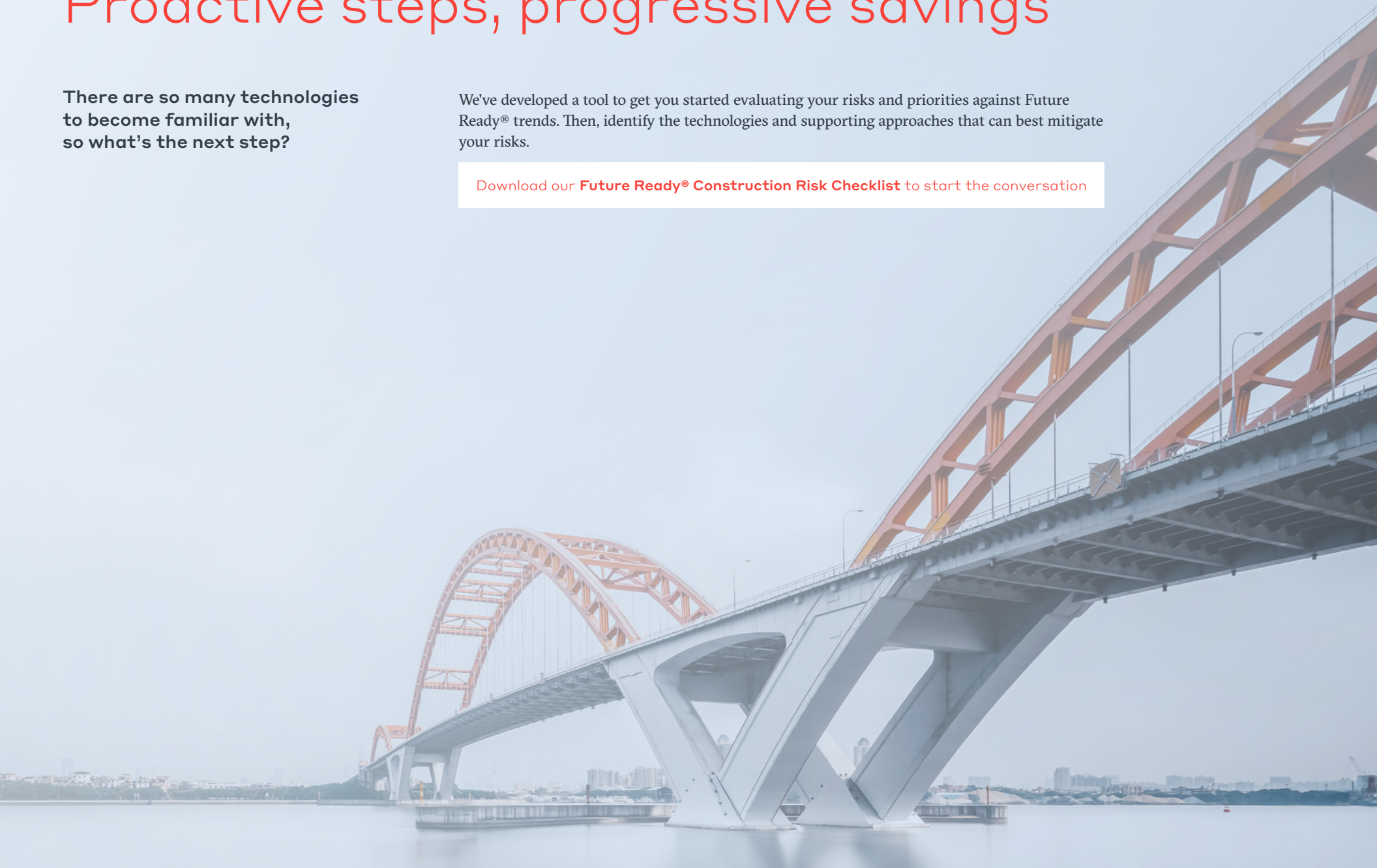
* *In case you think it's not worth training older workers in new technologies, consider two things: First, most skills have only a **three to five year shelf life**; it is worth providing this training to anyone who stays in the business that long — in addition to the fact that it increases their motivation and retention. Second, the net benefits of training older workers are valued at approximately $1000 per year Meadows, P. (2003). Retirement Ages in the UK: A Review of the Literature. Employment Relations Research Series No. 18. London: Employment Market Analysis and Research, The Department of Trade and Industry.*

Proactive steps, progressive savings

There are so many technologies to become familiar with, so what's the next step?

We've developed a tool to get you started evaluating your risks and priorities against Future Ready® trends. Then, identify the technologies and supporting approaches that can best mitigate your risks.

Download our **Future Ready® Construction Risk Checklist** to start the conversation



Opportunities abound to reduce the costs of construction by using smart solutions. But there are myriad reasons we don't pursue these solutions, even when the benefits outweigh the costs. We explore how to identify and dismantle those barriers in our final article of the Costing the Chasm series, ***The Behaviour Barrier****.*

ABOUT THE AUTHOR
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Discover the rest of our ***Costing the Chasm*** series on 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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