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METHODOLOGY UNDERLYING AN INFRASTRUCTURE ASSESSMENT

uOttawa

IFSD FINAL DELIVERABLE OUTLINE

1. What is the Systems Approach to an Infrastructure Assessment, and What is the Value
2. How to do an Infrastructure Assessment
    a) The Planning Dimension:
        - Infrastructure Stock Performance
        - Performance Measurement
        - Future Needs
    b) The Execution Dimension
3. System-of-Systems Approach
4. Data and Modelling
5. Fiscal Capacity Takeaways
6. Applying the Systems Approach to an Infrastructure Sector
7. IFSD Consultations

WHAT IS AN INFRASTRUCTURE ASSESSMENT?

1. Infrastructure is the interconnected substructures and networks that facilitate the functioning of a society

And…

2. A needs assessment can be defined as a systematic process for identifying the gaps between desired and current conditions, in order to better inform priority setting, organizational structures and resource allocation (Witkin & Altschuld1995; Watkins & Altschuld 2014)

A systems approach to an infrastructure assessment is a systematic process for improving performance across planning and execution by building the evidence base for optimal infrastructure decision-support. This is an emerging best practice.

PRINCIPLES UNDERLYING AN INFRASTRUCTURE ASSESSMENT

- It is a journey, not a destination
  - This should be ongoing, adding increased capability and integrating latest advancements and demographic, economic and environmental realities
  - Outcome driven, citizen focused and data enabled
- More informed and engaged citizenry
  - Citizen engagement key to outcome realization and informed prioritization
- Improved decision-support
  - Understanding infrastructure outcome gap across the well-being spectrum combined with the related lifecycle cost
- Better infrastructure performance
  - Optimize value-for-money
  - Improved coordination and collaboration
  - Better integration and moving away from silos across the full infrastructure lifecycle

The process does not stop after the NIA, it looks to continually improve the quality and timeliness of the evidence base to better inform infrastructure decision-support

THE CONCEPT OF AN INFRASTRUCTURE ASSESSMENT

What an infrastructure assessment is:

- Improving infrastructure performance in a jurisdiction
- Continuous strengthening of the evidence base to improve infrastructure decision-support
- Assessing the cradle-to-grave infrastructure process lifecycle

What an infrastructure assessment is not:

- A decision-making exercise
- A centrally driven dictate of infrastructure needs and funding criteria that is imposed on other orders of government

TOWARDS AN IFSD DEFINITION OF AN INFRASTRUCTURE ASSESSMENT

- In today's world and moving to 2050, a systems approach to an infrastructure assessment is critical for understanding interdependencies, breaking down silos and transforming from a project to a plan-based strategic and funding approach with forward looking pathways towards long-term well-being outcomes

- A systems-based infrastructure assessment is centered on improving performance in the infrastructure system
  - Performance is based off both planning and execution across the full infrastructure lifecycle

- The key enabler for improved infrastructure performance is high-quality and timely data that seamlessly flows upstream and downstream across the full infrastructure lifecycle

- Two to three years is insufficient time to assess the entirety of the infrastructure system
  - In order to see the forest from the trees, we need to define the full scope of the infrastructure system
  - Infrastructure assessments should be viewed as a natural sequencing of improving the evidence base over time and progressively building off prior infrastructure assessments

IFSD DEFINITION

Planning

Evidence Base that allows optimization of Public Value in a fiscally sustainable manner across the complete portfolio of well-being outcomes and infrastructure asset classes

Optimizing Infrastructure Performance

Execution

Continuous improvement of the efficiency and effectiveness of the infrastructure practices across the full infrastructure process lifecycle inclusive of the three orders of government, industry and all other key infrastructure stakeholders

OUTCOMES: (Performance Measurement Framework)

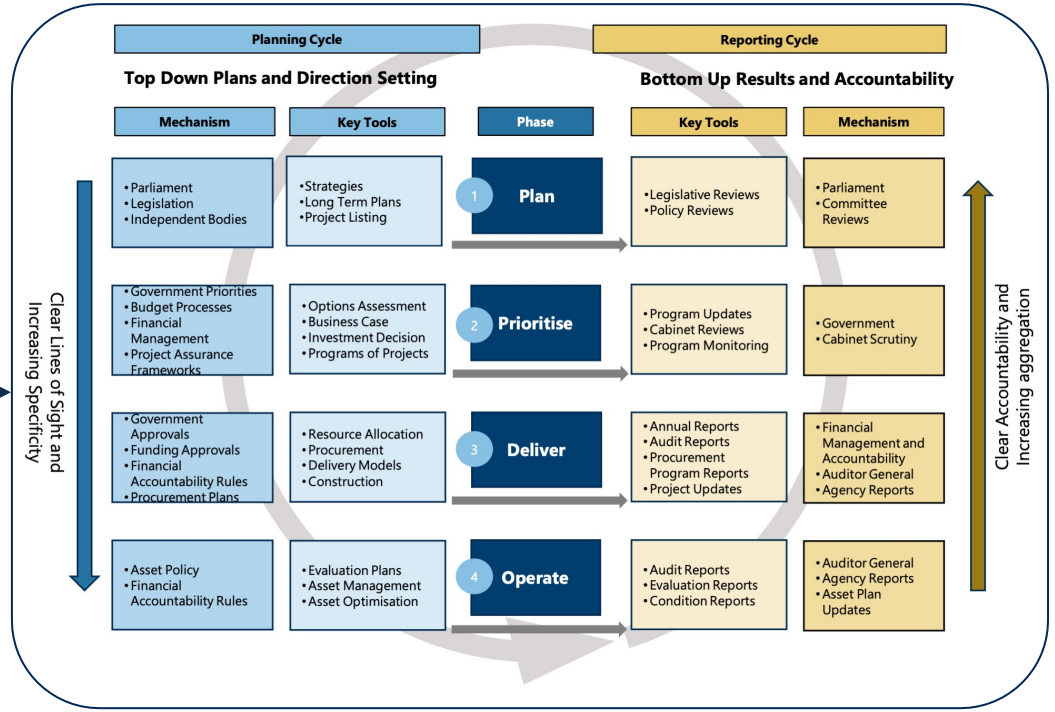
- Inclusion
- Environmental Sustainability
- Economic growth
- Resilience

Infrastructure Stock Performance

- Condition
- Function
- Utilization
- Capacity
- Etc.

Future Needs

- Demographics
- Economic transformation
- Climate change
- Technology disruptions



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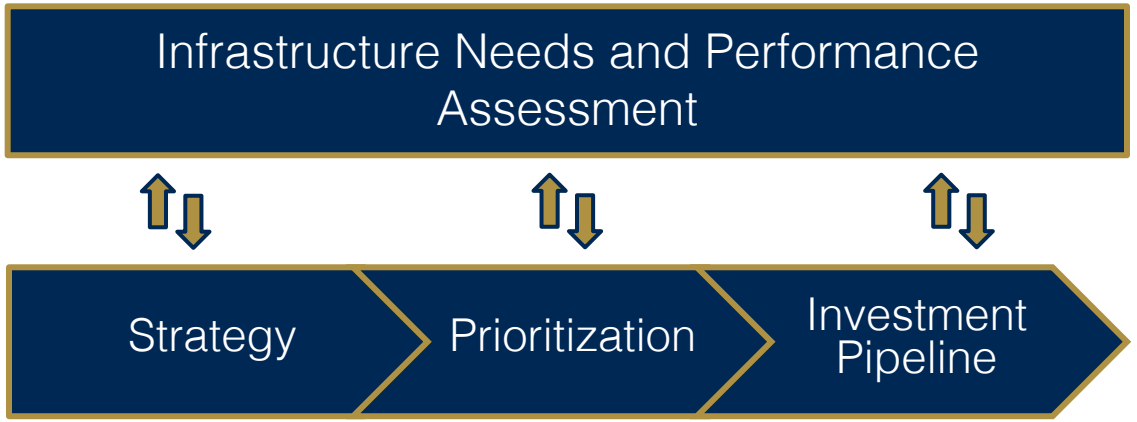
WHAT SHOULD FOLLOW THE INFRASTRUCTURE ASSESSMENT?



Canada's first National Infrastructure Assessment planning needs to consider how decision support can be augmented within the constraints of a two-year exercise and funding of $21 Million

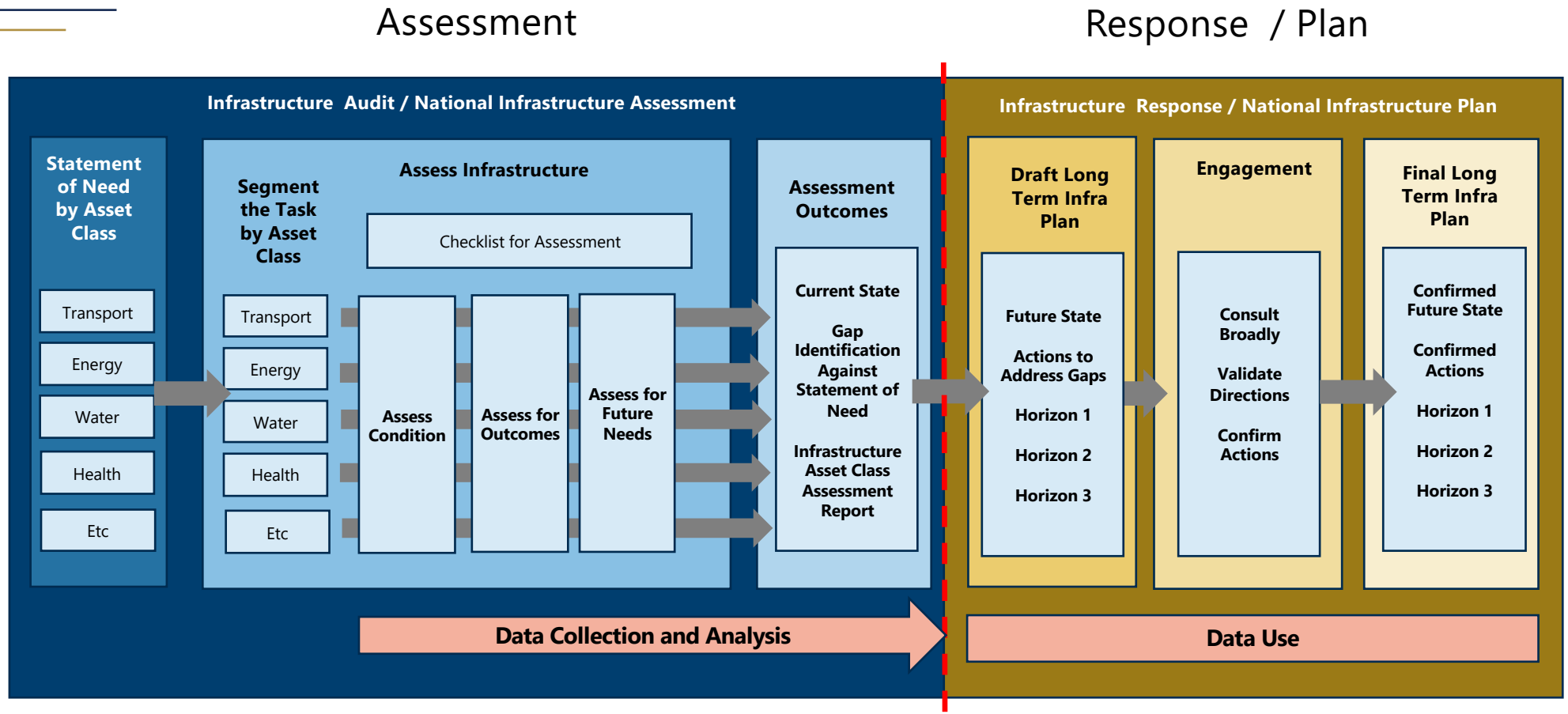
The purpose of the infrastructure assessment is to improve infrastructure performance and decision-support

The data and evidence gathered must support and guide decision-making

An infrastructure assessment should provide augmented decision support for the following:

1. Development of an infrastructure strategy
2. Funding allocation/prioritization decisions: investment and sustaining capital
3. Pipeline of infrastructure investments

AN INFRASTRUCTURE ASSESSMENT SUPPORTS EVIDENCE BASED DECISION-SUPPORT



- What you get for $22M depends on the level of granularity and scope you apply for each asset class.
- Some asset classes will be more mature and are likely to need less detailed assessment.

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AN INFRASTRUCTURE ASSESSMENT FIT FOR CANADA

Infrastructure plays an important role in connecting Canadians despite our vast geography

A tailored assessment approach must consider each the people, the place, and the asset/service—the who, where and what of infrastructure

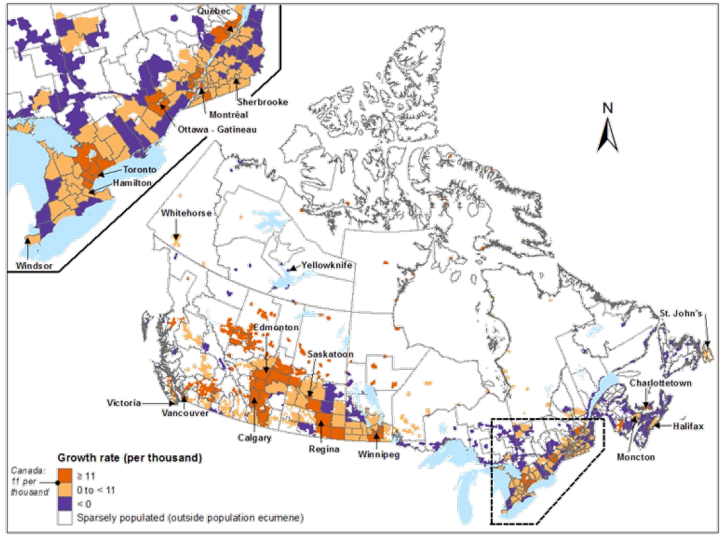
A Canadian Infrastructure Assessment should provide insight into how Canadians work, live and play, both now and into the future (i.e., to 2050)

A 2022 to 2050 roadmap should:

- Provide insight into Canada's evolving demographic landscape, segmenting the population base to better understand service level needs
- Better define the infrastructure implications of Canada's increasing shift to a service-based economy with more diverse trade partners
- Provide scenario-based analysis of future regional climate change impacts from coast to coast to coast

The future is uncertain, but an iterative assessment process will better enable us to adapt our pathway forward as we strive for the future we want to achieve.

Population growth rates:



Source: Statistics Canada, Demography Division

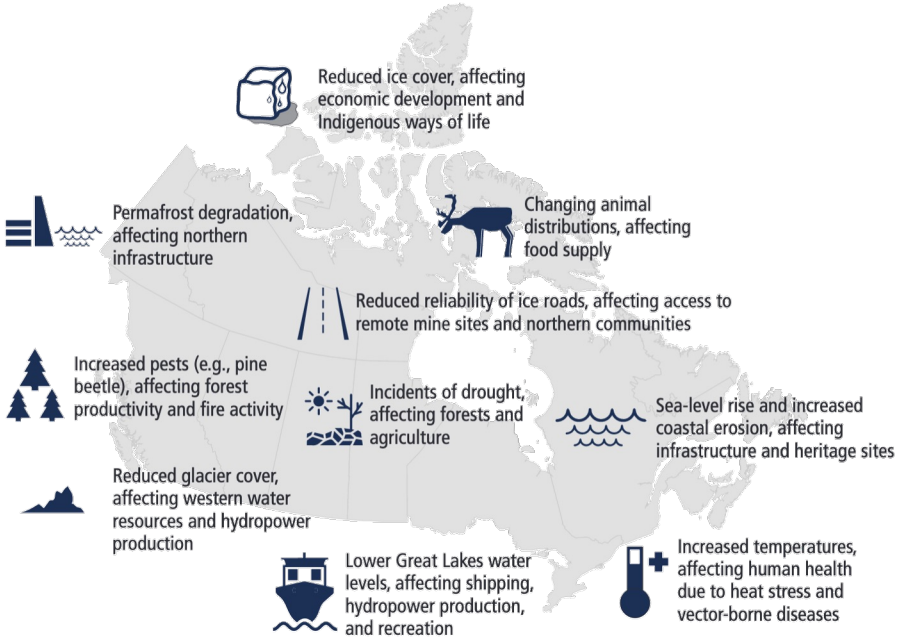
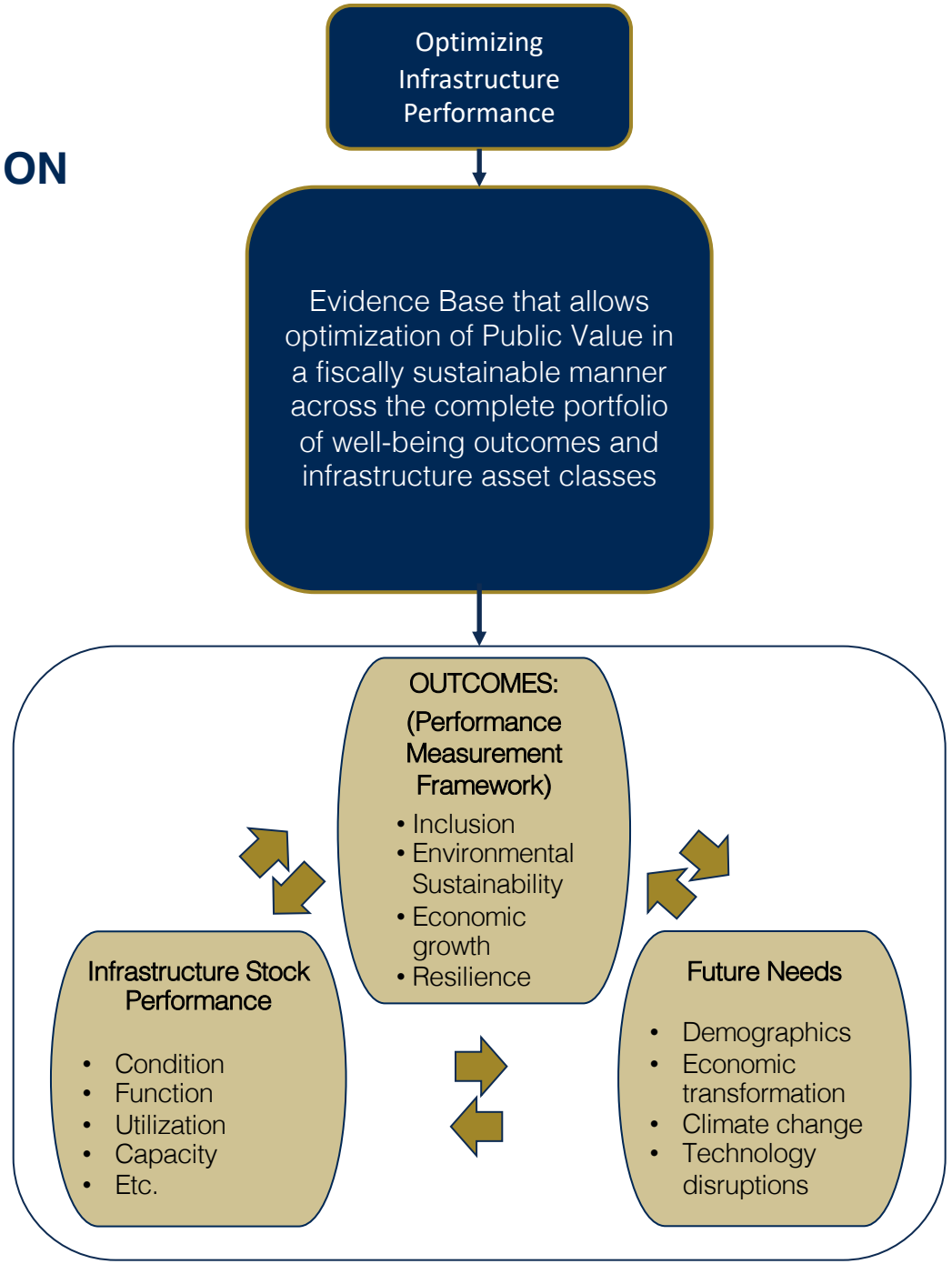


Image source: The Council of Canadian Academies

IFSD PLANNING DIMENSION



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ASSESSING THE PERFORMANCE OF THE EXISTING INFRASTRUCTURE STOCK

- There is a significant amount of data and analytics required to truly understand the holistic performance of the existing infrastructure stock
  - Are we continuing to fill an existing need?
  - Do we understand current and projected gap across a number of dimensions
- IFSD consultations indicate a challenge within Canadian jurisdictions to understand condition gap in a standardized manner across all the infrastructure owners/operators
  - Vertical fiscal imbalance exacerbates this challenge and it was consistently highlighted that most municipalities do not have the capacity to understand the performance of their existing stock
- A 5–10-year roadmap is required to progressively build from a basic understanding of the performance of the existing infrastructure stock to a richer, aspirational evaluation of existing stock performance
- There is an opportunity to develop standards and build capacity that could benefit all three orders of government in this work

PLANNING DIMENSION: PERFORMANCE OF THE EXISTING STOCK

Performance Element	Description	Data Source
Condition and Remaining Useful Life	What is the state of the asset?	Asset owner
Function	The ability and suitability of the asset to meet expected service levels and needs	Consumer of the services
Capacity	The ability of the asset to meet demand	Asset owner
Utilization	The rate at which the asset is used relative to its total capacity	Asset owner
Maintenance	Assessing if the asset is being properly maintained	Asset owner
Quality of Service/User Experience	Assessing if infrastructure service meet the quality expectations of their end users	Consumers of service
Capacity to Withstand Demand Surges	Assessing the assets ability to withstand any sudden demand increases that could be expected to occur under normal conditions	Asset owner
Safety	Assessing the level of risk associated with using an asset or accessing a service	Emergency services records
Criticality	Assessing interdependencies and cascading effects to understand how critical the asset is	System-of-systems analyst
Vulnerability	Assessing asset's total level of risk or exposure	Threat area subject matter experts (e.g., climate, cyber, etc.)
All-Hazards Resilience	Assessing the resilience of the asset	Resilience subject matter expert
Taxpayer Affordability	Assessing the reasonableness of the infrastructure charges to the citizen/taxpayer	Jurisdiction Finance Personnel
Lifecycle Cost Performance	Assessing the variance between actual lifecycle cost for the asset and the planned lifecycle cost that was in the final approved business case	Jurisdiction Finance Personnel
Benefits Realization	Assessing the variance between actual benefits (direct and secondary benefits) realized by the asset and the planned benefits outlined in the final approved business case	Jurisdiction Policy, Performance and Finance Personnel
Accessibility for those with Disabilities (inclusion performance)	Assessing the asset's ability to meet the service-level requirements of those with disabilities	Jurisdiction Policy Personnel
Service Accessibility (inclusion performance)	Assessing whether the asset/network is reasonably and equitably accessible to all citizens, and does not hinder their ability to access other resources and opportunities	Jurisdiction Policy Personnel
Disaggregated Affordability (inclusion performance)	Assessing whether all households and individuals are able to afford the service provided by the asset	Jurisdiction Policy Personnel
GHG Emissions	Quantifying the GHG emissions associated with infrastructure assets	Jurisdiction Environmental Personnel
Biodiversity Impact	Assessing the impact of the asset on biodiversity loss/protection	Jurisdiction Environmental Personnel
Ecosystems Impact	Assessing the asset's impact on surrounding ecosystems	Jurisdiction Environmental Personnel
Asset Optimization Performance	Assessing the degree to which a jurisdiction is maximizing the usage and benefits from existing infrastructure stock	Independent Appraiser

Basic Asset Management Maturity

Recommendations

1. Leverage and build off existing asset management and data resources
2. Develop a systematic and reasonable long-term roadmap towards the aspirational future performance assessment
3. Examine opportunities with sensors and digital technologies to develop a standardized ongoing aspirational future performance assessment

BUILDING AN INFRASTRUCTURE PERFORMANCE MEASUREMENT FRAMEWORK

- An infrastructure performance measurement framework will support building an evidence-based understanding of the contribution of the infrastructure stock to well-being outcomes
- The performance measurement framework also incorporates international commitments such as Net Zero 2050 and the UN Sustainable Development Goals
- The performance measurement framework supports connecting the infrastructure stock with future pathways towards the attainment of long-term policy targets and international commitments
- The performance measurement framework is the key mechanism for informing prioritization and selection by quantifying current and projected gap across the entire spectrum of well-being outcomes and the entire portfolio of infrastructure asset classes

PLANNING DIMENSION: PERFORMANCE MEASUREMENT FRAMEWORK

Opportunities

1. Build architecture to align performance of existing stock and asset classes with well-being outcomes and medium to long-term performance measures
2. Examine alignment opportunities with respect to federal, provincial / territorial and municipal well-being outcomes (see next slide)

Infrastructure Systems Performance Measurement Framework

	Existing Outcome Frameworks and Measures			
Ultimate Outcomes	1. Better Life Index, OECD 2. Global Liveability Index, Economist Intelligence Unit 3. Quality of Life Framework, Finance Canada and Statistics Canada 4. Greenhouse Gas Emissions Canadian Environmental Sustainability Indicators 5. Federal Sustainable Development Strategy Indicators The Canadian Indicator Framework for the Sustainable Development Goals			
	Possible Indicators:			
	Growth	Inclusion	Sustainability	Resilience
Strategic Outcomes (planning)	Benchmark to peer countries (e.g., G7) GDP per Capita / GDP growth Productivity growth Competitiveness Indicators Labour force participation Employment related to infrastructure Innovation indicators Change in real GDP attributable to federal investments in infrastructure Value-added total of sectors	Gini coefficient Regional Employment rates Poverty rates Disability Accessibility ratings Cost / Affordability metrics Access Ratings (for infrastructure services as well as other services and opportunities that require infrastructure to access) Proximity analytics	GHG Emissions (% reduction from baseline year) Sector GHG per value added % electricity from clean sources Passenger VKT / Population Transportation mode share Per capita GHG emissions Air Quality Health Index ZEV as percentage of sales	Number of households/ individuals directly impacted by natural disasters Annual cost of natural disasters • Insurable losses • Government costs • Private uninsured losses • Damaged infrastructure
Value for Money (execution)	Lapse rate Approval timelines Environmental assessment timelines User satisfaction with infrastructure services		Percentage of projects completed on budget Percentage of projects delivered on time Taxpayer affordability Aggregate lifecycle cost performance	

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FUTURE NEEDS ANALYSIS

- This element seeks to provide the early line of sight into Canada 2050 across a number of dimensions to try and proactively assess whether the infrastructure stock will remain fit for purpose into the future
  - Towards a prosperous, competitive, healthy and happy Canada in 2050

- This analysis builds off the O Canada assessment and focuses on the following
  - Canada's people: where will they be, what will they look like and what might be their service level expectations in 2050
  - How will climate change impact Canada spatially and what are the resilience, economic and other infrastructure implications with respect Canada 2050 vs Canada 2022

- What technology innovations will impact how Canadians work, live and play in 2050 and what are the opportunities and challenges arising therefrom

An early line of sight for answering how we can best deliver services and outcomes to citizens in an uncertain future

PLANNING DIMENSION: FUTURE NEEDS ANALYSIS – PEOPLE & PLACE, 2022 TO 2050

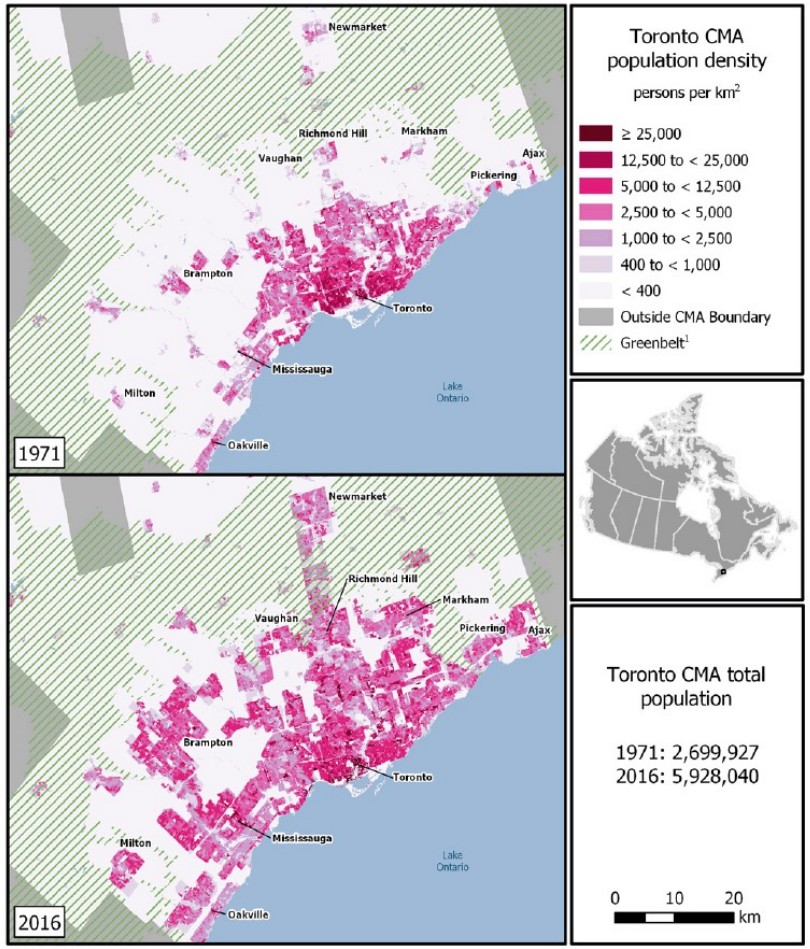
Individual Citizen

- Use foresight analysis and the expertise of subject matter experts (e.g., urban planners, social scientists) to extrapolate infrastructure service level expectations to 2050
- Leverage Statistics Canada census program indicators to identify citizen segments (i.e., urban citizens, rural citizens)
- Assess infrastructure asset classes and identify the related infrastructure service levels
- Map service level expectations to citizen segments to better identify who will access what infrastructure services and the degree to which service level expectations differ by citizen segment

Businesses

- Segment businesses by location, industry (goods/services), expected industry growth to extrapolate infrastructure service level expectations to 2050

Map 1
Toronto census metropolitan area population density, 1971 and 2016

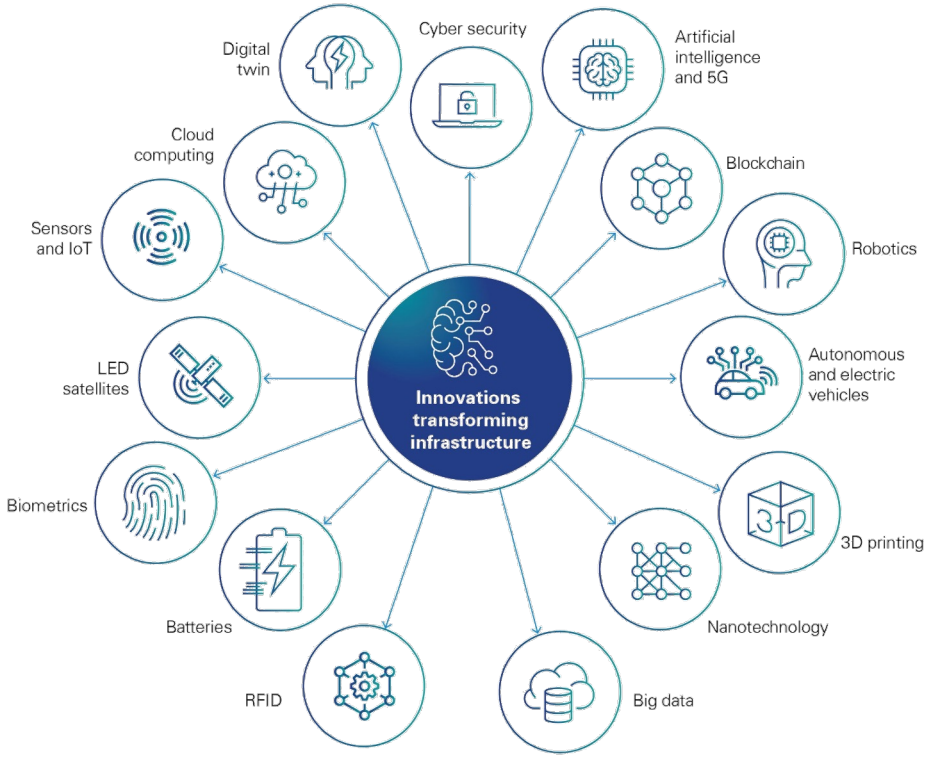


1. The Greenbelt area is included on the 1971 map for references purposes only.
Note: These maps show dissemination block (DB) population density in 1971 and 2016. The 1971 DB populations were adjusted by proportionately allocating 1971 enumeration area (EA) populations to the 2016 DB geography, based on the 2001 DB to 1971 EA population ratios. While some misallocation of 1971 EA populations to DBs that were non-residential in 1971 likely occurs, the overall impact on the 1971 population density map is expected to be small.

https://www150.statcan.gc.ca/n1/pub/16-508-x/16-508-x2019001-eng.htm

PLANNING DIMENSION: FUTURE NEEDS ANALYSIS – TECHNOLOGICAL INNOVATIONS

Pipeline of Potential Infrastructure Technology Innovations



From: KPMG

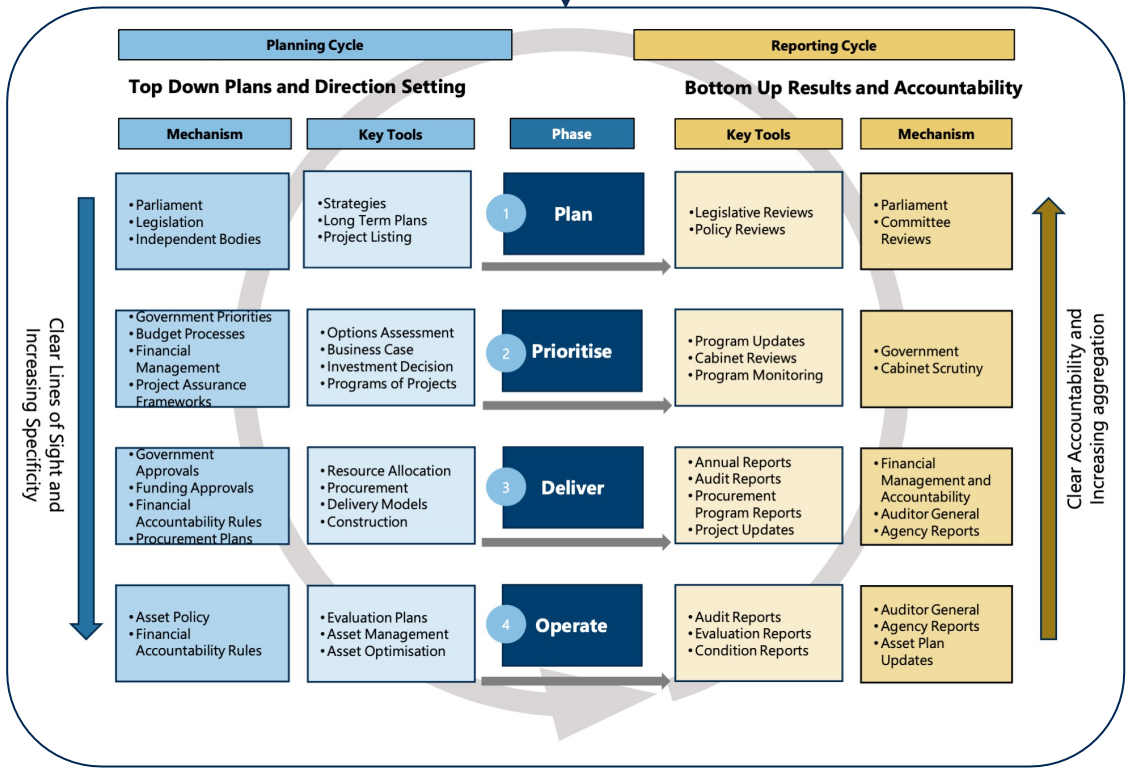
Infrastructure Implications of Technology Innovations

	Expected Impact by Timeline	Asset Class/ Supply Impacts	Demand/ Service Level Impact	Obsolescence Impact	Reform / Regulation Implications	Demand Management Implications	Infrastructure Response Action Items with Timelines
Quantum							
Blockchain							
AI							
Biotech							
Nanotechnology							
Robotics							

IFSD EXECUTION DIMENSION

Optimizing Infrastructure Performance

Continuous improvement of the efficiency and effectiveness of the infrastructure practices across the full infrastructure process lifecycle inclusive of the three orders of government, industry and all other key infrastructure stakeholders



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IFSD EXECUTION DIMENSION: ABILITY TO FOCUS ON KEY PAIN POINTS

Cradle-to-Grave Lifecycle for the Infrastructure "Business":

Multiple Execution Assessment Options:

1. Alignment and efficiency/effectiveness across all three orders of government across the full lifecycle
2. Focus on one of the four phases: plan, prioritize, deliver, operate
3. Focus on one or more of the function areas across all four phases of the lifecycle
4. Focus on one or more of the key underlying fundamental enablers across the full lifecycle:
5. Focus on constraints: data, market capacity (materials, personnel), supply chain dependencies

The Infrastructure System Assessment Model provides a checklist of diagnostic questions for the three planning elements: performance of the existing stock, performance measurement framework and the future needs analysis

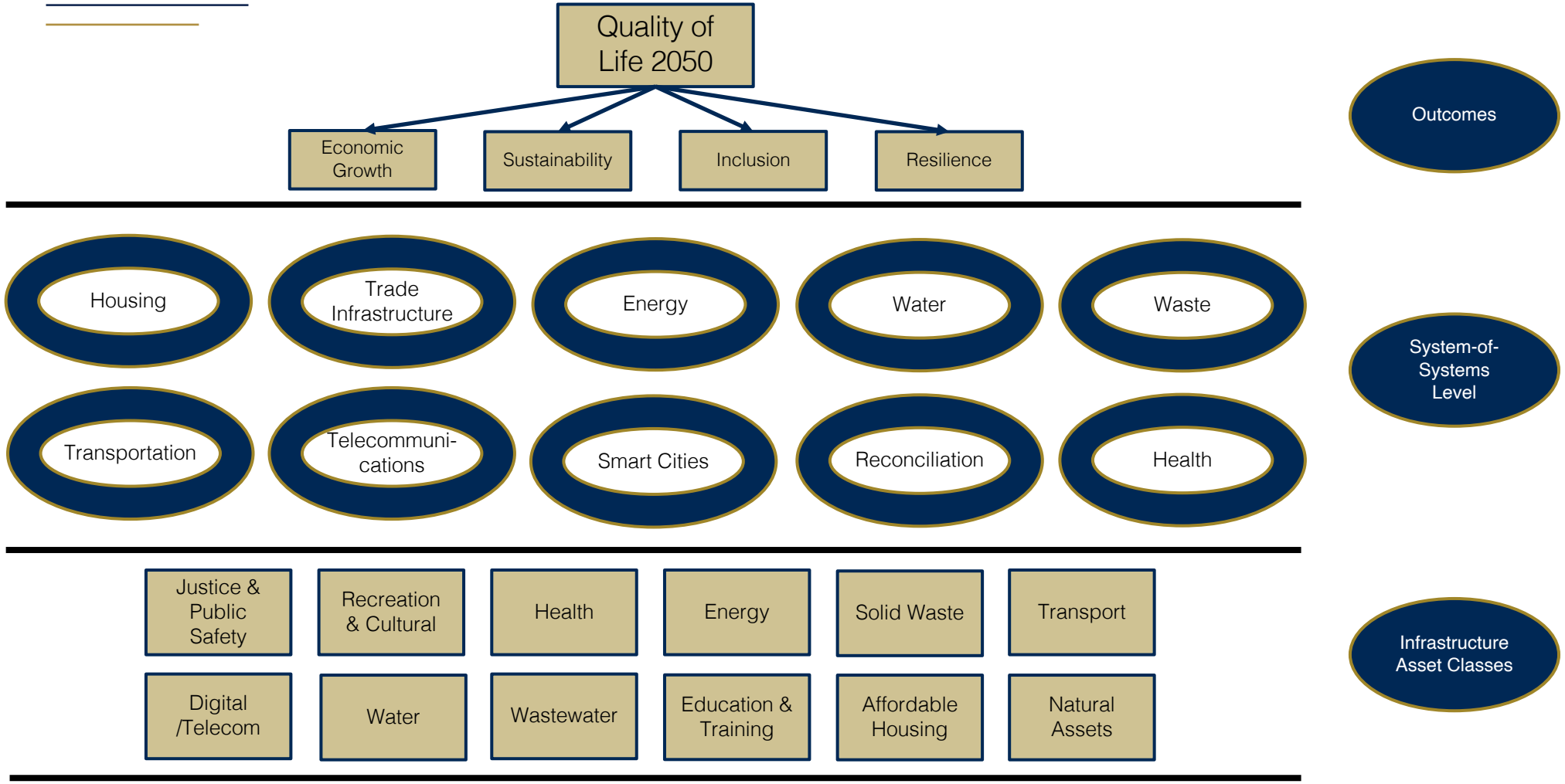
IFSD EXECUTION DIMENSION: A STANDARDIZED DIAGNOSTIC TOOL THAT CAN BE APPLIED TO THE SYSTEM AS A WHOLE OR FOCUS ON ONE ELEMENT OF THE SYSTEM

Infrastructure Stock Performance	Performance Measurement	Future Needs Assessment
Does the tool exist?	Does the tool contribute to economic growth? If not, why not?	Does the tool support adoption of changes arising from megatrends like new technology implications, rise of consumers, shifting global power, climate change, mass urbanisation? If not, could it?
When was the tool introduced?		
When was the tool last reviewed?	Does the tool contribute to an inclusive society? If not, could it? What would need to change?	Does the tool support changing infrastructure demand patterns? If not, could it? What would need to change?
Is the tool fit for purpose?		
Who is the custodian of the tool?	Does the tool contribute to resilience of infrastructure? If not could it? What would need to change?	Does the tool support changing labour force trends and implications? If not could it? What would need to change?
Does the tool generate data? Is the data used?		
Does the tool have appropriate governance? If yes, has this been reviewed?	Does the tool contribute to sustainability outcomes? If not, could it? What would need to change?	Does the tool contribute to net zero 2050? If not, could it? What would need to change?
Other considerations etc. etc.		

EMERGING BEST PRACTICE: SYSTEM-OF-SYSTEMS CONSIDERATIONS

- An approach that is based off the principle that there are interdependencies between infrastructure asset classes that can be thought of as a consolidated network or “system-of-systems” that delivers well-being outcomes around how citizens work, live and play
- Similar to the infrastructure assessment, the system-of-systems should be tailored to the key system-of-systems that are most important for Canada
- This is a transformational shift as the current information management systems and processes tend toward being project and asset based; they are not fit for the purpose of assessing interconnected system-of-systems

TAILORING THE INFRASTRUCTURE SYSTEM ASSESSMENT MODEL FOR A CANADIAN SYSTEM-OF-SYSTEMS APPROACH



System Level Considerations

- System-of-systems will link well-being outcomes with infrastructure asset classes
- Identify interdependencies
- Establish service levels
- Link to place & citizens
- Link to outcomes
- Tag network of contributing asset classes

DATA IS MISSION CRITICAL FOR AN INFRASTRUCTURE ASSESSMENT (AND BEYOND)

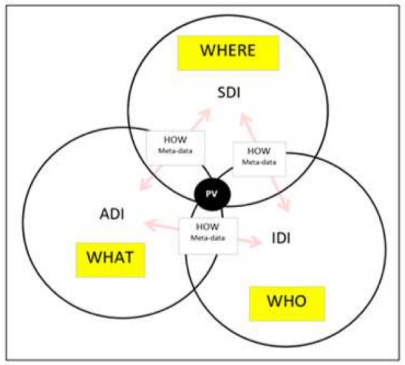
- The data is the tissue that can connect each phase across the full infrastructure lifecycle
- Canada should consider investment in data as a key foundational element towards improving infrastructure performance
- Canada would not be starting from point zero and can leverage good work being done elsewhere
  - Centre for Digital Built Britain and National Infrastructure Systems Model in the United Kingdom
  - Data standards work in New Zealand

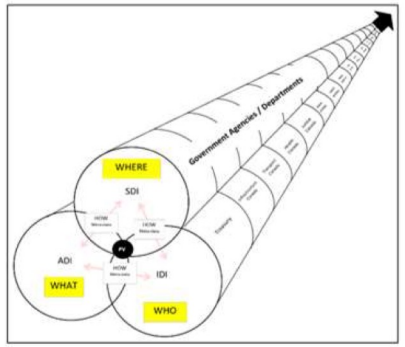
THE DATA STANDARDS ROADMAP

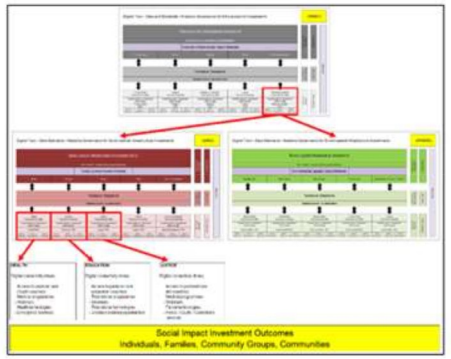
Five-Step Roadmap

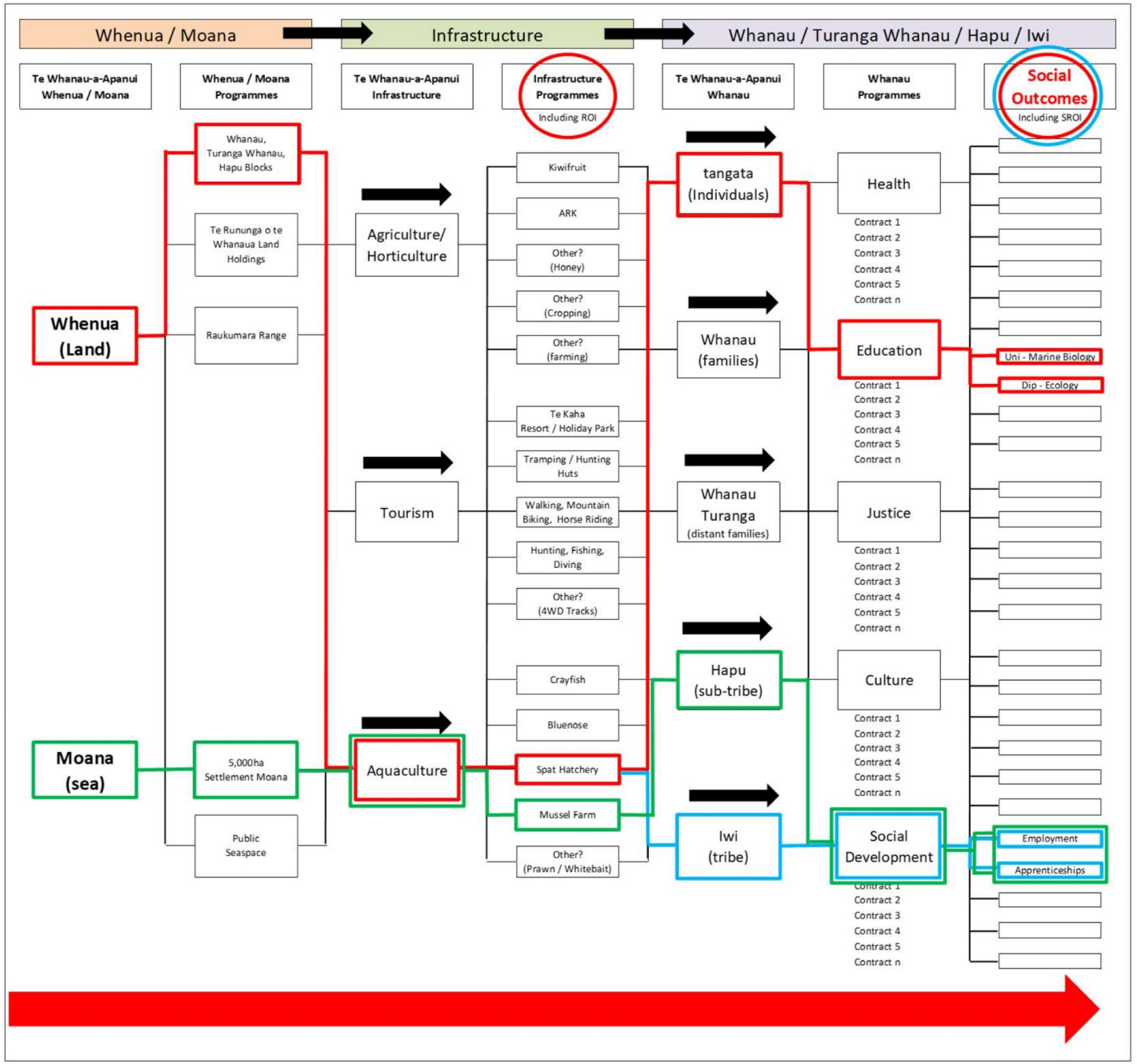
1. Define the lexicon underpinning individual infrastructure investment decisions
2. Identify the “whole-of-government” standard seeking data driven infrastructure investment decisions
3. Build functionality for interoperability analytics, seeking data driven infrastructure investments – the foundations seeking social impact outcomes
4. Create the architecture for infrastructure investment pathways seeking social outcomes
5. Demonstrate the infrastructure investment pathways towards long-term social outcome targets

THE DATA STANDARDS ROADMAP









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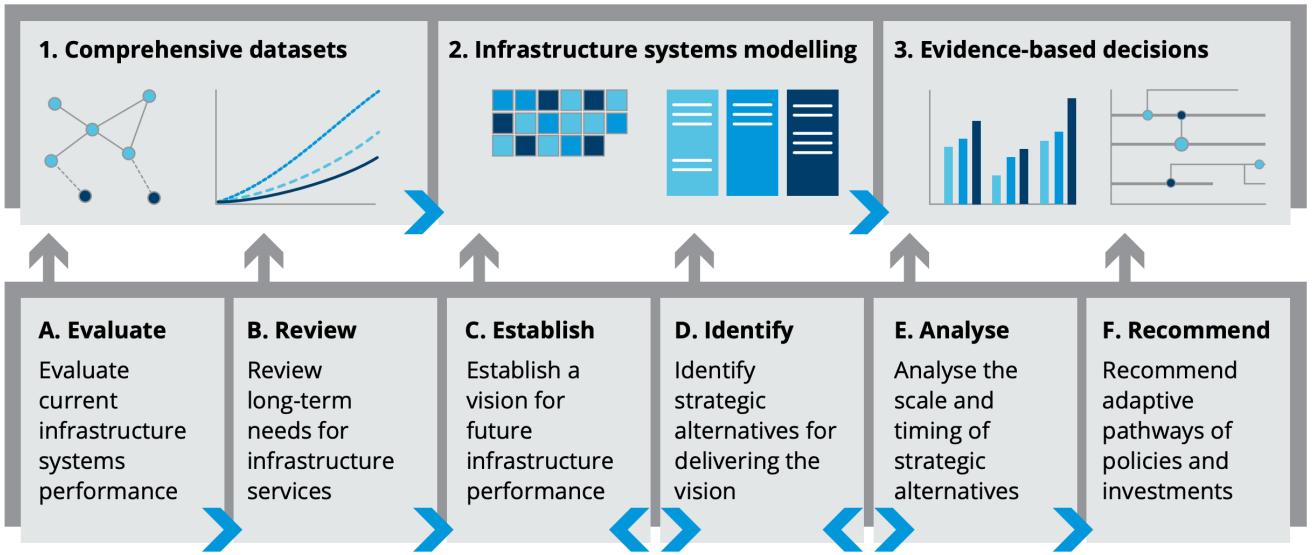
SYSTEM-OF-SYSTEMS MODELLING

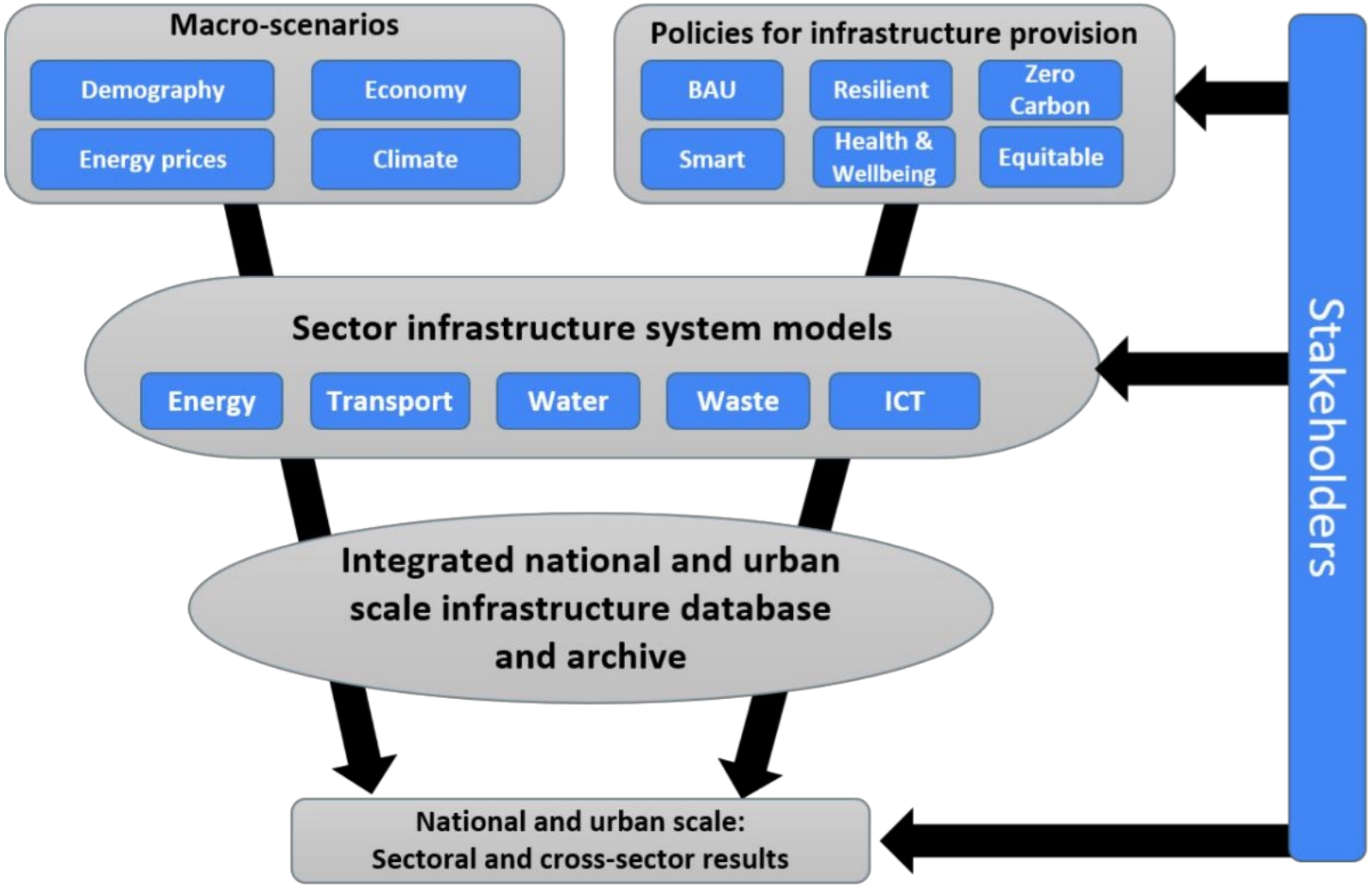
- Systems-of-systems modelling maps real-world network interdependencies within a robust modelling framework
- Cascading impacts can be captured within the model
  - The impact of different energy sector investment pathways on the transportation sector could be modelled, providing invaluable insights
  - System-wide impacts of climate-related network failures can be modelled to augment asset-based resilience assessments



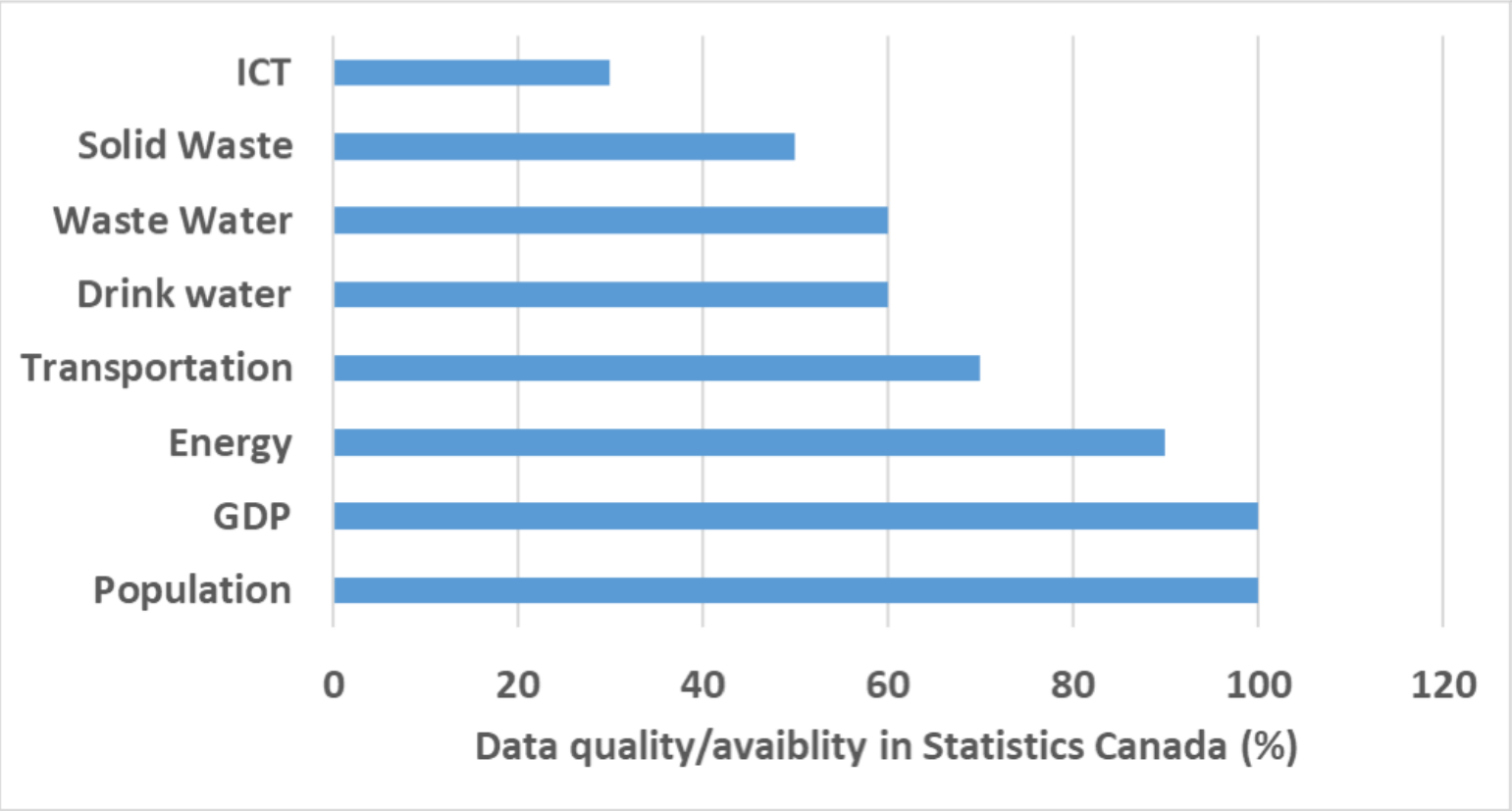
From: Government of St. Lucia, UNOPS and ITRC

ITRC's (UK) NISMOD platform is a state-of-the-art platform system-of-systems interdependency model, coupling independent sector models with a complex systems model integration framework (SMIF)

CONCEPTUAL FRAMEWORK FOR A CANADIAN SYSTEM-OF-SYSTEMS MODEL



ESTIMATE OF DATA COVERAGE IN CANADA FOR MACRO-DRIVERS AND SECTOR LEVEL DATA



- The data quality and availability is most mature for the energy, followed by the transportation sector
- The estimated model development time and beta testing indicates that the model for each sector could be developed in a 2-year timeframe
  - However, these timelines for the water, waste and ICT sectors are contingent on getting high quality data from partners in these sectors

FISCAL CAPACITY TAKE AWAYS

- There is fiscal capacity both at the federal level and the combined subnational level to address infrastructure investment needs
- Some provinces and the three territories combined have fiscal gaps. They do not have room for extra investment if they have to fund it from own source revenues
- The investment illustrative scenarios show that the fiscal situation at all levels of government would improve. All levels of government would have a higher fiscal capacity or lower fiscal gap if the investment leads to an increase in productivity growth of 0.2 percentage points
- If the needs assessment identifies important infrastructure gaps, the fiscal capacity analysis supports the case for a larger federal share of infrastructure investment funding to address these gaps
- The fiscal capacity analysis can also be included in the infrastructure needs assessment toolbox to help set a fiscal remit that would make the implementation of the needs assessment more feasible

APPLYING THE SYSTEMS APPROACH TO THE ENERGY SECTOR

- Conducting an infrastructure assessment for an infrastructure sector requires alignment to a policy framework
- The quality and availability of data in the infrastructure sector needs to be considered
- A theory of change template is value-added with respect to linking recommendations/actions/interventions with future oriented pathways and roadmaps towards long-term outcomes

ENERGY SECTOR – SYSTEM MAP AND CONCEPTUAL MODEL SCHEMATIC

Outcome Areas

Growth	Inclusion	Sustainability	Resilience

Costs, Benefits & Trade-offs

Strategy/Scenarios:

Incentives, regulations, policy-shifts, demand-management, and investment changes to shift supply and demand and change energy supply mix

Inputs / Demand Drivers

Exogenous Drivers:

-Demographic projections
-Economic projections

Endogenous Drivers:

-Price projections

Energy Demand

ENERGY SERVICES

Key areas of society and the economy that rely on energy services.

CONNECTIVITY

NRCAN sectors: Residential, Commercial, Industrial, Transportation, Agriculture

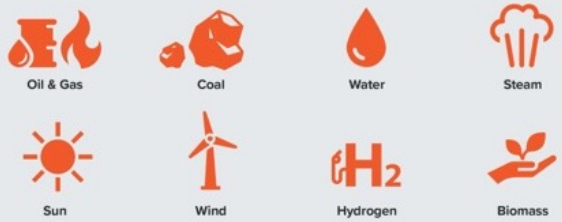
External Energy Market → export potential

Supply Mix

INFRASTRUCTURE

There is a significant amount of infrastructure and technology supporting the generation and movement of energy.

FUELS



ENERGY INFRASTRUCTURE

Outputs

-Total demand
-Peak demand
-Demand per household
-Cost per KWh

-Total supply
-Disaggregated supply by source
-New capacity

-Renewables % of market
-Total GHG emissions
-GHG emissions disaggregated by source
-GHG per household

Energy Services and *Infrastructure* images from New Zealand Infrastructure Commission: https://www.tewaihanga.govt.nz/strategy/state-of-plays/energy/.

THEORY OF CHANGE FOR ENERGY INFRASTRUCTURE

Actions & Interventions	Outputs	Intermediate Outcomes	Ultimate Outcomes
Firms Supply-side: - Invest in low-emissions energy production for use as an input for production Demand-side: - Actions to decouple energy consumption from economic growth	- Increased energy supply to firms - Reduced energy intensity of economic growth / productivity	- Energy sector supports productivity growth	Energy sector supports a growing Canadian economy
Households Supply-side: - Invest increasing generation capacity to keep pace with population growth and shift to EVs Demand-side: - Demand-management for more efficient allocation of energy at-peak	- Increased energy supply to growing population and increased demand due to technological changes (e.g. EVs) - Decreased peak energy demand for households	- Energy sector supports population growth and efficient distribution	

OUTCOME-BASED LOGIC MODEL

INTERCONNECTED SECTORS CONTRIBUTING TO GROWTH AND COMPETITIVENESS

QUANTIFYING CURRENT OUTCOME GAP

Asset Classes

1. Transportation
   - Ports
   - Airports
   - Highways and borders
   - Multi-modal urban
2. Energy
3. Telecommunications

Outputs/Services

1. Energy as an input for production
2. Multi-modal transportation to connect workers and firms
3. Access to domestic and international markets through trade corridors
4. ICT as an input for firms
5. Livability to attract workers and firms to Canadian cities

Outcomes

1. Productivity
2. Firm competitiveness
3. Ability to access global markets and supply chains
4. Access to labour markets for both workers and firms
5. Population change in urban centers

Headline indicators from Toward a Quality of Life Strategy for Canada:
Household incomes, employment

Sustainable Development Goals:
Decent work and economic growth; Industry, innovation and infrastructure

METHODOLOGY FOR THE ENERGY SECTOR

Assessment Element	The Purpose of the Assessment Element
Baseline Assessment of Infrastructure Stock Performance	Assess condition and performance of the existing energy infrastructure stock
Performance Measurement Framework	Define how the energy sector contributes to well-being outcomes and cascading impact on outcomes
Future Needs	Determine the key drivers of how people live, work and play today as well as scenarios for the future

Examples of the Methodology Workstreams for each Assessment Element

Process	Models	Data/Analytics	Consultations
• Condition assessments • GHG emissions assessments • Visual inspections • Security and resilience assessments	• Demand models • Capacity models • Climate models • GHG emissions models • Agent-based models	• Risk analytics • Resilience analytics • Lifecycle cost analytics • Service levels analytics • Benefits realization analytics	• Satisfaction surveys • Citizen engagement • Subject matter and domain experts
• Defining well-being outcomes and developing macro KPIs • Developing a performance architecture linking infrastructure to outcomes	• Logic models • Economic growth models • Inclusion models • Resilience models • Sustainability models	• Inclusion related mobility • Inclusion infrastructure performance • Sustainability infrastructure performance	• Geo-located user satisfaction surveys • Citizen engagement • Policy experts • Performance experts
• Future scenario planning • New technology maturity assessments • Urban planning trends	• Demographic models • Economic models • Labor force models • Mobility models • Urban planning models • Rural planning model • Net zero 2050 models	• Inter-generational analytics • Interoperability analytics • Long-term sustainability analytics • Long-term inclusion analytics • Long-term resilience analytics	• Futurists • Urban planners • Emerging technology experts • Behavioral economists

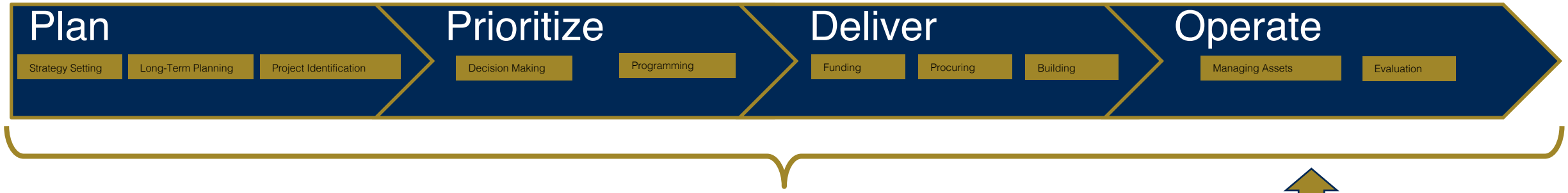
IFSD CONSULTATION SUMMARY

Consultations from INFC Stakeholder Outreach:	
Engineering/Construction:	2
Other Private Sector:	17
Sector Groups	6
Advocacy / Non-profits:	2
Green Infrastructure/Buildings:	13
Researchers/Academia:	5
Municipalities	5
Municipal Associations and Asset Management:	6
First Nations and Indigenous Groups:	4
Provinces and Territories:	6
Federal Departments, Agencies & Crown corps:	10
Total from INFC outreach:	76
Targeted IFSD Outreach:	
Domestic:	6
International:	6
UK Visit:	8
Total targeted outreach:	20
Total outreach:	96

SITUATING KEY FINDINGS FROM CONSULTATIONS IN THE INFRASTRUCTURE PROCESS LIFECYCLE

Procurement process do not appropriately factor in cost-avoidance, value-for-money, and non-financial benefits, but rather prioritize lowest project costs (5 occurrences)

Data gaps, alongside a lack of demographic, spatial and temporal granularity, makes analysis challenging (8 occurrences)



Private sector needs stable plan/strategy/ spending (5 occurrences)

Issues with municipal: asset management, asset inventorying and data consistency, quality, and standardization (10 occurrences)