Systems Level Innovation

ENGGEN 403 – Lecture 6

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Learning Outcomes

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- Define how to develop and craft the relevant multiple Problem Statements in a complex system
- Consider how elements and tools of Systems Thinking can help to identify alternatives for improvements, solutions and interventions
- Apply tools for synthesis and identification of improvements for challenges within a complex system.
- Describe the steps and process to develop a long list and short list of alternatives against which stakeholders and Key Success factors can be assessed
- Apply tools for synthesis and identification of improvements for challenges within a complex system.
- Assess the role and challenges of uncertainty, ambiguity, and risk in the context of Systems level innovation

Agenda

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- Context and Importance of KSFs
- Innovation at the Systems Level
- Providing Solutions and Creating Value in Complex Systems
- Systems Thinking in Practice
- Application to Previous Systems Projects
- Recap and What's Next

Context and Importance of KSFs

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- Key Success Factors: Requirements that potential solutions are assessed against
- Look at overlaps of necessary requirements
- The more complex problem, or the more problem spaces; the more KSF you may have
- Don’t loose sight of the overall problem!
- All KSFs are necessary requirements, but not all necessary requirements are KSFs

Wicked Problems

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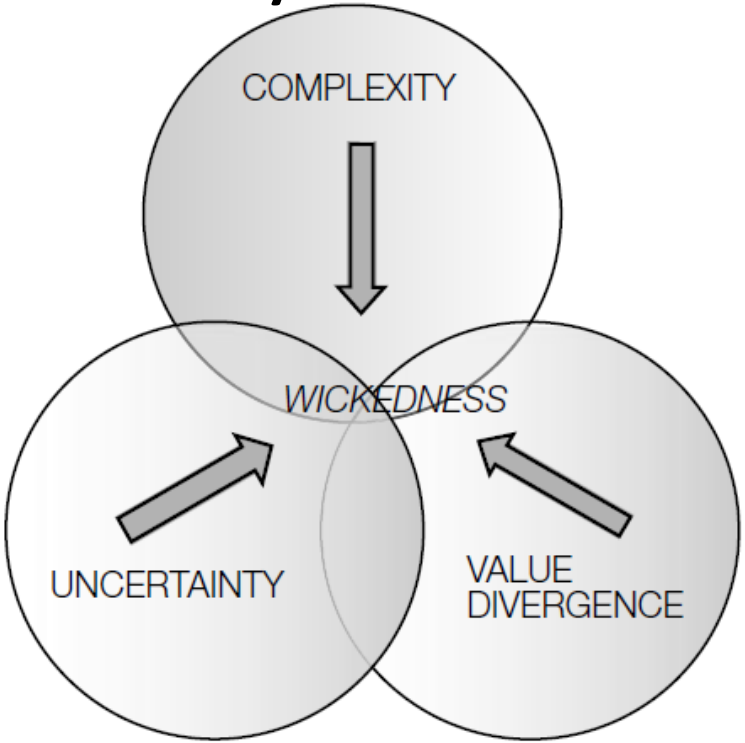
System



Knowledge

Stakeholders

Wicked Problems

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Unsolvable

Undefinable

Unverifiable

Unique

Uncertainty

Complex issues involving many stakeholders with conflicting requirements

Challenge can be broken down into component problems that are potentially solvable or improvable

Systems Challenges

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1. Explore, Define and Analyse the **challenge** to identify some of **the underlying problems**. Remember how to form specific **Problem Statements** from the focus **problems**.
2. Identify the **users/stakeholders**
3. Determine the **requirements** of the users/stakeholders
4. Select the **Key Success Factors (KSFs)** that a solution must meet
5. Come up with different **options** that are potential solutions to the problem **("longer list"** and "**long list**")
6. **Assess** those options against the CSFs and determine the "**short list"**
7. Carry out **economic analysis and societal impact** of the shortlisted options
8. Determine which option creates more **value** and suggest it as the best **way forward**
9. Define a **plan to implement** it

Similar to 303, but in ENGGEN 403 the challenge must first be broken down and each step

You're Consultants...

ST in Practice

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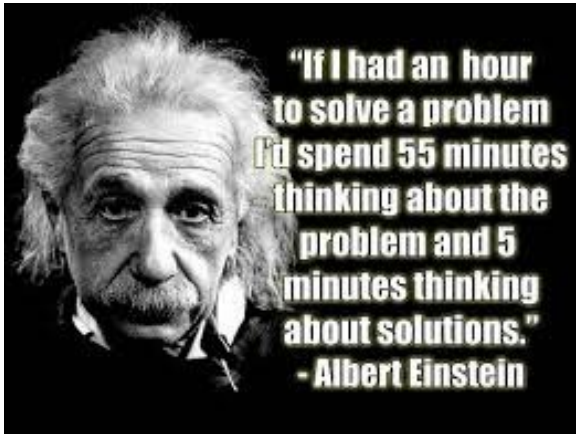
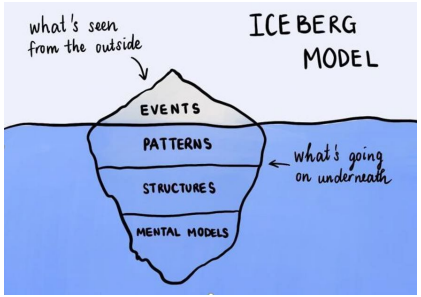
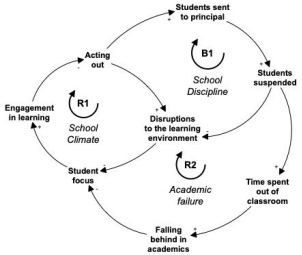
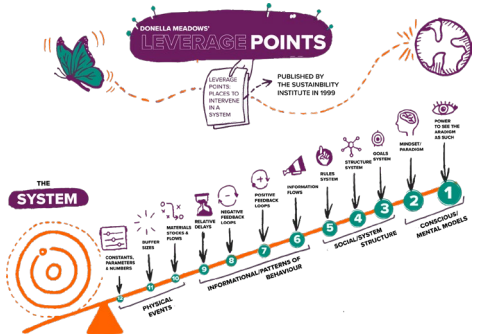
- Consider what we've discussed about systems, the relationships between elements within a system, and the forces and impacts between systems
- Explore, decompose, deconstruct, diagram, capture relationships, understand forces, consider stakeholders, and other activities to fully understand the problem(s)!
- Resist (like really resist!) the urge to jump to solutions or label one or more sub-systems as the root of the problem
- Root of problems in a complex systems are nearly always multifactorial - and interrelated - probe and go deeper!



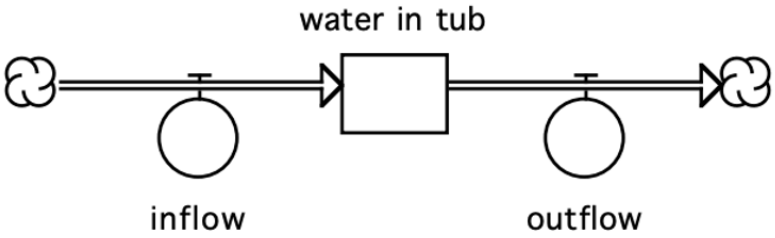
Explore and Define Problems

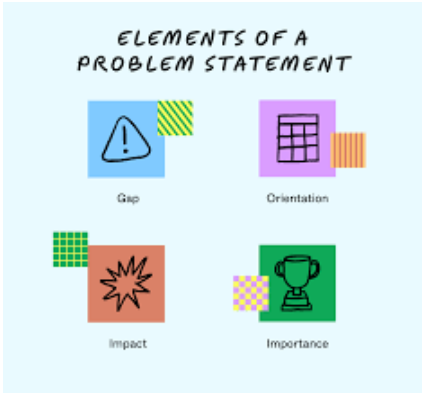






Understanding stocks and flows





Resources and Some Research

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Additional Resources and Supporting Material

Government health system review and current plans

- Health and Disability System Review Pūrongo whakamutunga - Final Report
- Te Pae Tata Interim New Zealand Health Plan 2022
- Budget 2022 - Health reform funding

Spending in areas outside of healthcare

- Investments in Education are Investments in Health
- Tackling Wasteful Spending on Health

What other countries are doing

- What Does Innovation in Australian Healthcare Look Like in 2022?
- Switzerland: #1 in the 2022 World Index of Healthcare Innovation
- Medical technology Switzerland
- Israel: #6 in the 2022 World Index of Healthcare Innovation
- Global Health Challenges, Meet Israeli HealthTech Solutions
- Singapore to test bed new health technologies with $1.7M funding
- Netherlands: #2 in the 2021 World Index of Healthcare Innovation
- Denmark: #11 in the 2021 World Index of Healthcare Innovation
- The rise of innovation and technology in Danish healthcare
- United Kingdom: #13 in the 2020 World Index of Healthcare Innovation

Frameworks for Impacts on Societal Wellbeing

- Living Standards Framework
- He Ara Waiora

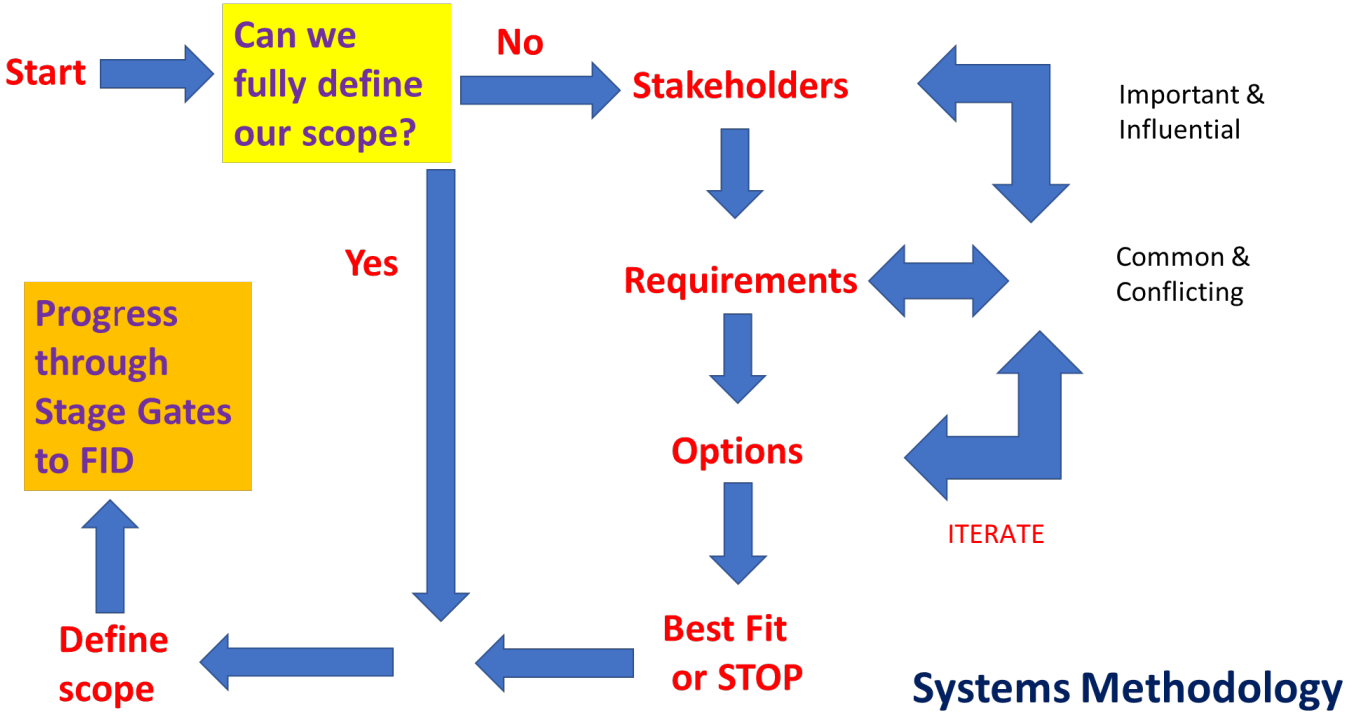
Exemplar Reference Resources:

2022 Exemplars

1. Report 1
2. Report 2
3. Report 3
4. Report 4
5. Video 1
6. Video 2
7. Video 3
8. Video 4

How Best To Manage The Team

Best Fit Iteration



Problem Statement(s)

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Application of Approach

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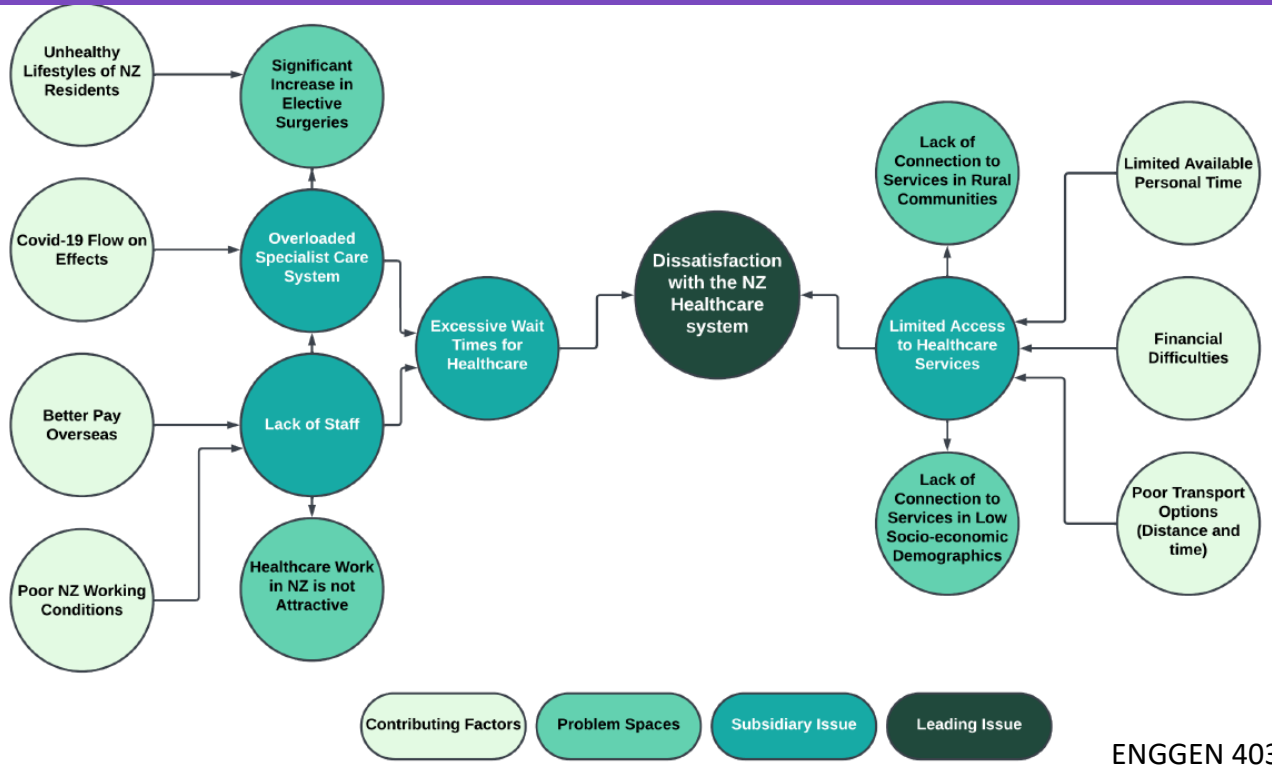
What new innovations can be made at the systems level to improve the prevailing access and waiting time issues faced by New Zealanders in our health system over the next 10-15 years?



Application of Approach

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What new innovations can be made at the systems level to improve the prevailing access and waiting time issues faced by New Zealanders in our health system over the next 10-15 years?

PROBLEM STATEMENT 1 (20%)

New Zealand has several vulnerable groups such as Māori, Pasifika People, elderly, and disabled people, who face more barriers to accessing healthcare than other New Zealanders, despite New Zealand having a publicly funded healthcare system that aims to provide universal healthcare for all New Zealanders.

PROBLEM STATEMENT 2 (30%)

New Zealand's primary and secondary healthcare systems are poorly integrated, making it difficult for medical professionals and patients to navigate. This results in inefficiencies and patients failing to access the care they need.

PROBLEM STATEMENT 3 (25%)

Many visits to hospitals and emergency rooms are unnecessary or preventable. This puts excess pressure on the New Zealand healthcare system resulting in long wait times for these services.

PROBLEM STATEMENT 4 (25%)

Wait times for elective surgery and specialist appointments are excessive, with average wait times of up to a year for some specialists. These wait times will only continue to worsen as New Zealand's population continues to grow and the demand for healthcare increases.

Stakeholders

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Table 1: Key Stakeholder Requirements

Stakeholder	Necessary	Nice-to-Have	Aspirational
Ministry of Health	Accountability mechanisms for performance monitoring. New solutions abide by laws and regulations. Justified use of government resources and financial sustainability (Ministry of Health, 2021).	Public support and engagement. Long-term healthcare sustainability. Shortest repayment period.	Achieving health equity and eliminating disparities (Te Whatu Ora, 2023a). Innovative funding models. Comprehensive healthcare reform.
Te Whatu Ora – Health New Zealand	Effective resource allocation and management of health services. Efficient healthcare operations.	Seamless integration of services. Improved patient experience and medical accessibility.	Innovative healthcare delivery and systems. Technological advancements.
Te Aka Whai Ora - The Māori Health Authority	Improved Māori health outcomes, with less health disparities. Cultural competence and responsiveness (Te Aka Whai Ora, 2022).	Community engagement and trust. Collaborative partnerships.	Achieving health sovereignty for Māori.
The Public Health Agency	Effective population health strategies and response plans. Equity-focused approaches (Manatu Hauora, 2023).	Timely public health alerts and communication. Data-driven decision-making.	Leading global public health efforts. Influencing social determinants of health.
Health Professionals	Safe and enjoyable working conditions (Small, 2023). Motivated to stay within New Zealand's healthcare system (Te Whatu Ora, 2023b). Have sufficient staffing levels (Brettkelly, 2023).	Professional development opportunities. Support for mental health and well-being (Forbes, 2023). Better access to diagnostic tools.	Consultation in problem development and decision-making processes.
Urgent Care Patients	Immediate medical care (OECD, 2020; Quinn 2022, 2023). Competent staff available (Te Tāhū Hauroa, 2022).	Additional support services like mental health counselling and social worker assistance.	Extra attention and amenities for urgent patient's family and caregivers
Vulnerable Populations	Improved access to healthcare (physical access, financial access, etc.). Access to specialised care options. (Bhatt & Bathija, 2018)	Community support programs. Rehabilitation services.	Non-discriminate employment opportunities.
Pharmaceutical and Medical Suppliers	Transparent procurement process that aligns with industry standards and regulations. Timely payments and a streamlined invoicing system.	Open channels of communication for feedback and improvement, as well as the possibility of expanding the range of products or services supplied.	A fully integrated supply chain system that allows for real-time tracking and analytics, enhancing efficiency and decision-making.
Non-urgent Care Patients	Quality healthcare services with timely access to care. Inclusivity and cultural competence.	Affordable services and medicine (Te Tāhū Hauroa, 2021).	Active involvement in health decisions (Bombard et al, 2018).
Rural Communities	Means to reach and use healthcare facilities and services (Rural Health Information Hub, 2022; McCaull, 2022).	Increased support and alleviated pressure for rural health practitioners (McBeth, 2023). Efficient transportation options.	Access to reliable and sustainable after-hour services. Further development of telehealth services (Te Whatu Ora, 2023a).
Low socio-economic communities	Inclusive community involvement. Education on healthcare reform.	Tailored solutions for regional disparities.	Cost-effective solutions that can be sustained in the long term.
Health Insurance Providers (ACC)	Immediately informed on any healthcare policy and regulation changes.	Collaboration with an extensive network of health providers. Decrease in hospital-related injuries (Brown, 2017).	Patients have timely access to a wide range of healthcare services.

Key: Manage Closely | Keep Satisfied | Keep Informed | Monitor

Key Success Factors (KSFs)

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2.5. Critical Success Factors

The following critical success factors (CSF) represent the objectives vital to the project's success. The recommended options must meet all critical success factors for a viable solution.

1. **Expand Opportunities for Patients to Access Healthcare Services.**

The solution will improve healthcare accessibility for rural and low socio-economic communities. Access to healthcare must be provided at a fair cost. Improving healthcare access is the core project driver and key stakeholder priority. This CSF will ensure the weaknesses of the current system are addressed.

2. **Improve Working Conditions for Healthcare Workers.**

6

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Provide favourable healthcare working conditions. Favourable conditions include justifiable working hours, fair compensation, workplace amenities and benefits, opportunities for career development, and career security. This CSF is critical to promoting attractive career options and comparable employment experiences to international counterparts. Short staffing limits healthcare services, meaning retaining the current workforce and attracting future employees is crucial.

3. **Increased Efficiency in Healthcare Operations.**

Improved efficiency in resource allocation (equipment, funding, and personnel) and administration processes is required to reduce the wait times. Improvements in these areas will also contribute to a positive healthcare experience for patients and caregivers. The COVID-19 pandemic revealed vulnerabilities in the healthcare system's ability to provide care. The solution must increase efficiency to aid the development of a resilient healthcare system that can respond adaptively.

4. **Cost Efficiency and Financial Viability.**

Investment is a justified allocation of the Government budget considering the impact on other sectors and national debt consequences. A justifiable NPV supports expenditure, balancing initial investment with long-term benefits. As government funding is balanced between conflicting expenditure priorities, the project spending must support healthcare outcomes without compromising other areas of need.

5. **Accommodate Vulnerable People and Promote Equity.**

Address the current health system shortcomings in accommodating vulnerable people and equity. The solution will enable equal access to healthcare resources and services for patients. Vulnerable people include frequent users of the healthcare system, disabled individuals, children and elderly, and those with mental illnesses who should not be adversely impacted by solution implementation in the short or long term.

6. **Aligns with the New Zealand Public Health Strategies.**

The solution will support the transition to Te Whatu Ora, a centralised healthcare system, and address weaknesses identified in healthcare strategies. Alignment with public health plans is essential to achieving government priorities. Alignment also acts as a driver to motivate the government to execute the project, regardless of the national ruling party.

Long List

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Table A1: Long-List Options

#	Option	Description, Benefits and Drawbacks
1	Do Nothing	Make no adjustments to the current healthcare system.
2	Boost Locally Produced Workforce	Increase the number of trained healthcare professionals in New Zealand. This approach synthesises several longlist ideas and will be threefold: (1) The addition of a third medical school in New Zealand to facilitate the education of more medical students; (2) increase the student capacity of Auckland and Otago medical schools through an education funding boost; (3) improve resourcing and appeal of healthcare professions such as nursing. There is potential for the new medical school to only produce General Practitioners, to address New Zealand's GP shortage. Boosting existing medical schools will increase numbers of medical specialists.
3	Boost Internationally Sourced Workforce	Current inefficiencies with immigration processes serve as a significant deterrent and barrier for overseas healthcare workers looking to move countries. Addressing barriers within existing immigration processes, such as cost or 'qualification discrepancy' barriers, will facilitate larger volumes of international healthcare workers moving to New Zealand. Incorporation of a retention clause can be explored to ensure those who immigrate remain in New Zealand.
4	Unique Professional Development Opportunities	Attract healthcare workers to stay in NZ through offers of further education. Revisiting roles and responsibilities within clinical settings to identify appropriate responsibilities that may be delegated to others to reduce workload. For example, Experienced Healthcare Assistants can be trained to take blood and ECGs so nurses do not have to.
5	Boost Workforce through Subsidising Studies	Boost Workforce Through Subsidising StudiesIncentivise study of clinical degrees through partially or fully subsidised study. A retention clause ensuring individuals remain in NZ for a set amount of years post-graduation will help address New Zealand's staff retention issues.
6	Better Working Conditions and Pay	Attract existing healthcare workers to stay in NZ by improving pay. Working conditions will also be improved with mental health support and transportation subsidies for healthcare workers.
7	Prevention Through Education	Construct and provide a more comprehensive health education strategy to improve health literacy and awareness for the public and high-exposure groups. Vulnerable groups such as Māori are disproportionately represented in poor health outcomes and New Zealand's non-communicable disease statistics (Pollock, 2011).
8	Better Integration of Technology in Health Practices	Research into AI to be used for current health practices. Robotics will be used to conduct basic medical tests. AI will streamline administrative processes such as patient notes and analysing test results.
9	Expand Rural Access to Healthcare Schemes	Expand the number of mobile health clinics and services for rural areas. Review the 'National Travel Assistance Scheme' for transport subsidies as the eligibility criteria is too narrow and the application process is convoluted at present.
10	Health Website Update and Awareness Campaign	Update the government health website to be more accessible and user-friendly, including a health app, and an awareness campaign about this resource, to connect patients with relevant specialised care and services for disadvantaged groups.
11	Promote Use of Private Healthcare for Higher Socioeconomic Groups	Incentivise private health care for people in advantaged socioeconomic positions by having a government subsidy that reduces health insurance costs. This would reduce the demand on the public healthcare sector.

DFV & Sustainability

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3.1. Initial Options Assessment

A comprehensive DFVS assessment was conducted as an initial evaluation of the long-list options. The complete assessment can be found in the Appendix 8.3 Table 12. Below, Table 3 presents an overview of the evaluation alongside each option's projected cost.

Table 3: DFVS Assessment

	Option																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Annual Economic Costs Order of Magnitude (Million $NZD)	0	500	260	450	600	0	1	70	380	1	100	20	200	1	20	20	10	320	0	0
Desirability	L	H	H	M	H	H	H	H	M	M	M	H	L	M	L	H	M	H	M	L
Feasibility	H	M	H	H	M	H	H	H	H	M	L	M	M	H	H	H	L	H	M	H
Viability	H	M	M	M	M	H	H	M	L	H	M	H	M	H	H	L	L	M	H	H
Sustainability	L	H	H	H	M	H	H	M	M	H	M	H	H	H	H	M	M	M	M	M

KSFs/KPIs/DFV

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INITIAL OPTIONS ASSESSMENT

To decide upon which options will be chosen from the longlist to create the shortlist, each option was judged based on the five critical success factors alongside the concepts of feasibility, and viability. Additionally, each option was assessed against a key performance indicator (KPI) of desirability. Options that satisfied each requirement the greatest were chosen for the shortlisted options. The options assessment is shown in table 3 below.

Table 3: Initial options assessment of long listed options

Longlist Option	CSF 1	CSF 2	CSF 3	CSF 4	CSF 5	Viability	Feasibility	Desirability
Do nothing								
Reflux valves								
Reshape terrain								
Permeable surfaces								
Storm surge barriers								
Reclaimed land								
Managed retreat								
Reservoir								
River modification								
Seawalls/stopbanks								
Coastal reinforcement								
Floodplains								
Storm protection in houses								
Mangroves/Trees								
Marina Barrage								
Pilotis buildings								
Create wave farms								

CSF KEY
- Does not satisfy
- Partially satisfies
- Satisfies

KPI KEY
- Does not satisfy
- ↓
- Satisfies

Short List

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SHORTLIST OPTIONS

Do nothing

Do nothing proposes that New Zealand does not adapt to reduce the impacts caused by severe weather. This option is the most risk-averse, and would not satisfy any of the stakeholders. This option also does not address the New Zealand Climate Change Amendment Act of 2019.

Dry dams - permeable surfaces at the city level

This solution is two-fold. It focuses on eliminating flooding at the root of the cause through dry dams and mitigating the effects of rainfall in dense cities through permeable surfaces. Intense rainfall at high country stations exacerbates the effects of flooding in low lying communities. Introducing dry dams will regulate river flow before they reach towns. Dry dams are less invasive on river ecology and do not reduce river flow in dry conditions. To combat local flooding in dense populations, this solution also introduces initiatives such as porous pavements, bioswales, and green roofs. These additions will reduce the strain on stormwater drainage during heavy rainfall.

Flood Barriers

Flooding is exacerbated by storm surges during high tide. Introducing preventative measures, such as seawalls, floodwalls, and upstream planting will mitigate the effects of flooding on some communities. Sea walls are large concrete or masonry structures built parallel to the shore to protect inland areas against waves and coastal erosion. During storms, they prevent additional flooding of low lying communities. Floodwalls are engineered structures designed to contain a river within its embankment during high flow levels. It prevents the encroachment of water and debris into residential areas. Upstream planting is a more natural preventative technique. Planting vegetation such as trees and mangroves in rivers upstream from communities may retain excess flood water and improve the soil stability of the river banks.

River modification

Flooding from high river flow during heavy rainfall results in severe risks to local communities as well as Māori fisheries downstream. Rivers can be modified by creating flood water diversion channels which can reroute excess flood water away from flood prone areas, reducing flood damage. Excess water may be rerouted out to sea, into designated floodplains, onto land where it can be slowly absorbed by the ground, or into a reservoir for use elsewhere. Another method of modifying existing channels includes dredging a river to remove material such as debris, rubbish, or excess soil. Widening of the river channel, if the surrounding area allows, may increase its carrying capacity therefore reducing the risk of overflow during intense rainfall.

Identify SL Options for BC

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Table 7: Social benefits and considerations for the 'Do Nothing' option

LSF	Pros	Cons
Financial and Physical	• Government spending is not required and can be allocated to other sectors.	• No further health interventions to address the financial burden of preventable non-communicable diseases. • The efficiency of the healthcare system remains the same. • Delayed infrastructure upgrades due to budget constraints.
Natural	• Initiatives to protect environmental assets remain unchallenged .	• Inefficiencies in the healthcare system lead to wasted or poor management of resources.
Human	• No disruption to the existing health care system.	• Medical staff continue to be overworked. • Vulnerable communities continue to experience barriers to accessing healthcare. • Access and wait times remain problematic.
Social	• Allows for reallocation of government resources for critical issues like the housing crisis, and potentially benefiting NZ residents' health.	• No commitments made to improve the health outcomes of vulnerable groups. • Healthcare needs of Māori are not met, resulting in the failure to meet Te Tiriti obligations.

Recap & What's Next

- Systems Thinking is about understanding the problem well and the interconnectedness of it
- How will your team share an understanding and ideate?
- What ST tools will you use and how?
- What team/project management tools will you use and who is responsible for what communication?
- Longer list/long list/short list

NEXT WEEK:

- Traditional CBA
- Social Considerations
- GDP & Government Spending

THEN:

- Social CBA

Thank you and see you tomorrow!