Socio-economic adaptation to ongoing Taranaki volcanism
A Co-Created System Dynamics approach

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Introduction

At present, nearly 800 million people in 86 countries live in a direct (within 100 km) setting of active volcanoes[1]. On average 31 volcanoes erupt each year.

Apart from direct hazards (lava flows, pyroclastic flows, lahars, ash, tephra fall, and landslides[2]) volcanic eruptions often result in indirect impacts and generate risks that can be observed far beyond the locality of the event. Indirect and intangible losses result from the highly interconnected, interrelated, and interdependent natural, human, and physical networks and their dynamics.

10% of world's population

live within 100 km of active volcano

31 erupt each year (on average)

Taranaki volcano


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According to recent studies[3,4,5] Mt. Taranaki located in the western North Island is the most likely volcano to generate national-scale consequences for Aotearoa in the near future.

In modern times, New Zealand has not experienced an eruption that would resemble the Taranaki case, and therefore, contingency plans for such an eventuality had not been developed.

33% - 42% of at least one eruption in the next 50 years

NZ$1.7 - 4.0 billion of GDP

117,561 people live in Taranaki region

Why should we care?

- Mt. Taranaki poses a 33% to 42% chance of at least one eruption in the next 50 years[6].
- A year of disruption caused by a single eruption at Mt. Taranaki could be as high as ~NZ$1.7 – 4.0 billion of GDP[4]. However, the overall cost of an eruption is likely to be much higher due to flow-on and indirect impacts.
- Approximately 117,561 people live in the Taranaki region[7].
- The region is important for New Zealand economy because of its oil and gas, dairy farming and meat production, mining, fertilizers manufacturing, electricity generation and distribution[4].

The study is a part of a project, "Transitioning Taranaki to a Volcanic Future (TTVF)," funded by MBIE within Endeavour Fund. The TTVF project aims to develop the knowledge, tools, and readiness to assist Aotearoa-New Zealand in the better-informed decision and adaptation processes in case of long-term disruption caused by volcanic activity.

A new form of resilience for Aotearoa-New Zealand

The response of Aotearoa-New Zealand to hazard mitigation and risk management has been built on the 4Rs approach (i.e., reduction, readiness, response, and recovery). This assumes that the hazard is static, linear, and regular and that individual events are finite in length.

4Rs: Reduction → Readiness → Response → Recovery

static | linear | regular | finite

By contrast, an anticipated Taranaki volcanic event is predicted to be complex, its impacts will also be complex, nonlinear, and dynamic[8].

All of these features mean that applying a 4Rs approach is fraught with challenges.

complex (consisting of many interacting components)[5] | complex impacts | nonlinear (differential impact causing disproportionate change) | dynamic (changes over time)[8]

Aims

The primary aim of this study is to select and stress-test socio-economic pathways that improve the ability of community, business, and Government to adapt through a complex, long-term, multiscale hazard event, simulated by volcanic disruption at Mt. Taranaki.


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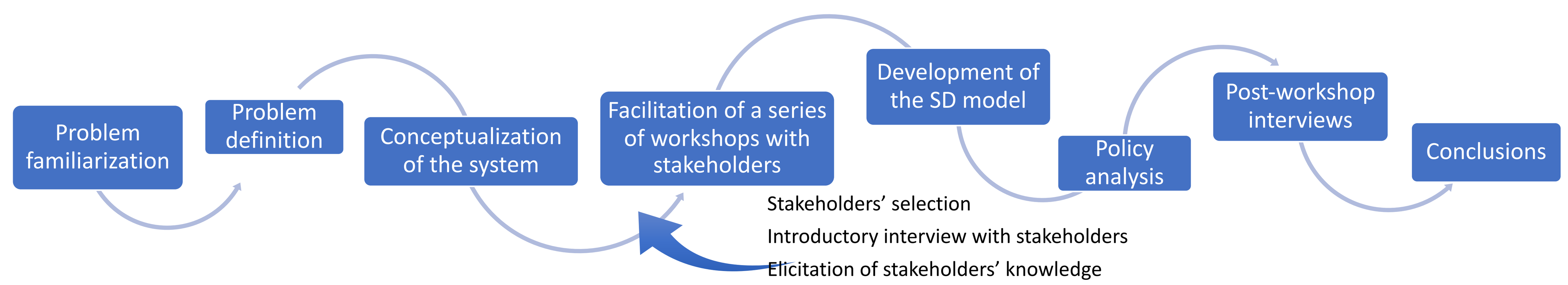
Methodology

The study employs a multi-method, transdisciplinary System Dynamics approach combining qualitative and quantitative research activities. The process consists of a series of stakeholder co-created workshops that, with the help of a computer simulation software (Stella Architect), help to create a System Dynamics model of a regional and national socio-economic system. The process includes several stages illustrated below.



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