

Building Bridges: What pandemic preparedness can learn from Real-Option Analyses of water infrastructure in the Netherlands

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Introduction

The recent Covid-19 pandemic has put the ability of countries to respond to a communicable disease (CD) outbreak on high priority for policymakers. Although effective interventions exist, policymakers can struggle with quantifying the value of pandemic preparedness (PP) measures, because outbreaks are uncertain as well as highly variable. Additionally, PP measures are irreversible, upfront capital investments with uncertain benefits in the future.¹

A field with a similar mix of uncertainty, variation in exogenous factors and high capital requirements is the management of water in the Netherlands. The Netherlands is a water-bound country, with 26% of its territory lying below sea level. Water infrastructure which protects its inhabitants, as well as accommodates trade, is key for the welfare of the country and brings along multisectoral benefits for society. To cope with long-term natural and societal developments regarding the demands for infrastructure, planners include domains of flexibility in project planning, construction or final use, which can be realised ex-post if deemed necessary.

Financed by public funds, these projects have brought forward the need for Dutch public agencies to develop investment analysis approaches to inform legislators. More specifically, there is a need for a methodology that can quantify a particular project's flexibility to adapt to changing exogenous demands. Conventionally, decision-making in the Netherlands is informed through societal cost-benefit analyses (CBA), which express the multisectoral benefits of a project through net-present value (NPV) and internal rate of return (IRR) metrics. These approaches analyse the costs and monetised benefits over a determined time horizon showing whether a project can be deemed financially beneficial. Real-option (RO) analysis in this context has proven to indicate the value of project flexibility over its lifetime.²

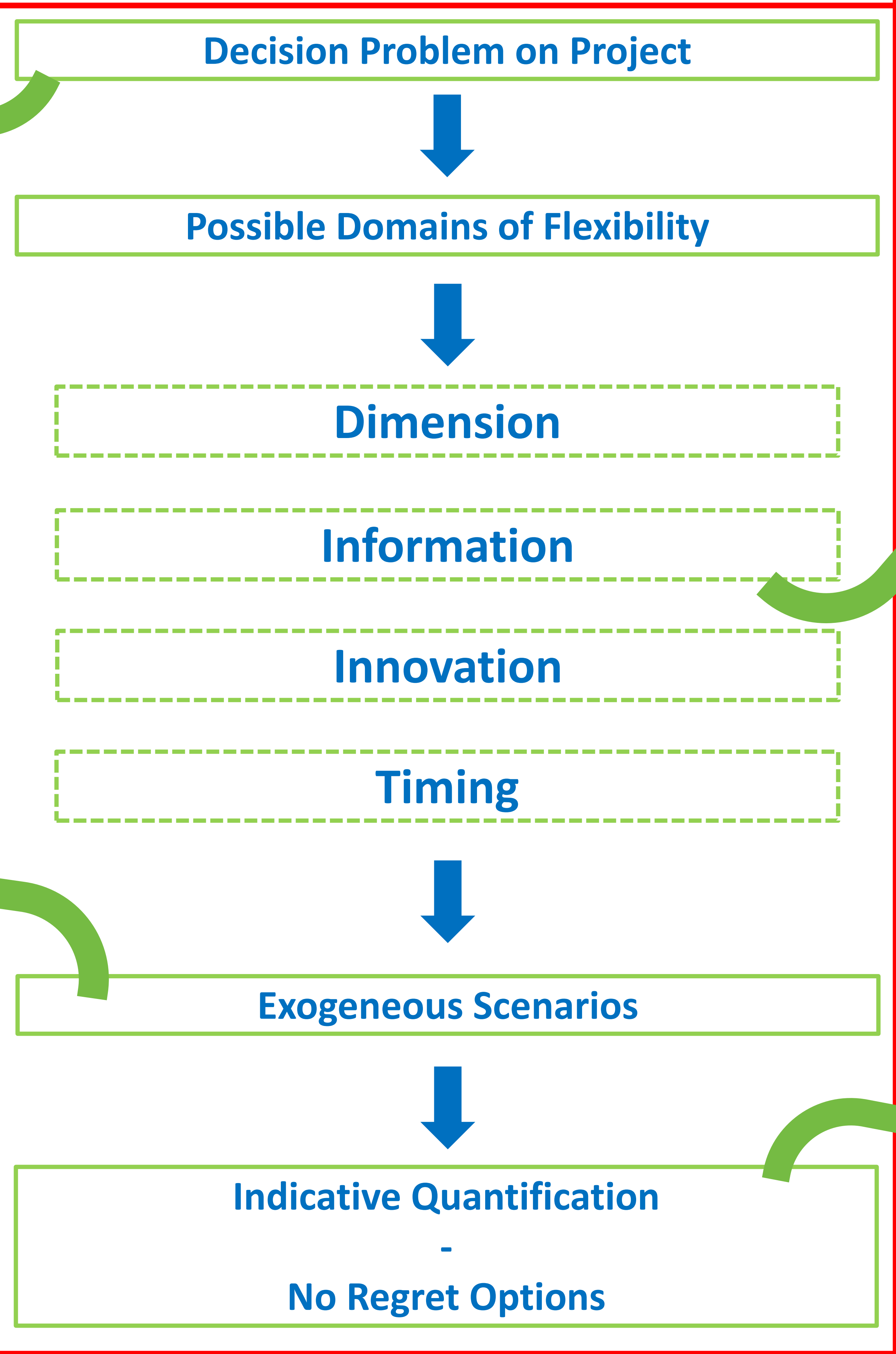
The term RO refers to the right, but not the obligation to take action within a certain project. The value of a RO is determined by exposing a static project design as well as a project design including different forms of ROs with different exogenous scenarios. The scenarios are determined by assessing important drivers of costs and monetary benefits and potential ranges. Subsequently, the obtained NPV and IRR metrics are compared and a positive difference in the project including a RO is determined to be added value by the option.

*"Real-Option refers to the **right, but not obligation**, to take a specified action in a future point of time."*

Yet these come at a cost, leading to the question:
Is incorporating RO beneficial for decision-makers and society?

When wanting to quantify the value of a RO, the benefit of a flexible project design should be compared with a static (conventional) design, when exposed to different scenarios.
The specific scenarios should be determined by assessing relevant virologic and epidemiological trends influencing the possible effectiveness and demand for a PP measure. Optimally, these should be validated by medical experts.

Figure 1. Flow-chart to decision problem using a Real-Option approach



Examples for different option domains:

Dimension; Reserve space for extending the vaccine production facility

Information; Do research on better patient risk-factor identification after vaccination campaign has already started

Innovation; Invest in production facility to be able to produce future anticipated vaccines e.g. mRNA

Timing; Postponing investments into research or facilities ("wait and see")

When quantifying an RO, this should be done indicatively given the rather large uncertainties surrounding the parameters and their probabilistic distributions. If a RO is beneficial under all scenarios, it will be a "no regret" to exercise.

Conclusion

Valuing the flexibility in PP measures is key in informing decision-makers on project design, selection and funding. Future research should implement the RO approach using a case-study on vaccine production capacity or platform technology.

Pres. Author Photo

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*"If a Real-Option is beneficial under all included scenarios, it will be a **no regret** to exercise."*

References: ¹Attema, Lugner & Feenstra, Investment in Antiviral Drugs: A Real Options Approach,; *Health Economics*, DOI: 10.1002/hec.1549; ²Bos & Zwaneveld 2014, Reële opties en de waarde van flexibiliteit bij investeringen in natte infrastructuur, CPB Achtergronddocument, DOI: 10.13140/RG.2.1.1478.7442