

Change the Model Change the World

10 Minutes of fun with Rishi Prabhakar, Palisade Asia Pacific

Why should you listen to me?

1. I'm a mathematician, and we're usually right.
2. 20+ years experience in modelling.
3. My presentation title has a rhyming scheme.
4. The stock PowerPoint theme I'm using is mostly green, which makes me appear environmentally friendly.

Why do our models need to change?

- ▶ Your models are wrong - *professional modeller.*
- ▶ My models are wrong - *professional modeller.*
- ▶ But they're useful! - *everyone.*

What is “wrong” in a model?

- ▶ Simplifications of the real world (unavoidable).
- ▶ Assumptions remove complications/realism:
 - ▶ We don't know about it.
 - ▶ We don't know how to do it.
 - ▶ We can't be bothered.
- ▶ Examples:
 - ▶ Complex dependency structures. *Functional. Correlation matrix. Copulas.*
 - ▶ Parameter estimation is actually guessing. *Limited data. Data limitations. Hard to conceptualise.*
 - ▶ No visibility or understanding of a model element. *Unknown unknowns!*

Get to the point

- ▶ Are we simply missing the potential scope of our projects in our models?
- ▶ Removing assumptions known or otherwise, rather than radically changing our approach, may be all that needs to be addressed.
- ▶ This represents no more than making current models more realistic, which has always been the goal of modelling over time.
- ▶ If “cost to us” is replaced partially at least by “cost to all”, where would that lead?

How do we measure this?

- ▶ Some models are purposely designed to be environmentally ethical:
 - ▶ LONGEVITY DISTRIBUTION. Extinction Risk in Endangered Species. Optimise a captive breeding and relocation strategy for higher survivability. (University of California, Berkley)
 - ▶ POPULATION HEALTH. Biosecurity for Aquatic Farmers. Minimise the impact of disease on fish farm populations while limiting spend on testing. (World Aquatic Veterinary Medical Association)
 - ▶ In these examples (and others) the measurement is an obvious implication of the modelling, and directly relates to notions of ethical decision making and sustainability. But we talk in “money”.

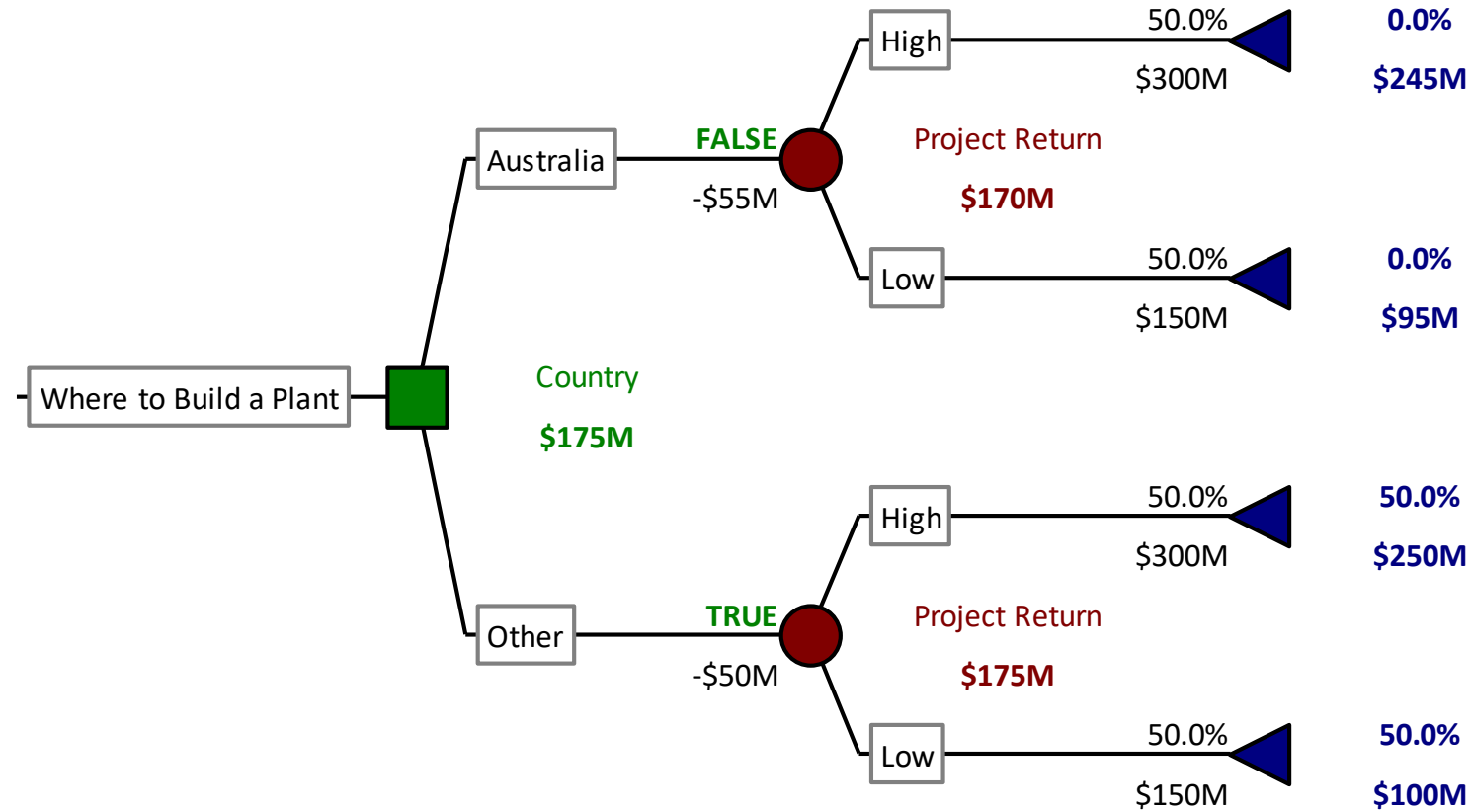
Yeah, so about that money

- ▶ Models can focus on financial impact and with ethical implications:
 - ▶ COST MODEL. Minimise the cost of meeting environmental liabilities. (Triangle Economic Research)
 - ▶ COST-BENEFIT ANALYSIS. Biofuel production financial modelling. (Purdue University)
 - ▶ Now we're definitely talking in dollar-terms. There is specificity in these models though. We can get closer to regular cost estimation decision-making models (exactly?) that also include environmental impact and broader ethical concerns.

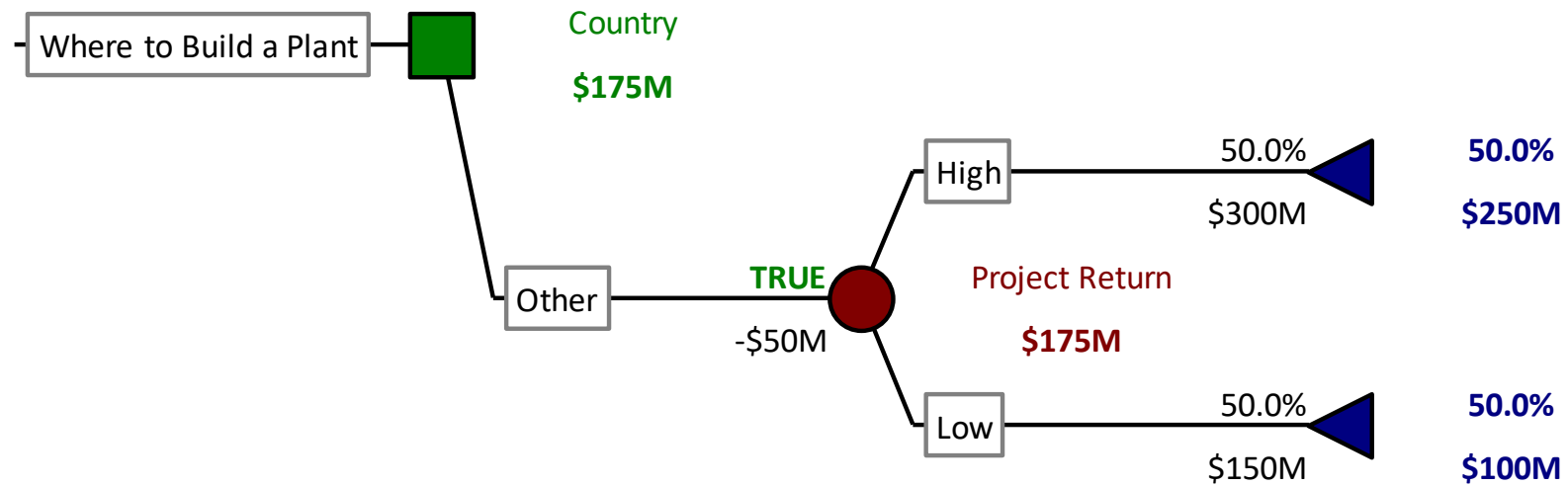
Approaches to these costs

- ▶ There's the cost of cleaning up our mess, but we mostly already include this.
- ▶ Do these clean up costs include loss of species or reduction in species' population? The longer term impact of habitat reduction? Human health impacts? How would these be priced? T.R.I.C.K.Y.
- ▶ Unexpected impacts.
 - ▶ E.g. building a new, multi-storey carpark in the city has a resource cost. But the value isn't only in charging people to leave their car there. More parking spaces means less time spent driving around looking for a parking spot, thus lowering the carbon footprint for each journey. This positively impacts the health of humans and non-human animals alike.
- ▶ If someone else pays for our mess, do we include that?

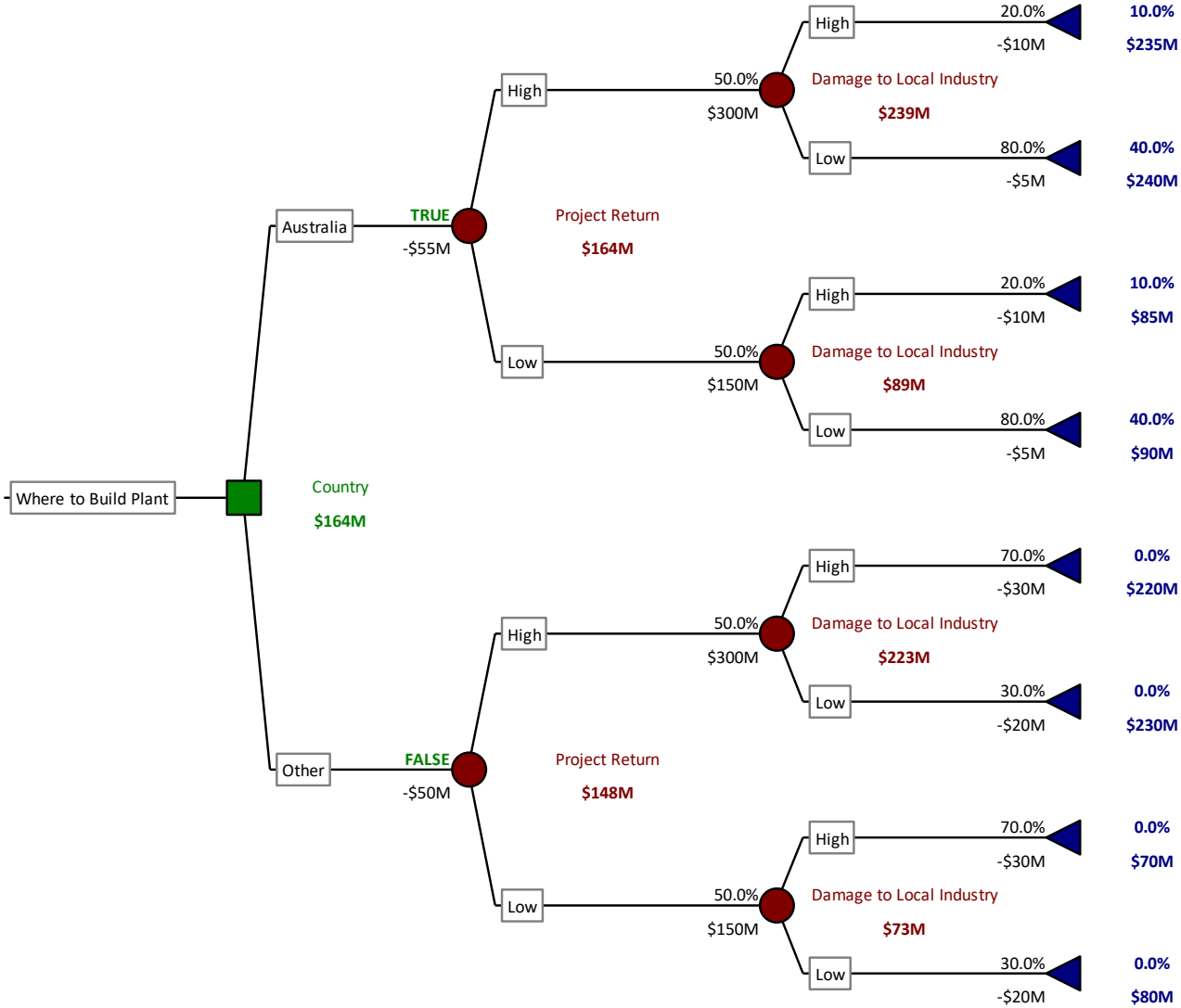
Outrageously simple example



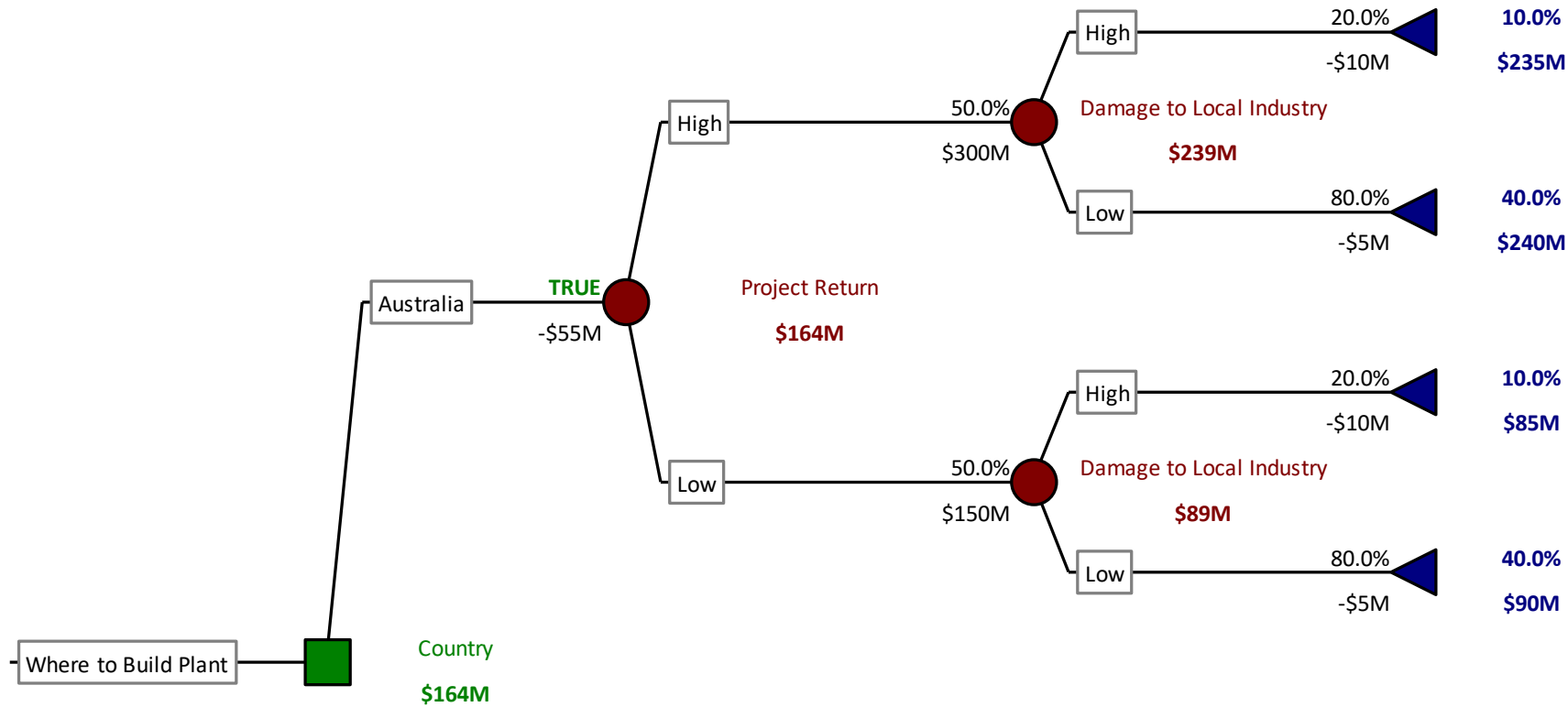
And the winner is...



Now we add a conscience



And we all win!



Is there a lesson here?

- ▶ All models are inaccurate due to avoidable and unavoidable assumptions that limit the realism of the model and the data it generates.
- ▶ An example of an assumption you may not have considered is the cost to an ‘innocent party’ due to your actions. E.g. a local fishing industry, a species that lives in the wrong place, habitat loss causing islandisation and long term extinction events.
- ▶ Ethical liability can be modelled just like any other cost in the project. Measurement can be problematic.
- ▶ This might not represent ‘real’ money, but it is real. And it can impact your decision making for the better.