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Workshop report: RP3035

Workshop and case study testing

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1 Introduction

This brief report provides notes from a workshop that was organised by CSIRO and Sydney Water. The aim of the workshop was to explore the potential uses of the Agent-Based Model describing water conservation behaviour. The model was developed as part of the Low Carbon Living CRC project RP3035. Two examples of how the model could be applied were described.

2 Workshop background

Workshop details:

- The workshop was carried out on 3 May 2018 at the Sydney Water offices in Parramatta.
- Participants were primarily from Sydney Water, but there were also invited guests from other agencies.
- The primary purpose of the workshop was to report back and collect feedback on the application of the modelling tool applied to scenarios defined by Sydney Water.
- The secondary purpose was to discuss how the capability can be used by Sydney Water into the future.

3 Conceptual description of model

Features of the modelling capability were presented to Sydney Water, including how the:

- Model has the capacity to explore the following behaviours
    - Outdoor behaviours: mulching, drip irrigation, drought tolerant plants, etc.
    - Indoor behaviours: tap off brushing teeth, shorter showers, half flush button, etc.
    - Outdoor technology: rainwater harvesting, rainwater tank maintenance, etc.
    - Indoor technology: appliances, water saving toilets, shower heads, etc.
- Model is used to explore influence of 'choice architecture', i.e. nudging, in particular:
    - Role of influencers, i.e. retailers, plumbers, etc.
    - Rule of thumb heuristics, i.e. imitation, social comparison, etc.
    - Influence of awareness and behavioural triggers (see Figure 1).
- Decision making parameters are based on survey data, accounting for behaviour drivers, estimated based on Logistic regression (Binomial). Key behavioural drivers are:
    - Self-reported priorities, i.e. hassle, money, environmental outcomes, water supply resilience.
    - Personality, i.e. ambition and tendency towards conformity.

- Perception of uncertainty, i.e. perceived lack of control, outcome uncertainty, confidence and cognitive laziness.

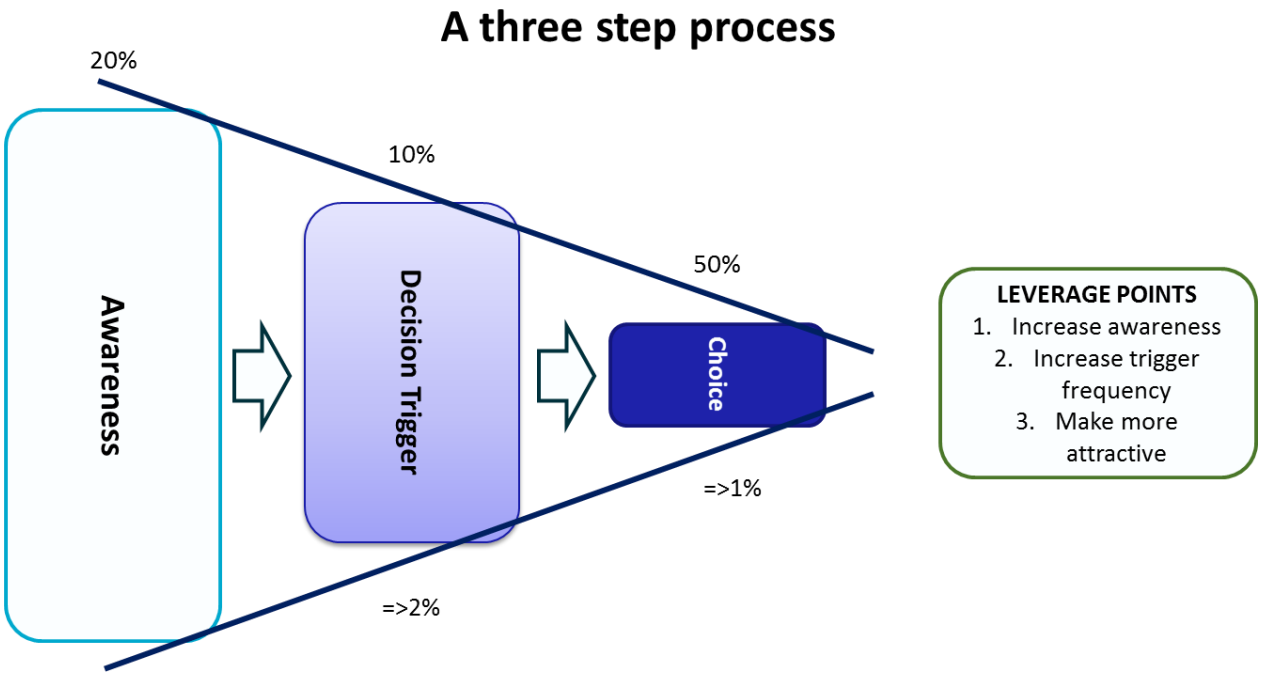

Figure 1: Leverage points to increase adoption.

4 Practical application of model

After the conceptual presentation, Magnus Moglia demonstrated the model applied to two practical cases (chosen by Sydney Water staff):

A. WaterFix

B. Rainwater tank maintenance

4.1 WaterFix

Sydney Water has had the WaterFix program for a number of years. The structure of the program is described on the Sydney Water website, as per text box 1. Essentially, a customer can contact Sydney Water to arrange an appointment with a plumber to reduce leakage and/or install water saving devices. Sydney Water then pays the plumber for the services, and subsequently charges the customer for the services via the water bill (at a small profit). The average estimated water savings per annum for the time period 2011-2018 is 23.8 kl/household/annum. With a discount rate of 5.9% Sydney Water estimates that the cost of water savings is approximately $2.12/kL.

Text Box 1: For over 15 years, we've helped our customers reduce their water bills by providing a range of fixed-price plumbing services through our residential WaterFix® service.

Our qualified plumbers can:

- repair leaking toilets, taps and showers
- repair burst and broken pipes
- install WELS 4 star rated Caroma toilets and cisterns
- install WELS 4 star rated taps
- install WELS 3 star rated showerheads
- install water efficient fittings on your existing fixtures
- install compatible toilets, showerheads and taps you supply.

All appointments include a free water efficiency audit. Our plumbers will check your property for leaks and opportunities to reduce your water use and save you money.

Source: http://www.sydneywater.com.au/SW/your-home/saving-water-at-home/bathroom/waterfix/index.htm

Unfortunately, due to the low uptake of the WaterFix program our first survey was not able to provide us with the information to allow us to estimate key parameters, especially around choice. Therefore, we used the following assumptions regarding awareness, triggers and choice. We therefore had two scenarios that we explored:

- Business as usual (calibrated based on our current understanding and known rate of adoption):
    - Awareness of WaterFix at 10%
    - The chance of a decision being made when aware: 14%
    - The chance of choosing to participate in WaterFix, if making a decision: 14%
- Plumbers promoting WaterFix, i.e. when people see a plumber he/she will ask if the householder would like to participate in WaterFix.
    - Awareness of WaterFix (being over-ridden through the direct contact with the plumber): 44%
    - Chances of making a decision when confronted with an offer by the plumber: 60%
    - Chances of choosing to participate in WaterFix, under these circumstances: 30%

Our application of the NED model to WaterFix had to be based on these assumptions, and it was agreed that we would collect additional data in order to establish more accurate data on these parameters. The results of the simulation in these two cases are shown in.

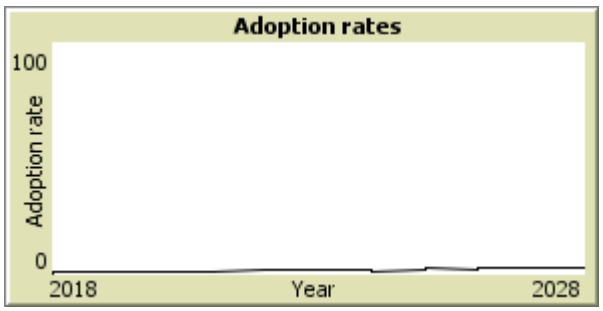

Figure 2: Adoption rates in the business as usual case (final adoption rate = 2%)

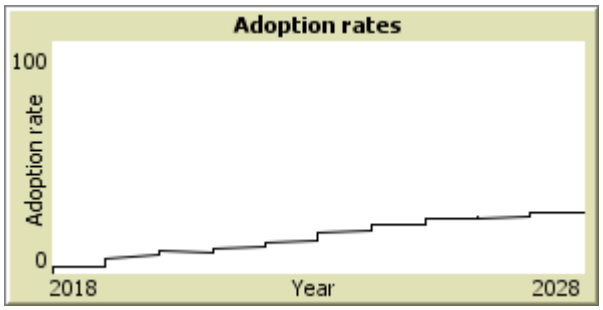

Figure 3: Adoption rates in plumbers' promotion case (final adoption rate = 26%)

Conversation then ensued on how to reform the WaterFix program in order to increase adoption rates. It was considered quite a feasible prospect to work with plumbers to promote the program. It was also discussed how the program could be made to be more attractive to householders. Since the workshop, Sydney Water have put the WaterFix program on hold whilst reviewing the best method for delivering it.

4.2 Rainwater tank maintenance

It has been established that householders need to maintain pumps and other aspects of their rainwater harvesting systems in order to maintain water savings capacity. It has therefore been thought that Sydney Water would put in place strategies that promote householders to maintain their tank systems. Based on our household survey we were able to establish some of the key parameters of the model.

The choice model is of the form:

$$\ln\left(\frac{p}{1-p}\right) = a \cdot x_1 + b \cdot x_2 + \cdots + z \cdot x_n$$

, where p is the probability of choosing to maintain the rainwater tank system, and x1… xn, are influencing factors and the parameters a..z are estimated using Binomial Logistic regression. Parameters and factors are described in table.

Table 1: Influencing factors and associated parameters

Factor	Value
wMoney	1.051
wHassle	-1.838

wLackOfControl	-2.352
wConformity	5.146
Income	0.005983
Age	-0.02415
Dwelling type	House: 0 Apartment/unit: 0.3139 Townhouse: 15.16 Etc.

The trigger for making a choice is based on a number of background parameters relating to issues such as media coverage and dam levels (inferred from history and academic papers). This means we can explore different scenarios on water supply circumstances, i.e. "another Millennium drought", "another drought", and "no change". We illustrated how such background issues have a considerable impact on adoption behaviours.

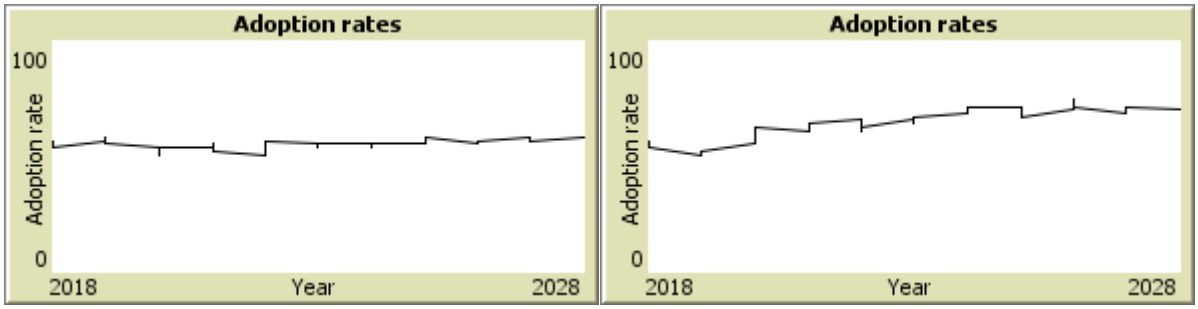

Figure 4: The impact on the adoption of 'maintenance of rainwater system switch' of another Millennium drought (to the right) and compared with a no change scenario (on the left).

We also explored interventions, such as changing the perceived hassle (1->0), the monetary benefit (1->3) and the level of peer pressure (1->2). This created the result as per Figure 5.

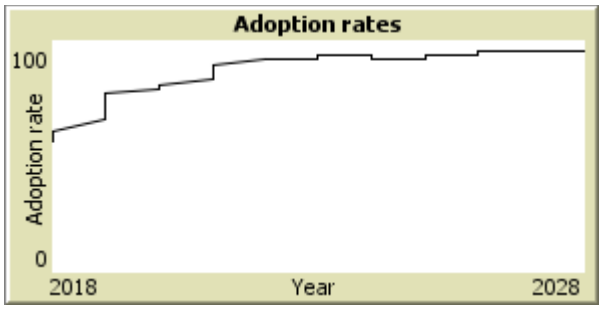

Figure 5: Impact of hypothetical intervention

It was also noted that a particular intervention design will have to be tested with a focus group in order to establish perceptions of features.

5 Sydney Water feedback

- There was very positive feedback on the presentation and the model showcase.
- Sydney Water indicated a fast growing interest in water conservation, due to a range of accentuating factors.
- Sydney Water in particular await the results of our Choice Experiment on Smart Meters.
- There is a need to collect further data on stated intentions on different designs on the WaterFix program.
- There is also an urgent need to provide validation of our model, against the "old WaterFix" program. The methodology for this is yet to be established.
- We also need to explore information relating to plumbers as Sydney Water confirmed the possibility of working with them in partnership. In particular, it will be necessary to find out how often and why people see a plumber so we can establish a frequency based on underlying attributes.
- There is also interest in using the model as a 'policy sandpit' although this interest is more informal from more technology-oriented Sydney Water staff. We need to share the model as soon as possible.
- Our primary focus should currently be on WaterFix program.
- Demand forecasting seems something that could be possible but we are not quite ready to discuss this yet.

6 Agreed Next Steps

It was agreed that the focus should be on two key issues:

1. Collecting more empirical data through a survey. This has now been completed.
2. Validating the model against the 'old WaterFix' intervention.
3. Finalising the user interface.

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