



Game Theory: Waterway Restrictions

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Objective: Enhance a company's incentives to 'go green' by abiding by waterway regulations

01 - Look at Policies



Designing a Utility Function:

- ✓ Observed current waterway policies
- ✓ Cultivated three targeted characteristics: *money, reputation, vitality*
- ✓ From these policies, formulated a weighting for each characteristic
- ✓ Created a probability for these weights, α
- ✓ Grouped variables and formed the utility



$U(f) = \alpha[11M + 15pR + 7V]$ Keep in mind, this utility function is weighted from the policies' point of view. In other words, it represents the 'likelihood' of a penalty targeting a certain field.

M - the monetary gain
R - the reputation held
V - the vitality maintained

03 - Review the Result



Observing the fallout:

- ✓ Viewed the business's decision
- ✓ Deciphered the pay-off matrix to understanding their choice

		Environment		
		Positive Change	No Change	Negative Change
Businesses	Abide by Regulation	-2	-4	-4
	Disregard Regulation	-1	-1	-4

In this instance, the business had a greater or equal utility if it disregards the regulation: this is called weak dominance.

02 - Consider a Choice



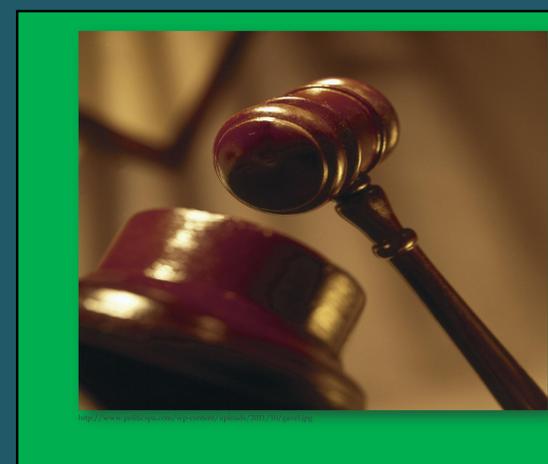
Building a Pay-off Matrix:

- ✓ Considered the players involved, the *business* Vs. the *environment*
- ✓ Since the environment cannot make a choice, conformed pay-off matrix to resemble a lottery
- ✓ Determined a range of choices/outcomes
- ✓ Filled in each decision block using the utility

In each column, an expected value is generated using the utility function. This value is the expected gain of the business.

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		Positive Change	No Change	Negative Change
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04 - Analyze the Outcome



Forming a Suggestion:

- ✓ Overviewed the variables
- ✓ Considered early prevention vs. heavy fines and penalties
- ✓ Determined which characteristic is most cost-effective to target, *reputation* through media

Suggestion:

In order to discourage businesses from disregarding regulations, it is vital to address early prevention: businesses should have a stronger fear of getting caught.

Conclusion: Increase the perceived probability of being caught



References:

- [1] www.EPA.gov
- [2] R. Duncan Luce and H. Raiffa, Games and Decisions, New York: New York, 3rd Ed. (1958), pp. 2-6, 12-55
- [3] G. Owen, Game Theory, New York: New York, 2nd Ed. (1982), pp. 115-125
- [4] This work was supported by the National Science Foundation under grant #CNS-1063041.

Future Work:

- ❑ Conduct further research to help solidify the utility function
- ❑ Use this process to model a current example and form suggestions
- ❑ Modify the utility function to consider counties and integrate them into a whole

