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Economic perspectives on nitrogen in farming systems

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Source: Yara International

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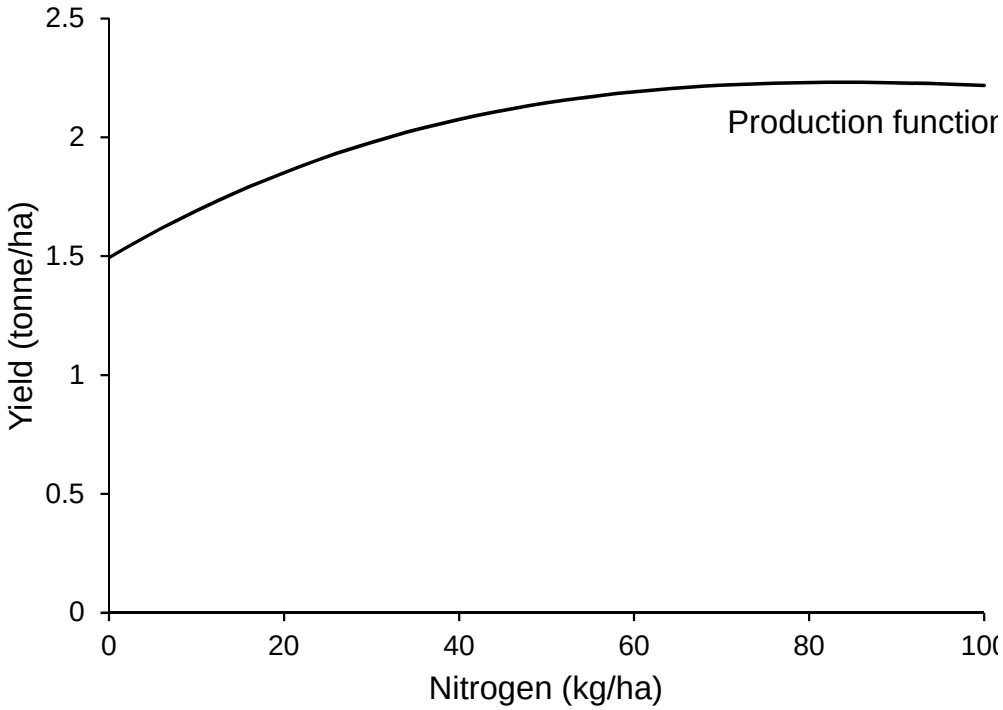
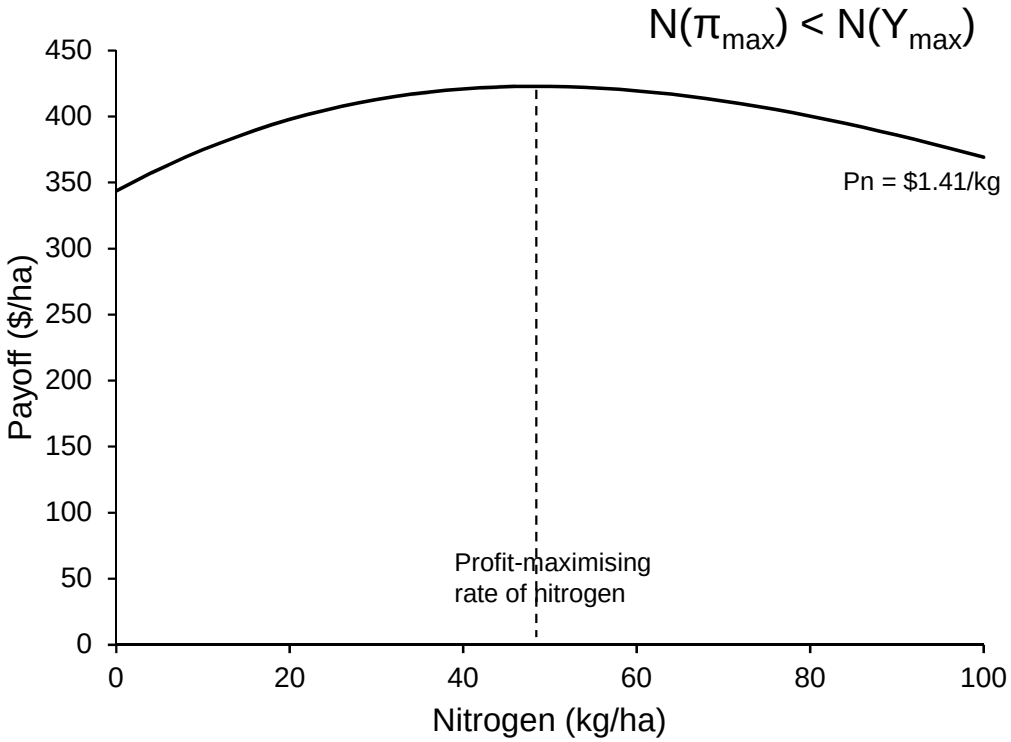
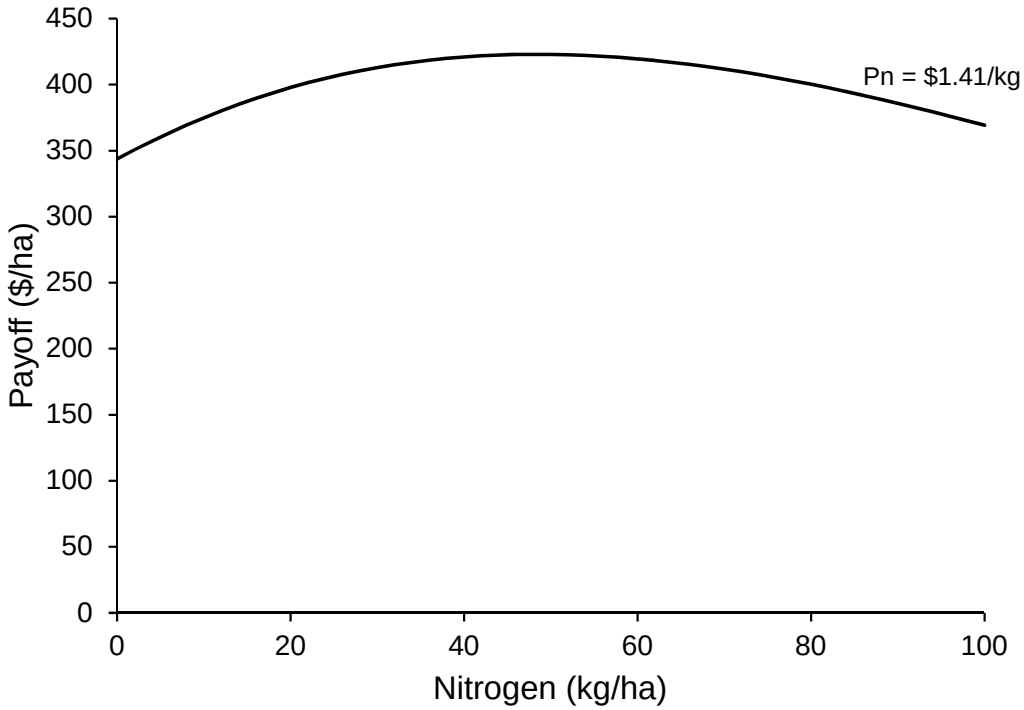
Optimal nitrogen rates

- What rate of N fertilizer would maximise a farmer's profit?



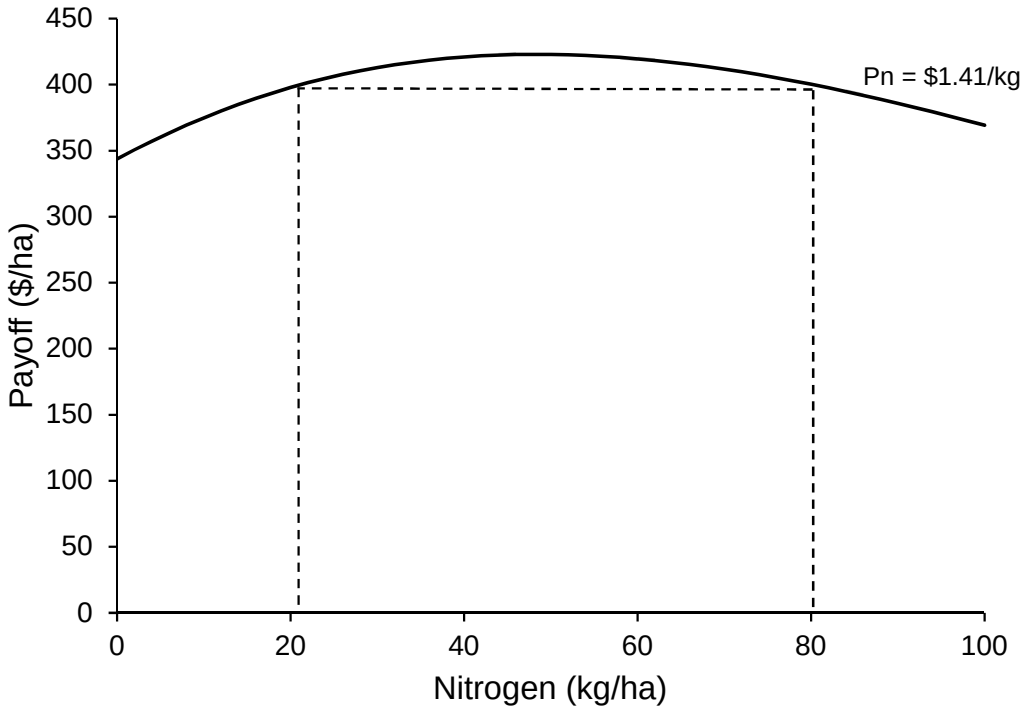


Flat payoff functions



- What range of N application rates would give payoffs within 5% of the maximum payoff?

Flat payoff functions



- 22 to 80 kg/ha!!
- Varying the N rate within the vicinity of the optimum hardly matters in terms of farm profit

Flat payoff functions

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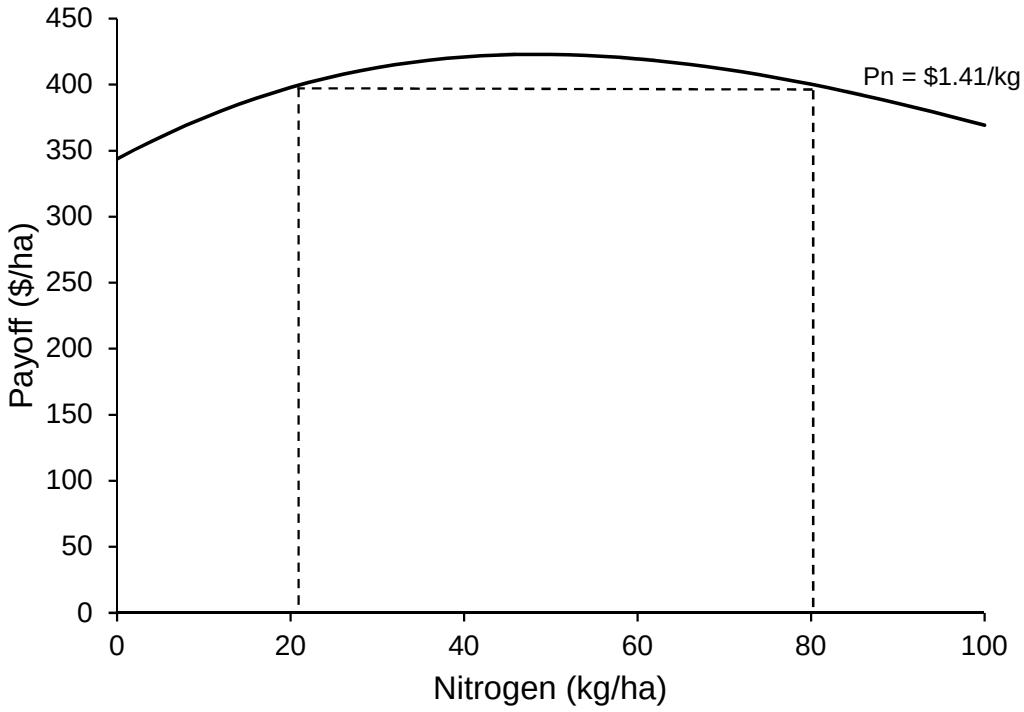
- This result is common/normal
- The width of the flat area varies, but it's often pretty wide
- Not widely appreciated, but it's not a new insight
- Jardine (1975) told agronomists about it and "observed such reactions as complete disbelief, blank incomprehension, incipient terror, and others less readily categorized".

Flat payoff functions: implications



- Farmers have flexibility – can adjust rates for other reasons (e.g. risk, environment) at low financial cost

Flat payoff functions: implications

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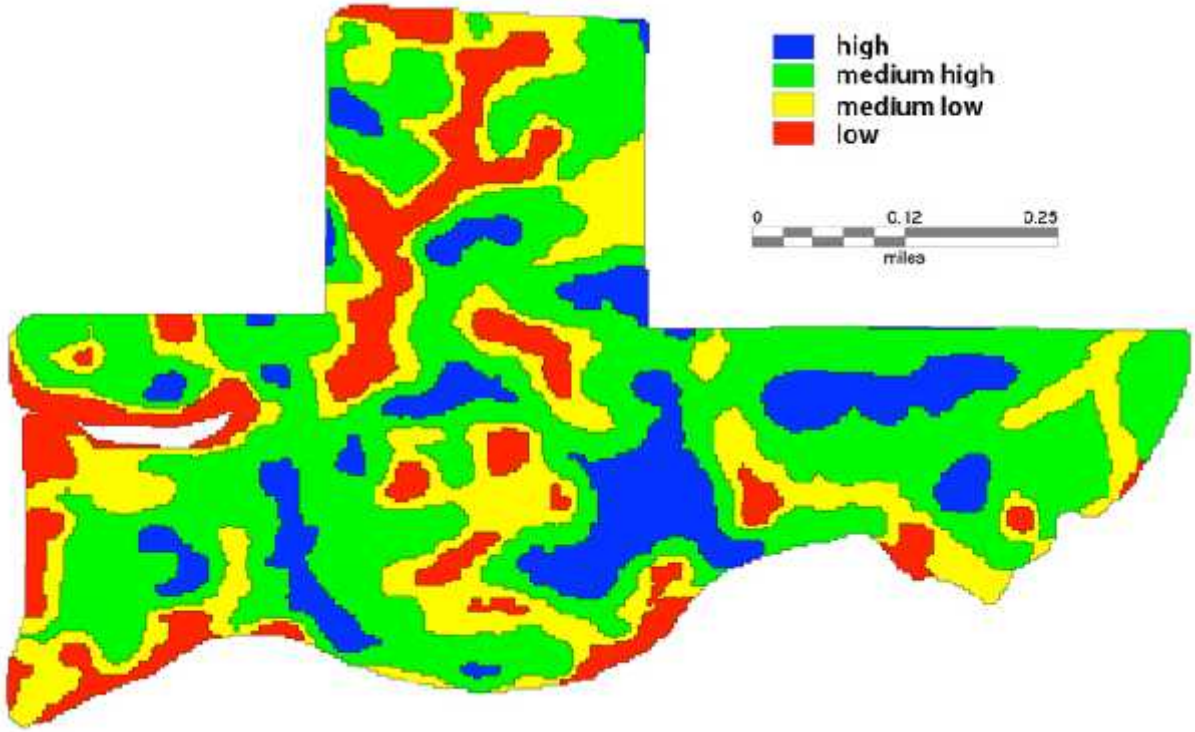
- Precision agriculture technologies that adjust rates often not very beneficial to farmers



Flat payoff functions: implications

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- If farmers are over-fertilizing, it probably costs them very little
- Almost no financial incentive to cut back

Flat payoff functions: implications

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- Research or extension to recommend N rates is often not very beneficial to farmers (unless they are off the payoff plateau)

N rates and Risk

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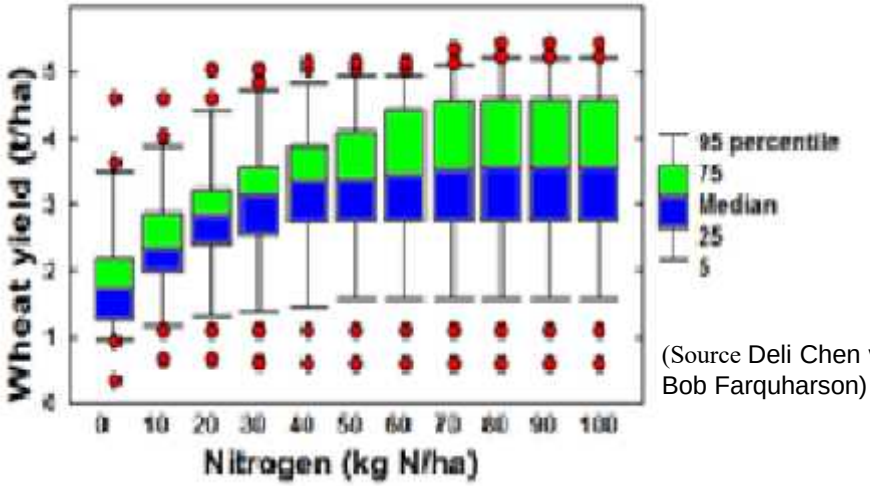
- Farming is risky
- Most farmers are prepared to sacrifice some expected profit to reduce risk (they are “risk averse”)
- Risk aversion varies between farmers
  - High variance within a population
  - Tends to be relatively low for wealthy farmers
  - Higher for low-income farmers

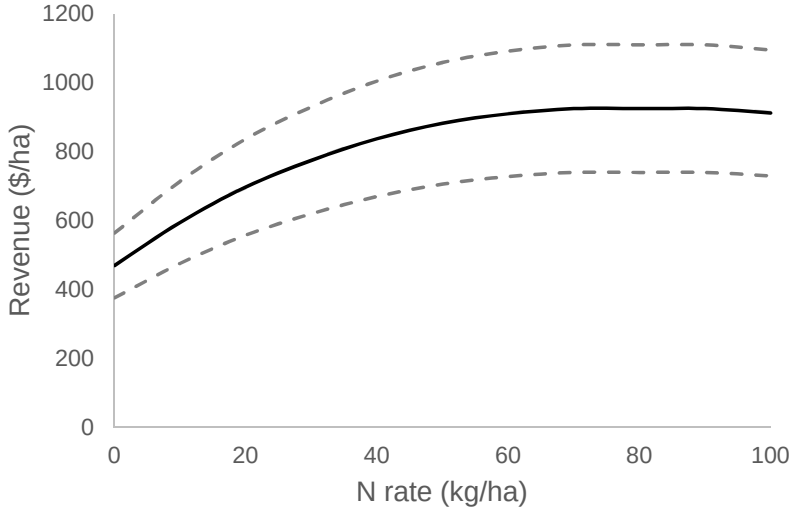
Are high N rates more risky or less risky?

- Some suggest ↑N ⇨↓risk
- Evidence shows the opposite



(Source Deli Chen via Bob Farquharson)

Simulated wheat yield responses to applied N fertiliser, Wagga Wagga



Contribution of price risk to overall revenue risk

- Risk aversion reduces optimal N rate (but not much)

Adoption of BMPs by farmers

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- Enormous interest in what determines farmers' decisions about adoption of new farming practices
- Important for
  - Research planning
  - Extension priorities
  - Policy design
- Thousands of studies
- Some clear insights
  - Human dimensions
  - The technology

Learning process - stages

- Awareness of problem or opportunity
- Non-trial evaluation
- Trial evaluation
- Adoption (or not)
- Review and modification
- Disadoption

Social factors influence adoption

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- Related to communication, trust, credibility
  - Social networks
  - Physical proximity
  - Extension
- Other personal and demographic factors
  - Off-farm income
  - Property size
  - Age/education
  - Goals

A variety of goals

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(i) material wealth & financial security
(ii) environmental protection and enhancement
(iii) social approval and acceptance
(iv) personal integrity, ethics
(v) balance of work and lifestyle

The new technology/practice

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- Relative advantage (relative to whatever it replaces)
  - Profit (short-term and long-term profits, farming system effects, adjustment costs, opportunity costs)
  - Riskiness
  - Consistency with other goals (environmental, social, personal)
- Trialability (how easy is it to get over the learning hump?)
  - Observability
  - Novelty
  - Long time scales

Predicting adoption of BMPs

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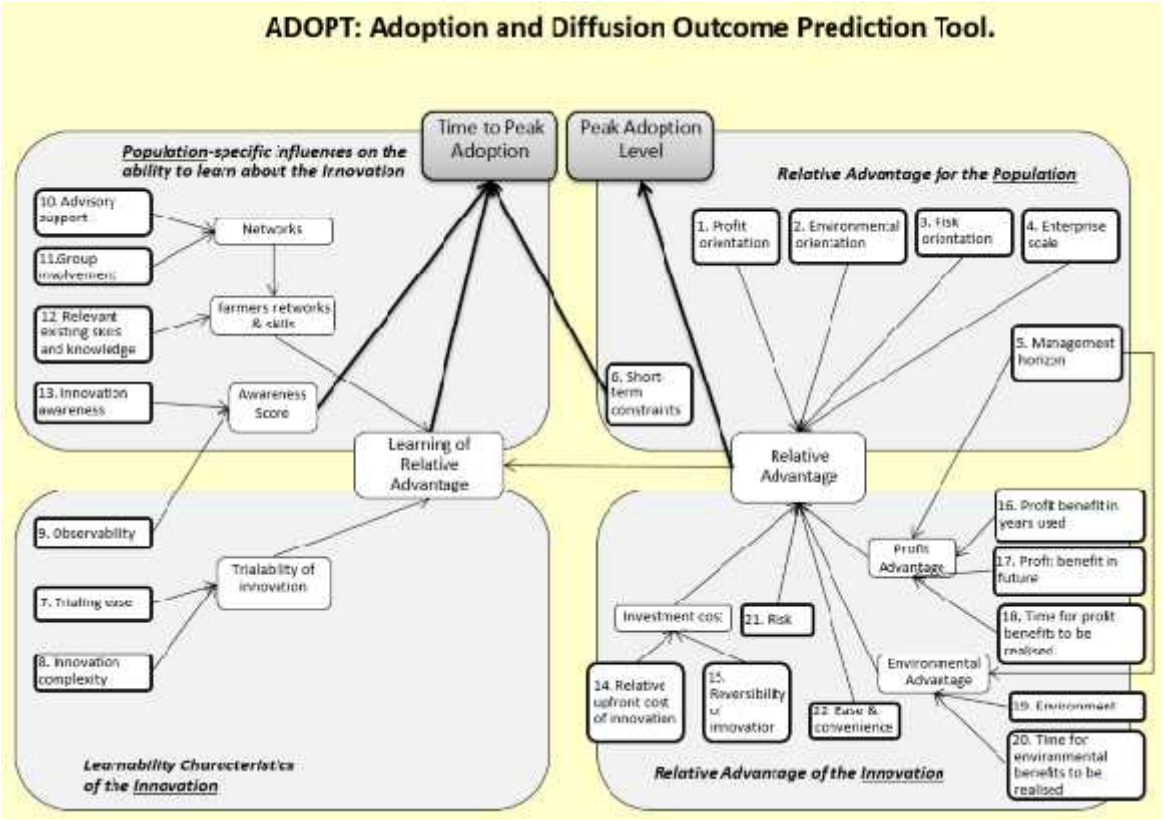
- "ADOPT": Adoption & Diffusion Outcome Prediction Tool
- 22 key questions about
  - the target farmers
  - the practice
- Quantitative predictions
  - Peak level of adoption
  - Speed of adoption
- Developed & developing country versions
- www.csiro.au/adopt



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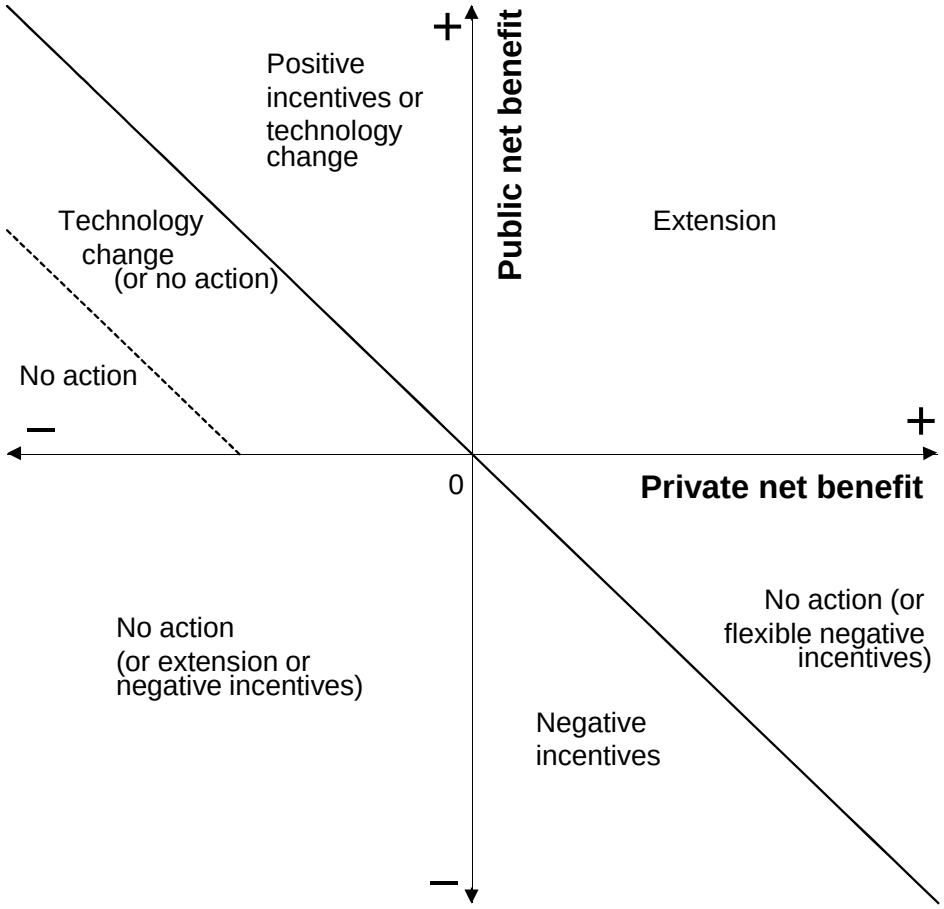
Policy mechanism choice



- Public: Private Benefits Framework
- Recommends most appropriate and cost-effective mechanism to encourage behaviour change
- Depends on the public and private benefits and costs of the new behaviour
- www.DavidPannell.net

INFFER (Investment Framework for Environmental Resources)

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- Simple but comprehensive tool to evaluate public investments in environmental improvements
- Integrates information about behaviour change with values, project effectiveness, project risks, time lags, and life-cycle costs to provide
  - Robust project logic
  - Benefit: Cost Analysis
  - Public: Private Benefits Framework
- www.inffer.com.au

MOOC: “Agriculture, Economics and Nature”

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YARA

N rates: N taxes and N subsidies