Technology adoption, scaling and impacts

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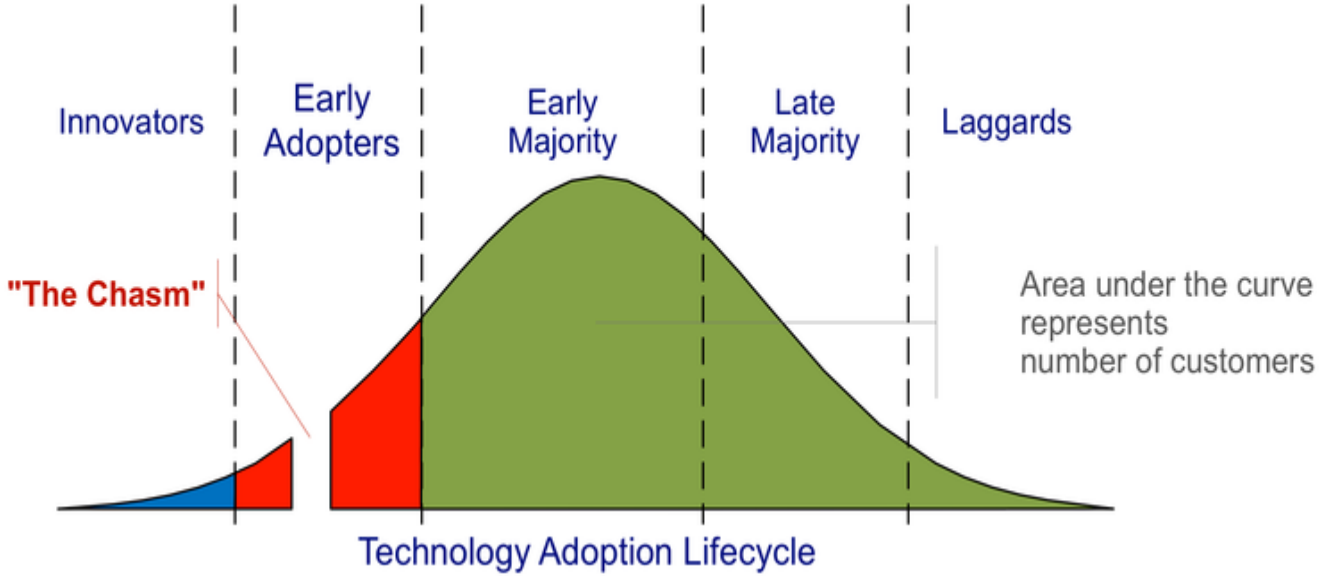
Impact Unit

Outline

- Adoption
  - Characteristics of NRM interventions
  - Barriers to adoption
- Scaling
  - Prerequisites for successful scaling
  - Scaling strategies/approaches
- Impact
  - Impact measurement
  - Challenges

Adoption: what do we know about NRM interventions?

1. Adoption Rates tend to be lower than for commodity based technologies
    - Agroforestry interventions (e.g.FMNR) versus hybrid maize seeds



2. Have lagged impacts

3. Require huge initial investment outlays

4. Have both tangible and non-tangible benefits hence complex impact pathways

5. Tend to have some element of "public goods"

Innovators (2.5%)

- Are risk takers with sufficient resources to try new ideas even if they fail

Early adopters (13.5%)

- Selective about which technologies to start using
- Are considered the "ones to check with for new information and reduce other peoples' uncertainty by adopting

Early majority (34%)

- Take their time before adopting a new idea
- They are willing to embrace a new technology as long as they understand how it affects their lives

Late majority (34%)

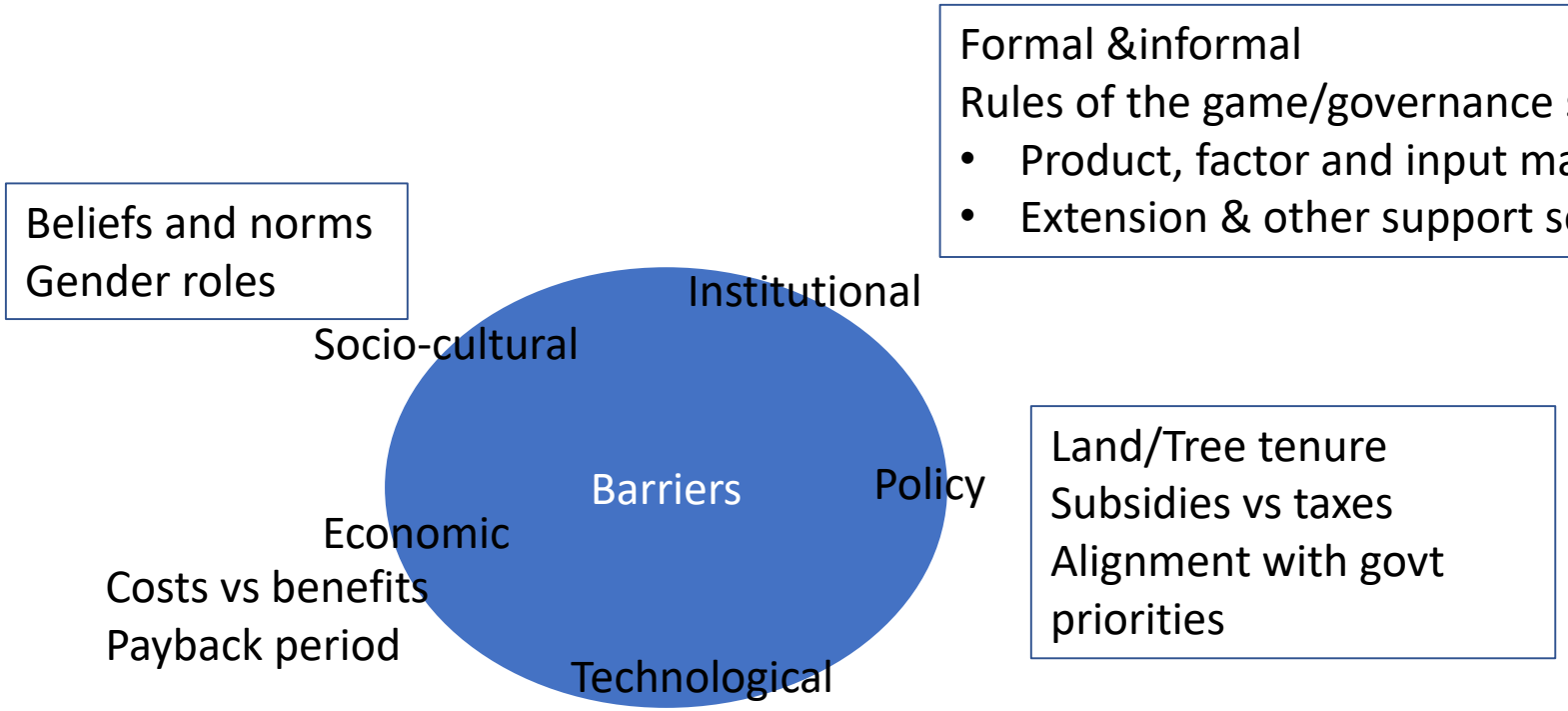
- Adopt in reaction to peer pressure, emerging norms, or economic necessity,
- Most uncertainty around a technology must be resolved before they can adopt

Laggards (16%)

- Conservative and traditional
- Make decisions based on the past
- Economically unable to take risks on new ideas

Barriers to adoption of NRM Technologies

Why Low Rates ? → **Mismatch between scaling strategies and adoption barriers**



Scaling of interventions

Scaling up and out

Expansion of beneficial impacts of agricultural research and rural development intervention

Scaling strategies should be designed to address Adoption barriers

Behavioural

- Characteristics of individuals/community

- Attitude, knowledge and perception

Structural

- Characteristics of the innovation
- Methods of implementing the innovation

- Access to inputs
- Business development Services
- Infrastructure

Prerequisites for successful scaling

- Credible and contextually appropriate technology
- Capacity building
- Awareness creation and learning
- Identification of Scaling pathways
- Enabling environment – policy, institutions
- Incentives and accountability — Unlock structural barriers
- Effective partnership — Follow up sustainability
- Effective monitoring and evaluation — Feedback, refining, co-learning

Scaling strategies/approaches

1. Innovation platforms (VIP4FS)

2. Planned comparisons (DryDev, VIP4FS)

3. Innovative extension approaches
   - Volunteer farmer trainer (EADD, PSE, Makerere)
   - Lead Farmers

4. Incentive mechanisms (carbon credit-payment for ecosystem services)

5. Value chain development approach

6. On-farm Demonstration plots (DryDev)

7. Rural resource centres (T4FS)
   - Hub approach

8. Participatory on-farm trials (T4FS)

Scaling approaches/strategies

1. Innovation platforms

- ✓ Coalition of stakeholders representing organisations with different backgrounds
- ✓ Diagnose a problem, identify opportunities and find ways of achieving a common goal

- **Institutional**
  - ✓ Value chain governance
  - ✓ Strengthening of rural institutions-formalisation
  - ✓ Linkage with financial institutions
- **Market innovations**
  - ✓ aggregation/group marketing
- **Policy and legal framework**
  - ✓ Advocacy and lobbying for fair marketing practices-quality coffee
  - ✓ Standardisation of weights and measures
- **Technological innovations**
  - **Labour saving**

Planned comparisons

WHAT IS IT?

Theory led comparisons that are thoughtfully designed to test certain hypotheses or generate lessons to inform the design of larger interventions

- **Testing and contextualising cost effective**
  - ✓ Scaling approaches
  - ✓ Technologies/NRM interventions
  - ✓ models for upgrading value chains
  - ✓ Models for engaging private sector actors
- Opportunities for experience sharing and co-learning

Zai pits planned comparison in DryDev

Dairy Planned comparison in Uganda

What is the most (cost) effective approach to promote the uptake of improved (high value) fodder production and feeding practices among dairy farmers?

Approaches

1. Information + nursery establishment
   - Training
   - Subsidised germplasm

2. Information + nursery establishment+ peer-to-peer learning + reward for participating ‘citizen scientists’
   - Training
   - Subsidised germplasm
   - Peer-to-peer learning

Coffee planned comparison in Uganda

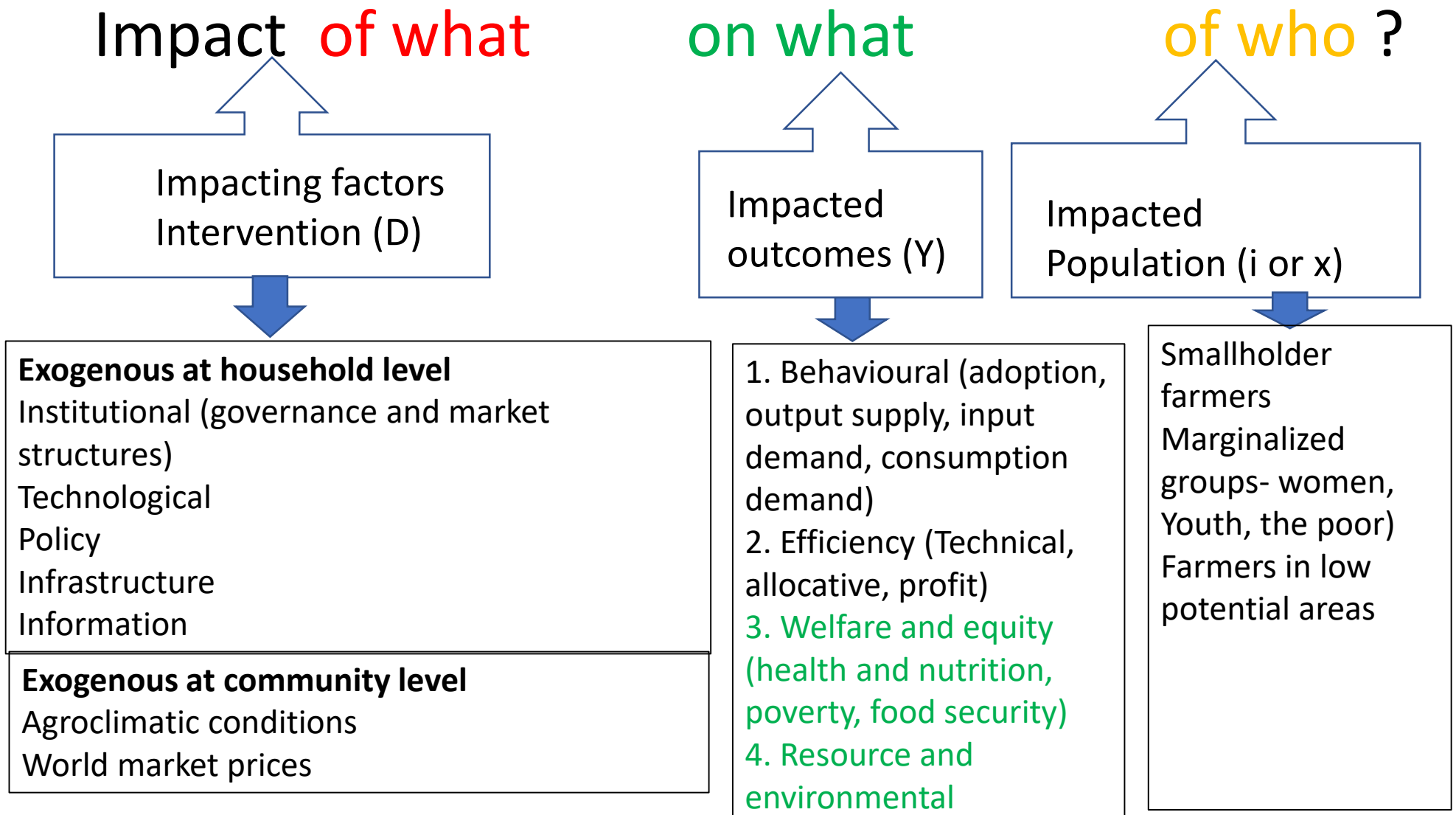
How can smallholder coffee farmers be encouraged cost-effectively to engage in selective harvesting that increases both the quality and the quantity of coffee that they sell?

1. Information=business as usual
   - Selective picking of coffee cherries

2. Information + peer farmer meeting
   - peer learning =behaviour change

3. Information + buyer visits + automated buyer calls
   - nudges to induce behaviour change
   - visits to build loyalty and trust

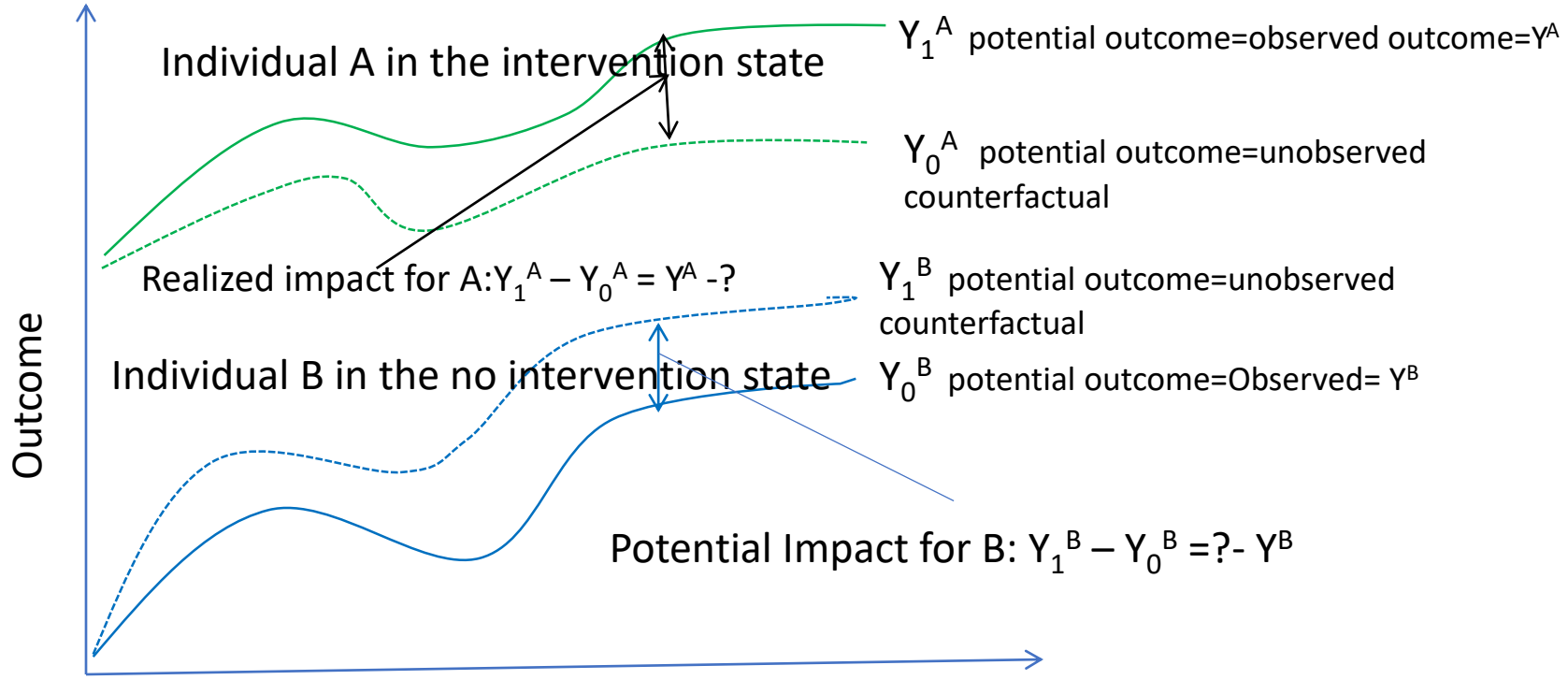
Impact evaluation question



2. Measuring Impacts

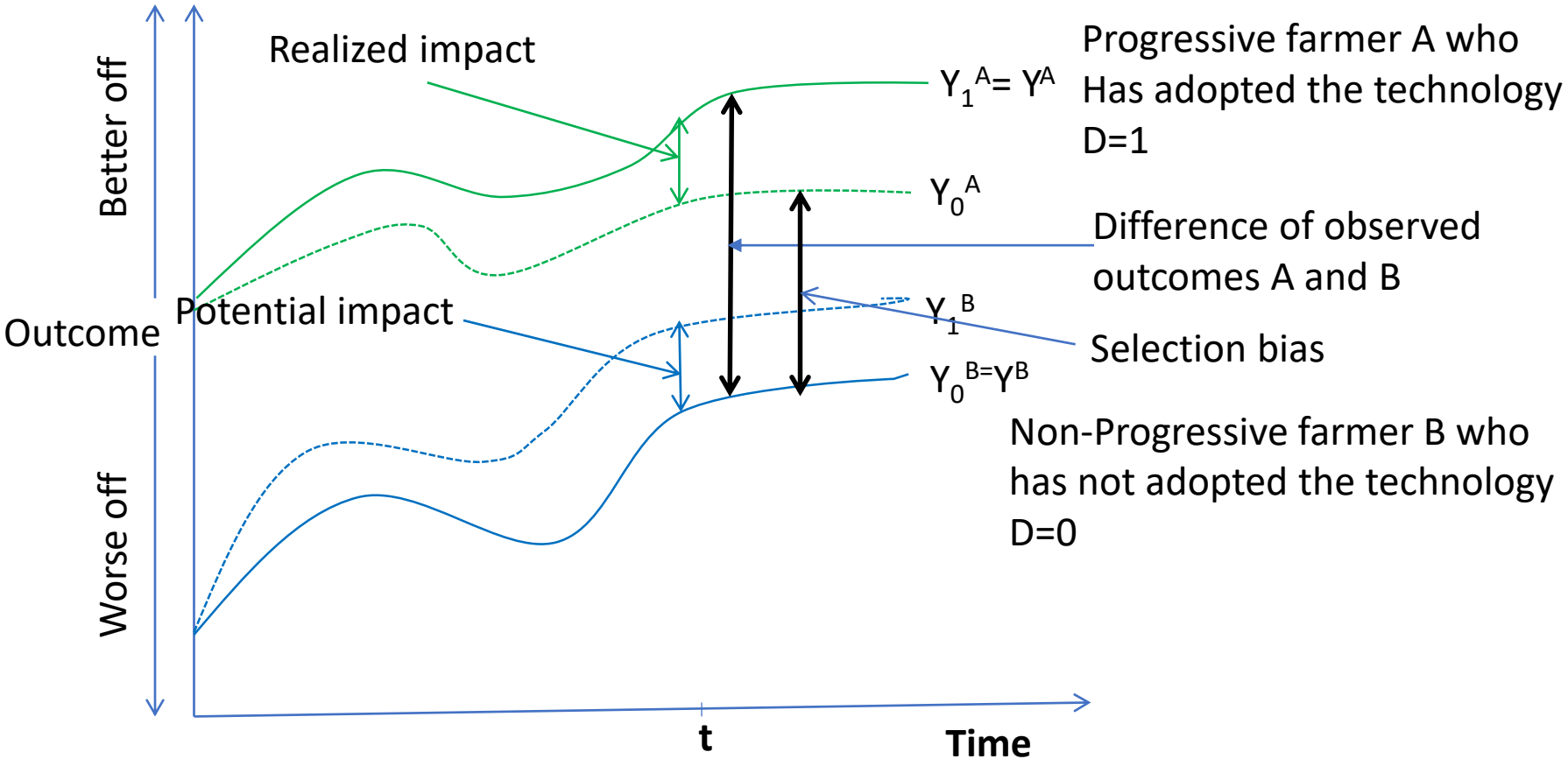
The fundamental evaluation problem

- ✓ Impossibility to observe the counterfactual corresponding to any change induced by an intervention
- ✓ Attribution problem



Individual level impact parameters

Overestimation of impact parameters



Realized impact=$Y_1^A - Y_0^A = Y^A$ -? Under adoption (D=1)

Potential impact= $Y_1^B - Y_0^B$ =?- Y^B Under non adoption (D=0)

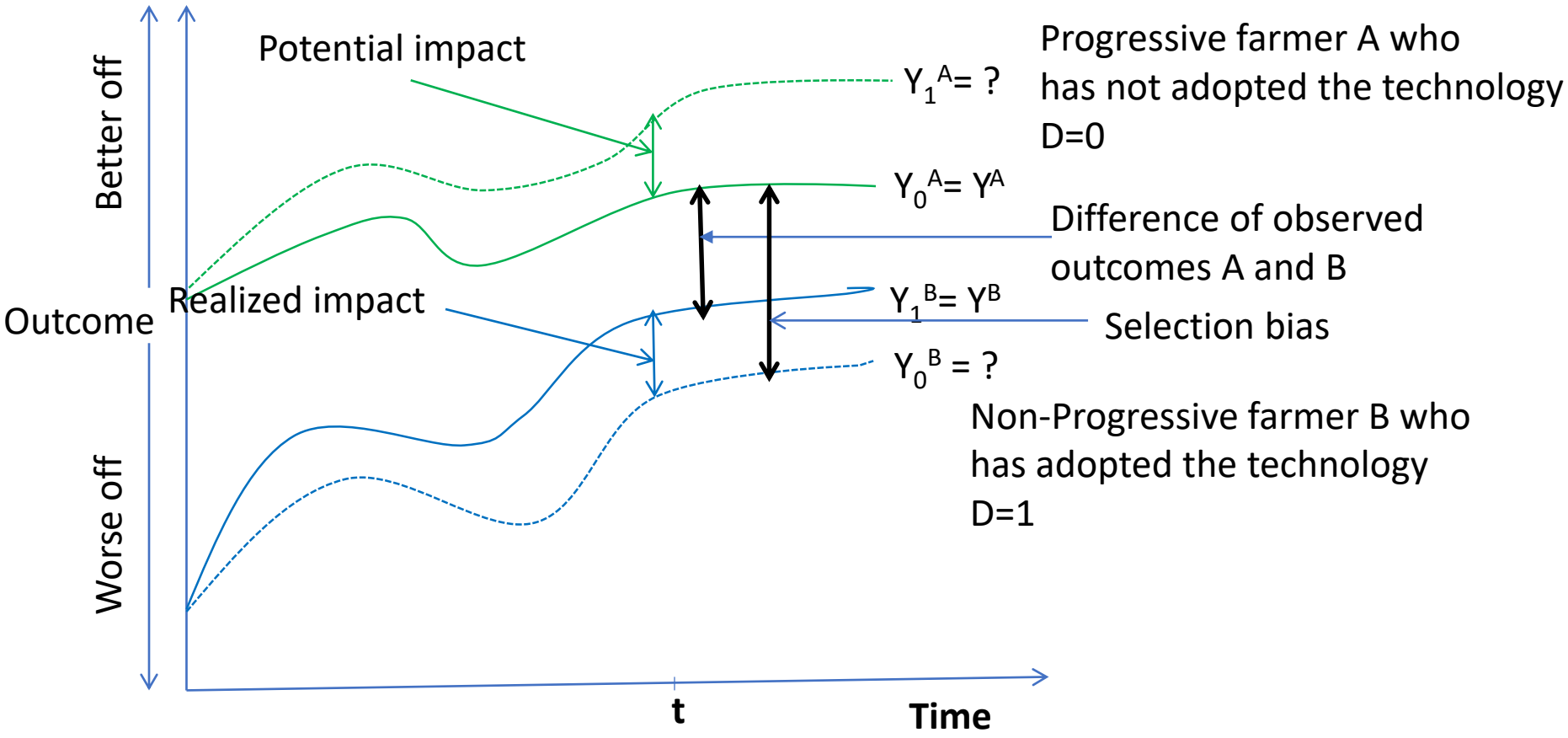
Mean impact= $(Y_1^A - Y_0^A)*P$ (D=1) + $(Y_1^B - Y_0^B)*P$ (D=0) = $(Y^A$ -?$)*P$ (D=1) + (?-$Y^B)*P$ (D=0)

Difference of observed outcomes= $Y^A - Y^B = Y_1^A - Y_0^B$ (naïve impact estimate)

Selection bias= $Y_0^A - Y_0^B > 0$ overestimation of impact)

Individual level impact parameters

Underestimation of impact parameters



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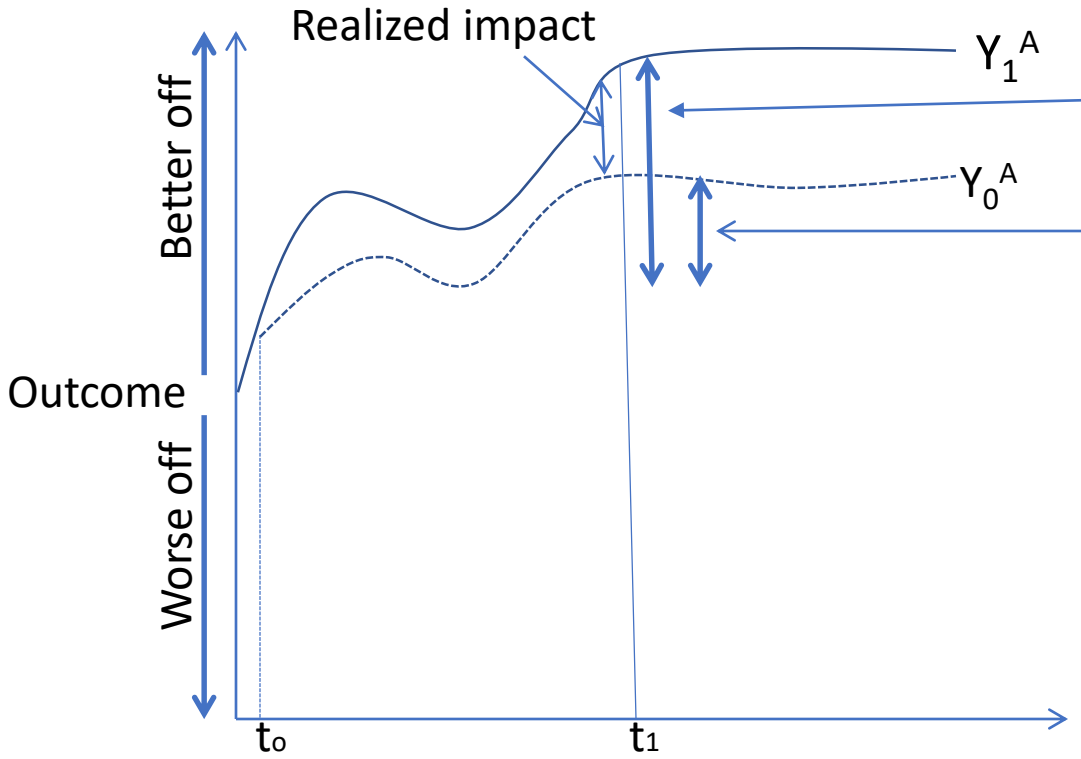
Difference of observed outcomes= $Y^B - Y^A = Y_1^B - Y_0^A$ (naïve impact estimate)

Selection bias= $Y_0^B - Y_0^A > 0$ underestimation of impact)

SOLUTIONS TO THE FUNDAMENTAL PROBLEM

Naïve approaches

Before and after comparison

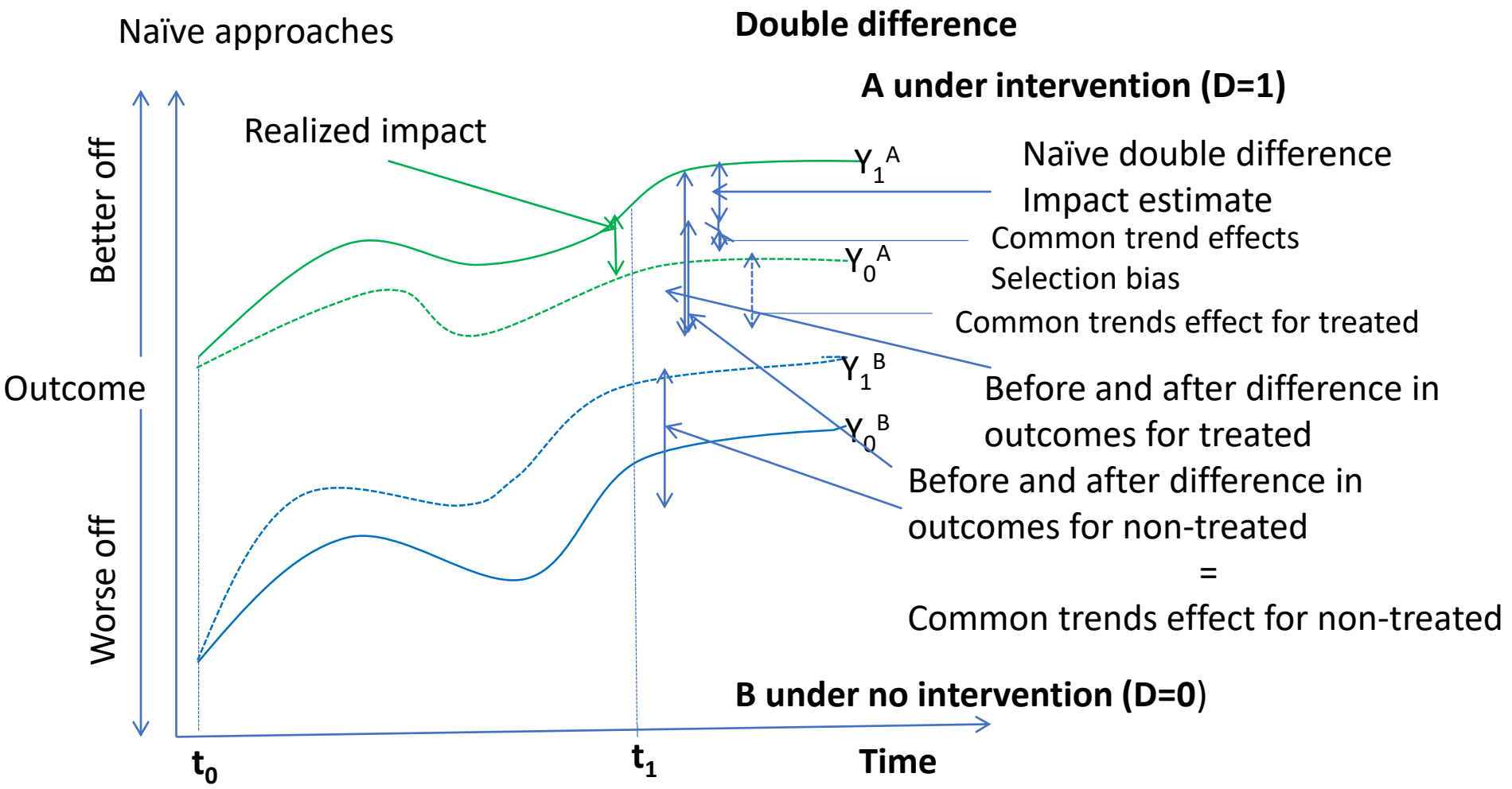


Realized impact=$Y_1^A(t_1)- Y_0^A(t_1)$ under intervention

Naïve before-after impact estimate= $Y_1^A(t_1)- Y_1^A(t_0)$

Common trend effects= $Y_0^A(t_1)- Y_1^A(t_0)$

Controls for selection on observables and unobservables



Realized impact=$Y_1^A(t_1)- Y_0^A(t_1)$ under intervention

Naïve double difference estimate=$\{Y_1^A(t_1)- Y_1^A(t_0)\}-\{ Y_0^B(t_1)- Y_0^B(t_0)\}$ (Difference of after and before observed outcomes)

Assumption: selection on unobservables is time invariant

Common trend selection bias==$\{Y_0^A(t_1)- Y_1^A(t_0)\}-\{ Y_0^B(t_1)- Y_0^B(t_0)\}$

Impact Evaluation designs

✓ Experimental design-Randomised control trials (RCTs)

- Random sampling of eligible persons prior to programme implementation
- A randomly selected sub-sample assigned to treatment and control groups
- Ex-post survey of both treatment and control groups
- Baseline survey (**optional**)
- **Analysis**-difference in mean outcomes of treated and control group
- Control for covariates (**optional**)

✓ Quasi experimental designs – constructed controls

- Random sampling of eligible voluntary participants and non-participants to construct a comparison group
- Ex-post survey of both treatment and comparison groups
- Baseline survey (**optional**)
- Analysis-difference in mean outcomes
  - Instrumental variable based methods
  - Matching methods
  - Difference-in-difference

NRM related impact studies

Evaluating livelihood and poverty impacts of NRM interventions

Majority focus on

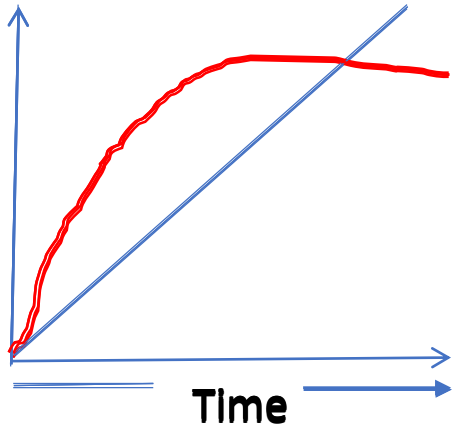
computation of simple efficiency indicators (NPV, BCR, IRR)

Need to consider doing

Analysis of distributional and equity impacts

Challenges with Evaluating Impact of NRM interventions

1. Timeframe for full potential impacts typically long & non-linear, with multiple pathways



Development of Theory of change

3. Tends to be bundled with other interventions

e.g. microdosing,
conservation agriculture
Agroforestry-FMNR

2. No one size fits all—need for tailoring to context

FMNR- Sahel versus FMNR in East Africa

4. Typically taken up with varying levels of intensity—not a 'binary technology'

Suggested reading

Karl Hughes, Seth Morgan, Kathy Baylis, Judith Oduol, Emilie Smith-Dumont, Tor-Gunnar Vågen, Hilda Kegode (2016) Assessing the downstream socioeconomic and land health impacts of agroforestry in Kenya. Unpublished report

Ajayi OC, Place F, Kwesiga F and Mafongoya P. 2006. Impact of natural resource management technologies: Fertilizer tree fallows in Zambia. Occasional Paper no. 5. Nairobi: World Agroforestry Centre

Neufeldt H, Negra C, Hancock J, Foster K, Nayak D, Singh P. 2015. Scaling up climate-smart agriculture: lessons learned from South Asia and pathways for success. ICRAF Working Paper No. 209. Nairobi, World Agroforestry Centre. DOI: http://dx.doi.org/10.5716/WP15720.PDF

Ajayi m.T, Fatunbi AO and Akinbamijo O. O (2018). Strategies for Scaling Agricultural Technologies in Africa. Forum for Agricultural Research in Africa (FARA), Accra Ghana

Thank You