institute of development studies

Beyond Adaptation:

A Technographic Approach to Analysing and Understanding Technological Change in Agriculture

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This presentation is based on the following publications:

Glover et al. (2016) 'The adoption problem; or why we still understand so little about technological change in African agriculture.' *Outlook on Agriculture* 45(1).

Glover et al. (2019) 'Rethinking technological change in small-scale agriculture' *Outlook on Agriculture* 48(3)

Glover (2018). 'Farming as a performance: a conceptual and methodological contribution to the ecology of practices.' *Journal of Political Ecology* 25(1)**.**
Glover (2022). 'Affordances and agricultural technology.' *Journal of Rural Studies* **94.**

Technography, a study of:

1. **Making**
   - Techniques + Material transformations + Human purposes
   - Performed by individuals and task groups

2. **Distribution of information and power**
   - Exigencies of the task
   - Structure and coordination of task groups in time and space

3. **Construction of rules (protocols, routines, rituals…)**
   - Institutional rules, norms, cultures
   - Guilds, professional associations, secret societies, unions, cults; apprenticeship and initiation ceremonies

Let me begin by talking about *Technography* as conceptual framework and method.

Approximately, the *ethnography of technique / technology*

Through a technographic lens, technology is viewed as a domain of technical practices, in which tools and techniques are deployed purposefully to transform materials and so to achieve human, social objectives (Jansen and Vellema 2011).

This technographic understanding of technology is associated with the ethnographic scholarship of social anthropologists such as Marcel Mauss (Schlanger 2006), François Sigaut (1998), and Paul Richards (2000) from whom I learned as a postdoc at Wageningen University, NL.

The Wageningen approach to technography was summarised in a paper by my former colleagues Kees Jansen and Sietze Vellema in 2011—who spelled out the three components of technography as shown here.

Jansen, K. and S. Vellema (2011). "What is technography?" *NJAS Wageningen Journal of Life Sciences* **57(3-4): 169-177.**

A technographic concept of technology

Practices
(tasks, techniques, routines, skills & knowledge,…)

+

Relationships
(connections, interactions, transmissions, exchanges,…)

To simplify things, let me offer this technographic understanding of technology as Practices and Relationships.

A technographer understands the term *technology* to mean not only technical systems, tools and artefacts but also the techniques, practices, institutional cultures and forms of social organisation that are involved with the deployment and use of those systems, tools and artefacts.

Technology viewed through the *skills* and *agency* of *technological practitioners*

- Not **gadgets**, **devices** and **machines** but **practices/techniques** and **relationships** (among people and between people and things)
- **Purposeful action** by individuals and groups ("task groups")
- Mobilising and using **knowledge, bodily skill, tools and instruments** of various kinds (includes living organisms)
- **Coordinated action:** assembly and choreography of resources in time and space; a socio-material phenomenon.
- People everywhere are **technological practitioners**

This is **not the popular understanding of technology** to mean gadgets, devices, machines, algorithms—
… a conception very often embodied in the form or artefacts such as smart phones, drones, computers, engines… or immaterial artefacts like computer programmes, computer code…
… that is, **entities outside ourselves**, independent of us, with a kind of autonomy and agency of their own.

Instead, it is a view of technology:
- Not as products, artefacts, but practices and systems
- About purposeful action—making and doing
- Individually and in groups—assembly and coordination of forces to achieve material transformations.

People everywhere are **technological practitioners**, from birth onwards

With this in mind, it becomes impossible and irrelevant to conceptualise technological change as *technology transfer* or as *adoption.*

Agriculture as technology

Farming as **technological practice**

- Use and coordination of an array of tools and resources – including living organisms – and techniques, to **build a livelihood from the land**

- Enabled and constrained by **material world** (realism and materialism) and by **cultural routines**

Farmers as technological practitioners

Farmers as **technological practitioners**:

- Skilled actors and decision-makers
- Socially and culturally embedded
- Located in space and situated in time

NB skilled – not necessarily 'skilful'

Small-scale farming as a *performance*

- Not a planned activity but a **skilled performance unfolding in real time**

- Grappling with **contingency**, coping with **surprises**, making decisions under **uncertainty**

- **Improvisation**: not a random churning, but a structured response to contingencies; mobilisation of a **repertoire of practised skills, responses**

What tools do we have to understand farmers as technological practitioners?

1. **Performance**

Paul Richards' analogy of the **musician** performing with other musicians in a band. Seeking harmony, rhythm, melody…

- Not always *economically utilitarian profit maximisers*
- Cautious risk spreaders and risk mitigators
- Practising diversified livelihoods that include a farming component
- Not necessarily able to devise and implement **plans**—because they lack control.
- Use **rules of thumb** and other decision-making heuristics to navigate through seasons and annual cycles

NB there's an argument that this analogy is irrelevant to the circumstances of large-scale, industrialised and factory-like farms, e.g. the US grain industry or the US and Argentinian dairy and meat industries. It's about the skills of small-scale farmers in difficult, constrained situations.

References
- Richards, P. (1989). 'Agriculture as a performance.' *Farmer First: Farmer Innovation*

and Agricultural Research. R. Chambers, A. Pacey and L.-A. Thrupp, eds. London, Intermediate Technology Publications**: 39-42.**

- Richards, P. (1993). 'Cultivation: knowledge or performance?' *An Anthropological Critique of Development: The growth of ignorance*. M. Hobart, ed. London, UK, Routledge**: 61-78.**

Affordances

*"An affordance is a **perceived property of an artifact that suggests how it should be used**."* (Pfaffenberger 1992)

*"…affordances are functional and relational aspects which **frame, while not determining, the possibilities for agentic action** in relation to an object."* (Hutchby 2001)

*"…the concept of affordance … refer[s] to the **properties of an object that render it apt for the project of a subject**."* (Ingold 2002)

*"An affordance is a **relationship between the properties of an object and the capabilities of the agent** that determine **just how the object could possibly be used**."* (Norman 2002)

But how do we understand the skills of a performer?

2. Affordances:

Affordances are **enablers and constraints** upon (human) agency;
Factors in our surroundings that facilitate or block our schemes and intentions.

Here are some examples of how affordances have been defined

Reference:
Glover, D. (2022). "Affordances and agricultural technology." *Journal of Rural Studies* **94: 73-82.**

" *"We can see, for example, that something **can be eaten or thrown**"*

(Costall 1995)

But to make that idea simpler, a nice and intuitive way to convey what affordances are is Alan Costall's suggestion that 'We can see, for example, that something can be eaten or thrown' (Costall 1995, 470).

A chair or a tree-stump affords a place to sit; a table affords a place to write or eat a meal;

How affordances arise

- **Interactional:** material and biophysical
- **Perceptual:** cognitive; subjective
- **Experiential:** you can discover and learn about them
- **Relational:** specific to 'functional pairs' (actors with capacities + objects with potential uses)
- **Situational:** contextual, temporal, *(potentially) dynamic*

To summarise:

- Affordances are qualities that arise through **interaction** between a user or users and an object or a collection or network of objects

- They are **perceptual** in the sense that they have to be perceived by a potential user: this makes them subjective; they depend not only on actual physical possibilities but on the perception that such possibilities exist: they can be modified by human factors, such as confidence, for example.

- They are **experiential** – they can be discovered through interaction, play, tinkering… they can be observed and emulated.

- They are **relationships**: between specific 'functional pairs' (Gibson). But also relationships that are modified by structures: cultural frameworks, institutional relationships.

- They are **situational**: arising from a specific relationship in a particular time and place. And thus potentially dynamic as situations change.

Where to look for affordances in agriculture

Biophysical and material interactions/relations
- Tools and equipment; landscapes; living organisms

Symbolic and ritual interactions/relations
- E.g. 'Men's tasks' and 'women's work' in farming

Social and economic relationships
- Household wealth, incomes; farm assets; access to finance, credit

Political-economic and institutional relationships
- Politics, power, local governance norms
- Patents on GM seeds; technology agreements, end-user licences on seeds, farm equipment, firmware

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As researchers, where do we look for affordances in technological designs?

Biophysical and material interactions/relations.

- In the domain of agriculture, farmers must contend with tools and equipment, living organisms and natural environments that have lives of their own.

Symbolic and ritual interactions/relations.

- In the domain of small-scale agriculture, it's common for some tasks to be considered men's domain and some tasks as women's work.

Social and economic relationships.

- These are often the sorts of things agricultural economists and impact evaluators typically look for…

Political economic and institutional relationships

- Social and political capital; access to power and justice; inclusion/exclusion in decision-making

- Patents on GM seeds; technology agreements; end-user licences (e.g. US tractor licences and the assertion of a 'right to repair')

Improving affordances in small-scale agriculture

1. **Increase the agency of practitioners:**
    *   *Raise awareness; Strengthen capabilities; Increase capacities; Build confidence; Train new skills;…*

2. **Reduce obstacles and ease constraints in the situation**
    *   *Change the technological design; increase availability; lower the price; make the technique simpler;…*

It follows that **the affordances of a given object or environment will be different for different individuals and situations.**

This makes them **dynamic**.

This also makes them **modifiable** by learning and experience. **To change the affordances and thus change the range of possibilities, you can work on the relationship from two different directions: you can change the capacities or perceptions of an agent, or you can modify the characteristics of the object, environment or other entity**

This is what development projects, programmes, schemes do: trying to modify affordances.

There are two ways of doing this: [slide]

The problem with 'adoption'

Technology is not something people **have** or **lack**, or something that is **transferred** as discrete units from one place or community to another

Technology is something people **do** and **make**

When technology moves, it is not simply **transferred** but **communicated** (as a **proposition**)

If it is to be 'successful', it has to be **remade** *in situ*

Involves a local **reconfiguration** of **social and technical practices** and **social—material relations**

So why do we conclude that the concept of adoption is inadequate and out-of-touch?

The foregoing insights lead us to question mainstream ideas about *technology transfer* and *technology adoption*.

The concept of 'adoption' is still widely used in **impact-evaluation studies** in agriculture for development (as in other fields of development).

But the idea that a technology is invented by someone or some organization – e.g. a company or an agricultural research institute – then 'transferred' as a fixed package from one site to another, where it is adopted, proves to be a highly problematic in practice.

When technology moves, its social and material relations and surrounding institutions also change. In fact, the technology itself changes.

Empirically, we observe that the technology as designed is often ignored (leading to the widely lamented phenomenon of 'nonadoption', experimentally productive technologies that are 'left on the shelf');

Alternatively, the technology is unpacked, decomposed, reassembled and reconfigured into a local practice, a redesign that the original designer/inventer might not have anticipated, planned, intended or desired. But evaluators, looking for something called 'adoption', may not be well equipped to detect or understand these new configurations of their original design.

Understanding technological change:
What theories and concepts do we have?

–Diffusion theory

–Induced innovations theory

–Evolutionary approaches

–Critical political economy approaches

–Agricultural Innovation Systems

–Social Construction of Technology (SCOT) / Social Shaping of Technology (SST)

–Actor—Network Theory (ANT)

–Social Learning

–Actor-oriented approaches

–Technology as situated practice or performance

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Part of our argument is that conventional methods and techniques of technology promotion and evaluation have not taken into account progress in various academic fields in advancing our understanding of technology and technological change

We reviewed some theories of technological change

Some have been more influential than others on mainstream practices of technology promotion and evaluation

i.e. the 5 in the left-hand column

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Theories of technological change

Some more influential than others on mainstream practices of technology promotion and evaluation—the 5 in the left-hand column

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The ideas of technology transfer and adoption fit harmoniously with the first three…
Technology is conceived as a sort of mobile black box, which moves from one place to another…
… a sort of plug-and-play concept

- Famous **diffusion theory** of Everett Rogers (epidemiological metaphor)
- **Induced innovations**: technological change as the result of exogenous push—but the content of technological practice is taken for granted and often seen as being signified by technical artefacts.
- In **evolutionary approaches**, new technologies are seen as akin to genetic species or varieties seeking to survive in an ecosystem (survival of the fittest)

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Critical political economy approaches recognise practitioners' agency to some degree;
They understand that technologies are socially shaped;

But technology is seen largely as a sort of (in)dependent variable… often under the control of a dominant player (e.g. big corporations, big science); or perhaps reshapable by political struggle (e.g. challenging patents).

Agricultural innovation systems literature recognises agency of multiple players involved in the shaping, spread and uptake of technologies… but sometimes the substance of the technological content and change process is not directly addressed.

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But social science analysis of technological change has developed in other ways, less well incorporated into mainstream theory and practice

The 5 in the second column, for instance. [click]

Understanding technological change:
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- **SCOT/SST and ANT** are very good at understanding that technology involves an assemblage or network of human and nonhuman actors/actants that are linked and organised to achieve material transformations.

- **Participatory and social learning** emphasise processes of social negotiation, participatory action, interactive learning…

- **Actor-oriented approaches** emphasise the role of **encounters** at the interface between different communities of practice, bodies of knowledge

Understanding technological change:
What theories and concepts do we have?

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–Actor-oriented approaches

–**Technology as situated practice or performance**

Last but not least, as discussed at the head of my presentation, is a technographic approach, that understands technology through the lenses of practices and relationships, performance of tasks and operations…

- Technology as practice
- Through the lens of *habitus*, for example.
- Technological systems as cultural traditions and institutions—passed from one generation or cohort to the next. A cultural expression
- Different tools and techniques for similar operations in different cultures (e.g. trench-digging in WW2)

Problems with the concept of adoption

– Too **linear**, too **binary**

– Too **simplistic**—a simple, once for all, one-for-one substitution of *y* for *x*

– Empirically, what we very often observe is **not a replication of a standard design** but a range of variation, adaptation

– *In practice, evaluation studies often fail to specify observable indicators that **signify adoption**… when they do, they often take the visible artefacts as symbols of technological change.*

– There is **agency on both sides of the relationship** between an intervention and the target population of 'users'; the users sometimes do things that are unexpected, unanticipated, unintended by the designers or 'interveners'

So why is the concept of adoption flawed?
It fits comfortably in the former theories of technology and technological change—the ones that are mainstreamed

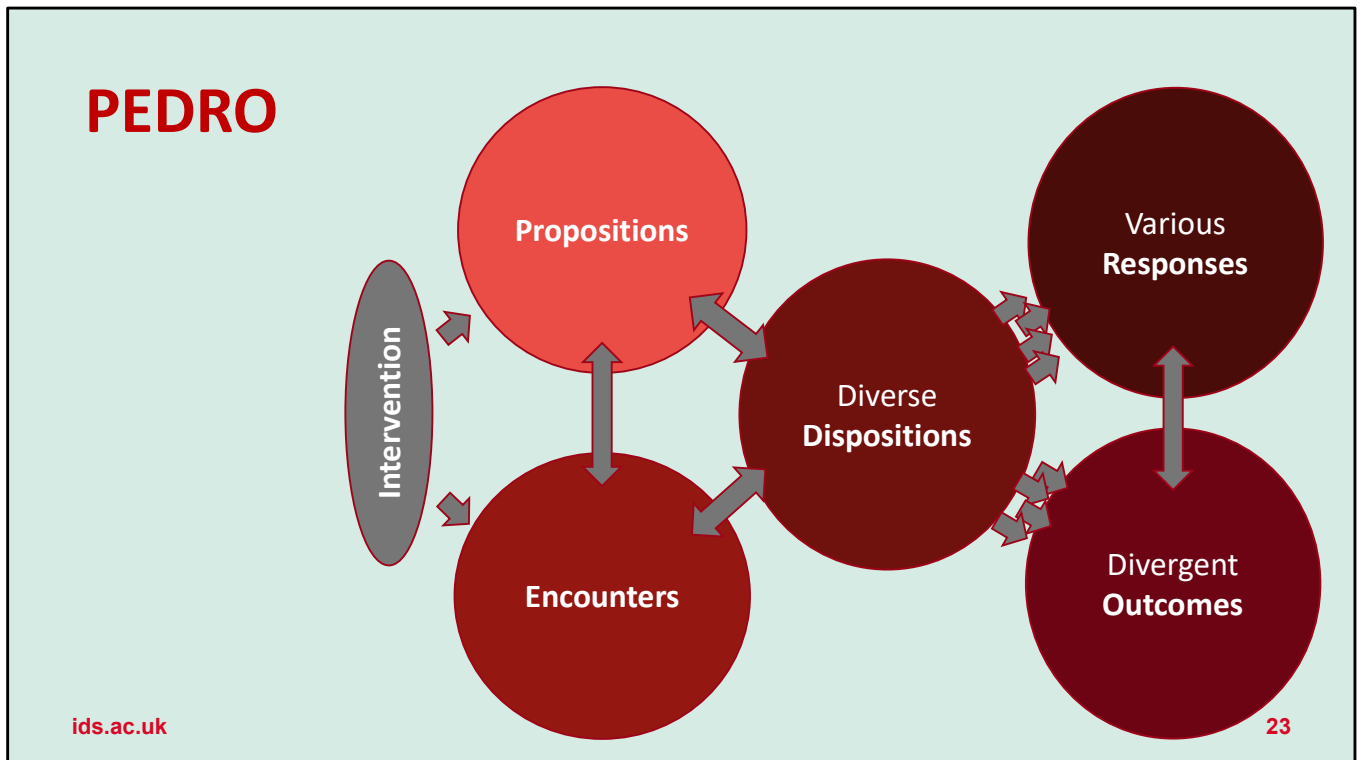Think of the case of an impact evaluator going into the field, looking for something they call 'adoption'
• Based on preconceptions about what the technology is for, who should use it, how…
• Deterministic expectations about what the end state should look like
• Certain observable artefacts or operations are assumed to signify adoption
[In fact, empirically, we often see studies published that do not clearly define what adoption looks like.]

But in practice, when we go to the field, we typically see a complex and sometimes messy reality in the field;
not binary 'adoption' but adaptation, incremental iterations, selective uptake, integration of old and new features in a local reconfiguration.

Adoption studies can lead to *false positives* and *false negatives*
[Describe]

PEDRO

Intervention

Propositions

Encounters

Diverse **Dispositions**

Various **Responses**

Divergent **Outcomes**

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This led me and some colleagues to reconceptualise technological change using a concept which we argue is better than adoption;
Better aligned with current thinking and theoretical concepts about what technology actually is—how it actually occurs

In 2019 we published a paper in the journal *Outlook on Agriculture*, which introduced the **PEDRO framework**.
[NB Originally we used the term PEDR framework, without the O for Outcomes.]

We decomposed technological change ('adoption') into interrelated aspects:
•   Proposition
•   Encounter
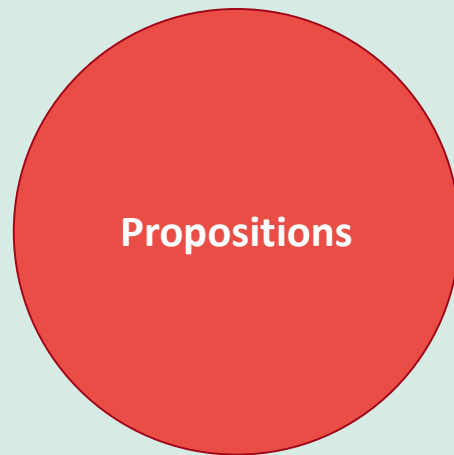•   Disposition
•   Response
•   Outcome

The framework seeks to recognise that there are *different actors* and *divergent forms of agency* involved in a process of technological change—and to look at the change process through the agency of the technological practitioners, the ones actually involved in the doing and making.

PEDRO framework.
Glover, D., J. Sumberg, G. Ton, J. Andersson and L. Badstue (2019). "Rethinking technological

change in smallholder agriculture." *Outlook on Agriculture* 48(3): 169-180.

PEDRO

Propositions

1. Biophysical / material components

2. Methods, techniques, practices

3. Proposed mode of engagement in agricultural production

Propositions

An initial idea, concept, suggestion; an invitation; a message; **'Something you could try; an option to do things differently, in order to achieve new or modified outcomes…'**

1. **Biophysical resources**
   - e.g. tools, equipment, energy, built infrastructure, living organisms, fertilisers, pesticides…
2. **Methods, techniques and practices**
   - Instructions, recommendations, guidelines, protocols, bodily skills…
3. Proposed **mode of engagement** in agricultural production
   - e.g. farming as a **business**, farming in a **cooperative**, farming for **self-sufficiency**

PEDRO

Encounters

- Deliberately orchestrated and choreographed

- Unplanned, unintentional

Encounters

The occasion or arena where the proposition is brought to attention.

- May be deliberately orchestrated by an external agency (e.g. by a development programme, sales rep, extension officer, farmer field school, demonstration plot…)
- May emerge in unplanned ways through the agency of a farmer or labourer (e.g. through gossip, observation of neighbour's activities, exposure to advertising, broadcasts, social media…)

- Encounters have both qualitative and quantitative aspects:
  - not just the number of e.g. farmer meetings, visits to demonstration plots,
  - but also the quality of the encounters, e.g. is there a relationship of trust, confidence, transparency between farmers and interventions?

PEDRO

Dispositions

- Structured (situated, positioned)

- Agentic (volitional)

Dispositions
- Different dispositions for different actors (households, individuals, communities…)
    - Dispositions have a **structural aspect** (e.g. how a labourer / household / decision-maker is situated financially, socio-culturally, generationally, etc.)…
    - … and an **agentic aspect** (a farmer's individual aspirations, skills, self-confidence, etc.).

"the variety of dispositions is shaped simultaneously by the individual characteristics and circumstances of people and households, by the dynamics and quality of the encounter and by features of the proposition. Each of the three components of the proposition – the material, the practical and the relational – may create a specific set of affordances for different individuals and groups. Combinations of cultural, economic, biophysical, spatial, temporal and other factors shape perceptions of a proposition. They generate a spectrum of multiple, unique dispositions among the variety of people and households that encounter the proposition. They determine whether, and in what ways, a proposition is perceived as a relevant and interesting opportunity for each individual decision maker."

… shaping whether someone is positively or negatively disposed towards the proposition.

- Potentially *modifiable*

- Capability – psychological and physical capacities
- Opportunity – social and physical possibilities

- Motivation – automatic (spontaneous, reflexive) and reflective (calculating, reasoning)

Michie, S., M. M. van Stralen and R. West (2011). "The behaviour change wheel: A new method for characterising and designing behaviour change interventions." *Implementation Science* 6(1): 42.

PEDRO
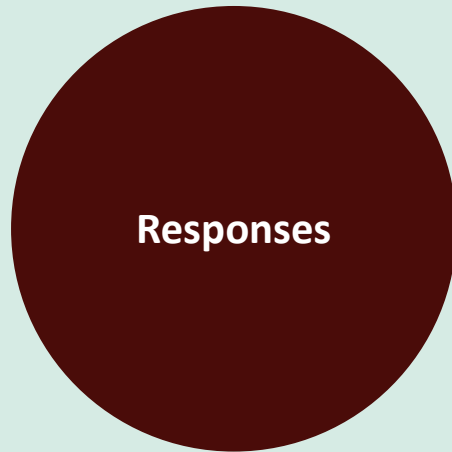
Responses

- Ignore
- Explore
- Deplore
- Adore

Range of responses available

The spectrum of potential responses is potentially wide and diverse; not just 'to adopt or not to adopt'

Responses could include at least 4 types—with variations within them:
- **Ignore** (do nothing; wait and see)
- **Explore** (check it out, try it for yourself, see how it works)
- **Deplore** (resist, subvert, campaign against).
- **Adore** (go all-in with commitment)

The thin concept of 'adoption' is simply inadequate to capture the range of responses that could emerge within these types.

PEDRO
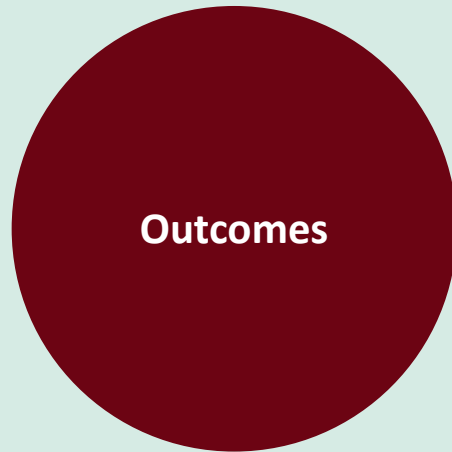
Outcomes

- Likely diverse and heterogeneous

Outcomes:
Different for different people, groups, localities

Hence, the implications of a **technological design** might be different for a **young woman vs. an older man**; a person who's **completed year 12 education vs. someone who dropped out of school**; a person with **farm assets vs. someone without land**.

Depending on e.g. capabilities and capacities, aspirations, material and financial resources
Gender, age, wealth…

Some implications

I've been hosted at UPLB by the SciCom department of the College of Development Communications… and through these conversations I've seen more clearly that before how the PEDRO framework can be analysed through a communicative lens

PEDRO can be used for the analysis and evaluation of technological change:
- *ex ante* (to inform design and guide implementation)
- *ex post* (to inform evaluation)

- Study the ramifications (rather than the 'impacts') of a technological change intervention in **non-deterministic ways**
    - with fewer preconceptions about what you think the technology is for, how you think it ought to be used, by whom, for what…
    - Instead, see what people actually do with the ideas and materials you introduce.
- Think about your **proposition** and **how it is supposed to appeal to your target audience**.
    - How accessible is it? How compatible is it with the existing set-up? How flexible and adaptable is it?
- How will the **encounter** be **organised and orchestrated**?
    - How will the target population be identified and engaged with?
- What kinds of **dispositions** can you **anticipate**? How do you scope those dispositions?
- What range of **responses** are you **potentially catering for**?
    - How flexible and adaptable is your design?
- How diverse are the **outcomes** from your intervention?

At a level of overarching principle, the role of agricultural R&D is affirmed as to enrich, broaden and deepen the selection of feasible and effective options available for poor and small-scale farmers to use to improve their lot.

- **Not 'best practices' or fixed technology packages**; not trying to predict and identify winners; but creating technological options with broader and **more inclusive affordances**, catering to **more diverse capabilities**, generating and promoting **more flexible and adaptable technologies**…
- … accompanied by communication, extension and training designed to **help farmers adapt and adjust things** to suit their circumstances.

People working with PEDRO today

–**Genowefa Blundo-Canto**, **Marie Ferre** and colleagues at CIRAD, Montpellier, FR

–**Sam Coggins**, PhD candidate at Australian National University

–**Thomas Lee**, University of Technology Sydney, Australia

–**Hubert Noel Takam Tchuente**, PhD candidate at IITA, Nigeria

–A group of researchers from **Uruguay**

–**Myself, Giel Ton** and other IDS colleagues in work for/with The Rainforest Alliance

There is a lot to be unpacked, operationalised, instrumented, and tested in relation to PEDRO.

Does it work?
Is it practical, accessible, affordable, effective?
How can it be instrumented, operationalised in the field?
Unpacking the individual components P, E, D, R, and O

I've been working on this with collaborators from DSC-CDC and others at UPLB these past 3 weeks.

I'm looking forward to further engagements.

institute of development studies

Thank you

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