Qualitative Comparative Analysis (QCA)

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Outline

- Basics of QCA
- QCA steps; application to our case examples
  - Selection of Outcomes and Causal Factors
  - Calibration
  - SuperSubset Analysis
  - Truth Table
  - Boolean minimisation
  - INUS analysis

Background of QCA as a research approach

- Invented as an approach to social science research by Charles Ragin
- Seminal monographic work by Ragin is
  - *The Comparative Method* (1987)
  - *Fuzzy-Set Social Science* (2000)
- Two textbooks
  - Rihoux & Ragin (eds.) (2009)
  - Schneider and Wagemann (2012)
- It became popular as a method for small-n analysis (5-30 cases)
  - historically used mainly by political scientists to compare countries
- but can be used on large n, too
  - Barbara Vis (2012) “The Comparative Advantages of fsQCA and regression analysis for moderately large-N analyses”, SMR 41
  - The lower limit remains… it’s a comparative method
  - Method for **systematic cross-case comparison**

Applications to Development Evaluation

- CIFOR (Centre for International Forestry Research)
  - a comparison of national REDD+ policy processes
  - “Enabling factors for establishing REDD+ in a context of weak governance” (2014)
- DFID
  - Review of evaluation approaches and methods for interventions related to violence against women and girls (2014)
  - Evaluation of the Africa Regional Empowerment and Accountability Programme (2015), Coffey International
    - “Qualitative Comparative Analysis – A Rigorous Qualitative Method for Assessing Impact”, Coffey “How-To” note
  - Evaluation of the Medicines Transparency Alliance (MeTA) (2015)
  - Macro Evaluation of DFID’s Policy Frame for Empowerment and Accountability (2015)
- HIVOS International
  - What triggers actors’ response to dissemination of investigative media products in Tanzania and Kenya? (2014)
  - “Testing The Waters”: How can Information and Communication Technologies (ICTs) for monitoring be strengthened and made more inclusive to achieve greater sustainability of rural water services? (2015)
  - What are the factors of success in creating child labour-free zones? (2015)
- The Global Environment Facility
  - Evaluation of GEF Biodiversity portfolio (2015): what factors are responsible for the existence of functional Protected Area Systems at the national level? What factors are responsible for the decrease in illegal incidents across Protected Areas?
- Evaluation of Budget Support for gender equality in primary education (2015)
  - Forthcoming in EJDR – European Journal of Development Research
- Oxfam, Palladium…

What is QCA

- Qualitative Comparative Analysis
  - The translation in latin languages is “quali-quantitative comparative analysis”
  - Based on qualitative constructs & Set-Theory (a branch of mathematical logics) at the same time
  - Qualitative & rigorously formalised at the same time
- An approach for causal inference based on systematic cross-case comparison
  - It cannot be used on 1 single case! Adds most value over 3-5 cases.
- Method for deductive analysis / test of (causal) hypotheses
- Method for inductive data analysis
  - Secondary use?
  - In my experience it doesn’t work very well as a purely empirical tool for data analysis
    - It might work as such under specific circumstances (e.g. with small datasets)

QCA steps

1. Choose one (or more) **outcome(s)** to explain / causally attribute
2. Create a working hypothesis on which **factors** explain this outcome
   - QCA benefits from other methods such as RE, CA, in general TBE
3. Collect **data** on all factors for a group of cases
4. Organise the data in a dataset (**calibration**)
5. **Analyse** the dataset
6. **Interpret** the findings
7. Choose different factors / outcome and **repeat**
   - QCA is a cycle: it is often **iterative**, a “dialogue between theory and data”

Step 1: Outcome Selection

1. Functional management system for protected areas at the national level
2. Decrease in trends in incidents of illegal activities
3. Users use ICT in the way specified by the initiative
4. Rural water points are repaired based on ICT reports and data analysis
5. Strengthened relationships and shared understanding between policymakers and NSAs around the importance of citizen and civil society engagement in policymaking
6. Increase in female primary school enrolment
7. Improved service delivery
8. Women and girls are free from GBV and the threat of GBV
9. Changed social norms
10. Empowerment (control over assets and resources, etc.)

Challenges in Outcome Selection

- Many intermediate outcomes
  - No (high-quality) data on ultimate outcomes
  - Only one outcome at a time

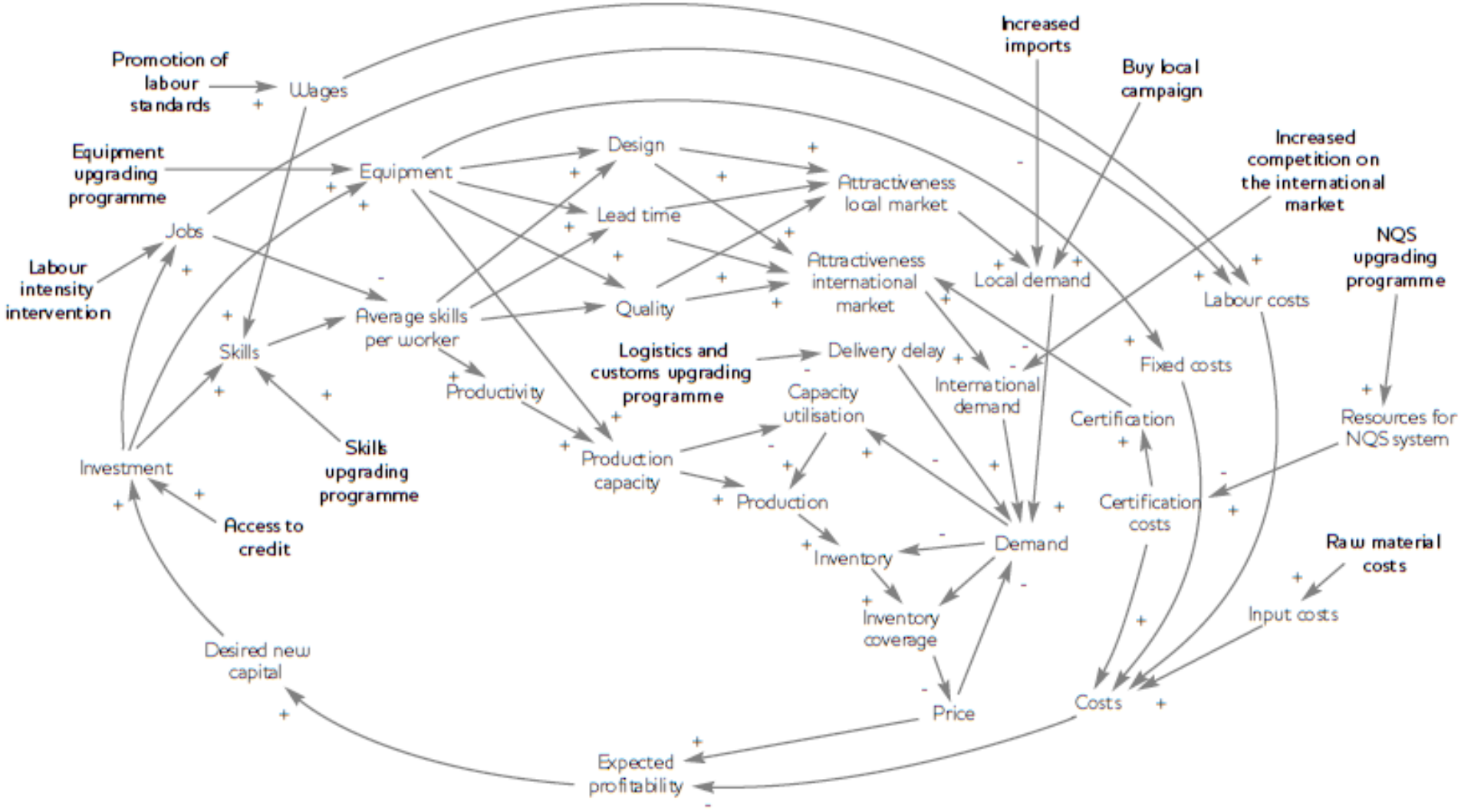
- Outcomes (and causal factors) need to be defined in binary terms of **presence (1)** or **absence (0)**
  - **CAVEAT 1:** not true in "fuzzy-set QCA" (fsQCA), where outcomes can take values across a scale (but not too long, 4-point or 6-point scale max)
  - CAVEAT 2: it can be three different values in "multi-variate QCA" (mvQCA)
- Sometimes it's not easy to understand if different outcomes lie along a scale (can be represented with a sequence of values), or are qualitatively different (belong to different scales)
  - Women's empowerment
  - Is change in social norms a high form of women's empowerment or qualitatively different from improved individual access to resources and participatory spaces?
  - Does women's empowerment (presence, 1) require both? Or do we define these constructs as separate outcomes?

Step 2: Selection of Causal Factors

- The starting point are usually **Theories of Change** on what affects the selected outcome(s)
- Evaluation Approaches based on Generative Causality that QCA can be combined with
  - Systems-Based Evaluation
    - Holistic view of factors affecting the outcome, including feedback loops; might lend itself to simulation of complex dynamics
  - Realist Evaluation
    - Magnifying lens on specific interactions in the causal chain or system (e.g. a specific “arrow”)
  - Explanatory CMO configuration
    - Context-Mechanism-Outcome
  - Contribution Analysis
    - Causal chain, with risks & assumptions for each step / link

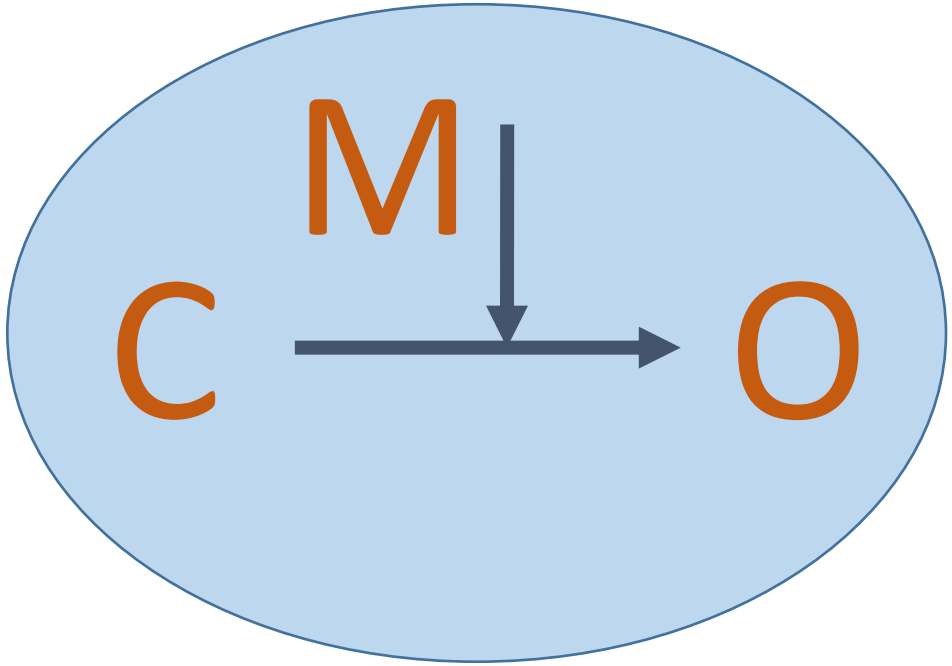
A complex system… the leather shoes sector in Ethiopia

Derwisch & Loewe (2015) "Systems Dynamics Modelling in Industrial Development Evaluation" *IDS Bulletin* 46.1



Context-Mechanism-Outcome Configuration

- Detailed explanation of why each arrow holds
- Explanation of the behaviour of specific stakeholders
  - Thinking, decision-making, action
  - “The girl did not attend school because her parents did not allow it”
- On the basis of a context with specific resources / opportunities / constraints
  - Financial benefits, skills, social rewards, institutional structures, prestige, anything that constitutes an incentive or an obstacle for a specific behaviour or decision.



Step 2: Selection of Causal Factors

- The difference between the above approaches and QCA is that these ToCs feed into the creation of “lists of causal factors”
- Causal factors are “translated” in terms of **presence (1)** and **absence (0)** of given constructs
  - Market Competition (high, low)
  - Model of Service Provision (community-based / bottom-up, state-based / top-down)
  - Institutional Capacity (high, low)
  - Political Pluralism (high, low)
  - Type of Intervention (demand-based vs. supply-based)
  - Availability of wireless connectivity (high, low)
  - Freedom of media and presence of accountability mechanisms (high, low)

Outcomes and Causal Factors emerged from the group work

1. Women starting successful business in rural Afghanistan as a means of economic empowerment
    1. Equal access to markets, infrastructure, roads, ICT (for home-based work), developed business-related skills, legal right to work / own a business, business regulations recognize women, women have access to finance, community leaders are supportive of women-led businesses, security, safety to move, travel, sell, whether your commodity is sellable, market analysis (how do they know?)
2. National Statistics Offices can produce statistical information according to Eurostat standards
    1. Sufficient staff, adequate technical skills of staff, equipment (software / hardware), coordination / cooperation with agencies that can provide data & statistical offices of other countries, stakeholders within country perceive need of high quality data, institutional or political pressure or demand for high quality data, burden of reporting on donor-funded projects vs. amount of time to do your ordinary work

Challenges in the Selection of Causal Factors

- In many IEs, ToCs are poorly developed
- Based on available knowledge, the list of factors which could potentially contribute is either:
  - Long (20+)
  - Poorly specified (broad and vague constructs like “capacity to engage”)
- Do not go for “every little helps” strategy
  - Factors do not add up in QCA; the outcome is not a sum
  - Remember “chemical causation”: you want to understand how some factors react in combination with some others, not the individual contribution of every possible single factor to a “pile”
    - PIE not PILE!
- **Think in terms of “necessary factors”**: factors that, if removed, create a malfunction, a qualitative difference, not just “a little less of the outcome”
  - Ex. AREAP: CA showed that stakeholders thought “champions” were necessary

Challenges in the Selection of Causal Factors

- Causal factors) need to be defined in binary terms of **presence (1)** or **absence (0)**
  - **CAVEAT 1:** not true in "fuzzy-set QCA" (fsQCA), where outcomes can take values across a scale (but not too long, 4-point or 6-point scale max)
  - CAVEAT 2: it can be three different values in "multi-variate QCA" (mvQCA)
- Hence they are called "**conditions**"
  - Not "variables"!! (pie vs. pile)
- Sometimes it's not easy to understand if different conditions lie along a scale (can be represented with a sequence of values), or are qualitatively different (belong to different scales)
  - If you cannot organise them in a sequence, they are qualitatively different

Example from "Testing the Waters"

- **Outcome: "Rural water points are repaired based on ICT reports and processing"**
- **Conditions / Causal Factors:**
  - **Funds are sufficient for carrying out the repair**
  - **O&M responsibilities are clear to all parties**
  - **Spare parts are available for the repair**
  - **A mechanic is available to carry out the repairs**
  - **The LGA / service provider has accountability mechanisms in place to ensure that ICT reports are acted on (repairs are carried out)**
- **Note: most of these can be thought of as "necessary conditions"**

Step 3: Data Collection

- QCA is **neutral** in terms of **data collection techniques**
  - Information can be drawn from documentation, surveys, all kinds of interviews
- Need for data on all factors, for all cases
  - **Missing data is costly**
  - Need to remove the case or the condition
- Lack of available data on specific conditions / cases (even one) might **reduce the list of conditions (or cases)** that can be included in a QCA analysis
- **Iteration**: fill in data gaps, or include new conditions / cases after the first rounds of analysis

Step 4: Data organisation and Calibration

	3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.2.2	Outcome
	Funds are sufficient for carrying out the repair	**O&M responsibilities are clear to all parties**	**Spare parts are available for the repair**	**A mechanic is available to carry out the repairs**	**The LGA / service provider has accountability mechanisms in place to ensure that ICT reports are acted on (repairs are carried out)**	**The ICT initiative supports existing sector responsibilities for O&M i.e. repairs**	**O3REPAIR**
Smart Handpumps Kenya	**1**	**1**	**1**	**1**	**1**	**1**	**1**
M4W Uganda	**0**	**1**	**0**	**0**	**0**	**1**	**0**
Maji Matone Tanzania	**0**	**0**	**1**	**0**	**1**	**1**	**1**
Maji Voice Kenya	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Next Drop India	**1**	**1**	**1**	**1**	**1**	**1**	**1**
HSW Zanzibar	**0**	**1**	**1**	**1**	**0**	**1**	**0**

Calibration

- Process of assigning numerical values to empirical manifestations of conditions in specific cases
- Two strategies: compatible, can overlap, but conceptually different
  - Deductive / Top-Down
    - define presence / absence / intermediate degrees according to theory
    - and hope that your sample reflects diversity
  - Inductive / Bottom-Up
    - define presence / absence / intermediate degrees according to the extremes / diversity you have in your group of cases
    - and hope that the categories fit the theory well – if there is any theory!

Defining achievement and non-achievement of outcomes

Achievement of outcome 1	1Non-achievement of outcome
Successful ICT reporting: Users or their representatives, including government staff, directly or indirectly, use ICTs in the way specified by the initiative to report rural water supply functionality to the local government authority or relevant stakeholder; this could be either through ad hoc crowdsourcing or through government- or service provider-led, regular updating mechanisms.	Unsuccessful ICT reporting: Users, or their representatives fail to use ICTs to report rural water supply functionality, or bypass the ICT channel using other forms of communication with the local government authority or relevant stakeholder.
Achievement of outcome 2	Non-achievement of outcome 2
Successful processing of ICT reports: Local government authority (national sector government, if relevant) or service provider process and follow up on ICT reports.	Unsuccessful processing of ICT reports: Local government authority (national sector government, if relevant) or service provider do not process and follow up on ICT reports.
Achievement of outcome 3	Non-achievement of outcome 3
Successful service improvement: Water points are repaired or targeted planning takes place based on ICT reports and processing.	Lack of service improvement: Water points are not repaired, or no targeted planning takes place as a results of ICT reports.

Defining presence and absence of conditions

Outcome 2: Successful processing of ICT reports		
2.1 Enabling environment is conducive to processing of ICT reports		
2.1.1Internet / GSM reception at local government / service provider office environment.	GSM / internet reception problems do not inhibit effective data processing.	There are challenges related to receiving ICT-based reports.
2.1.2 Computers and electricity are available to receive and store reports.	Yes.	No.
2.1.3 There is access to the necessary software to store and process data.	Yes.	No.
2.1.4 There is access to back-up support for solving ICT-related problems.	Yes.	No.
2.2. Characteristics of processing ICT reports		
2.2.1 The responsible agency has sufficient human resources and knowledge to process ICT reports.	Yes.	No.
2.2.2 There is clarity in procedures for following up on the ICT report.	Procedures for following up are clear.	Procedures are not sufficiently clear or the system does not require follow up.
2.2.3 The operational costs are largely met by the (local) government / service provider.	The (local) government are covering the operational costs.	The (local) government / service provider are not paying for the operational costs.

Defining presence and absence of conditions

Outcome 3: water points are repaired based on ICT reports and processing		
3.1 Enabling environment is conducive for carrying out repairs.		
3.1.1. There are sufficient funds for carrying out the repair.	In the majority of cases, water user committees or the responsible agency has sufficient funds for carrying out repairs.	In the majority of cases, water user committees struggle to collect sufficient funds for carrying out repairs.
3.1.2 Operation and maintenance responsibilities are clear to all parties.	In the majority of cases, responsibilities are clear.	In the majority of cases, responsibilities are not clear.
3.1.3 Spare parts are available for the repair.	In the majority of cases, spare parts are available.	In the majority of cases, spare parts are not available.
3.1.4 A mechanic is available to carry out repairs.	In the majority of cases, a mechanic is available.	In the majority of cases, a mechanic is not available.
3.2 Characteristics of the operation and maintenance model / sector planning procedures		
3.2.1 The local government / service provider has accountability mechanisms in place to ensure that ICT reports are acted on (repairs are carried out).	There is an established way of following up on processed ICT reports.	Who follows up on processed ICT reports is unclear.
3.2.2 The ICT initiative supports existing sector responsibilities for operation and maintenance.	The mechanisms put in place by the initiative are in line with sector responsibilities.	The mechanisms put in place by the initiative contradict existing sector responsibilities.

Calibration in the Water Points evaluation

- (Achievement of) Outcome 3 was initially defined as a disjunction
  - "Water points are repaired **OR** targeted planning takes place based on ICT reports and processing".
- Because in one case water points were not repaired but the fact that targeted planning took place was considered partially successful
- However it was just one case; then in another case data was missing; while in all the other 6 high quality data was available on whether repairs had taken place or not, with or without targeted planning
- **DANGER: comparing apples and oranges**
- The team decided to focus on repairs, on which the cases seemed clearly comparable

Defining presence and absence of conditions

Description of condition	Definition of achievement	Definition of non-achievement
Outcome 1: Successful ICT-based reporting		
1.1 Enabling environment is conducive to reporting		
1.1.1 GSM reception	The network is reliable (e.g. in urban areas) or the data can be sent when the facilitator has reception e.g. back in the office	The network is not reliable
1.1.2 ICT devices can be charged.	Charging phones does not provide a serious obstacle to reporting breakdowns.	There are significant problems with keeping phones charged, and this inhibits reporting.
1.1.3 Users or their representatives have access to the ICT device used by the initiative.	The person responsible for reporting has access to a phone.	There is a challenge with access e.g. the person responsible for reporting does not have access to a phone.
1.2 Characteristics of the reporting process		
1.2.1 Is the data reported periodically or related to specific incidences?	The data is reported when there is a specific incidence.	The data is reported periodically.
1.2.2 Does the report require human interaction or is it automatic?	It requires human interaction.	It is automatic.
1.2.3 Who reports? Crowdsourcing or government / service provider-led?	Reporting is based on crowd sourcing.	Reporting is government / service provider led.
1.2.4 People reporting the problem prefer the ICT-mechanism over alternatives.	People prefer the mechanism, there are different options from which people can choose, or preference is not important because it is part of peoples' job description.	There is resistance against the proposed communication method of reporting.
1.2.5 The costs of reporting is not a problem for the person who reports.	Cost is not an issue, or users are prepared to pay a higher cost to alternatives.	Cost is an issue, including when government staff use the allocated credit for other purposes.
1.2.6 People who want to report the problem have sufficient information and knowledge to do so.	People who want to report the problem have sufficient information and knowledge e.g. access to the number.	People who want to report the problem encounter problems in using the ICT reporting mechanism.

Calibration in fuzzy-set QCA (AREAP)

Conditions	Existence of space for dialogue between state and civil society	Capacities of key civil society actors to engage with state	Horizontal coordination between key civil society actors	Outcome: Stronger national and regional policy making and implementation
Cases:	0 = no or weak evidence to support 0.33 = some evidence to support 0.66 = strong evidence to support 1 = practical certainty	0 = no or weak evidence to support 0.33 = some evidence to support 0.66 = strong evidence to support 1 = practical certainty	0 = no or weak evidence to support 0.33 = some evidence to support 0.66 = strong evidence to support 1 = practical certainty	0 = no or weak evidence to support 0.33 = some evidence to support 0.66 = strong evidence to support 1 = practical certainty
DRC	0.66	0	0.66	0.66
Senegal	0	0.33	0.66	0.33
South Africa	0	0.66	0	0

Calibration Challenges

- Providing qualitative descriptors of all values (including between 0 and 1)
- Defining degrees of membership to the ideal type represented by the “1”
  - How do we choose a 2-point VS. 4-point VS. a 6-point scale?
- Degree of membership to one ideal type VS. a different ideal type
  - The different “states” a condition is in must be ordered, in sequence
  - If this is not the case, they are not values of the same condition, they are another condition
- “People who want to report the problem have sufficient information and knowledge e.g. access to the number” **is better than** “People who want to report the problem encounter problems in using the ICT reporting mechanism”.
- “Cost is not an issue” is **no better or worse than** having information; it’s a **qualitatively different factor**.

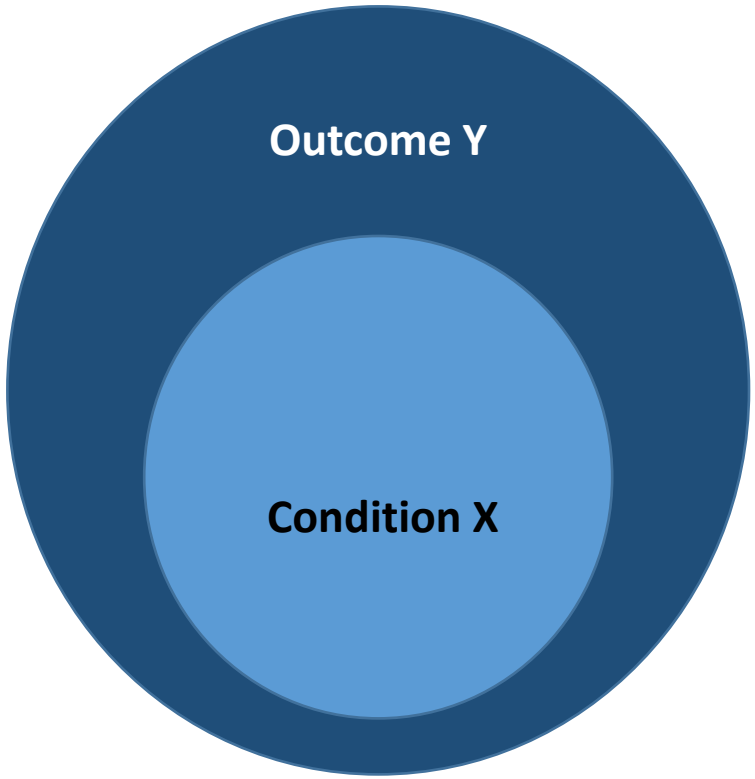
Group Work

- Before we address data analysis (Step 5) and to some extent interpretation of findings (Step 6), create a dataset for your chosen intervention.

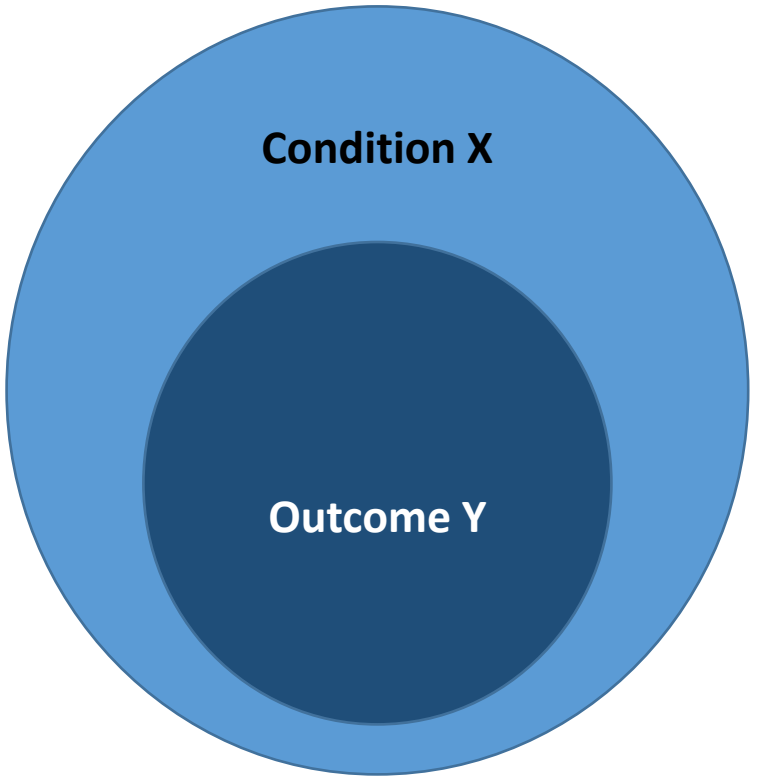
Analysing the dataset

- Three groups of procedures available to synthesise the information in the dataset
  - Starting from the analysis of single conditions, to increasingly complex combinations
- **Necessity Analysis**
  - What (groups of) conditions are necessary for success?
- **Sufficiency Analysis**
  - What packages / recipes / combinations of conditions are sufficient for success?
- **INUS Analysis**
  - Which conditions make the difference, in which context (for whom and under which circumstances)?
  - It might not always be the same factor to make the difference all the time…
- Interpreting the Combinations
  - Why are those conditions all needed at the same time?
  - How do they interact with each other?
  - Why are some required in specific contexts and some aren't? What is exactly their role there?

Necessity and Sufficiency in set relations



Condition X is SUFFICIENT for Outcome Y



Condition X is NECESSARY for Outcome Y

The dataset

	3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.2.2	Outcome
	Funds are sufficient for carrying out the repair	**O&M responsibilities are clear to all parties**	**Spare parts are available for the repair**	**A mechanic is available to carry out the repairs**	**The LGA / service provider has accountability mechanisms in place to ensure that ICT reports are acted on (repairs are carried out)**	**The ICT initiative supports existing sector responsibilities for O&M i.e. repairs**	**O3REPAIR**
Smart Handpumps Kenya	**1**	**1**	**1**	**1**	**1**	**1**	**1**
M4W Uganda	**0**	**1**	**0**	**0**	**0**	**1**	**0**
Maji Matone Tanzania	**0**	**0**	**1**	**0**	**1**	**1**	**1**
Maji Voice Kenya	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Next Drop India	**1**	**1**	**1**	**1**	**1**	**1**	**1**
HSW Zanzibar	**0**	**1**	**1**	**1**	**0**	**1**	**0**

Necessity Analysis

- A.k.a. superset analysis
- Evaluation question: *What (groups of) conditions are necessary for success?*
- Group cases with the same outcome and search for consistently present conditions
  - 4 successful, 2 unsuccessful cases
  - One trivial condition (322): necessary BUT always present in both successful and unsuccessful cases (also necessary for lack of success…)
  - 2 necessary conditions:
    - **321: Accountability Mechanisms in place**
    - **313: Spare parts are available**

The dataset for “LGA or SP process and follow up on ICT-based reports of water points failure”

	2.1.1	2.1.2	2.1.3	2.1.4	2.2.1	2.2.2	2.2.3	
	GSM reception	Availability of computers and electricity	Access to necessary software to store and process data	access to ICT-back up support	HR and knowledge to process ICT reports	clarity of procedures for follow-up on ICT reports	operational costs largely be met by government / service provider	Outcome
Smart Handpumps Kenya	1	1	1	1	1	1	1	1
M4W Uganda	0	1	1	1	0	1	0	1
Maji Matone Tanzania	1	1	1	1	1	1	0	0
Maji Voice Kenya	1	1	1	1	1	1	1	1
SIBS Timor Leste	0	1	1	1	1	1	1	1
Re-imagining Reporting, Bolivia	1	1	1	1	1	1	0	0
Next Drop Bangalore, India	1	1	1	1	1	1	1	1
Human Sensor Web Zanzibar	1	1	1	1	1	0	0	0

Necessity Analysis

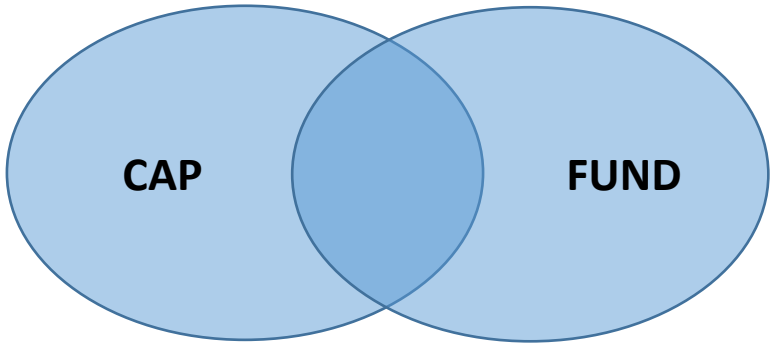
- A.k.a. superset analysis
- Evaluation question: *What (groups of) conditions are necessary for success?*
- Group cases with the same outcome and search for consistently present conditions
  - 5 successful, 3 unsuccessful cases
  - Three trivial condition (212 213 214): necessary BUT always present in both successful and unsuccessful cases (also necessary for lack of success…)
  - 1 necessary condition:
    - **222: Clarity of procedures for following up on ICT reports**

Set Theory

- The logical operations can be applied to sets
- Sets as concepts, ideal types (e.g. functional governance system, availability of skills, sufficient funding, institutional capacity, etc.)
  - Can have quantitative elements but are inherently qualitative, social science constructs
- Projects with:
  - Good Institutional Capacity (CAP) and / or
  - Sufficient Funding (FUND)

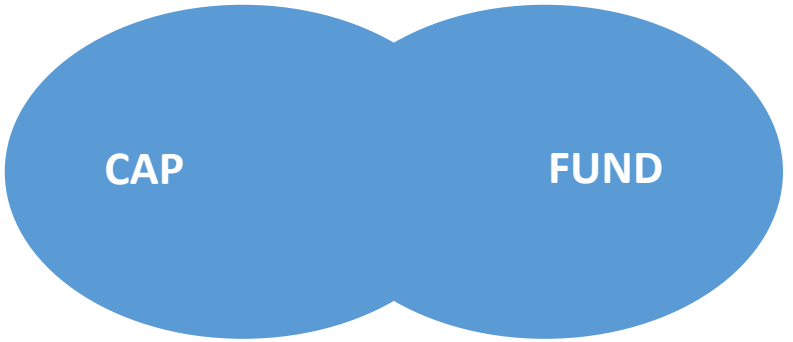
CONJUNCTION (COMBINATION, INTERSECTION)

CAP * FUND [CAP] ∩ [FUND]



DISJUNCTION (UNION)

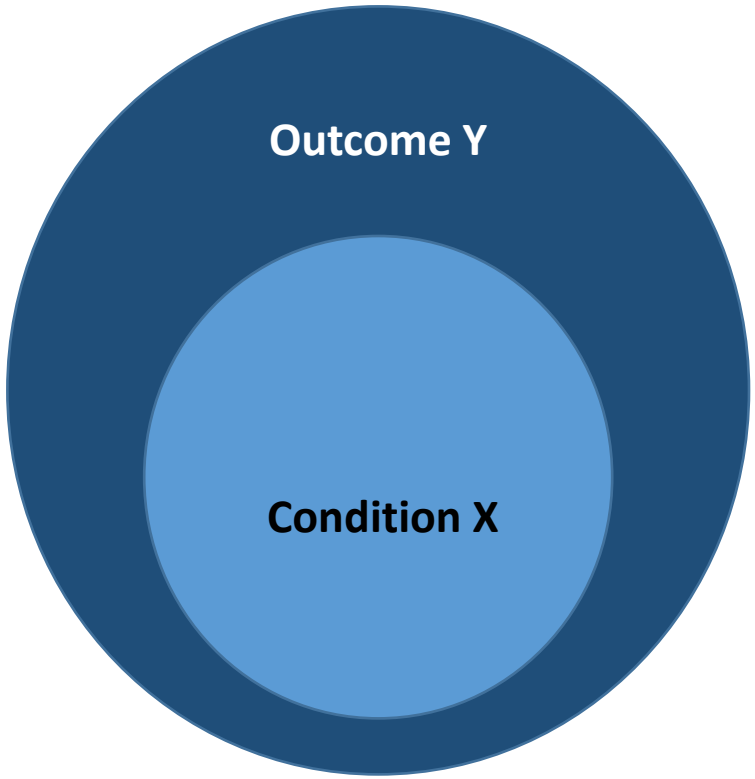
CAP + FUND [CAP] U [FUND]



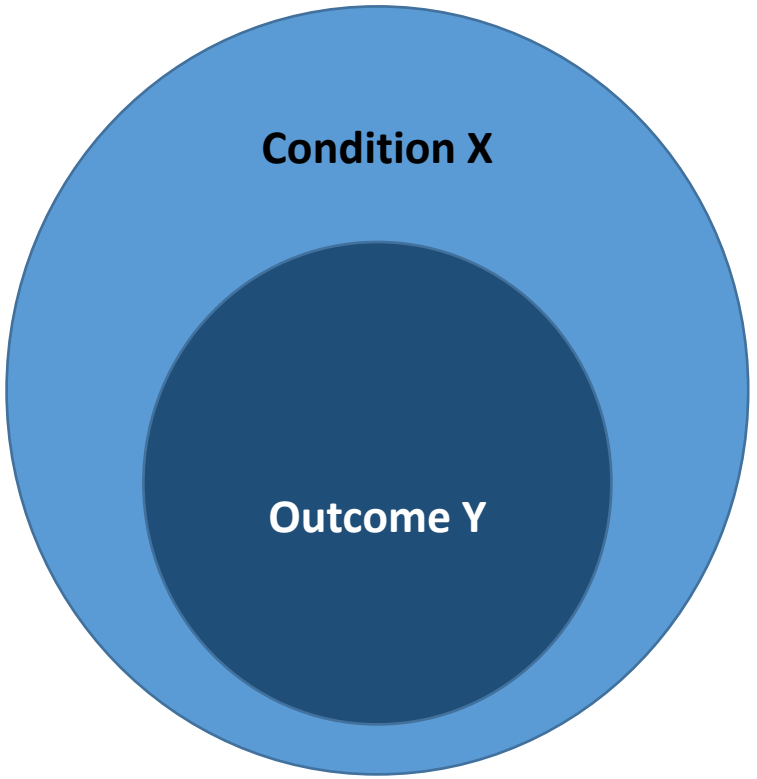
Challenges of the Necessity Analysis

- When more than one condition is necessary… the conjunction / combination is necessary, too.
- When no single condition is necessary… some disjunction / logical union will probably be
  - Necessity of Disjunctions
- **Necessity-Consistency score** of one condition
  - frequency of successful cases presenting that condition on total # of successful cases
  - What we saw above were "perfectly necessary" conditions (consistency = 100%)
  - If a condition is present in 4 out of 5 successful cases it is 80% necessary.
- **Triviality** of Conditions
  - A condition always present in all cases, both successful and unsuccessful
  - Necessity-Coverage: 5 pos, 3 neg = 5/8 = 63%

Necessity and Sufficiency in set relations



Condition X is SUFFICIENT for Outcome Y



Condition X is NECESSARY for Outcome Y

Sufficiency Analysis (Subset Analysis)

- Two types: Subset Analysis and Boolean Minimisation
- Evaluation question: *what [packages / recipes / combinations / conjunctions] (**groups**) of conditions are sufficient for success?*
- **Subset Analysis**
- Grouping cases sharing specific (groups of) conditions (e.g. one)
  - 4 successful, 2 unsuccessful cases
  - 3 subset-sufficient conditions:
    - **321: Accountability Mechanisms in place**
      - Observed over 4 cases (all 4 successful cases are covered / present this condition (which is then also necessary)
    - **314: A mechanic is available to carry out the repairs**
      - Observed over 3 cases (3 out of 4 successful cases): sufficiency coverage is 75%.
    - **311: Funds are sufficient for carrying out the repairs**
      - Observed over 3 cases (3 out of 4 successful cases): sufficiency coverage is 75%.

The dataset

	3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.2.2	Outcome
	Funds are sufficient for carrying out the repair	**O&M responsibilities are clear to all parties**	**Spare parts are available for the repair**	**A mechanic is available to carry out the repairs**	**The LGA / service provider has accountability mechanisms in place to ensure that ICT reports are acted on (repairs are carried out)**	**The ICT initiative supports existing sector responsibilities for O&M i.e. repairs**	**O3REPAIR**
Smart Handpumps Kenya	**1**	**1**	**1**	**1**	**1**	**1**	**1**
M4W Uganda	**0**	**1**	**0**	**0**	**0**	**1**	**0**
Maji Matone Tanzania	**0**	**0**	**1**	**0**	**1**	**1**	**1**
Maji Voice Kenya	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Next Drop India	**1**	**1**	**1**	**1**	**1**	**1**	**1**
HSW Zanzibar	**0**	**1**	**1**	**1**	**0**	**1**	**0**

Challenges of the Subset-Sufficiency Analysis

- If more than one condition are sufficient… both their combination and disjunction are also sufficient.
- If no single condition is sufficient… a combination of two or more will probably be.
  - Sufficiency of combinations
- **Sufficiency-Consistency score**
  - frequency of successful cases presenting that condition on total # of cases presenting that condition
  - What we saw above were "perfectly sufficient" conditions (consistency = 100%)
  - 313 "Availability of spare parts" is 80% sufficient (4 cases out 5 are successful)
- **Non-representative conditions and Sufficiency-Coverage**
  - The % of cases covered by the sufficient condition (combination)
  - Usefully complements info on sufficiency: how much info / diversity in the dataset are we missing if we focus on that one sufficiency relation? In statistics sometimes referred to as "% of explained variance"

Sufficiency Analysis (Boolean minimisation)

- Progressive reduction / synthesis of the dataset
- Creating a Truth Table
  - Selecting a number of conditions (lower or equal than those in the dataset)
  - Merging identical cases / rows / combinations
  - From **8 cases** with 7 conditions each **to 5 combinations** with 7 conditions each to **5 combinations with 4 conditions each**
  - All rows in the Truth Table are different
- Challenges:
  - Limitations on the # of conditions that can be analysed at the same time
  - Finding the right # of conditions

The **dataset** for "LGA or SP process and follow up on ICT-based reports of water points failure"

	2.1.1	2.1.2	2.1.3	2.1.4	2.2.1	2.2.2	2.2.3	
	GSM reception	Availability of computers and electricity	Access to necessary software to store and process data	access to ICT-back up support	HR and knowledge to process ICT reports	clarity of procedures for follow-up on ICT reports	operational costs largely be met by government / service provider	Outcome
Smart Handpumps Kenya	1	1	1	1	1	1	1	1
M4W Uganda	0	1	1	1	0	1	0	1
Maji Matone Tanzania	1	1	1	1	1	1	0	0
Maji Voice Kenya	1	1	1	1	1	1	1	1
SIBS Timor Leste	0	1	1	1	1	1	1	1
Re-imagining Reporting, Bolivia	1	1	1	1	1	1	0	0
Next Drop Bangalore, India	1	1	1	1	1	1	1	1
Human Sensor Web Zanzibar	1	1	1	1	1	0	0	0

The **Truth Table** for "LGA or SP process and follow up on ICT-based reports of water points failure"

	2.1.1	2.1.2	2.1.3	2.1.4	2.2.1	2.2.2	2.2.3	
	GSM reception	Availability of computers and electricity	Access to necessary software to store and process data	access to ICT-back up support	HR and knowledge to process ICT reports	clarity of procedures for follow-up on ICT reports	operational costs largely be met by government / service provider	Outcome
Smart Handpumps Kenya, Maji Voice Kenya, Next Drop Bangalore, India (3)	1	1	1	1	1	1	1	1
M4W Uganda	0	1	1	1	0	1	0	1
Maji Matone Tanzania, Re-imagining Reporting, Bolivia (2)	1	1	1	1	1	1	0	0
SIBS Timor Leste	0	1	1	1	1	1	1	1
Human Sensor Web Zanzibar	1	1	1	1	1	0	0	0

Sufficiency Analysis (Boolean minimisation)

- Synthesising the Truth Table (the minimisation algorithm)
  - Groups almost identical combinations sharing the same outcome
    - Identical means equal except on one condition (“one-difference rule”)
- Challenges
  - Sometimes solutions are too complex
  - We can test smaller models (with fewer conditions)
  - We can add logical cases
    - Logically possible combinations with no empirical support in the dataset
    - Risky to add them – the assumption needs to be strongly justified because they can have a strong impact on the findings

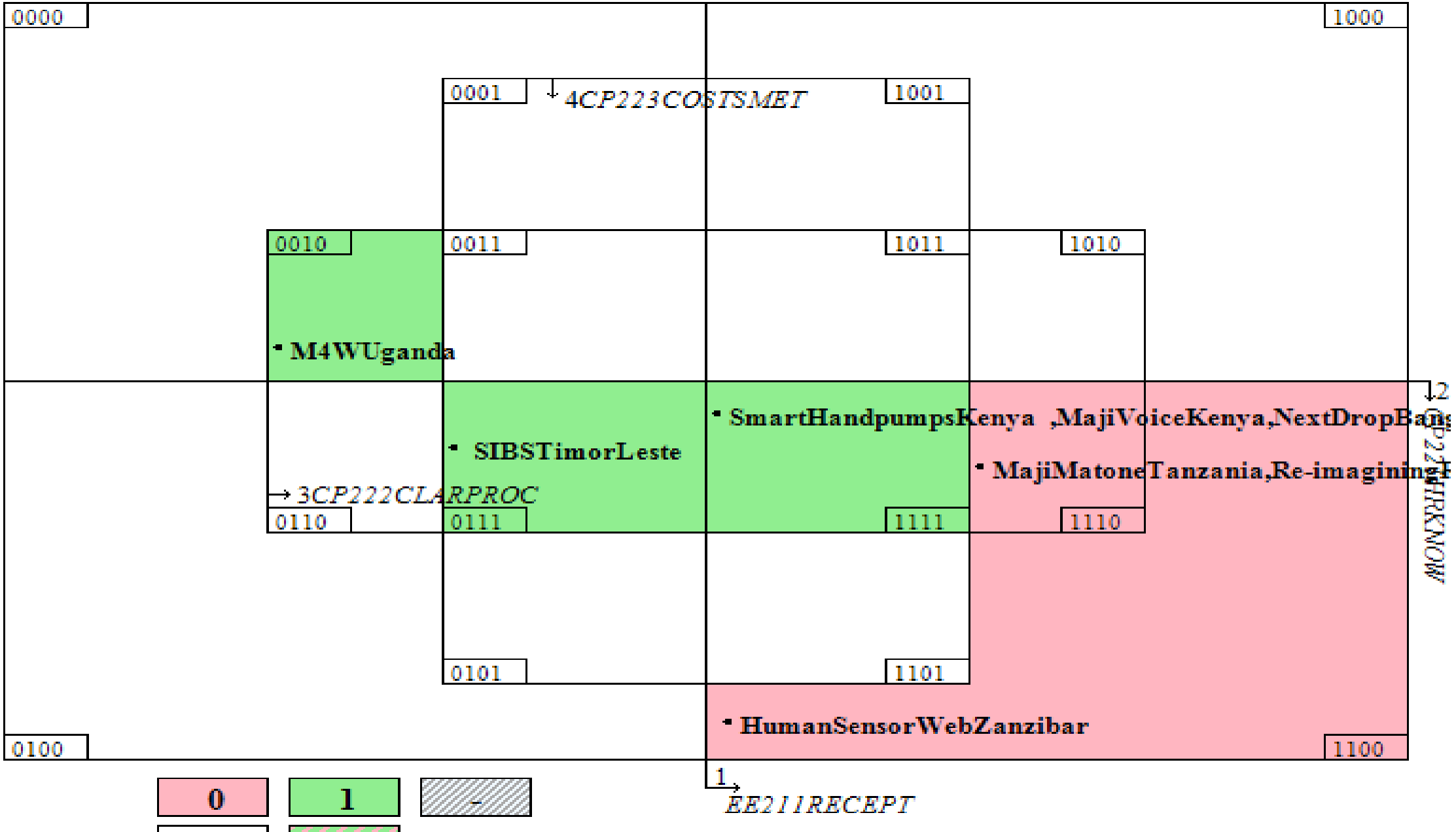
The **Boolean Minimisation** for "LGA or SP process and follow up on ICT-based reports of water points failure"

	2.1.1	2.1.2	2.1.3	2.1.4	2.2.1	2.2.2	2.2.3	
	GSM reception	Availability of computers and electricity	Access to necessary software to store and process data	access to ICT-back up support	HR and knowledge to process ICT reports	clarity of procedures for follow-up on ICT reports	operational costs largely be met by government / service provider	Outcome
Smart Handpumps Kenya, Maji Voice Kenya, Next Drop Bangalore, India, SIBS Timor Leste (4)	-	1	1	1	1	1	1	1
M4W Uganda	0	1	1	1	0	1	0	1
Maji Matone Tanzania, Re-imagining Reporting, Bolivia, Human Sensor Web Zanzibar (3)	1	1	1	1	1	-	0	0

- 212*213*214*221*222*223 => Outcome
- No211*212*213*214*no221*222*no223 => Outcome
- 211*212*213*214*221*no223 => NO outcome

The Venn diagram

- Potentially a relatively steep learning curve BUT in my view the single most informative tool in QCA
- Synthesis of all the information in a dataset / model, available at a glance
- Lines divide the bi-dimensional space into “special areas” corresponding to single conditions
- Intersections of “special areas” represent intersections / combinations of conditions
- Smallest areas represent intersections of 4 conditions:
  - are identified by their 0-1 combinations (e.g. 0011)
  - include the cases they cover (black dots)
  - Are painted green if the combination is consistently successful (perfect sufficiency)
  - Are painted pink if the combination is consistently unsuccessful
  - Are left white is the combination is purely logical, not supported empirically in the dataset
- CHALLENGES
  - Works with up to 5-condition models
  - No information on sufficiency-consistency (e.g. beyond contradictory cases)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Necessity and Sufficiency in the Venn diagram

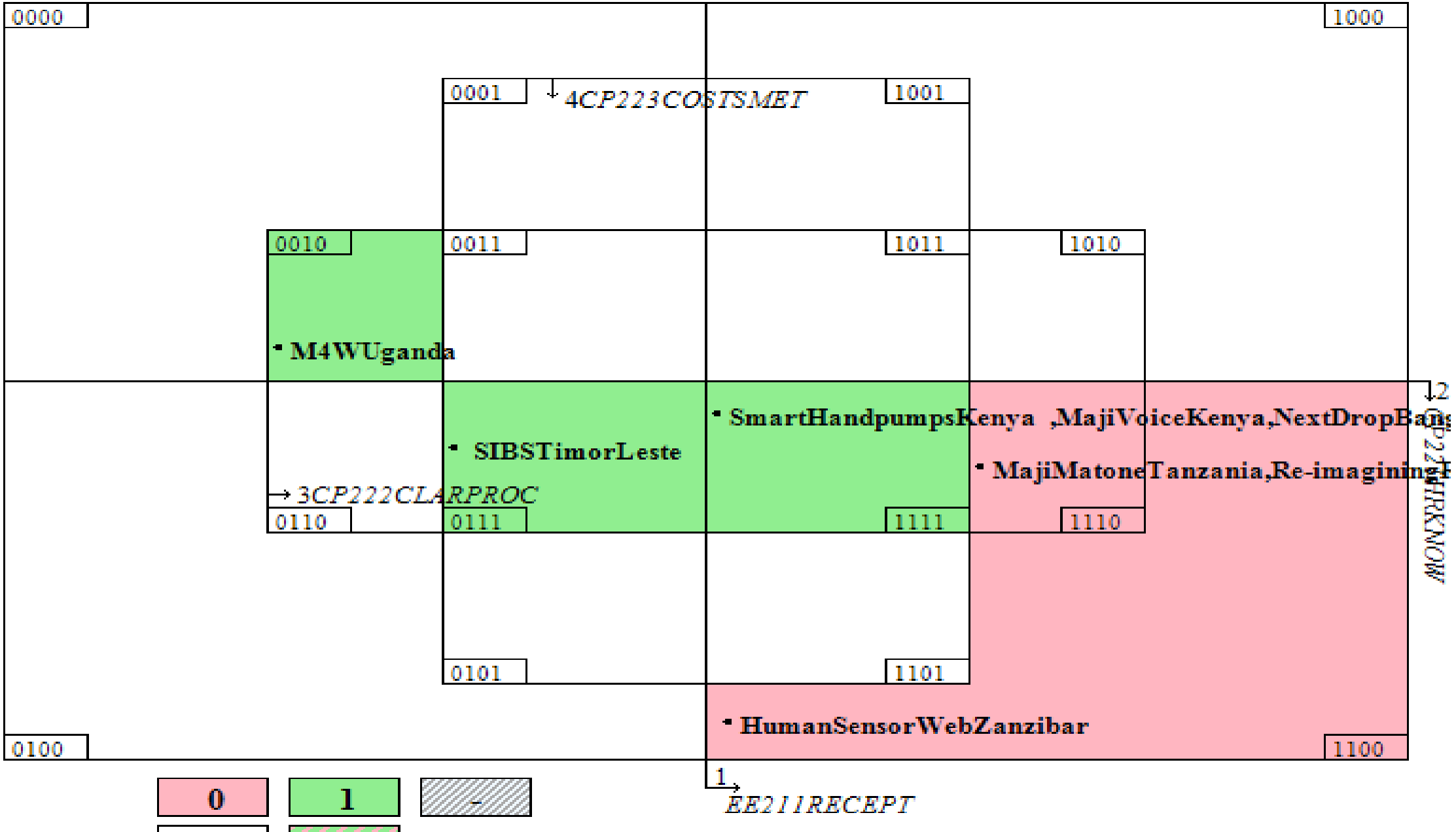
- Necessity
  - **Where are the green areas located?**
- Subset sufficiency
  - **Is there any pink** in specific (intersections of) special areas?
- Minimisation sufficiency
  - Are specific (intersections of) special areas **completely green?**
- The difference between the two types of sufficiency is clear in the VD
  - For SS, it is enough that no pink is present, and there is at least some green
  - For MS, the area must be completely green with no blank / white spaces
    - The white spaces that are the “missing pieces” to paint a special areas green are the logical cases that, if included in the minimisation, can simplify the solution
- Minimisation Sufficiency is stronger / more conservative than Subset Sufficiency

The INUS analysis

- Did the intervention make a difference, for whom and under what circumstances?
- What other factors made a difference, for whom and under what circumstances?
- **I**nsufficient but **N**ecessary Condition of an **U**nnecessary but **S**ufficient combination / package
- The package as a whole is sufficient for success – but it **needs** the INUS condition. If we take the INUS condition away, the "recipe" loses sufficiency (no longer leads to success).
- Insufficient by itself – it needs the other conditions to be successful, is not so when combined with a different package
- The package is sufficient but unnecessary – other pathways can lead to success

In “Testing the Waters”:

- Meeting costs of repairs makes the difference between success and failure when all other (3) conditions are positive
  - Reception, knowledge of HR, clarity of procedures for processing of data
  - In the two cases covered by 111**0** (MMT, RIR) ICT data are **not** analysed
  - In the three cases covered by 111**1** (SH, MV, ND) ICT data are analysed
- **The only difference** between these two groups of cases, one successful and one not, is that in the former the operational costs of data analysis are mostly covered by the government or the service provider
- However covering costs is not necessary by itself – M4W Uganda (001 instead of 111) is successful but costs are not covered.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INUS analysis for "LGA or SP process and follow up on ICT-based reports of water points failure"

	2.1.1	2.2.1	2.2.2	2.2.3	
	GSM reception	HR and knowledge to process ICT reports	clarity of procedures for follow-up on ICT reports	operational costs largely be met by government / service provider	Outcome
Smart Handpumps Kenya, Maji Voice Kenya, Next Drop Bangalore, India (3)	1	1	1	1	1
M4W Uganda	0	0	1	0	1
Maji Matone Tanzania, Re-imagining Reporting, Bolivia (2)	1	1	1	0	0
SIBS Timor Leste	0	1	1	1	1
Human Sensor Web Zanzibar	1	1	0	0	0

- RECEPT*ICTSUPP*HRKNOW*COSTSMET => DATAPROCESSING
- RECEPT*ICTSUPP*HRKNOW*costsmet => dataprocessing

INUS analysis in the evaluation of budget support
Holvoet and Inberg (2015) forthcoming in EJDR

- Outcome: increase in primary school enrolment of girls
  - EDU: primary education is free at the national level
  - AID: relatively high aid volumes for primary education
  - GWG: gender working groups to participate in the budget process
  - PAF: inclusion of gender indicators in the main programming document (Action Plan)

- Where education is free and aid volumes are relatively high, setting up gender working groups makes the difference
- **EDU*AID*GWG => ENROL** (4 cases: Malawi, Ethiopia, Mozambique, Tanzania)
- **EDU*AID*gwg => enrol** (2 cases: Gambia, Zambia)

Interpretation, iteration, robustness

- Can the findings be due to chance?
- **How many cases do we need for "robust" findings?**
- Some "significance" tables have been developed for the sufficiency analysis (Marx & Dusa 2011)
  - I am developing some for the necessity analysis in the above-mentioned guide
- Indicate a minimum number of cases needed by number of conditions included in the model, to achieve given levels of confidence that the TT rows represent robust sufficiency statement (not due to chance)
- The higher the number of conditions included, the higher the number of cases needed for the same level of confidence.

Concluding Remarks: Benefits of QCA

- Opens up new possibilities for impact evaluation and synthesis, answering questions about **necessity and sufficiency of the intervention and other factors**
  - What makes the difference under what circumstances? Answered directly / empirically
- Relations, explanations and generalisations emerge, which do not necessarily emerge with other methods (focus on **intersections rather than correlations** of factors)
- Procedures are potentially fully transparent and replicable (**internally robust**)
- **Construct-robust**: QCA forces evaluation teams to start from theory and requires **high conceptual precision** (particularly when calibrating conditions)
- Exposes both theoretical and empirical limitations of knowledge, by maintaining a **constant dialogue between data and theory**
- A rigorous qualitative method for Assessing Impact!

Concluding Remarks: Challenges of QCA

- Usually presents a **steep learning curve** – difficult to integrate the expertise in research or evaluation teams
- Close collaboration needed between P.I. and QCA expert
- **Time needed is usually unpredictable**: dependent on the number of iterations leading to satisfactory findings
- Requires well-developed Theories of Change
- **Requires at least 3-5 cases** (comparative method)
- Sometimes **findings** are: **too complex** to be interpreted; or simple but **counterintuitive** so similarly **difficult to interpret**!

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