The reliability of off-grid solar mini-grids in Kenya and Senegal: an accountability dissolved among stakeholders and systemic constraints

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2. Mini-grids in Senegal and Kenya: a comparative approach

3. Electricity reliability, an issue with little accountability

4. Conclusion: there are multiple chains of accountability, but they are dissolved among stakeholders and systemic constraints

1. The research question

1 / Solar mini-grids for populations far away from the grid are presented as environmentally, socially and financially sound investments in Sub-Saharan Africa

2 / That is why international players and national governments promote these solutions through assertive politics (funding, technical assistance, regulations)

3 / Nonetheless, a large part of decentralized mini-grids stop working or work in a degraded way relatively soon (for example, in Senegal, half of the remaining ERSEN mini-grids are no longer working after an average of 6 years (Semis, 2020))

4 / While international players and African governments focus in solar mini-grids deployment, how can we explain that mini-grids' sustainability draws relatively few resources? In what ways do these actors embrace the questions of reliability of this electrical service, from a practical, regulatory and political perspective? How does maintenance become an issue and redefine the interactions between actors?

Research object: sample of solar mini-grids in Senegal and Kenya, installed at least 5 years before data collection.

Disclaimer

Materials from Senegal are consolidated:

- Etienne, Emilie. « Reliability and accountability of off-grid solar electricity in Senegal ». *Flux* 129130, n° 3; 2022: 59-75. https://www.cairn-int.info/journal-flux-2022-3-page-59.htm
- Trompette, Pascale, Emilie Etienne, Rhosnie Francius. « At the Margins of the Grid: The Politics of Off-Grid Electrification in Senegal ». In *Off-Grid Solar Electrification in Africa: A Critical Perspective*, édité par Nathanael Ojong, Palgrave Macmillan Cham., 65-110, 2022. https://doi.org/10.1007/978-3-031-13825-6_3.
- Etienne, Emilie, & Pierre Robert. « Can isolated microgrids be viable? A longitudinal study of long-term sustainability in rural Senegal ». *Energy Research and Social Science*, In press.

Most materials from Kenya have been collected and analyzed with Théo Chamarande:

- Chamarande, T., E. Etienne, & S. Mathy. « Sizing isolated mini-grids in Kenya: Risk transfer to deal with multidimensional uncertainties and constraints ». *Renewable and Sustainable Energy Transition* 5; 2024: 100078. https://doi.org/10.1016/j.rset.2024.100078.

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1. The research question

2. Mini-grids in Senegal and Kenya: a comparative approach

- **2.1 From a bounded system to a multi-scalar vision of sustainability**
- **2.2 The fragmentation of the rural electrification sector in Senegal and Kenya**
- **2.3 The example of ERSEN mini-grids in Senegal: a multi-level social engineering**

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2.1 Literature review: from a bounded system to a multi-scalar vision of sustainability

The sustainability of mini-grids is mostly tackled through:

- Financial viability
- Technical aspects (ex: sizing)
- Local governance (ex: approach based on the Commons), socio-cultural aspects

These approach tend to consider mini-grids as bounded systems (Etienne & Robert, 2024)

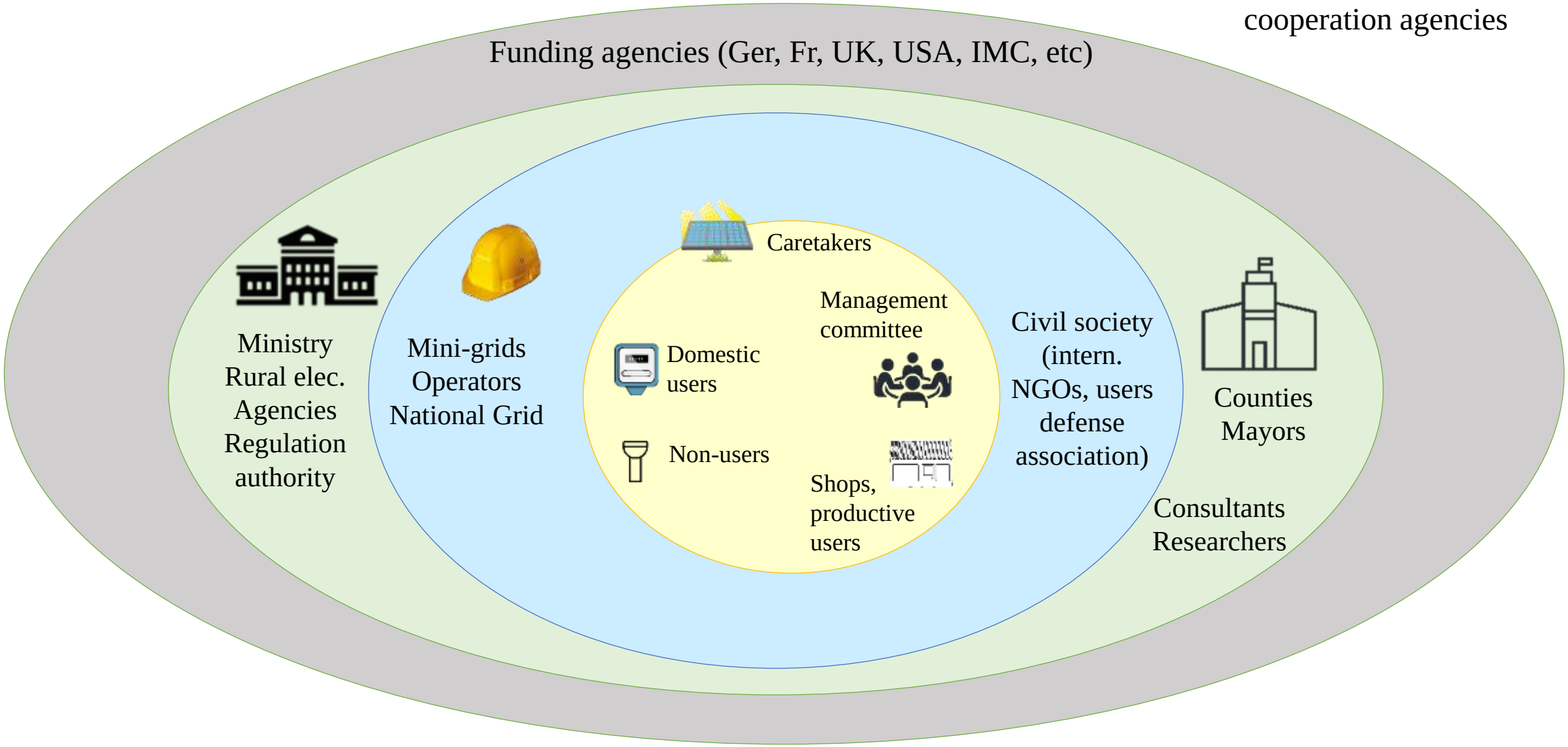
$\Rightarrow$ I rather focus on the political dimensions of electricity reliability, through the concept of accountability :

- How to *account for*, or to justify priorities?
- How are objectives *counted,* through monitoring and reporting tools?
- How are actors linked to one another through accountability mechanisms?

Accountability : «a relationship between an actor and a forum, in which the actor has an obligation to explain and to justify his or her conduct, the forum can pose questions and pass judgement, and the actor may face consequences» (Bovens, 2007)

2.2 Methodology and rural electrification fragmentation in Senegal and Kenya

- 144 interviewees
- 4 focus groups
- 3 days of participatory observation, with NGOs / cooperation agencies

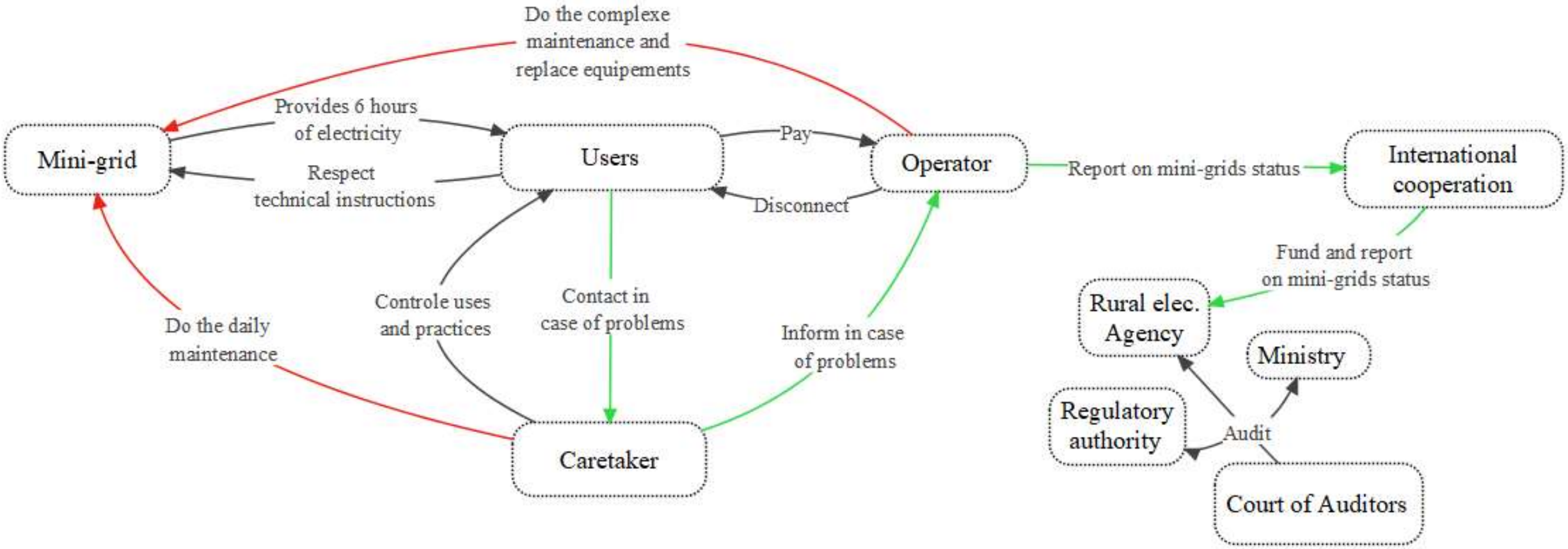


2.2 Methodology - Mini-grids management overview

	Senegal (4 ERSEN MG)	Kenya (T. MG)	Kenya (O. MG)	Kenya (K. MG)	Kenya (M. MG)
Funding agencies	International cooperation Senegalese SMEs	International cooperation	UK university REREC Battery company (in-kind donations)	International cooperation	Public sector
Developer	International cooperation Senegalese SMEs	International cooperation	UK university	International private company	National electricity company
Operator	Senegalese SMEs	County company International company (technical)	Village cooperative	International private company	National electricity company
Caretakers	Villagers	County company Sub-contracted villager	Village cooperative	Villagers	National electricity company
Monitoring	International cooperation Rural elect. agency	County company Regulatory authority	UK university	International private company	National electricity company
Payment systems	Fixed monthly fees (cash)	Pay-as-you-go	Pay-as-you-go	Pay-as-you-go	Pay-as-you-go

2.3 Example of ERSEN mini-grids: a multi-scalar « social engineering »

2.3 Example of ERSEN mini-grids: a multi-scalar « social engineering » (bis)



Key responsibilities of actors: red for those related to maintenance, black for others

Information flows related to electric service reliability (green)

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- **3.1 Electricity reliability monitoring systems: multiple information channels**
- **3.2 Insufficient penalties and incentives for comprehensive maintenance of mini-grids**
- **3.3 Competing priorities for State agencies at the expense of electricity service reliability**
- **3.4 State agencies face minor consequences in the event of rural electricity discontinuity**

4. Conclusion: there are multiple chains of accountability, but they are dissolved among stakeholders and systemic constraints

3.1 Electricity reliability monitoring systems: multiple information channels

In theory: mostly bottom-up monitoring systems

- *Users > caretakers > operators > State*
- *Kenya: smart mini-grid > operator (remote monitoring)*

In practice: multiple information flows, both bottom-up and top-down

- **Bottom-up:**
  - In Senegal, users often bypass caretakers and contact directly operators and State agencies
  - Informal communication networks (Whatsapp groups, phone calls) seem to be preferred over institutionalised channels

- **Top-down**
  - Senegal: one-off reports from the State and funding agencies
  - Kenya: regular planned visits from the Regulation authority (not in O. mini-grid)

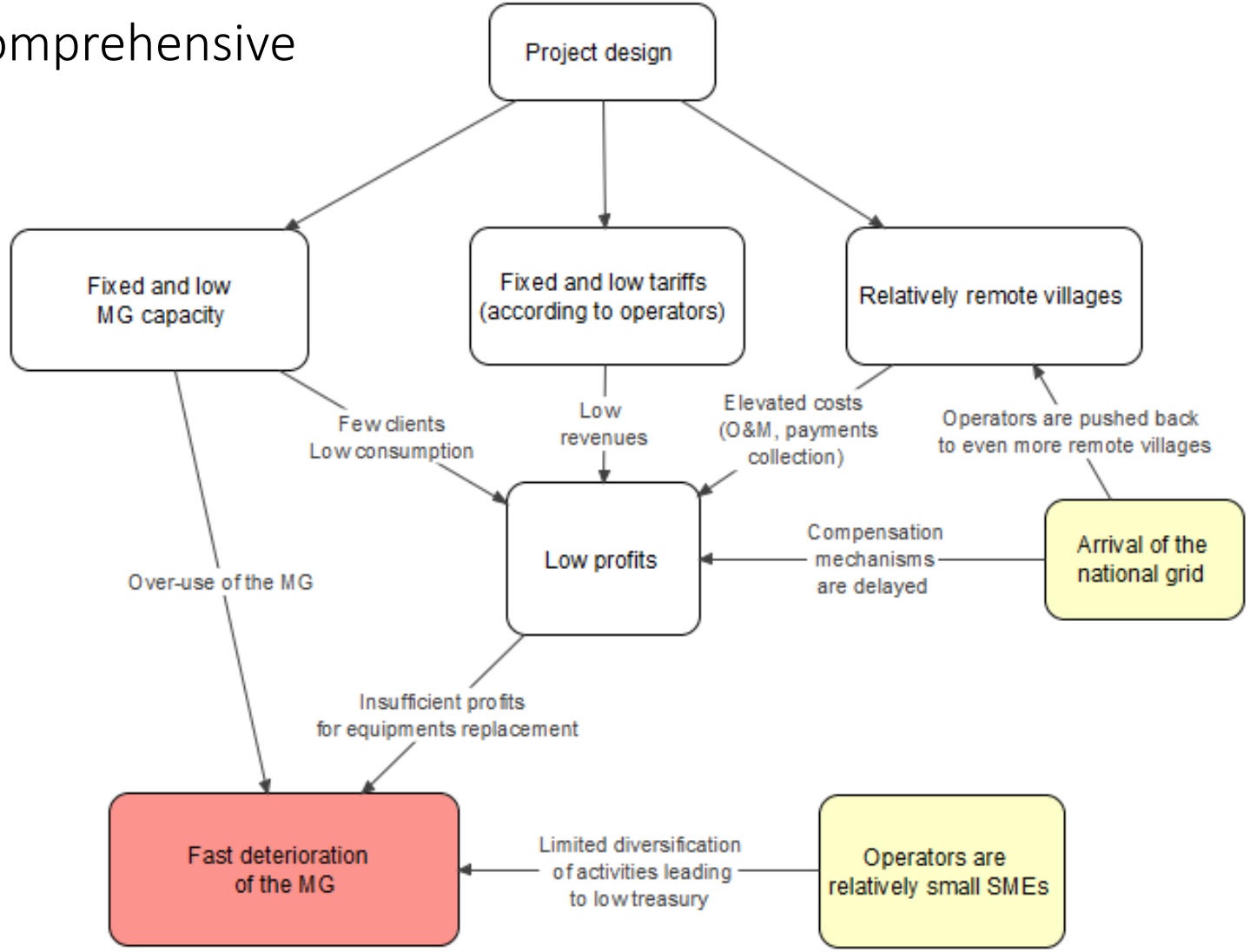
3.2.1 Little financial interest for a comprehensive maintenance of mini-grids

In theory: electricity bills cover operational costs (including replacement of faulty equipment)

In practice:

- Undersized MG: fast deterioration
- Oversized MG: low fees collected
- Optimistic assumptions on components' lifespan
- High costs for O&M
- One case: financial fraud

=> Profits are low/inexistent?



ERSEN MG cost-benefit tensions (Senegal)

3.2.2 Insufficient penalties for comprehensive maintenance of mini-grids

No financial sanctions have been applied to mini-grids operators. How can we understand this?

Senegal:

- Legal delays in operators contracting makes it impossible to apply sanctions
- Recognition of operators fragility (economics, human resources)
- Desire to support Senegalese SMEs

« It is our job, the job of NGOs and others, to strengthen these companies, especially as they are Senegalese companies. If they are strong companies, they will employ many more people, so the unemployment rate will decrease" (Rural Electrification Agency)

Kenya:

- Mini-grids provide relatively reliable electricity compared with the grid
- The O. mini-grid is not included in monitoring from the Regulatory Authority
- Dialogue is favoured over sanctions

3.3 Competing priorities for State agencies at the expense of rural electricity service reliability

Senegal:

- Rehabilitation of mini-grids is discussed
- BUT increasing the electrification rate is the top priority

Kenya:

- The main focus for mini-grids is deploying new ones in the North of Kenya
- The Regulation Authority also controls petrol, perceived as a more complex topic than mini-grids
- The grid itself has a medium reliability
- Devolution of energy to the counties: blurring responsibilities

3.3 Competing priorities for State agencies at the expense of electricity service reliability (bis)

Conceptualising the State priorities:

1. Cogent and inert indicators (Boussard, 2011)

Cogent indicators : related only to a "specific activity of the organisation" but radiate "throughout the organisation ", "extremely reductive".

Inert indicators : "have no life in the organisation“, "They are only figures, written on paper, perhaps even in colour, but which the actors do not use to express their work situation".

⇒While access to electricity is a "cogent" indicator, its reliability remains an "inert" indicator

2. *Decoupling* (Bromley and Powell, 2012, p. 7)

We see a phenomenon of decoupling between policy and practice, i.e. a situation where "rules are not routinely implemented or violated"

3. Forum drift (Schillemans, Busuioc, 2015)

State forums **choose** not to make operators accountable.

3.4 State agencies face minor consequences in the event of rural electricity discontinuity

Funding agencies > State relationship

Funding agencies: desire to promote market models: (fictional expectations; Beckert, 2016)

Plenty of funding for new public-private partnerships, but little for maintenance (Perros et alii., 2022)

Little financial pressure on the State for off-grid rural electricity reliability

SENEGAL'S SE4ALL RURAL ELECTRIFICATION

ACTION AGENDA AND INVESTMENT PROSPECTUS 2018

WORLD BANK GROUP ESMAP

3.4 State agencies face minor consequences in the event of rural electricity discontinuity

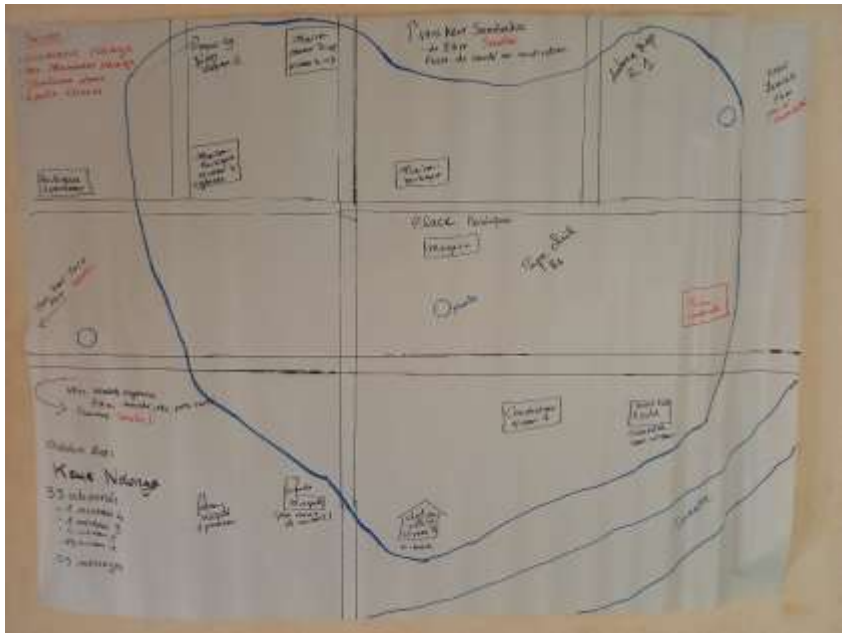
Citizens > State relationship

Geographic remoteness, small village size, multiple vulnerabilities

Hopes for a connection to the national grid (Senegal)

Little collective mobilisation on rural electricity

Little political pressure on the State to provide reliable off-grid rural electricity



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Conclusions

- Accountability chains exist
- They are multiple
- But they are dissolved among stakeholders and systemic constraints

=> (lack of) maintenance unveils “broader structures of privilege, inequality, and justice that shape who has control and whose interests are ignored” (Henke and Sims, 2020, p. 4)

Questionnements pour de futures recherches

- Comment mieux prendre en considération les évolutions de l'infrastructure et de ses acteurs dans le temps?
- Comment comprendre le peu de modularité mise en œuvre sur les mini-réseaux existants? Quelles sont les barrières techniques, financières, régulatoires, à cette modularité?
- Comment les données des « smart mini-grids » sont-elles utilisées? En quoi modifient-elles ou non les pratiques de maintenance et les poids des différents acteurs (usagers, gestionnaire villageois, exploitant)?
- Peu de modèles communautaires dans les cas étudiés: quelles différences en termes d'acteurs et de leurs évolutions?

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Thank you

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