

LESSONS FROM DEPLOYING LARGE SCALE SOLAR ELECTRIFICATION IN BANGLADESH. CAN THE LAST-MILE BECOME THE FIRST?



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AGENDA

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1 Introduction



Microenergy Systems at TU Berlin

The MES Research Group is dedicated towards the understanding, improving, innovating and communicating Fair & Sustainable Global Energy Systems Development & Transitions by taking a MicroPerspective.

Taking the MicroPerspective means taking the perspective of citizens, households and SMEs when it comes to energy access and energy transition processes.

We have an interdisciplinary approach. Our focus areas of research are:

- Energy & electrical engineering (grid studies, storage, development of DC appliances, ...)
- Socio-economics, business models, psychology
- Product & service design
- Macro Economics & Energy Policy

Setting the scene for SDG 7, energy access by 2030

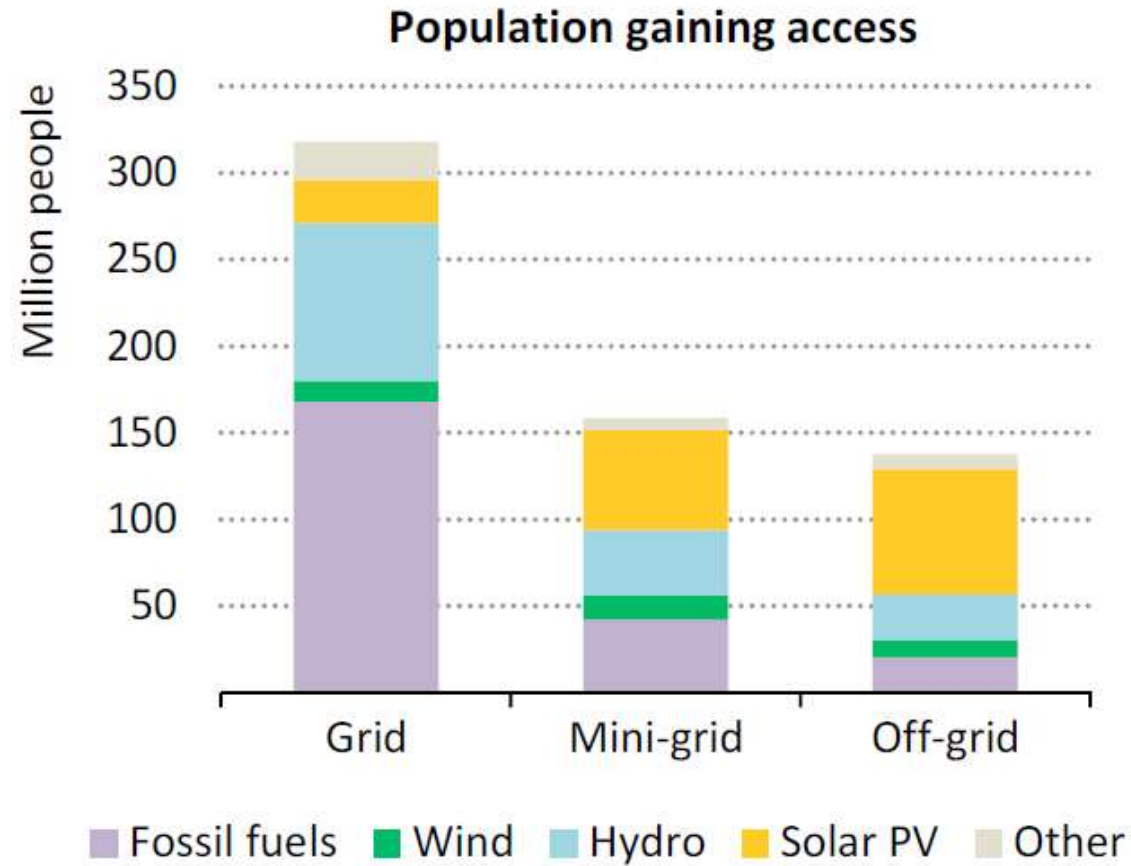


Figure 1: Cumulative population gaining access to electricity and cumulative investment in the New Policies Scenario, 2017-2030

Source: World Energy Outlook (2017)

Demand and possible solar PV sources for off-grid applications

Amount of Energy per Day	Energy Service (Applications)	Least Cost Energy Source Options
Up to 10 Wh	Pico solar systems such as solar lanterns, small telecommunication receivers, and small road signs	PV
Up to 100 Wh	Small solar home systems, medium telecommunication systems, road signs, and street lights	PV
Up to 1 kWh	Advanced home systems, large streetlights, schools	PV, wind, and small hydropower
Up to 10 kWh	Farms, global systems for mobile communication repeaters, large schools, health posts	Biofuel generator, PV, wind, and small hydropower
Up to 100 kWh	Mini-grids, large rural hospitals	Biofuel generator, PV, wind, and small hydropower

The case of solar home systems in Bangladesh

- 165 Million inhabitants
- Complex geography, climate **and** history
- Next eleven-market
- Approx. 40% had no access to electricity at the beginning of this century
- 15 Million households use kerosene lamps
- IDCOL & World Bank started credit-based SHS program in 2003
- from 50 000 units in 2003 to more than 4 million installed SHS in 2018
→ largest off-grid electrification initiative in the world



2 Methods & Theoretical Background

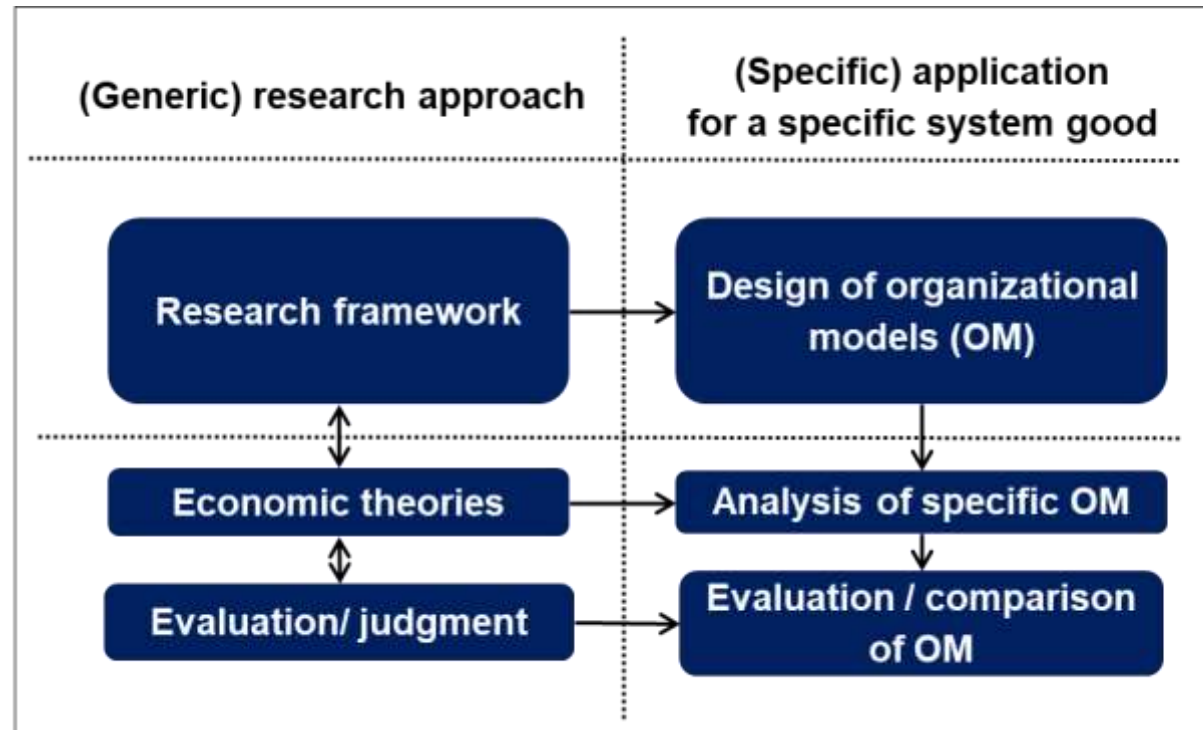
Research objective: can the last-mile become the first?

- Success factors of SHS deployment over the last two decades
- Critical assessment of the stakeholder perspectives to make last mile the first one
- Focus: organizational model (OM) analysis
- Outlook + potential of swarm grid electrification



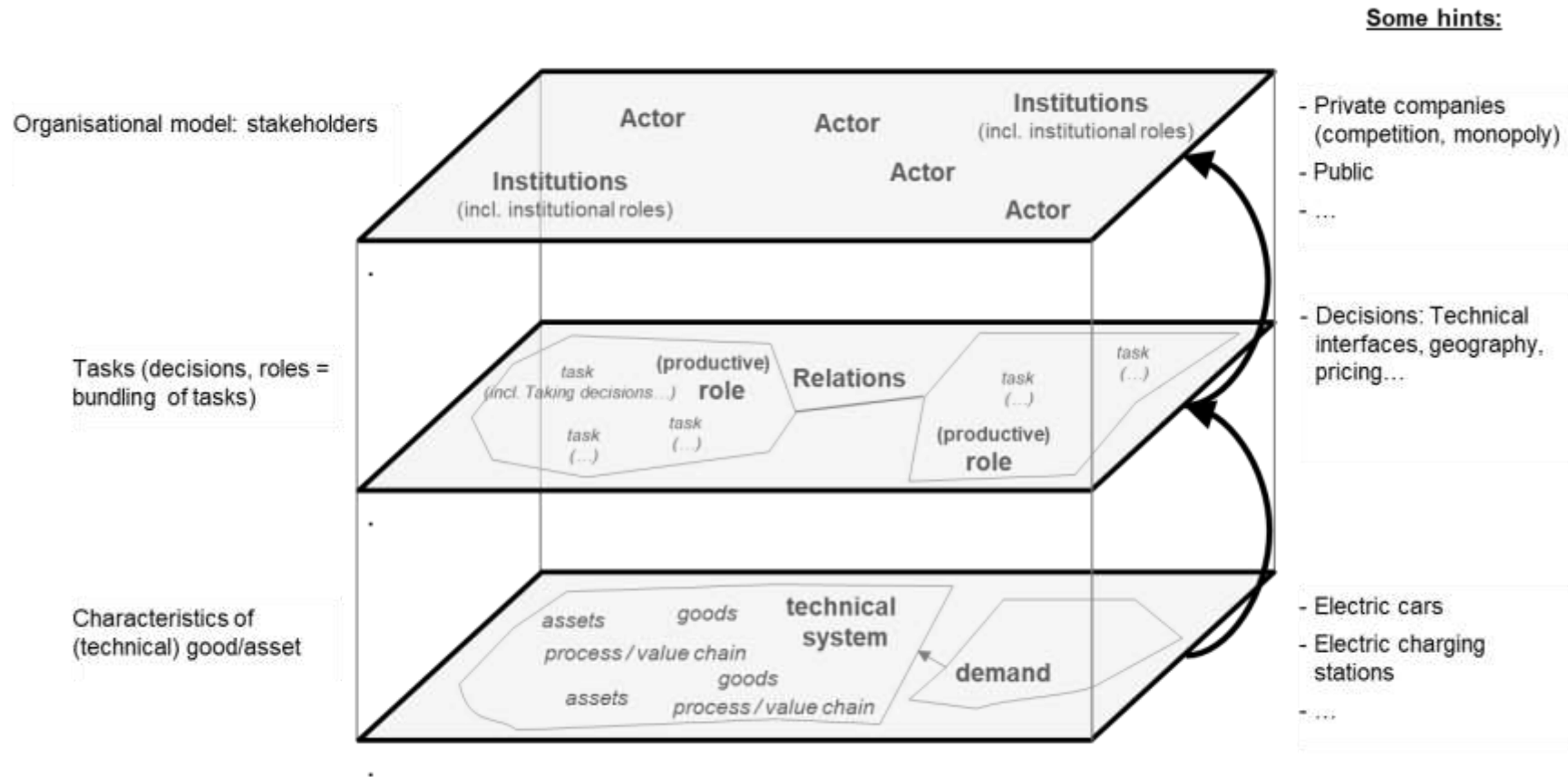
Generic OM for
large-scale SHS
deployment

Theory: organizational models for provision of infrastructure



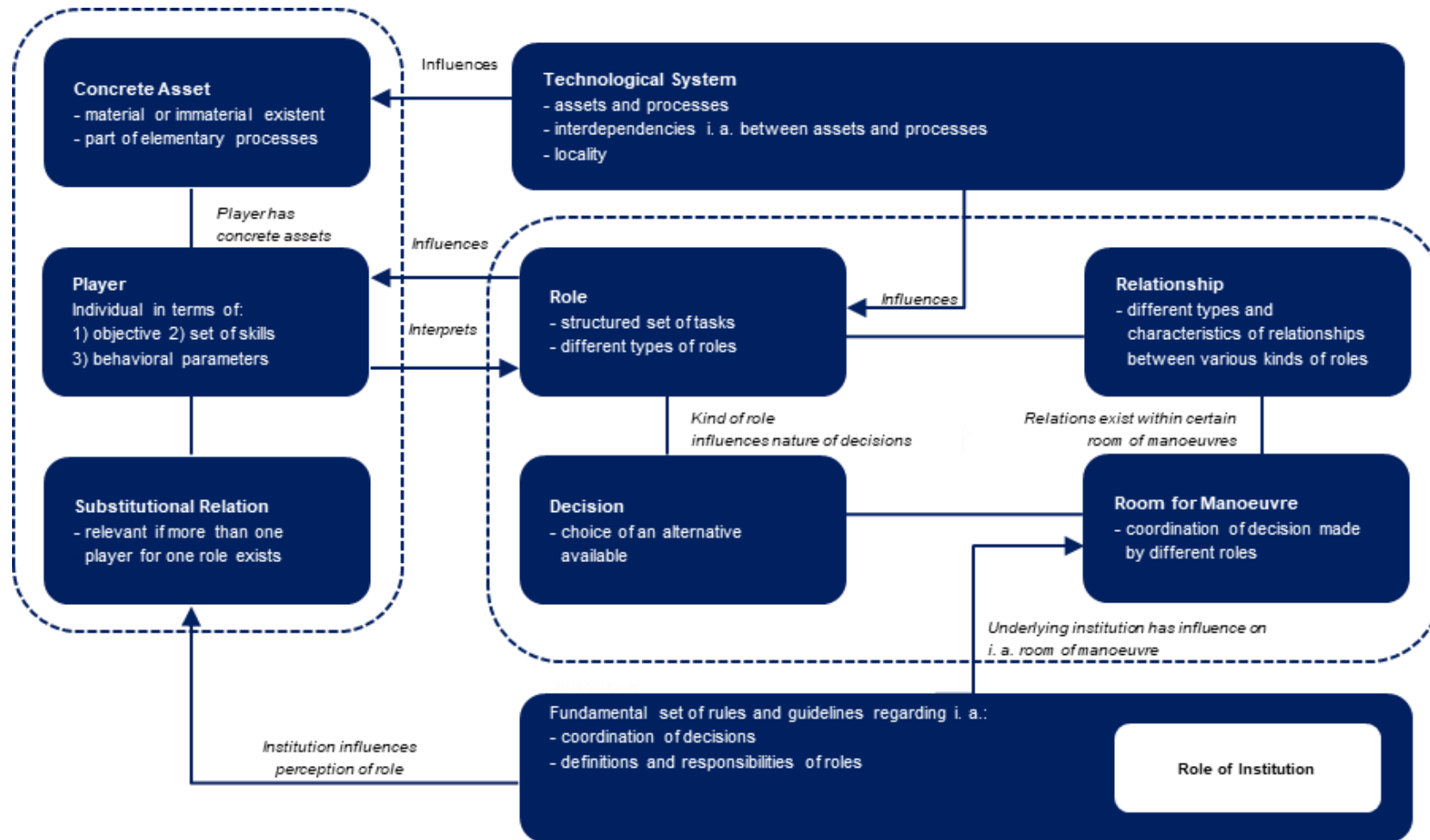
Source: Beckers et al. (2012).

Basic assumptions about key elements



Source: Beckers et al. (2012).

Central elements of the research framework



Source: Beckers et al. (2012).

3 Findings

3.1 Literature review

- 100 publications reviewed
- 28 publications have been shortlisted and finally referenced
- Principal references:

Martinot, E., Cabraal, A., Mathur, S., **World Bank/GEF solar home system projects: experiences and lessons learned 1993–2000.** *Renewable and Sustainable Energy Reviews*

- review of 12 SHS programs, valuable source for understanding the challenges at the beginning

Bertsch, N., Marro, P., **Making RE a Success in Bangladesh: Getting the Business Model Right.** *ADB South Asia Working Paper Series*, 2015.

- most consistent review of the Bangladeshi SHS program

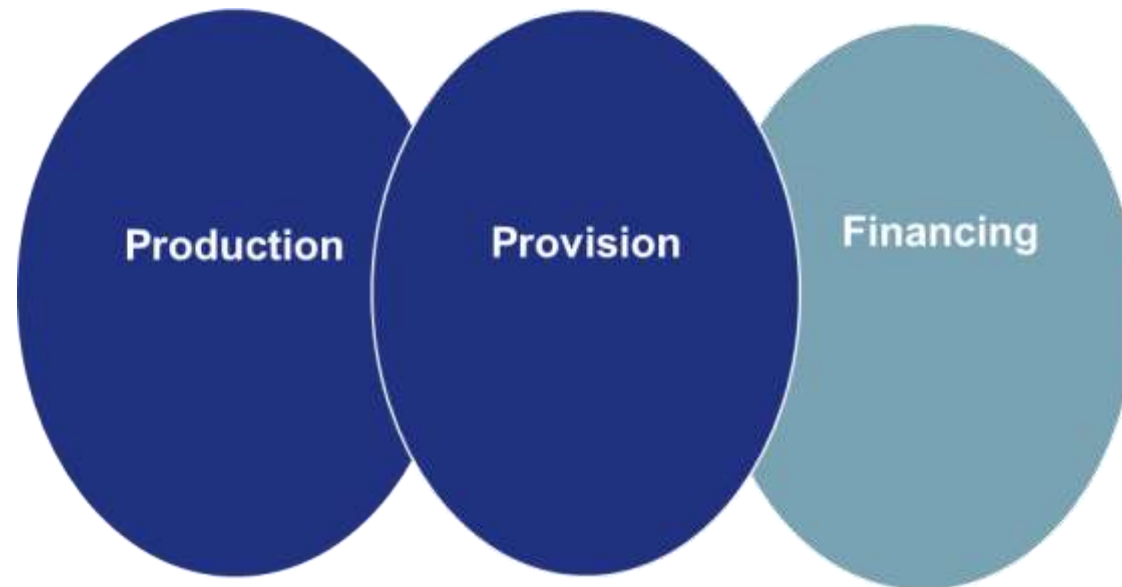
Tiedemann, S., **The Bangladeshi Solar Home System (SHS) Programme: Relevance and Development of the Supply Side.** *CISD Yearbook of Global Studies*, 2015.

- unique discussion of the supply side

Tyabji, N., Chase, J., **IDCOL-lapse: the unmaking of an off-grid solar market,** *Bloomberg New Energy Finance: New York*, 2016.

-> rare publication on the recent collapse

3.2 Scope of research



Furthermore, our OM analysis is divided into the following phases:

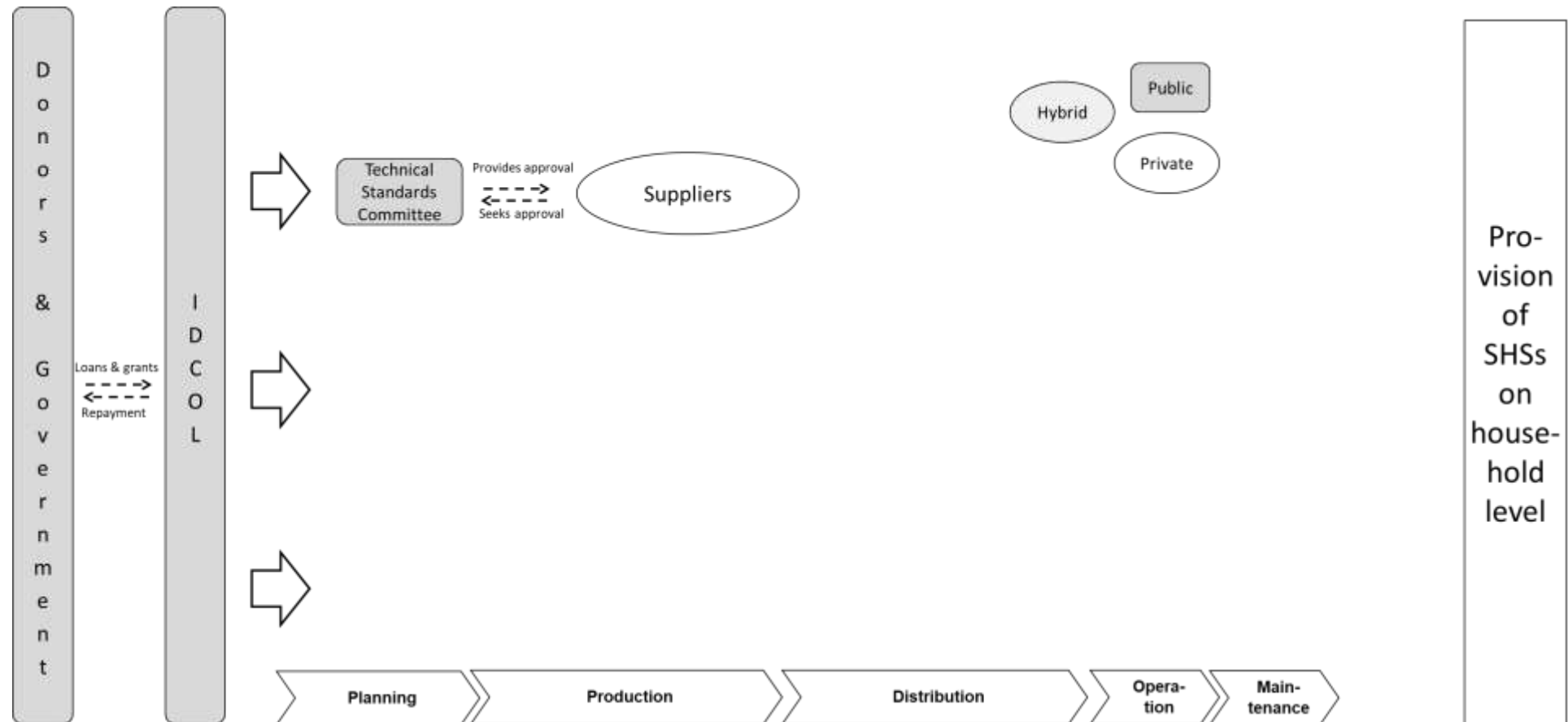
- (i) early days (1991 – 2002)
- (ii) take-off (2003 - 2010)
- (iii) peak (2011 – 2014/2015)
- (iv) recent developments (2016 – present)

3.3 The proposed organizational model (1)



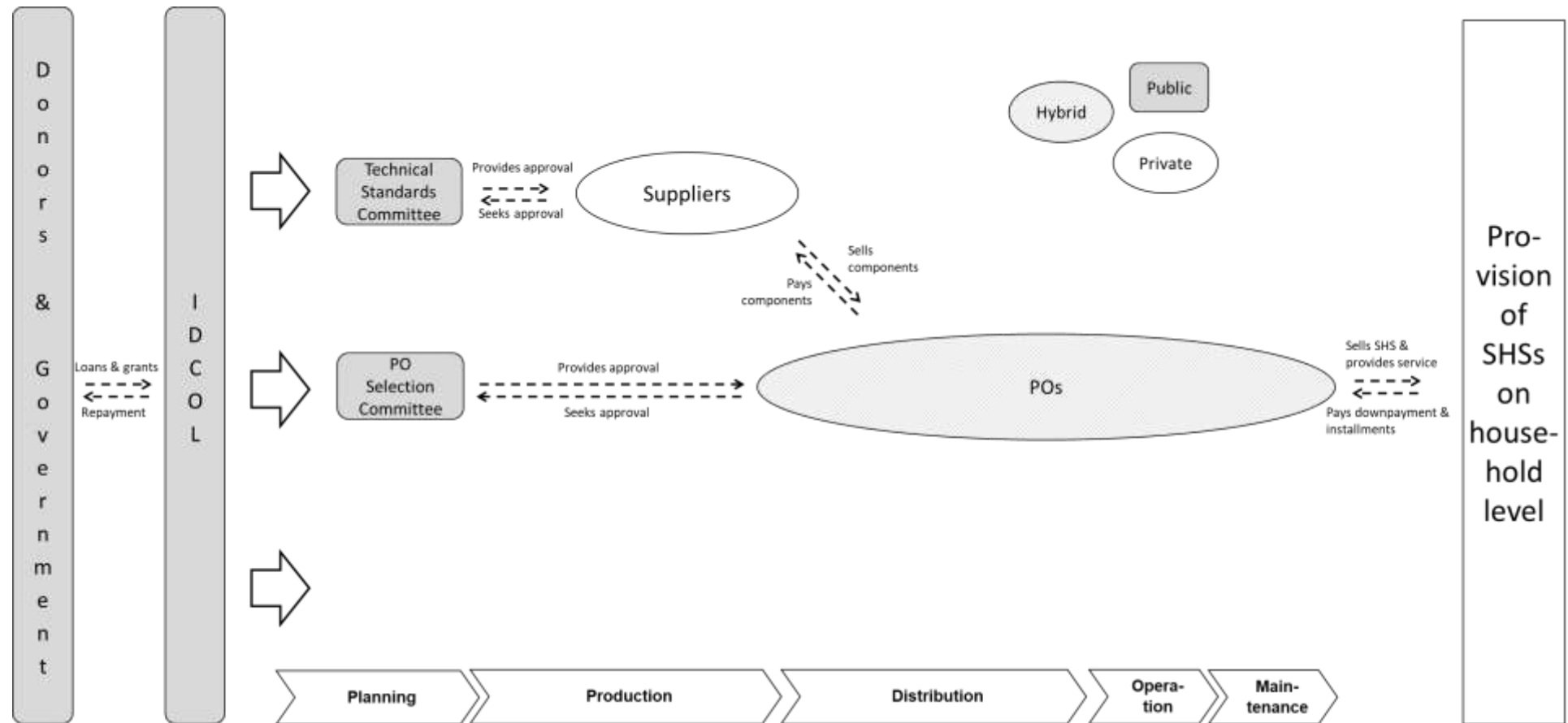
Source: own compilation

3.3 The proposed organizational model (2)



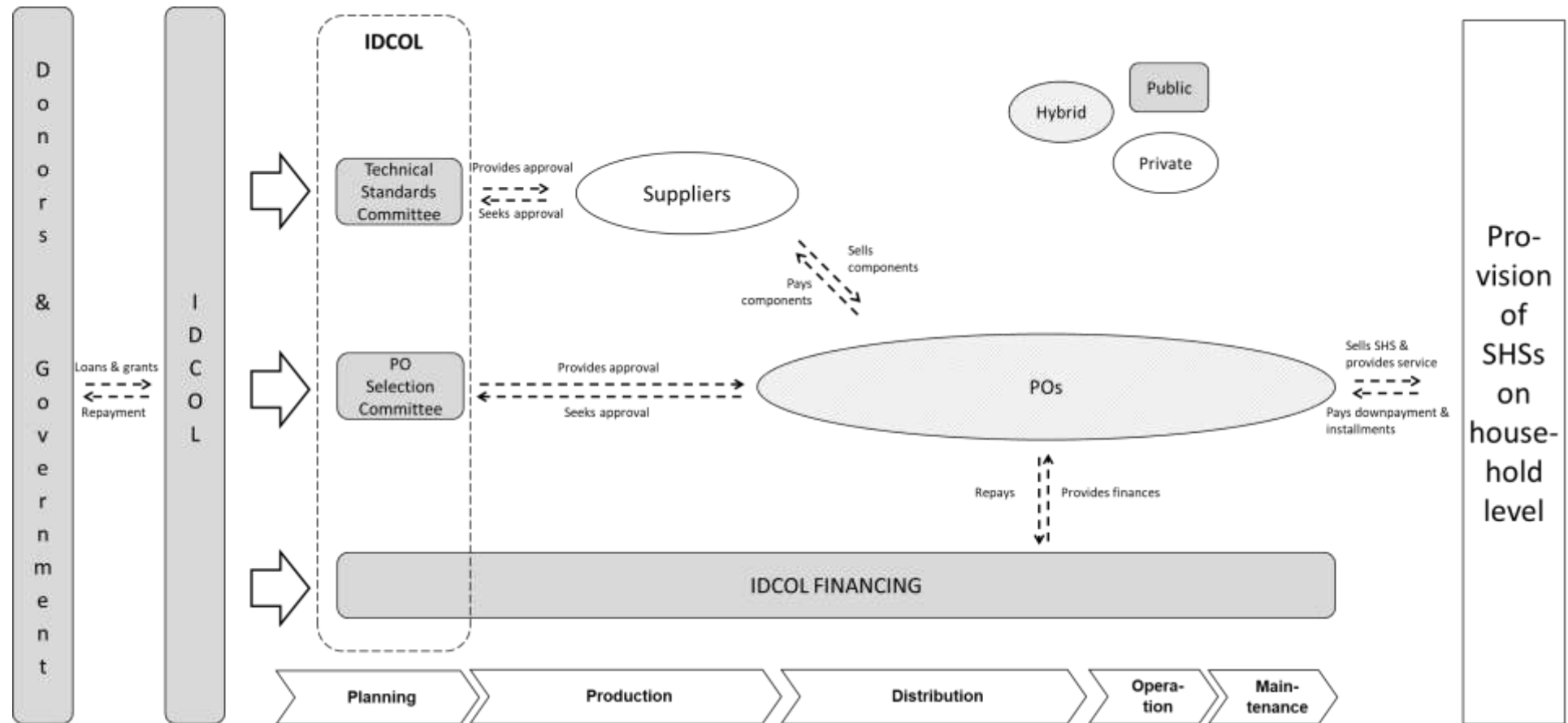
Source: own compilation

3.3 The proposed organizational model (3)



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3.3 The proposed organizational model (4)

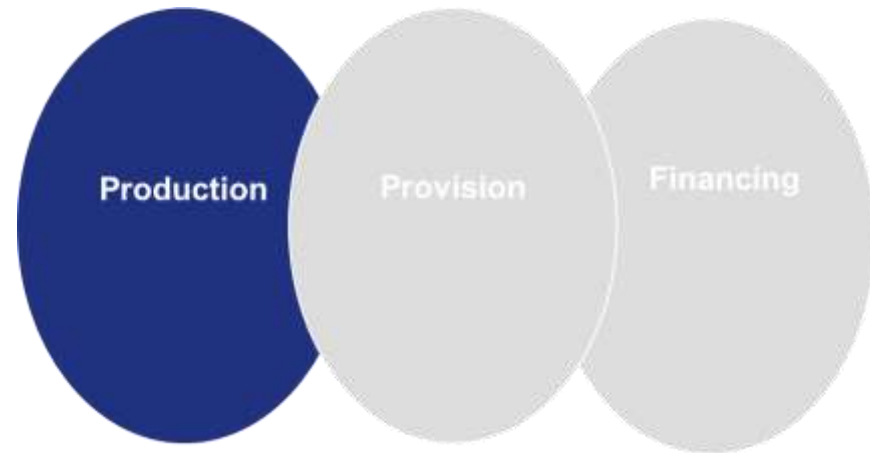


Source: own compilation

3.4 Part 1: Production

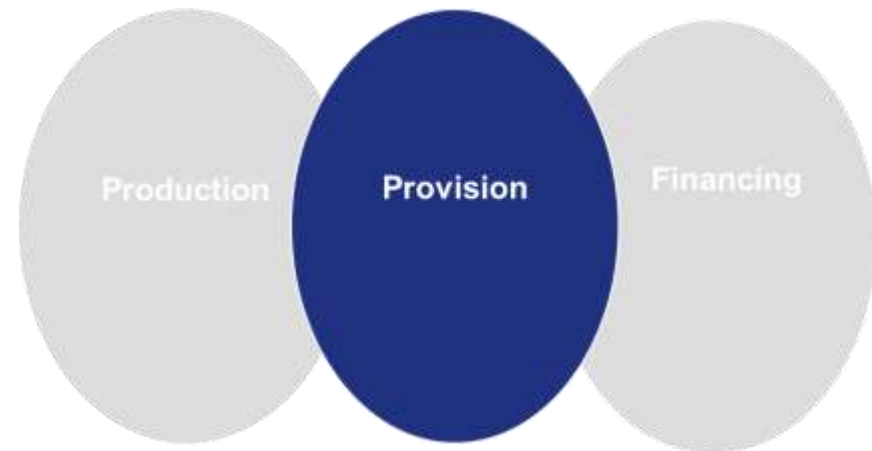
- IDCOL fostered local manufacturing.
- Manufacturing examples:
 - Charge controller
 - Battery

- Findings:
 - Diverse supplier structure & efficient supply chain
 - More than 30 000 jobs created
 - SHSs are 50% cheaper than in East Africa



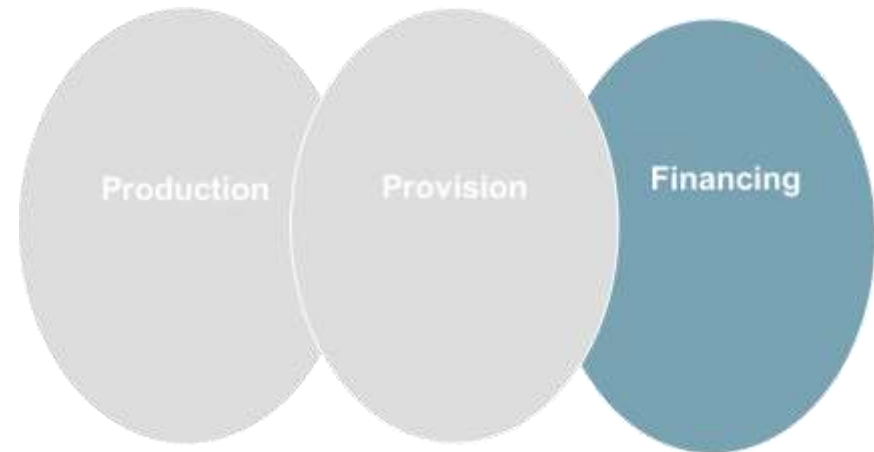
3.5 Part 2: Provision

- Last-mile provision is key driver of success
- Examples:
 - Partner Organisation Grameen Shakti
 - Battery component
- Findings:
 - Efficient decentral distribution scheme
 - Healthy competition
 - Strong quality control



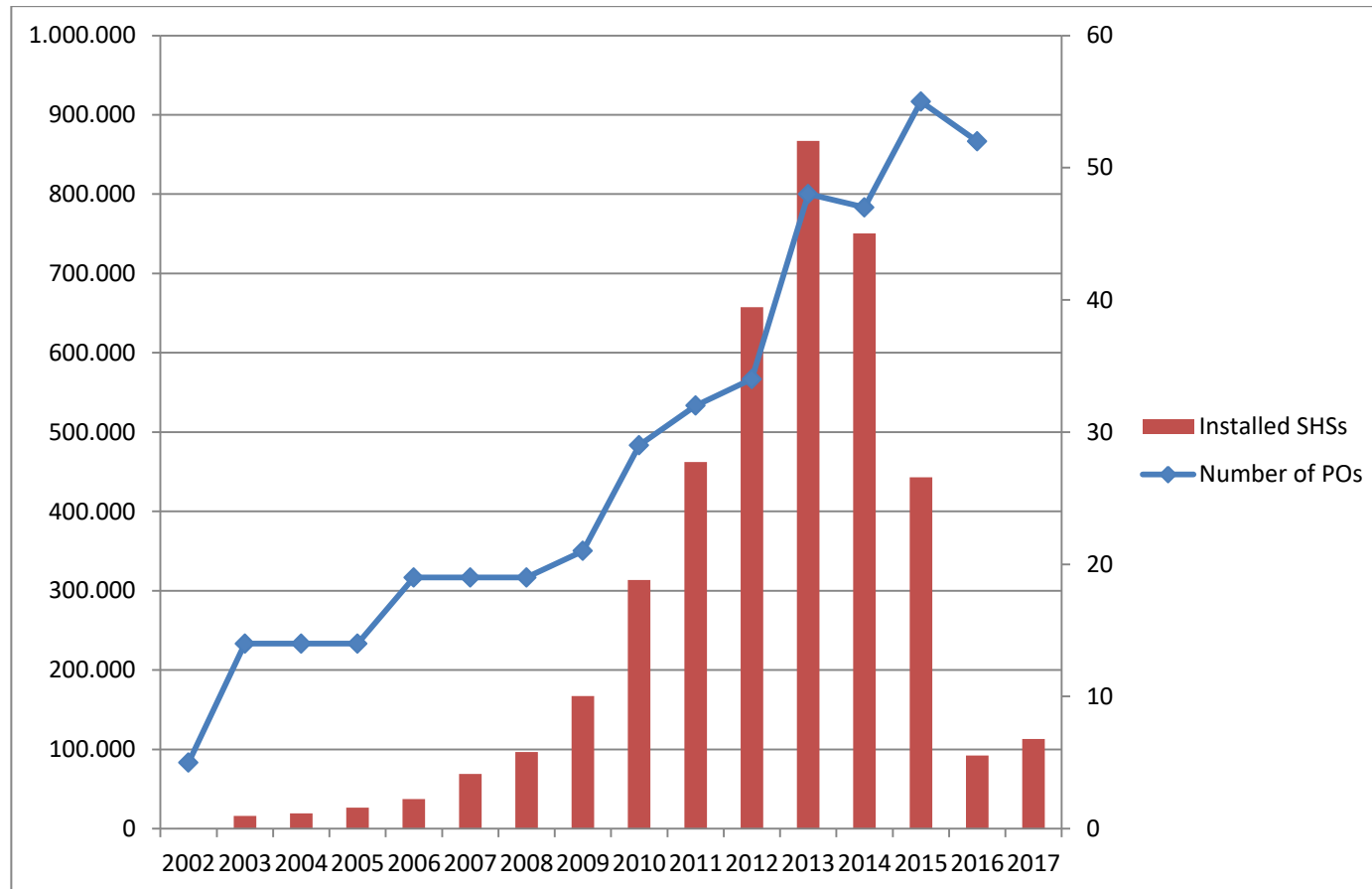
3.6 Part 3: Financing

- Most critical component
- Soft loan facility made the success possible
- Examples:
 - Buy-down grant for households
 - Refinancing
 - Institutional grant
- Findings:
 - 4 million systems deployed
 - Cost to government: USD 700 million or USD 170 / SHS
 - Centralized management

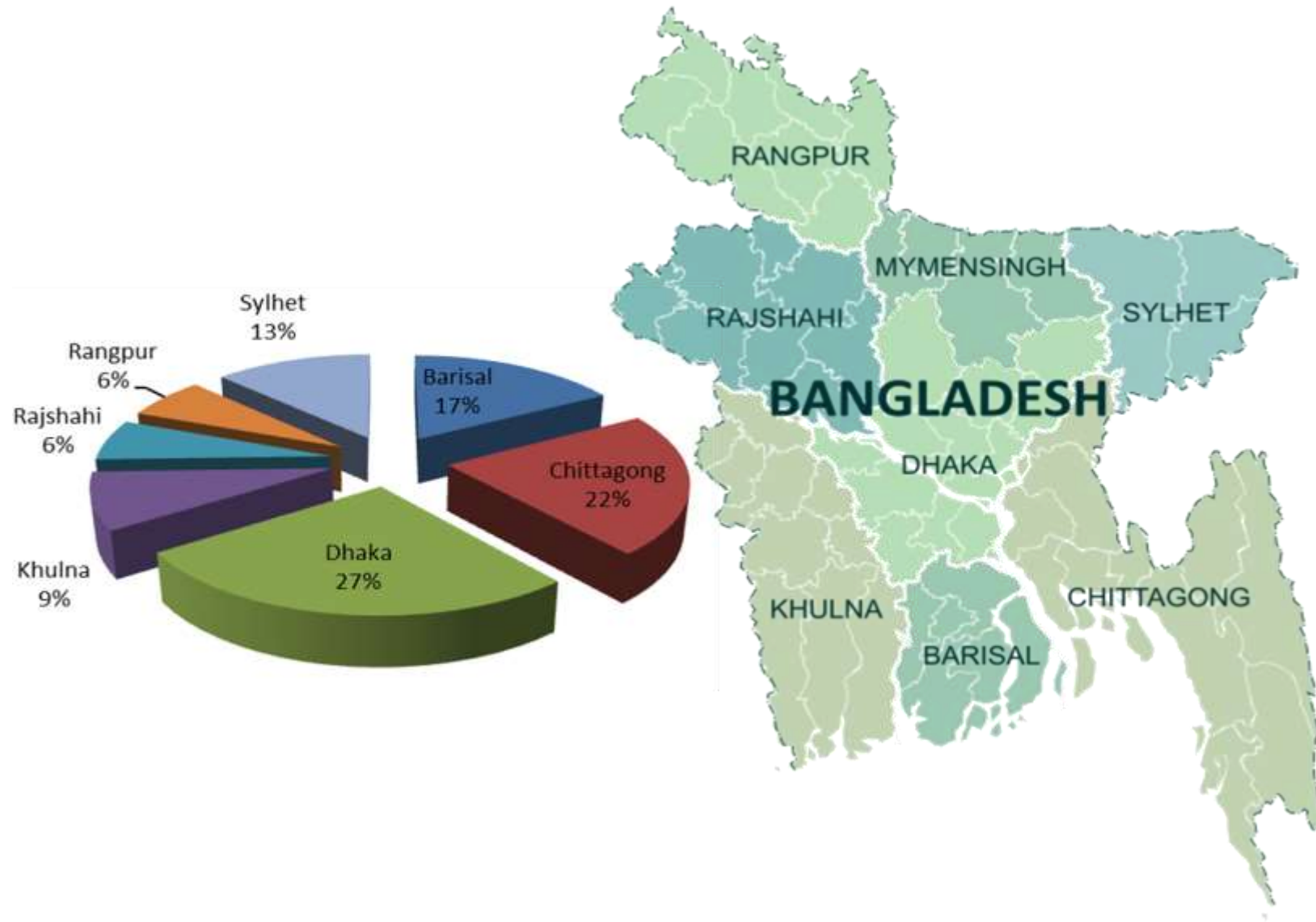


4 Outlook/further research

4.1 Installed SHSs vs. POs



4.2 Geographic distribution of installed SHSs



5 Final conclusions

Provision

- MFI structures highly useful for rural and decentral distribution
- POs were unique forms to organize distribution
- Are they really sustainable?

Financing

- IDCOL was the key driver for a sound financial ecosystem
- Top-down approach was efficient to kick-start program
- Expansion vs. consolidation



Production

- Strong and well-developed supply side
- Indirect government support fostered private sector development
- How to protect against (cheap) imports?

Outlook

- Reasons for the collapse
- How can innovation (P2P) solve recent challenges?
- Which country is next?

Thank you for your attention!

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