

Central- vs. Decentral Infrastructure Supply: General Consideration and Application to Nigeria

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Overview

Due to multiple economic, demographic and social challenges in undeveloped countries and especially rural areas, most countries in Sub-Saharan-Africa (SSA) are discouraged and not capable of overcoming bad economic performance and too little growth. One option to help undeveloped countries out of that unfortunate situation is electrification, which through its direct and indirect effects can lead to sustainable economic growth. Figure 1 shows the cycle of potential effects triggered by electrification.

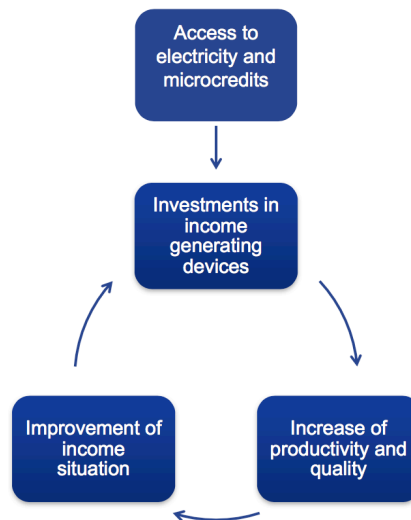


Figure 1: Potential Cycle of Development

Source: (Weiß/ Bütow, 2017)

While some parts of SSA suffer from political instability or insufficient education as well as inefficient administrative management, central and widespread projects seem almost unrealistic to succeed.

The crucial question now to answer is: According to which method shall the electrification now be implemented?

Methods

There are two existing basic theories dealing with contrary strategies. One the hand, Alfred O. Hirschman advocates the Bottom-Up (1966) approach and unequal growth, on the other hand, Jeffrey D. Sachs supports the Top-Down and equal growth approach (2015). Each strategy requires investment capabilities whose availability is the decisive factor for success or failure of the project.

Bottom-Up seeks first to establish such capabilities before the actual goal can be succeeded and does not require every single sector within the certain system to be kept on a very equal level of development. The progress can be considered as a “rocking chair movement”.

Top-Down requires investment capabilities from the beginning without actually establishing any. It offers a catalogue of solutions which can be adapted to any issue. The respective government then has to translate the theory into action on its own.

Furthermore an adequate power generating technology needs to be identified. Options are mainly Solar-Home-Systems (SHS), Microgrids or the Maingrid extension (MGE). SHS and Microgrids are generally rather decentral solutions, whereas the MGE is considered as a central one. Through detailed clustering the respective demand specifications can be identified and an adequate technology can be identified. In the following case study a geographic analysis has been chosen, in which the respective concentration of population as well as the availability of electricity supply in a certain area were determined and referred to the adequate instrument of electrification.

Results

In general an undeveloped country could never fulfill crucial requirements like the sufficient availability of investment capabilities to successfully implement a complex project as the electrification of millions of people. Therefore a strategy according to Top-Down cannot be the right choice. A Bottom-Down oriented method is a way better solution.

As the case of Nigeria shows there is no technology that can completely cover the demand on the least costs level, but an at least hybrid combination of Microgrids and Maingrid extension seems to be able to cover most of the demand. According to the case study the rather central solution of MGE could serve almost 80% of the demand while the decentral supply could only assure about 20% on the long run. Figure 2 presents the evaluation of this survey.

- Total results
 - Grid electrification: 34,446 cluster 57.1 million ppl
 - Mini-Grid electrification: 3,800 cluster 12.8 million ppl
 - SHS electrification: 7,210 cluster 2.8 million ppl

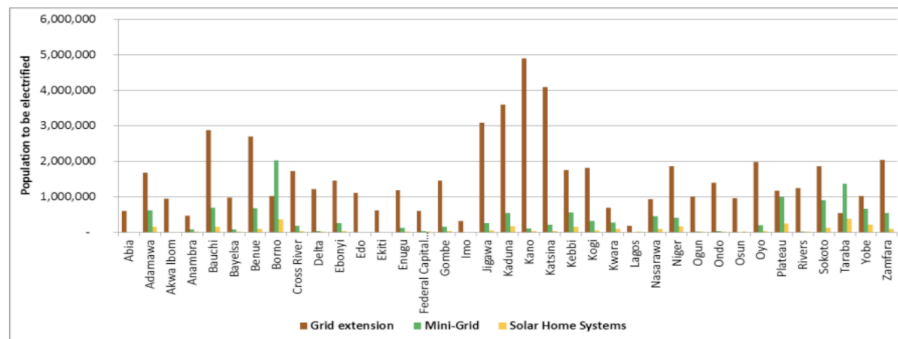


Figure 2: Total Result of the Geographic Analysis

Source: (Bleching, 2016)

Conclusions

According to this case study only decentral energy supply cannot cover the existing and developing demand economically, but can at least offer a temporary solution. The process of first electrification, due to its complexity, will definitely take some time. Electrification does not only include the connection but also the process of making it useful. Figure 1 above for instance presents the availability of microcredits as a second requirement to generate actual economic progress.

This is only one example of many why the electrification of SSA is such a complex project and therefore needs a detailed, accurate and efficient strategy of implementation. The analysis of basic theories and evaluation of power generating technologies are two of the most decisive factors .

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