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Nigeria's power sector: Analysis of productivity

Carlos Pestana Barros [a], Ade Ibiowie [b], Shunsuke Managi [c,*]

[a] Technical University of Lisbon, Rua Miguel Lupi, 20, 1249-078 Lisbon, Portugal

[b] Department of Actuarial Science, University of Lagos, Nigeria

[c] Graduate School of Environmental Studies, Tohoku University, 6-6-20 Aramaki-Aza Aoba, Aoba-Ku, Sendai, 980-8579, Japan

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ABSTRACT

Nigerian electricity market is characterized by inadequate electricity generation framework, compounded by lack of timely routine maintenances. This results in significant deterioration in plant electricity output. This study analyzes the productivity changes in the Nigerian power sector. Productivity increased on average in the power sector by the adoption of new technologies from best-practice power plants. The assumption of Hicks neutral technological change is found not to be suitable for the Nigerian power sector. This study finds that the plants are not using their capacity meaningfully, instead, there is a tendency to use labor.

1. Introduction

Nigeria needs to improve efficiency and reduce waste in the public sector, and strengthen the private sector as its engine of growth (Wolde-Rufael, 2009). It is generally accepted that this feature will only be achievable with an efficient electricity generation as the latter affects every gamut of the economy. Unfortunately, although the power sector is one of the most important industries supporting infrastructure of the country, electricity generation has remained underdeveloped and is in short supply. While the country is richly endowed with a vast supply of gas, coal, as well as solar and hydro resources, these seemed to be only sparingly applied. Currently, power generation is mainly from thermal plants, which contribute to about 60%, and hydro power plants that generate about 30% (Tallapragada, 2009).

The motivation for the present research is as follows. First, it is important to analyze the context of the Nigerian electricity market which is characterized by an inadequate electricity generation framework. This is compounded by a lack of timely routine maintenances, thereby resulting in significant deterioration in plant electricity output, which is a key reason for the lingering electricity power crisis. More than two decades of underprivileged planning and underinvestment has left a vast supply deficit (Ikeme and Ebohon, 2005). Furthermore, not much new infrastructure has been added in over a decade, despite rapid population growth and rising demand for power. The power sector has been in a state of collapse. In 1999 average daily generation was 1750 MW.

The situation, even after more than 10 years, is not really different as available capacity output is still less than 2.5 GW. Various measures that have been taken in the past to address the electricity generation and distribution problems seem to have yielded little or no results. This apparently led the federal government in 2004 to embark much needed reforms that was aimed at decentralizing operations in the power sector. Conceptually, the reforms were to solve a myriad of problems,

* Corresponding author.
E-mail address: managi.s@gmail.com (S. Managi).

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including limited access to infrastructure, low connection rates, inadequate power generation capacity, inefficient usage of capacity, and lack of capital for investment, ineffective regulation, high technical losses and vandalism, and insufficient transmission and distribution facilities (Adenikinju, 1998). In short, Nigeria seeks policies that can promote least-cost electricity generation while ensuring a constant increase in production.

Second, to adopt a performance model aiming to analyze the production of Nigerian electricity plants to investigate whether there are improvements in efficiency and productivity in the sector after the reform. Therefore, this study applies a data envelopment analysis (DEA) model to the Malmquist Index with biased technological change to frame the productivity change of Nigeria's power stations. Finally, this research aims to identify a sound energy policy that can assist Nigeria to improve its energy capacity through improved performance.

The remainder of this paper is organized as follows: Section 2 presents the contextual setting; Section 3 details the methodology; Section 4 presents the data and the results, and Section 5 concludes.

2. Background: energy in Nigeria

Electricity generation in Nigeria started in the city of Lagos in 1896. In the northern part of the country, the Nigeria Electricity Supply Company (NESCO) began operations in 1929 as an electric utility company in Nigeria with the construction of a hydroelectric power station at Kurra near Jos. The first attempt to coordinate supply and development of electricity occurred in 1951 with the establishment of the Electricity Corporation of Nigeria (ECN) by an act of parliament. In 1962, the first 132 kV line was constructed, connecting Ijora Power Station to Ibadan Power Station.

The Niger Dams Authority (NDA) was established in 1962 and was given the authority to build the hydro power prospects for the country. It sold electricity to ECN. However, ECN and NDA were merged in 1972 to form the National Electric Power Authority (NEPA), a company with exclusive monopoly over electricity generation, transmission, distribution, and sales throughout the country. Despite its long history, NEPA's development has been very slow and electricity generation in Nigeria had deteriorated over the years. This is rarely expected given the country's rich endowment in natural resources that could facilitate electricity production. The company from the inception appeared to be faced with the problems of lack of adequate funding and managerial strategies resulting in the steady decline of the company (Adoghe, 2008). While the transmission and distribution deteriorated, the demand for electricity continued to increase. This is in spite of the fact that many corporate organizations have folded up as a result of the harsh operating environment occasioned, in large part, by the poor and haphazard supply of electricity.

The paradox is easily explained by the increasing demand in domestic requirement resulting from an ever-increasing population. Analysts (see Tallapragada, 2009; Adoghe, 2008; Okoro and Chikuni, 2007) have advanced some reasons for the continued problem in the sector. A huge investment was undertaken in the area of power generation without a corresponding investment in the transmission and distribution networks. Other reasons identified include weak governance, poor institutional capacities, and inadequate investments. It is a classic example of the developmental paradox where there are tremendous resources, but little dividends.

Nigeria's economy is characterized by a large informal sector many of whom depend on electricity for daily production and livelihood. Since NEPA electricity is not always available many of whom have been forced to buy generators to continue production. This immediately has the effect of increasing their cost of production. Those who cannot afford the luxury of grid electricity are forced to abandon the trade often for no visible alternative. The result is that the rate of unemployment continues to rise. The experience in the formal sector is not much different, as corporate bodies have had to self-generate electricity in order to maintain production.

There is significant suspicion and conflicts between NEPA officials as provider on the one hand and consumers on the other, thereby encouraging illegitimate activities such as illegal connections to the national grid or the existing residential/industrial outfit, overbilling and under billing, payment via unscrupulous business collusion, and canalization of equipment which are then resold, in most cases, to private electricity institutions (Subair and Oke, 2008).

Often NEPA is confronted with reckless development of areas, which does not match its efforts. For example, small industries unexpectedly spring up in areas planned as residential. As a consequence, transformers and cables are overloaded until they are damaged. This is problematic since NEPA is not notified when new loads are added to existing ones. The costs of power supply interruptions are fairly large because of the predominating utilization of private generators for homes and industries with fire and health hazards, disturbance of scheduled productive activities and reductions in output. Furthermore, the unpredictable power supply often results in equipment malfunctioning (Subair and Oke, 2008). Currently, the national electricity grid consists of nine generating stations (3 hydro and 6 thermal). However, as stated, supply capacity largely lags behind demand in the country. Although some state capitals are connected to the national transmission grid system, they are served only haphazardly. In these circumstances, the proposed national integrated rural development is elusive as disabilities are experienced in every facet of NEPA operations.

In 2000 government restructured the power sector by unbundling NEPA into eighteen separate companies composed of six electricity-generating companies, one transmission company and eleven distribution companies. The restructuring was designed to encourage private participation by breaking NEPA's monopoly and paving way for Independent Power Producers (IPPs). It is yet to be seen whether the reforms will bring much desired changes, as the new structure is yet to be fully operational.