

Evaluation of Impact of Electricity Industry of Nigeria on Rural Electrification in Adamawa State of Nigeria

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Abstract

This paper evaluated the impact of electricity privatisation under Yola distribution company (YDCN) in rural Adamawa. Data used in this paper is obtained through a study involving 500 households in 9 local governments and focus group interviews. Under YDCN the enterprise aim at effective distribution of power, improve access and apprenticeship. The study used both qualitative and quantitative research techniques to obtain data on the privatization of electricity in the state. The result show that YDCN contributed to the objectives of energy regulation through improving of power supply and people livelihoods. However there were challenges, include irregular distribution of power, uneven connection of households and non-automated system of tariff. This paper implies that effective incorporation of public-private partnerships should focus attention to effective service with collective action, which ties the consumers on productive uses of power, apprenticeship, and economics growth through energy sustainability with balancing the aim of expanding the power supply and poverty alleviation

Keywords: Privatization; sustainable energy; regulation; rural poverty

1 Introduction

Privatization of electricity is the transfer of ownership of assets of power sector from public to the private enterprises with view improving efficiency. Privatisation is usually upheld as a means of improving economic performance in developing countries. However, the policy remains controversial in Nigeria and the relative roles of ownership and other structural changes, such as competition and regulation, in promoting economic performance remain unreliable (Parker and Kirkpatrick, 2007). The main justification for privatizing electricity networks involves 'recycling' publicly owned assets to fund other infrastructure sectors such as transport, conveying lower consumer electricity prices and providing greater quality of service by improving network of companies efficiency (Nepal and Foster, 2017). Liberalisation policy of power sector of the Federal Government of Nigeria (FGN) in 1998 has failed to attract investors, seven years later the government introduced the Electric Power Sector Reform Act (EPSRA) and established the Power Holding Company of Nigeria (PHCN), the initial corporation, and then unbundled it into 18 companies for effective energy distribution in the country (AEFC, 2017). The 18 companies is divided in to six (6) generating companies, one (1) transmission company (i.e. Transmission Company of Nigeria-TCN), and eleven (11) distribution companies (Awosope, 2014). The idea was to centralise the government's power producing assets in order to sell them to more efficient private investors that could recover and optimise production. New regulatory structures were put in place and a long-term policy was devised through public private partnership (PPP). Provision of universal energy is one of the components of the Sustainable Development Goals (SDGs) and there is a connection between the improvement of energy sector and achievement of SDGs as without access to energy the poverty reduction and community development will be an un fulfil vision (Terrapon-Pfaff *et al*, 2014). Access to electricity is a pre-requisite for sustainable livelihood and development. It is argued that modern sources of energy are basic for the improvement of living standards of populaces, creation of jobs opportunities and boosting productivity (Dinkelman, 2010; Akpan *et al*, 2013). Access to Power supply promotes economic and social development and leads to improvements in the quality of life

(Bensch *et al*, 2010). Lack of access to clean and affordable energy is considered as core dimension of poverty. The issue of disregarding of rural areas, public institution capacity, accountability and transparency has been the serious concern in project planning of Nigeria (Liman and Ngah, 2015). The main challenge is provision of sustainable electricity supply, poverty alleviation and combating the excessive use of firewood for domestic fuel. (Oyedepo 2012). Thus, the provision for sustainable and affordable electricity supply in Nigeria is a great task as about 50% of the population living in 18 out of the 36 States in the country has no access to electricity in 2015 (Ohiaries, 2015). This paper examines the impact of privatization of electricity in provision of access of power, improvement of the living condition of beneficiaries as and poverty reduction in the study area.

1.1 The Rural Electrification Delivery Under Electricity Industry in Nigeria

Prior to independence of Nigeria in 1960, the electricity market has been controlled by the state-owned electricity utility, National Electric Power Authority (NEPA) was formed in 1972 and the succeeding Power Holding Company of Nigeria (PHCN) in 2005. Both of them , aim at maintaining acceptable standards of service reliability, accessibility and availability of power supply in the country however the goal still remain elusive for both urban and rural areas (Ezenekwe *et al*, 2014). Towards achieving these objectives Power Sector (EPSR) reform, Act of 2005 was introduced to resolve the crisis in the electricity market, the act led the privatization process by the establishment of the distribution companies (Disco) under which Yola distribution company of Nigeria(YDCN) was also newly introduced, others include the generating companies and the transmission company In 2013 the (FGN) Federal Government of Nigeria through (ppp)Public private partnership reform program has auctioned at least 51% ownership of four thermal plants, two hydropower plants and distribution companies. The privatization programme enables the FGN the chance to prioritize energy sector reforms, through private intervention process with supervision from National electricity regulatory commission (NERC) (AEF,2017) Though substantial expansion in quantity, quality and access to infrastructural services especially electricity is fundamental to rapid and sustained economic growth and poverty reduction, yet for the past five decades, inadequate quantity, poor quality and low accessibility to electricity services has been a regular feature in Nigeria(Ezenekwe *et al*, 2014).

The privatization of electricity in Nigeria is targeted to reduce challenges of inefficiency in the Power sector in the country with the following objectives: provision of effective delivery of power supply through demand driven of energy generation, transmission of reasonable access of electricity to communities as well as the diversification of the sources of power generation and provision of employment and self-reliance among consumers. The failure of successive generations of public approaches to deliver energy needs of sub- Saharan African countries has motivated a deep inquisitive of the performance of public concepts and approaches of the rural electrification in the region (Terrapon-Pfaff *et al*, 2014) The energy institutions in developing nations is spending between 20-50%of their budgets on rural electrification projects(Oyedepo, 2012), however still 1.2 billion rural population worldwide are without access to reliable and affordable electricity in their homes ((Ahlborg *et al*,2015;WEO,2016).Although there is no single development theory which can deal with a wide ranging rural electrification development concepts, than the top-down development strategies did, nonetheless the public private-partnership of rural electrification theory provided demand centred theory and model (Hire math *et al*.2014;Bhattacharyya and Palit,2016).Which seems to be more effective in merging the resources of both public and private sectors to reach the needs of the communities that else would not be served by government alone(Zhang and Chen,2013).

1.2 Minimise ineffective Distribution and Services of Power Supply

Privatization of electricity industry in Nigeria targeted to address some challenges of inefficiency in delivery and services of electricity through extension of national grids to some villages which has enabled connection of some households to power supply. Grid extension is an engineering practise through which electricity is being drawn-out to target communities based on their relative distance to the existing networks (Kirubi *et al*, 2009). Private- public procurement of energy investment emerged due to failure of governments in developing nations to meet the task of provision of infrastructures needs for public services.(Grimsey and Lewis ,2002).It encourages companies investment in realization the objectives for attainment of sustainable energy control through public- private partnership. One of the major challenges against overcoming non-access to electricity in developing countries include dispersed population of the rural communities. Predominantly hamlets with difficult trends, where governments have to invest thinly for extending the grids to communities in which the projects are neither physically nor economically feasible (Martinot *et al*, 2014).

The World Bank in 2009 recommended that 25% of investment in the energy sector (\$10 billion per year) be allocated to produce and distribute electricity to the rural sub-Saharan Africa. Although the multilateral development interventions have increased their funding in rural electrification in the region, a lot is still needed to attend to the target objective (Benard, 2010).The energy problems of the region did not improved and even worsen up in some countries (Cook, 2013). Lack of access to electricity supplies affects as much as 90% of the population of rural areas of developing countries and most of them are in sub-Saharan Africa and South Eastern Asia where the connection rates are 48.4 and 11.9 % respectively of their rural populations (Barnes and Floor, 1996; Martinot *et al*, 2014; Makwe *et al*, 2012]). The poor performance of electricity in the sub-Saharan Africa is linked to political interference in utility policy, higher investment costs, lower profitability of extending service to rural areas and the high charges consumers must pay to connect to the electricity network (Golumbeanu and Barnes,2013).The electricity connection price is between \$50-\$250 per household, which naturally excluded the rural poor in Africa from having access of rural electrification (Bernard, 2010). Manos *et al* (2014) argued that: subsidizing the liquefied petroleum and gas for domestic used to reduce over reliance on charcoal and wood for domestic fuel and support conservation of vegetation cover The World Health Organization estimated that nearly four million people died yearly from indoor air pollution due to the use of traditional cooking methods in developing countries (Bonan *et al*, 2014).

TheUnited Nation's sustainable development goals agenda aim for universal access to electricity by 2030. However realizing this goal is tough as more than 1.3 billion people in developing countries has no access to electricity; with 590 million live in Africa (IEA 2012; Peters *et al*, 2015). Where the rural electrification rate in the continent is still only 14% (SE4All 2013). The investment for the universal electrification cost up to 640 billion US Dollars if collective access to electricity should be attained by 2030(Peters, 2015). Bohanazad *et-al*, (2013) argued that hydropower energy generation is the reasonable and reliable system of energy suitable for the developing countries. The hydropower technology is also used in water supply, flood control and enhancement of navigation. There was some efforts of improving rural infrastructures in sub-Saharan Africa after implementation of poverty reduction programes in the region. In spite the enormous potential and natural resources endowed to the region, it still remain the least developed and poorest in the world (Sembene, 2015). The low power generation and distribution capabilities of the sub-Saharan nations are responsible to their low phase of industrialization despite enormous potentials of hydroelectric power generation in the region (Bernard, 2010). Mainali *et al*, (2014) reflected that a significant correlation exists between per capita electricity generation and human resource development and this includes health education and income of the households. Van Els *et al*.

(2012) argued that lack of electricity supply tends to emphasize the existence of collective irregularity in living conditions also deepened the state of rural poverty (Esmap, 2005).

1.3 Privatization of Electricity Industry in Nigeria

The electricity industry in Nigeria has adopted an important steps of power improvements include corporatisation, commercialisation and privatisation of the successor companies, the inflow of a large volume of private sector investment through the creation of new power generation and distribution entities led to the subsequent development of a competitive electricity market in Nigeria(Owoicho,2017). Currently, the Federal Government owns 100% of the transmission company, while its hold on the generating companies is 20 per cent (with 80 per cent of equity sold to private investors) and in the case of the distribution companies, eleven of them that have been sold, government only sold 60 per cent and is still control 40 per cent by government (Awosope, 2014). *Madriz-Vargas* (2016) argue that among challenges facing implementation of public-private -based model of rural electrification project include the awful straits of power sector in rural areas, conflicting interests between investors and consumers in electricity tariff, low connection rates and low demand of the consumers due high poverty level. (Ogunleye, 2016). The Federal Government of Nigeria privatised the electricity industry with the view of improving the production capacity to 8,600 MW, in the country, so far it is only capable of guaranteeing an output of 4,100 MW to supply a population of 170 million people (Ogunleye, 2016).The Company collaborates with state energy institutions to manage the rural electrification delivery programme. In fact one of the obstacle of rural electrification in Africa is high cost of capital but low revenue generation, compared to the cell phone industries with medium capital with high revenue earning (Bernard, 2010).The public private participation in electricity reforms was design to establish an institutional mechanism for transferring rural electricity management to the private sector (Isa *et al*, 2014). Low connection rates and weak productive utilization identified in the 1980s, still remain today and impacts of such dimension manifest on health, education or income of the consumers. The culture for electricity consumption among household is limited to house lighting, radios and television, even in urban areas (Liman and Ngah, 2015). Usman (2013) argue that rmajority of the electricity consumers after privatisation are not satisfied with both the quality of services and attitude of the key actors of PHCN, neither have they satisfied with the network of the infrastructures put in place. In addition most of the consumers are unwilling to pay, due to irresponsive nature of the service providers. One of the strategies needed for tackling connection-related costs, and consumer charges is by adopting low-cost technologies and materials in addition to adjusting technical standards in household connections to reflect the lower loads in rural areas Golumbeanu *et al.*,2012). Planning for sustainable energy development through advance technology will reduce poverty if it is advance base on suitable strategy to link smaller and dispersed rural communities with national grid .This is to reduce high cost of distribution and transmission and bring about lower tariff. Moreover the rural areas could be connected through electricity generation from solar, wind hydro, biomass and tidal energy. *Manos et al.* (2014) argue that :the mixed public private partnership (PPP) is the best conception tool to re-enforce the development strategies in developing countries where the economic crises necessitated the cut down of public budgets in the delivery of rural electrification project. The mini grids of power derived from solar energy or micro hydropower utilizes small scale energy supply and upbeat distribution with lower ecological effects (Motta and Reiche, 2001). Others include electricity generation through renewable energy that operates on biomass plant (*Ahmad et al, 2011*).it is efficient and the transmission can be easily be monitored from the plant to level of consumers (*Alvial-Palavicino et al., 2011*) While Hire math *et al.* (2010), argued for decentralized energy model with the target of meeting the demand of small scale energy planning through bottom-up approach. The Hanning model of 1997 is one of the bottom-up approach engineering models that is affordable, reliable and ecologically sustainable to rural

communities in developing world. The software packages of the energy include the long range energy alternative planning system (LEAP), new earth 21 models, horizon Europe 2020 model and IST H2020model(Macri *et al.*,2016). These were developed to reflect on the environmental and economic benefits of energy management to the rural people.

2 Study Area

The study area covers rural Adamawa in Nigeria Adamawa state is located in the north eastern part of Nigeria, it lies between latitude 7° and 11° N of the equator and between longitude 11° and 14° E of the Greenwich meridian. Consisting of (9) nine local governments areas, cutting across 3 senatorial districts of the state. Namely: Fufore, Ganye Girei, Lamurde, Madagali, Maiha, Michika, Shelleng and Song, at-least 3 villages were purposefully selected in each of the 9 local Government areas of the state. Moreover 4 villages each were sample from Girei, Fufore and Maiha because there are more communities electrified in the 3 local councils and in all 30 villages were selected for this study It is characterized by high population growth of 3.3% and rapid urbanization of about 7%. (NPC, 2006). Based on 2006 population census, the study area has population of 3,178,950 people. Adamawa State is connected to the national grid through two injection points. The major sub-station is located along Numan road in Jimeta and is being fed from Gombe; through a 132kv transmission line. From this sub-station, 16 local governments are being served. The other sub-station is located in Uba and is being fed through a 33kv line from Dambuwa in Borno State and it served the 5 local governments in the Northern senatorial district (Musa and Adebayo, 1999). Incidentally villages with sparse population are those with the low records of index accessibility of electricity, considering the tough topographical trends and low demand of electricity in those communities. Physical appearances and size of residential unit play significance role in influencing demand to household connection to electricity .In general the rate of demand for electricity for entrepreneurial actives in the State has increased after Privatisation. In an effort to resolve the ineffective distribution and access to electric power the Federal Government of Nigeria encourage public- private participation in power sector at all level of governance.

3. Methodology

The study used data from both primary and secondary sources to study the Public private participation in electricity generation under the YDCN in Adamawa State, Nigeria. Data on the on disbursement for delivery of the programme, population served and the distribution of household connection to YDCN power in Adamawa state were from secondary sources such as Adamawa State District office of YDCN, as well as Adamawa State Ministry of rural Development. While data on community satisfaction, management of public private investment of electricity and aggregates of energy uses by the communities for human activities was obtained from primary sources.

.3.1 Primary data.

The primary data was obtained through household study, the data include back ground of the household, community satisfaction, assessment of delivery of the public private electrification programme and distribution of residential access to electricity among rural communities. Total of (500) respondents were designed for this study. A stratified random sampling was used and questionnaires were administered proportionately to (9) selected local government areas in Adamawa state, Nigeria being the study area. Also sample with the study are officers in ministry of rural development in the state. Interviews were held with the head of the households of the selected compounds across the rural communities in the study area. A total of (500) household heads were sampled, and this is supplemented by focus group interview and stakeholder analysis. All the respondents are delighted with the introduction of public private electrification in the area but were worried about hike in electricity tariff and irregular supply of power supply which they attributed due to inability of regulatory commission and government and co-investors

to monitor fully the implementation of privatization process and the inadequate investment by both parties to improve power generation sector.

3.2 Secondary data

The secondary data has been sourced: from the district office of the Yola distribution Company of Nigeria (YDCN) and the state ministry of rural development. The data included number of villages connected to national grids, population been served at each community in Adamawa state. The number of households connected to power supply sources. The average connection fess being charge to a potential applicant as well as average electricity monthly tariff charge to consumer’s respective households and for different voltage and land uses as well as the financial implication of implementation of the power supply monthly across all the rural communities.

4.0: Discussion of Findings

The data and findings of this study is presented using descriptive analysis. The results, shows that the rural electrification scheme under the public-private partnerships experienced low consumers’ satisfaction with an accounts of 24% in the state. Other finding is although the privatization covered all the state yet only few villages were connected to national grids, after the privatization .Distribution of household connection to electricity and access to skills training has improved by 28% and 33% respectively. There was only 7 % increase in uses of electric power for family entrepreneurship .While access to pipe born water supply has improved by 24% after the privatization The aggregate of family power uses shows that 40% uses power for lighting only. While 29 % relied on power for lighting, learning and telecommunication services and only 16% sometimes uses the electricity for both lightning and domestic services. Which poses threat to the vegetation cover in the state .The analysis suggest that 84% of the rural household in the state depend daily on fuel wood for cooking. On the other hand 9% of the respondent has access to power supply after privatization between an average of only 5-10 hours daily, while 32% have access to electricity between 11-15 hours. Whereas 35% are having access to power supply between 16-20 hours daily however 24% are not connected to electricity. Due the irregular power supply in the state the electricity delivery period varies according the location of the local governments, villages in the central senatorial enjoy more stable power supply than those in the northern and southern senatorial districts.

Table 1: Educational Background

Status	Frequencies	Percentage
Adult Education	85	17
Primary Education	140	28
Secondary Education	150	30
Tertiary Education	125	25

Source: field work 2017

In Table 1, 28% of the respondents attended primary school education only, while 30% had secondary school certificate, and 25% attended tertiary institution. However 17% of the respondent attended adult education only.

Table II: Access to training centers & consumers’ satisfaction and Household connection to grid

Item	Before Privatization		After Privatization		Progress
	Frequency.	%	Frequency	%	

Access to Training Centres	0	0	165	33	33
Household Connection	180	36	320	64	28
Consumers Satisfaction	00	00	120	24	24

Source: field work 2017.

As indicated in Table II, 165 respondents representing 33% replied having access to skills training centers after the privatization. Respondents also indicated there was only 36% of the household connected to electricity in the study area before privatisation of Power which improved to 64% of the households after Privatization. There was no one (0%) satisfied with the services of electricity supply before Privatization, however after the Privatisation 24% of the respondents admitted satisfaction with the supply of electricity after privatization.

Table III: Accessibility to Power Supply in Households

Average hours of power Available	Before Privatization		After Privatization		Progress
	frequency	%	frequency	%	%
Not connected at all	180	36	120	24	12
Available in 5 -10 hours daily	95	19	45	09	10
Available in 11-15 hours daily	125	25	160	32	07
Available in 16- 20 hours daily	100	20	175	35	15

Source: field work 2017

As indicated in Table 3, The percentage of respondent with the lowest daily access to power supply between an averages of 5-10 hours only declined from 19% to 9% after Privatization. While the percentage of category of power supply between an average of 11-15 hours increased from 25% to 32% of the respondents after privatization. Whereas those category with access of power supply between 16-20 hours increased from with the 20% to 35% after Privatization. The percentages of household that were not connected to power before privatisation declined from 36 to 24% after the Privatization. These households are unable to connect to power supply because they cannot afford the connection fees besides they could not bear the monthly tariff for the power supply.

Table IV: Uses of electricity by households

Uses of electricity by households	Before Privatization		After Privatization		Progress
	Frequency	%	Frequency	%	%
No Access	180	36	120	24	12
Lighting only	152	30.4	200	40	9.6
Lighting / Domestic Services /Television	06	1.2	16	3.2	14.8
Lighting/s/Television and Learning	132	26	144	29	03
Lighting/Radios/Television / Entrepreneurial services	12	2.4	45	09	07

Source: field work 2017

Table 4: show that respondents who depend on power for illumination of their home only increased from 30.4% to 40% after privatisation. On the other hand only 1.2% were using electricity services for lighting, domestic services and television viewing before Privatization which has improved to 3.2 % after the privatisation whereas as 2.4% uses power for lighting, television and educational used before Privatization which is improved to 4% while only 2.4% were using the electricity for entrepreneurial and lightning services which is slightly improved to only 9% after the privatization.

Table V: Improved drinking water, health and welfare

Improved drinking water health, and welfare	Before Privatization		After Privatization		Progress
	frequency	%	frequency	%	%
Access to Pipe born water	0	0	120	24	24
Access to lighting at Health centres	58	12	100	20	08
Access to ventilation	142	28	220	44	16

Source: field work 2017

As indicated in Table 5, none of the respondents (0%) had access to pipe born water before Privatization, this due to irregular power supply in their communities which is improved to 24% with the access to hygienic water supply after privatisation. While those with access to improved medical care that depend on electricity services increased from 12 % to 20% after Privatization. whereas respondents with access to electronic appliance such as fans which support homes ventilation increased from 26% to 44% after PHCN. In this regards privatisation has promoted access to clean water improved health and relaxation to the beneficiaries’ households.

Table VI: Dwelling Types and Monthly Rate of Tariff Paid for Electricity Before and After Privatization

Dwelling Type	Frequency	%	Phase	Amount(NGN) Before Privatization	Amount (NGN)After Privatization
Mud and Thatch	140	28	Single	2000-3000	4000-6000
Bricks Block and Concrete	60	12	Double	5000-7000	10000-14000
Traditional and Modern buildings	120	24	Single	3000-5000	6000-10000

Source: field work 2017

Table 6: shows that 28% of the respondents who are occupying traditional mud house connected on single phase were paying between NGN 3000-5000 monthly which has doubled to between NGN4000-6000. While 12% of the respondents who are occupying concrete and brick houses connected to double phases were paying tariff between NGN 5000-7000 monthly which is also doubled up to between NGN 10000-14000 after privatisation The consumers with grinding machine connected to the power decried bitterly about the hike in electricity tariff. The last category is 24% of the respondents who are occupying housing constructed from a combination of traditional and modern buildings materials connected to single phase were paying tariff between NGN 3000-5000 which is increased to between NGN6000-10000 after privatisation. In this regards privatisation increased inflated tariff to consumers.

4.1 Feedback from the Focus Group Discussion

In a focus group discussion a staff of YDCN linked the uneven power supply in the state to the awful straits of infrastructures in the power sector and irregular gas supply in the generating plants. He also complaint of slow response in payment of monthly bills by consumers. Although the consumers are slowly adopting into the productive uses of electricity in the study area, however, irregular power supply hindered progress of entrepreneurship in the area. The power sector reforms under act, 2005 removes operational and regulatory responsibilities of power from the Federal Government to an independent commission. It provided the legal backing for the unbundling of PHCN and formation of successor companies to take over functions, assets, liabilities and staff. The power reforms has being slow and did not fully made impact to the rural dwellers A respondent in a community decried of hike in the electric

bills in spite of poor services by the power holding company. He stressed that the monthly bills were centred on on rough estimates and perception on the physical outlook of a residential unit, which has been the reason of low consumers' response to settle their bills. "We travel to the neighbouring countries their rural power supply is regular and their electric bills is less". Remark an interviewee.

4.2 Management and Policy Recommendation

Attempt to address the inadequate distribution and access to rural electrification and poverty in rural Adamawa needs to be supported by all stakeholders including public, private and civil society The rural energy poverty is real with serious consequences on rural economy; although the results indicated that there are improvements in the distribution and access to rural electrification delivery due to privatization, still the three is low connection rates and underutilisation of power for productive ventures. While the consumers' satisfaction to the services provided by the power industry is still low. The study recommends the following items, creation of the electricity regulatory department in state ministries for rural development in Nigeria. With a unit of similar functions at work departments of local governments areas. This unit will strengthen the consumers participation in decision related to the power reforms, supply improvement and tariff plan at rural areas. The tariff system across the rural areas should be automated to ease the undue extortion from consumers in the name of estimation of energy bills by the power industry.

5. Conclusion

The privatization of electricity in rural Adamawa, Nigeria has uplifted the level of power supply in some rural communities. However despite some improvements in the delivery and access to power still a lot of effort is needed to improve the plan. The failure of the enterprises to make an effort for even coverage of households connection to power supply could be attributed due to the, obsolete power infrastructures , rural poverty, dispersed population of the rural communities as wells as inadequate power distribution and supply networks connecting the rural communities to the national grids in the state. A holistic approaches in desired in order to set standards in the ppp electrification project A study has observed a strategy of improving ppp in rural electrification through creating of enabling environment by enabling a mutual space shared by common interest and collective action among the stakeholders who collaborates to recognised a common goal in building their own rural electrification networks for enhancing sustainable economic development with a task of improving families wellbeing and poverty reduction as well improving the local economy (Terrapon-Pfaffet al,2014; Bhattacharyya and Palit,2016).

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