

Telecom Infrastructure Sharing, A Panacea for Sustainability, Cost and Network Performance Optimization in Nigeria Telecom Industry

Nosiri O.C., Agubor C.K., Akande A.O., Ekwueme E.U.

Abstract—The article emphasized the importance and the necessity for mobile network operators to visualize infrastructure sharing as an essential phase of development in the life cycle of mobile telecommunication industry in Nigeria. With the unprecedented network infrastructure challenges characterized by unfavourable business environment and the need for quick network deployment, prompted the need for harmonizing, collaboration and consolidation by the key service providers to reduce the OPEX and CAPEX while at the same time provide quality service delivery. The idea of telecom operators to pursue the policy of doing it alone on the ground to be the first network to reach a certain subscribers base should never be entertained in the Nigerian telecom industry. Numerous benefits ranging from network availability, reliability, innovation, expansion, customer satisfaction and economic sustainability are harnessed from telecom infrastructure sharing and therefore should be enforceable by the regulatory agency to ensure collaboration by the Nigerian network providers.

Index Terms — Infrastructre sharing, Subscribers, Telecommunication Industry, Network Operators,

1 INTRODUCTION

INFRASTRUCTURE sharing is a process where two or more operators share different infrastructure in a particular site as a mechanism for cost reduction, quality of service improvement and rapid network expansion while at same time creating a positive environmental impact with good economic sustainability[1]. The growth of the telecom market in Nigeria has continued at a geometric rate characterized by large geographical spread. According to [2], the Nigerian telecommunication market is one of the fastest growing telecommunication markets globally. This growth as well as network maturity becomes a very important aspect that requires adequate measures to curb the huge cost and burden incurred on telecoms investors and operators as they continue to expend huge capital expenditures on telecommunication assets and infrastructure in a bid to gain and sustain the competitive market. Due to the increase in competition along with new investments in the wireless communication industry, the decline in Average Revenue Per User (ARPU) and Revenue-On-Assets (ROA) has been pushing Nigerian telecommunication operators towards new techniques to maximize profit. In a reasonable point of view, network operators are required to play a fundamental role to support the economic and social development of a nation. Their contribution is critical in meeting enhanced policy objectives across the entire economy. Hence the need becomes paramount for all network operators to see infrastructure sharing as a necessary tool for network optimization.

Infrastructure sharing is not new in the telecommunication industry. Globally, Infrastructure sharing started materializing in 2001[3]. With the hype of 3G licensing in Europe and the big investments made in license acquisition, many operators were under pressure to share deployment costs and thus share infrastructure as means of reducing their rollout costs [3]. Today, Infrastructure sharing agreements are very advanced in developed countries. An interesting example of infrastructure

sharing is a tower company in India, Indus Towers, which claimed to be the world largest independent tower company having over 100,000 towers and having the capacity to rent out to the numerous operators in India [4].

From a general perspective, many regulators recognize infrastructure sharing as an essential element to fostering services-based competition and a means to limit adverse environmental impacts of network rollout. In fact, most regulators in the western world imposed facilities-sharing requirements on the telecommunication operators that are not service-specific in order to facilitate economically efficient use and investment in infrastructure [3]. However, in Africa, the infrastructure sharing initiative is being sluggishly implemented as a result of resistance from either the regulatory bodies or the network operators. Though, the approach has already seen significant economic improvement in some parts of the continent. Nigeria still has a majority of telecommunication towers owned by individual mobile network operators, despite the fact that the country has been one of the first markets in Africa to introduce the tower outsourcing model [5].

However, some network operators have seen reasons and the accrued benefits in site sharing while some other operators still never thought otherwise. In [6], revealed that some major wireless network operators in Nigeria such as MTN, ETISALAT, AIRTEL and VISAPHONE are lethargically adopting infrastructure sharing strategy while GLOBALCOM operators are still pursuing the policy of doing it alone as well battling with the idea of being the first to reach certain subscriber base through expansion without regard to its implications on the already high cost of doing business in the country. They centered on the struggle to gain more customers on the ground of better network coverage. They felt that sharing tower assets would mean giving away the advantages of a wider and better network.

The article aims at exploring the value of passive infrastruc-

ture sharing as a means of achieving cost efficiency, economic sustainability, rapid network expansion/optimization and revenue assurance in Nigerian telecommunication industry. It also geared towards encouraging the key players in mobile network industry in Nigeria, especially those that are not collaborating with the policy to embrace the strategy for economic benefit, low tariff and good quality of service.

2 LITERATURE REVIEW

The author of [7], analyzed the swift growth and development of telecommunication industry in India, which was centered on the adoption of infrastructure sharing by the network operators. Beforehand, they had their own arrangements to fulfill their infrastructure needs until they realized huge investments in the sector. He opined that it created huge income and promoted the opportunity for new entrants to compete favourably against the incumbent operators. He further explained that the development created numerous benefits which include rapid expansion of network and improved quality service delivery. Authors of [8], emphasized the main reason to consider infrastructure sharing which is primarily centered on network expansion including low income customers. They accentuated their evaluations based on the comparative analysis carried out in Europe between the costs incurred when an operator singly builds its own network or collaborate in infrastructure sharing with other operators. Their analysis showed a price decline from 175 Euros per meter to 65 Euros per meter. Author of [9], conducted analysis on cost performance of about 100 mobile operators in Europe. He found out that the greatest benefit of network sharing significantly was on the access layer of the mobile network, which comprised the base station subsystem and the passive infrastructure deployed across the country.

3 INFRASTRUCTURE SHARING IN TELECOM INDUSTRY

There are three dominant forms of sharing possibly deployed worldwide. They include passive sharing, active sharing and spectrum sharing.

- **Passive Sharing:** in this form of sharing, operators agree to share available non-electronic equipment which includes site space, buildings and easements, towers and masts and power supply [3,10]. This technique is suitable especially in densely populated areas with limited resource availability, in rural areas that are uneconomical to serve and where new site acquisition is difficult. It is the simplest form of infrastructure sharing adopted by mobile network operators.
- **Active Sharing,** involves sharing of electronic components and facilities such as base station equipment, microwave radio equipment, switching centers, sharing common network both circuit-switched and packet-oriented domains, antennas and receivers[10]. Each operator, however, has its own individual home network that contains the independent subscriber databases, services, subscriber billing, and connection to external networks. Active sharing requires additional planning and

deployment efforts to accommodate each participating operator's capacity needs [11].

- **Spectrum Sharing,** also known as spectrum trading, is a model that has recently developed in mature, regulated telecom markets [11]. It involves operators leasing their spectrum to other operators on commercial terms. Because spectrum is a scarce resource that may often be underutilized by one operator in a given area, spectrum sharing remains a viable option for two or more operators.

4 TELECOMMUNICATION INDUSTRY IN NIGERIA AND THE INHERENT CONSTRAINTS

There are various challenges confronting mobile network operators in Nigeria. These challenges impede the faster deployment of services to the underserved area and evidently, hinder the rapid growth and network expansion. Some of the challenges include sharp rising of site rentals, tower restriction and huge cost of demand by the government agencies. Others include erratic power supply, security threat and vandalization of network equipment.

- **Sharp Rising of Site Rentals:** Site acquisition remains a key aspect in establishing and building a cell site. Many operators are challenged by the high rising cost of site rentals. Site owners are now aware of more players desiring to rollout in urban and rural areas and hence the demand for tower sites and rentals are expected to continue to rise sharply on daily basis [12].
- **Tower Restrictions and Huge Cost Demand:** Both the urban planning ministries and local government authorities, as well as state governments place restrictions on new tower constructions on the grounds that they pose health hazards and distorts the beauty of the landscape. This unfriendly operating environment which has made the installation of base stations difficult because of the restrictions and huge demand from government agencies and the host community remain a constraint. To build a base station requires several approvals that operators must secure from government regulatory agencies such as National Communication Commission (NCC), National Environmental Standards Regulatory Enforcement Agency (NESREA), Federal Ministry of Environment (FME), State Ministry of Environment (SME), Local Government Agency (LGA), Federal Environment Protection Agency (FEPA) and Town Planning Authorities (TPA) where the mobile operators must get approval irrespective of other existing unfavourable conditions which also required urgent attention. According to the Industry Working Group (IWG) affirmed that telecommunication companies in Nigeria were fleeced of over 900 billion naira (3.75Billion USD) yearly by the state, local government and their agencies [13].

- **Power Issue**
The growth and expansion of mobile telecom networks depends on key support infrastructure centered on availability of power supply. Power supply, plays a major role in running the mobile network with a benchmark network uptime of 99.98% in order to maintain the reliability and quality of ser-

vice [3]. Operators have to keep their networks running on continuous bases 24 hours a day, 365 days a year, regardless of utilization. Demand for service may drop to zero during night hours on certain sites but operators have no option to switch the site off during these hours as they cannot predict subscriber movements. Grid power supply is a major concern in Nigeria and has affected telecom operations in terms of costs, reliability and efficiency. About 75% of the sites are off-grid and usually powered by diesel generators with huge Operational Expenditure (OPEX). The remaining grid-connected sites still suffer due to the poor quality of power supply and frequent outages lasting over hours. This had also led to a heavy dependence on diesel generators even for the grid-connected sites. A typical base station requires 3000watts to power a mobile telecommunication equipment in a cell site and is powered by two (2) 20 KVA generators running alternatively [1].

The use of diesel generators as a source of energy supply for cell sites require regular re-fuelling and adequate maintenance. These conditions remained unfavourable considering the ever-increasing cost of purchasing diesel which is currently at 160 Naira per litre, and which may not likely decline in price. Diesel constitutes a major chunk (93% of the direct costs of power) of powering telecommunication equipment in Nigeria, due to the poor grid power supply [3], consuming up to 66% of the total OPEX cost for cell sites [1]. Meanwhile, Operators typically ensure that their systems have backup mechanism such as battery banks to ensure continuity of service and business operations. The cost of running and maintenance of the batteries are quite expensive. Therefore, the use of diesel generators as the default power backup of off-grid and grid-connected telecom tower sites comes with its implicit disadvantages in terms of high cost of power, diesel logistics and theft, as well as having a negative environmental impact due to high carbondioxide (CO₂) emission per kWh consumed. Table 1 showed the key power sector indicators and their impact on telecom operations in Nigeria. It shows that Nigeria has one of the lowest per capita electricity consumption in the world at 121 kWh [3].

In addition to the poor grid power supply, Nigerian telecom operators face operation challenges. Site security is a major issue as there have been several cases of damage to tower assets across the country. This risk has hindered the mobile network operators to achieve their aims in delivering quality service as well rapid expansion of their networks. Thefts of equipment and vandalization have affected the OPEX of telecom sites. The terrorist group known as Boko Haram has further created difficulties for network availability and maintenance in the northern states of Nigeria, a dilemma which neither the government nor network operators are properly positioned to address.

5 THE NEED FOR PASSIVE INFRASTRUCTURE SHARING IN NIGERIA

The desire of wireless service providers in Nigeria to build more base stations have been accelerated by the need to provide coverage to geographic regions where the service provider has not previously served, fill in “dead spot” and areas where existing signals are weak or non-existence and meet the higher speed requirements of emerging technologies. The drive to meet these needs had led to the proliferation of new cell towers which are capital intensive, pose environmental health hazards and distorts the beauty of the environment [14]. The rapid growth in wireless mobile subscribers in Nigeria has been outstanding and recently escalating above 140 million subscribers [15]. The major players of mobile network providers in Nigeria are MTN, GLOBALCOM, AIRTEL ETISALAT, VISAPHONE and MULTILINK. Table 2 showed the number of subscribers in each major players in Nigeria. Figures 1 and 2, showed the percentage number of subscribers and the number of subscribers represented in a bar chart and pie chart respectively while figure 3 graphically represented the various operators against the number of subscribers.

TABLE 1
Key power sector indicators for Nigeria Source [3]

Generation	Installed capacity	5.8GW
Access to Electricity	Overall	52%
	Urban electrification	78%
	Rural Electrification	23%
Per Capita Consumption	kWh per year	121

TABLE 2
Six Nigerian Mobile Network Operators and the subscribers' rate

NETWORK OPERATOR	MTN	GLOBALCOM	AIRTEL	ETISALAT	VISAPHONE	MULTILINK
NO. OF SUBSCRIBERS	62,813,111	31,256,677	29,564,766	22,852,232	2,095,193	10,788
% NUMBER OF SUBSCRIBERS	42.27	21	19.89	15.37	1.40	0.07

Source: NCC 2015

- Site security threat

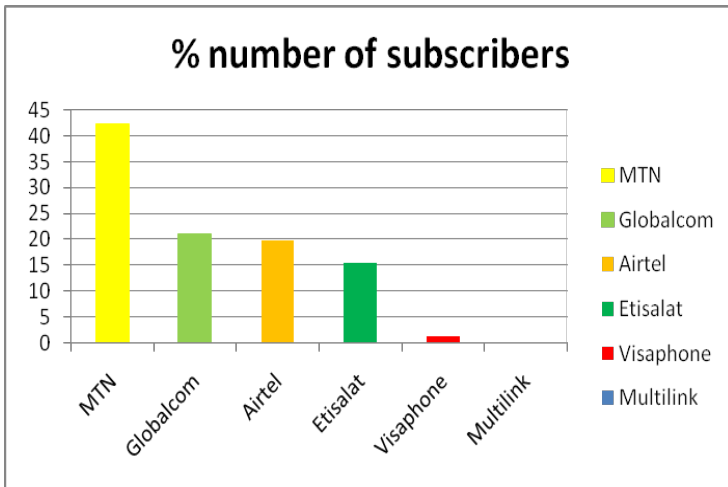


Fig. 1 A bar chart showing the percentage number of subscribers

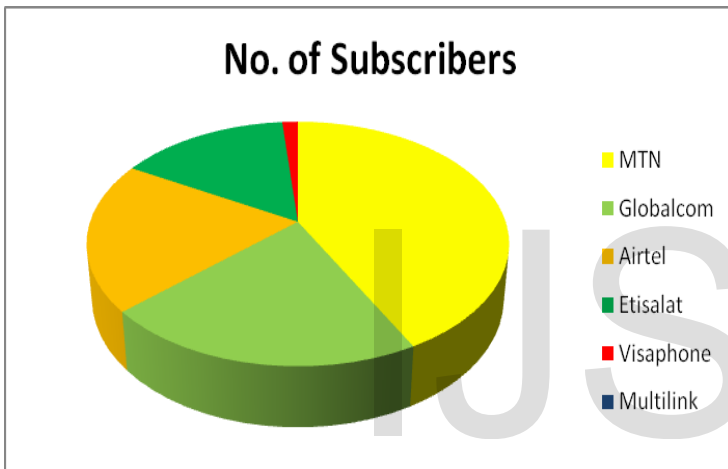


Fig. 2 Pie chart representing the number of subscribers

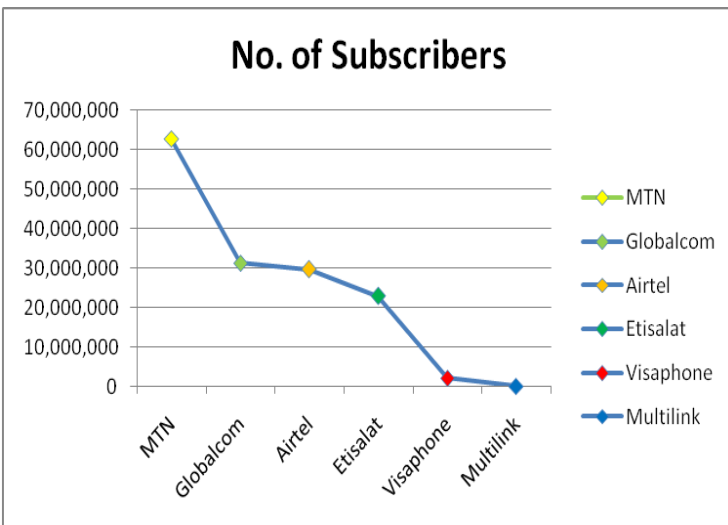


Fig. 3 A graph of various operators versus the number of subscribers

Due to this increase in subscribers growth as well with the heated competition among rivals, it becomes paramount for faster deployment of telecommunication infrastructure to further consolidate the socio-economic benefits of having

efficient communication infrastructure devoid of high tariff. Telecommunication industry in Nigeria do not have adequate infrastructure to shield the pressure generated by this rapid increase in demand for telecom services by the end users. As at September 2013, the numbers of Base Transceiver Station (BTS) was 27,000 [16,17]. According to [11], stated that Nigeria needs additional 33,000 Base Transceiver Stations (BTS) by 2018 to support the ever increasing demand of subscribers and to address the incessant poor network performance.

The cost of building the cell site is capital intensive, pose environmental threat and distorts the beauty of the landscape. It becomes necessary for the key players to consolidate in tower sharing as optimized strategy for reducing the heavy cost burden in network rollouts, expansions and upgrades. This is essential due to the increasing competition in telecom industry in Nigeria which is forcing the ARPU down and also the need for quality of service delivery in the form of site uptime. The current market uptime average is around 70% which will no longer be sufficient in a competitive environment [11]. Figure 4, showed the number of subscribers in Nigeria and the teledensity.

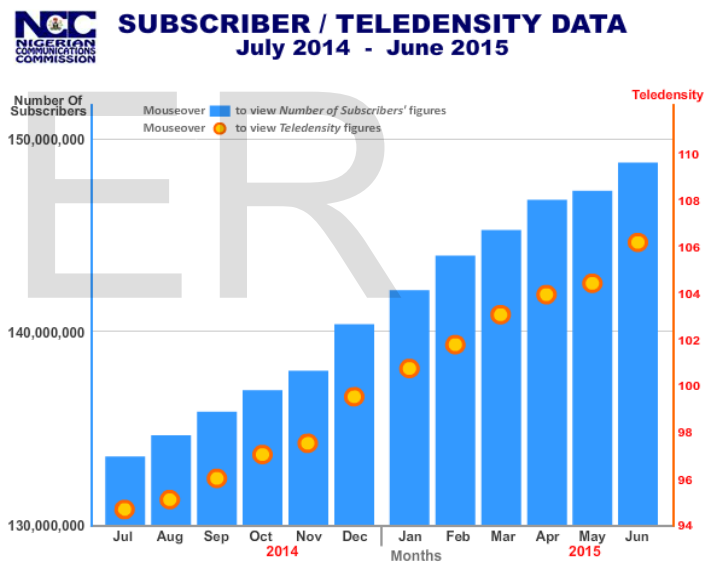


Fig. 4 illustrated the number of subscribers in Nigeria and the teledensity (Source NCC 2015).

One of the conditions that necessitates or promotes tower sharing requires a mature network and a growing market. This condition is matured in Nigeria telecom industry; hence the urgent need for collaboration and consolidation.

Table 3 illustrated the cost structure (% annual cost distribution) of a typical Global for Mobile Telecommunication (GSM) network in Nigeria which consists primarily the Capital Expenditure (CAPEX) and OPEX [1]

TABLE 3

The Percentage Annual Cost Distribution of a GSM network in Nigeria [1]

	Radio Network Accessories	% Annual Cost Distribution
a	Mobile equipment	18.1
b	Spares, support, training	7.6
c	Power	15.8
d	Site rental	10.2
e	Operations and maintenance	9.7
f	Network related OPEX	6.7
g	Civil works	13.1
h	Site equipment	11.3
i	Transmission equipment	7.3

From the breakdown illustrated in table 3, passive infrastructure sharing between operators can be applied to all the items except items (a), (b), (e), (f), and (i) which would require a higher level of trust between the operators. Thus the infrastructure sharing affects more than 50% of the cost structure in a GSM cell site [1].

6 Benefits of Passive Infrastructure Sharing

There are numerous benefits accrued in passive infrastructure sharing. Some of the benefits are listed thus [1,4,18].

1. Infrastructure sharing is a reliable way of lowering capital and operating expenditure. Wireless infrastructure sharing saves around 15% in OPEX and 30 % in CAPEX for operators. Around 40-60% of CAPEX is utilized to increase reach, provide innovative services, and improve customer satisfaction and for setting up and managing Telecom infrastructure.
2. Infrastructure sharing can expand coverage into previously un-served, underserved and, less dense areas and meeting up with the universal service targets
3. Infrastructure sharing helps to reduce barriers of market entry for new entrants into the telecommunications and broadcasting markets, hence making the telecom market more attractive to new investors and players in an effort to increase competition in these markets through the provision of reasonable cost alternatives for network infrastructure.
4. Infrastructure sharing allows operators to focus on improved innovation, good customer services and satisfaction, which geared towards higher ARPU.
5. Infrastructure sharing provides practical means to improving a country's competitive landscape with enormous opportunity to bridge up digital divide especially in under-developed countries in their far flung areas.
6. It allows incumbents to focus on customer-centric activities while releasing cash for new strategic investments.
7. It encourages operators to pursue a cost-oriented policy with the added effects of reduction in the tariffs chargeable to consumer.
8. Infrastructure sharing is a beneficial tool for stimulating mobile broadband provision in the areas that are other-

wise uneconomical to serve.

9. Infrastructure sharing facilitates better services and network deployment especially in congested urban centres where new site acquisition is difficult.
10. Sharing a new network removes the complexity and cost associated with re-planning existing networks.
11. It promotes a faster return on investment and an opportunity to focus more on the core business of the company by ensuring adequate telecommunication services.
12. Infrastructure sharing minimizes unnecessary duplication of infrastructure so as to protect the environment by ensuring that harmful interference is significantly reduced through the implementation of best practices in installation and safety precautions and promotes the beauty of the environment.
13. To promote fair competition through equal access being granted to the installations and facilities of operators on mutually agreed terms.
14. To ensure that the economic advantages derivable from cost savings (CAPEX and OPEX) are harnessed for the overall benefit of all telecommunications stakeholders and also undertake network expansions and capacity building in the underserved areas.
15. To promote the availability of a broad range of high quality, efficient, cost effective and competitive telecommunications and broadcasting services throughout the country by ensuring optimum utilization of telecommunications resources.

7 Challenges Confronting Passive Infrastructure Sharing in Nigeria

One of the challenges facing infrastructure sharing in Nigeria is the stiff competition between the operators in Nigeria. The operators are in frantic race to capture the market and as such they try to outdo each other in customer attraction and attention. Another challenge facing site sharing in Nigeria is the absence of enforceable legislation/regulation in favour of infrastructure sharing. This challenge is capitalized upon by established operators who make difficult demands on the other operators who want to share their infrastructure. These incumbent operators are usually unwilling to accept the opening of the infrastructure to other players and for new operators to trust the incumbents in providing them with the appropriate access to sites without deliberate tactical delays to prevent them from rolling out their networks effectively. Though recently, the regulatory body in Nigerian (NCC), has addressed the challenge by licensing co-location vendors such as Helios Towers, IHS, Swap Technology and MTI which is hoped to reduced the constraints.

8 Conclusion

Considering the various challenges facing telecommunication organizations in Nigeria which are confronted by the unprecedented network infrastructure issues, theft, vanderlization and the increasing OPEX and CAPEX costs as well the impact of Naira devaluation and the ever demanding network coverage optimization, has necessitated the urgency to consolidate

in passive infrastructure sharing to facilitate quick network expansion to accommodate the increase in the subscriber rate. The time has matured for the telecommunication companies in Nigeria to stop playing the number game of how much infrastructure and sites they own and start embracing the passive infrastructure sharing approach. Operators should start focusing on network expansion and increase in coverage radius using the most economic and efficient means (passive infrastructure sharing) possible to promote rapid growth in the industry and reduce the environmental health hazards and other drawbacks caused by having so many individual communications infrastructure. With the ARPU and Revenue Per Tower (RPT) declining over time, sharing of infrastructure becomes imminent. By sharing infrastructure, operators can optimize their CAPEX and OPEX, focusing on providing new and innovative services to their subscribers. On the other hand, the Nigerian Communication Commission (NCC) should ensure there is provision of adequate policy guidelines that are not biased but enforceable by law and mandate all network providers to collaborate in the passive infrastructure sharing formula. The body should also fortify security to telecom infrastructure to reduce the operational complexity and costs of running a telecom network in Nigeria.

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