



# Liberia Telecommunications Authority

## Public Consultation Document on the Definition of Relevant Telecommunications Markets

June 1, 2016

# Retail Market Definition

## Overview

Despite its relatively small population Liberia has a vibrant telecommunications sector in which new telecommunications services are regularly offered to consumers. The arrival of the ACE submarine cable and the start of operations of the Cable Consortium of Liberia (CCL) in 2013 had a major impact in the supply of retail broadband Internet. Virtually all the international satellite capacity that was being used to convey international traffic migrated to the new fiber optic submarine cable. CCL is owned jointly by the Government of Liberia (55%), Libtelco (20%) and the three mobile network operators (MNOs): Lonestar (10%), Cellcom (10%) and Novafone (5%).

Following the CCL's service launch the cost of international connectivity sharply declined which resulted in an explosion on the number of Internet subscribers. This has in turn required improvements in the access networks. Three private MNOs (Lonestar, Cellcom and Novafone), and, until recently, the government owned Libtelco compete for customers offering services over their wireless networks. Except for Libtelco's 100-200 fiber local loops connected to a partial fiber optic ring in Monrovia (approximately 20 Km. long), there is no fixed access network.

The growth of mobile and Internet use continues at a robust pace. Mobile penetration stands at approximately 75 percent while Internet penetration is at 21 percent; both numbers are high relative to Liberia's income. Anecdotal evidence suggest that these high penetration rates are influenced by the fact that many individuals have multiple SIM cards to take advantage of lower on-net prices and promotions; thus inflating the penetration rates of mobile voice and (mobile) Internet.

Following is a brief description of the main telecommunications operators and the main services they provide.

*Key indicators - Telecommunications market in Liberia (2012-2015)*

	2012	2013	2014	2015 (Jan.-Jun.)
<b>KEY MARKET INDICATORS</b>				
Mobile subscriptions	2,393,634	2,555,396	2,843,567	2,737,505
Mobile subscriptions per 100 inhabitants	68.4	68.3	74.5	
Domestic outgoing mobile minutes (million)	1,154.9	1,604.1	2,714.3	1,583.2
International mobile traffic minutes (million)	285.1	254.9	332.1	
Internet service providers	13	9	8	9
Internet subscribers	181,537	804,724	824,683	801,222
Internet subscribers per 100	5	21.52	21.60	20.6

inhabitants				
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SOURCE: LTA, CELLCOM, NOVAFONE AND LONESTAR.

## MAIN RETAIL SERVICE PROVIDERS

### *Libtelco*

The government-owned operator has retrenched substantially from the retail mass market as the private MNOs expanded service offerings. Earlier this year, it stopped providing mobile voice service through its CDMA network. Libtelco currently provides fixed (wireline and wireless) voice and broadband Internet to approximately 100-150 customers mainly businesses, international organizations, embassies, and government organizations in Monrovia. Libtelco uses its partial fiber optic ring in Monrovia to provide fixed voice and broadband Internet service.

Over the past years Libtelco has been slowly building a fiber optic ring around Monrovia. Libtelco's near term plans are to continue to serve large customers in Monrovia by offering fiber-based broadband Internet and expand its wholesale offerings to other service providers (dark fiber, backhaul, co-location).

### *Lonestar*

Lonestar was the first private MNO that deployed GSM technology in 1999. Since then it has played a pre-eminent role in the Liberian telecommunications sector. Lonestar uses GSM, 3G/4G, and WiMAX technology to provide a wide array of services including mobile voice/SMS, fixed-wireless and mobile data/Internet service in the mass market segment and value added services for government and private sector organizations. The Lonestar wireless access network covers approximately 75% of the population. Lonestar has also deployed an extensive microwave backbone network throughout Liberia and is planning to lay down fiber in the Monrovia metropolitan area in the near future. Currently, Lonestar accesses CCL's capacity via microwave backhaul links.

### *Cellcom*

Cellcom launched operations in 2004 and uses GSM and 3G/4G technology in its access network to provide voice/SMS and broadband Internet service (fixed wireless and mobile) to the mass market, and value added services to private and government organizations. Cellcom's wireless access network covers approximately 89% of the population in Liberia. Cellcom's access network has 201 base stations of which 118 are 3G/4G capable. Cellcom is the only MNO that accesses CCL's capacity by leasing Libtelco's dark fiber; the rest backhaul via microwave links.

### *Novafone*

In 2013 Novafone took over the operations of Comium. It uses GSM, and 3G/4G technology to provide a wide array of services including mobile voice/SMS, and fixed wireless, mobile broadband and value added services. Novafone's wireless access network has 105 base stations of which 39 are 3G/4G capable. Novafone access's CCL's capacity via microwave backhaul links.

### *Category 2 ISPs*

There are six so-called Category 2 Internet service providers: Powernet, Prosyte Ventures International, Nas Inter Global, Wen, Intercom Data Networks, and Electro Shack Inc. These

companies provide fixed wireless voice, data and Internet services to a small number of customers, mainly businesses. They do not buy capacity directly from CCL but from one of the three MNOs.

Although most of their customers are in the Monrovia areas, they also serve customers in remote sites using VSATs.

Based on the foregoing overview we were able to identify a list of retail telecommunications products to be considered as candidate relevant product markets:

- a) **Fixed voice access and call service:** this includes services provided by fixed-wireless technologies (e.g., GSM, WiMAX, VSAT) by the three MNOs and the six Category 2 ISPs, and Libtelco's fiber-based service. It includes the ability to call and receive calls from fixed locations. It includes the ability to place and receive calls to and from anywhere within Liberia and abroad.
- b) **Mobile voice/SMS access and call service:** These services are provided by the three MNOs. It includes the ability to place and receive calls to and from anywhere within Liberia and abroad. Similarly it includes the ability to send or receive text messages to and from anywhere in Liberia and abroad. Unlike fixed services, users of this product place or receive calls/SMS while travelling within the coverage area of the wireless network.
- c) **Fixed data and Internet access:** These services are provided by a combination of fiber and various fixed-wireless access technologies by the three MNOs, the Category 2 ISPs and Libtelco. Subscribers use this service to access data and the Internet at fixed locations usually via a computer terminal and a router or modem.
- d) **Mobile data and Internet access:** These services are provided by the three MNOs. Subscribers use this service to access data and the Internet anywhere within the coverage area of the wireless network. Subscribers use typically a smartphone or tablet to access data and the Internet.
- e) **Leased lines/circuits for businesses and organizations:** These are typically customized solutions to large private or international organizations and government. These services are provided by a combination of fiber and various wireless access technologies by the three MNOs, the Category 2 ISPs and Libtelco.

## Relevant Retail Markets

When defining the boundaries of relevant product markets, we considered that telecommunications services are sold in bundles. When a Liberian consumer purchases a SIM card, she is purchasing a bundle of services that may not be able to unbundle. The bundle may include the ability to originate calls, terminate calls on other networks, whether domestically or abroad, and the ability to send/receive SMS. Other services such as emergency calling may be included in the bundle.

Some services such as data and Internet access can be purchased separately from voice/SMS services and therefore, we considered this in our proposed market definitions. Furthermore, increasingly the boundaries of what services are fixed or mobile are being erased. The increased demand and supply-side substitution effects arising from fixed wireless technologies had contributed to this, as well as OTT services that can be accessed using smartphones and tablets.

We used the list of five tentative markets above and applied the following three criteria to justify identifying relevant product markets susceptible to ex ante regulations:

- a) **Size of relevant market must be significant:** Niche markets that are relatively small are not worth defining for the purpose of imposing ex ante regulations. For example, it would be questionable to define a relevant market for products used by a very small fraction of the population, or that in terms of revenue size represents a very small fraction of telecommunications retail services in Liberia.
- b) **Markets are concentrated:** The extent of market concentration is important; moderate or highly concentrated markets may be candidates to be relevant markets.
- c) **Markets have large and non-transitory barriers to entry or expansion:** Markets with large barriers to entry or expansion in conjunction with the other two criteria above should be candidates for being considered relevant markets.

We eliminated the fixed voice access and call service market based on the following reasons.

First, the overall size of this market appears very small. From interviews we had with the main service providers it appears that this market accounts only for few hundred customers in Liberia. Perhaps more important, using reasonable assumptions for the ARPU we estimated the market size in terms of revenue and confirmed its relatively small size.

Second, with nine or ten service providers in Monrovia and perhaps five companies (between MNOs and the category 2 ISPs) competing outside Monrovia, the market does not seem concentrated enough to be singled out for being susceptible to ex ante regulations.

We also eliminated the market for leased lines/circuits for the following reasons.

First, this market appears to be relatively new and will grow considerably as firms improve their access networks in the coming years. Second, there are three MNOs, and six Category 2 ISPs (plus Libtelco in some parts of Monrovia) competing for a reduced number of customers. These suggest that the market is not concentrated enough and still relatively small. This leaves us with the following three relevant markets.

- a) **Mobile voice/SMS access and call service,**
- b) **Mobile data and Internet access, and**
- c) **Fixed data and Internet access.**

Next we provide details on the rationale for the boundaries of each relevant market.

## **MOBILE VOICE/SMS ACCESS AND CALL SERVICE**

We started our analysis by considering mobile voice/SMS services as the relevant product market. This market includes local, national and international voice and SMS service bought by individuals, private and government organizations. It includes the ability to originate a call (or a text message) and to terminate it on any network within the national territory of Liberia or abroad.

This product is offered by the three MNOs. Consumers use this product with hand held devices that allow them to originate or receive calls or SMS anywhere within the coverage area of their network (e.g., as a mobile service). Consumers buy this product in a bundle which cannot be unbundled in the sense that consumers cannot buy voice only or SMS only when they buy “airtime.”

We first considered demand-side substitution effects. Clearly these are very strong between the mobile voice/SMS products of the three MNOs. This is evident by observing relatively similar prices across the three MNOs. Moreover, it is common to observe that some users have SIM cards from more than one MNO to take advantage of promotions. So if a promotion from Firm A is received, they use temporarily the services from A until the promotion expires. Then, if they receive a promotion from firm B, they switch temporarily to B. Switching costs are low because mobile phones are unlocked. This again suggests a high degree of demand-side substitution between the products of these three MNOs.

We also considered whether the product market should be expanded to include fixed wireless services. There are a reduced number of users, perhaps no more than few hundred (primarily non-residential customers) that use these services from fixed locations.

To evaluate demand-side substitution we considered that firms like Cellcom and others offer a home phone (fixed wireless) service at comparable prices to the mobile service on a per minute basis. We asked whether a small but significant non-transitory increase in price (SSNIP) could be maintained on the mobile voice/SMS product. Our assessment is that indeed it could be maintained because very few if any customers would stop using a mobile device and switch to a fixed wireless phone.

We then considered whether the product market should be separated between residential and business markets. We note that in Liberia prices do not vary between residential and business customers. A SSNIP on one of these segments, say, business, would not be sustainable as individuals will switch to residential service. Therefore, we reject the possibility of separating business and residential users into two separate markets.

The geographic market definition was analyzed also. To some extent the coverage of the three mobile networks overlap each other and cover approximately 75 percent of the national population. This suggests that the nature of competition is similar across Liberia and that the relevant geographic market is the national territory. A further element to support this is that the licenses of each network operator cover the national territory. Similarly, spectrum assignments have as geographic boundary the whole country. Thus, we concluded that the relevant geographic market is the national territory of Liberia.

Finally, we justify the identification of this market as being susceptible to ex ante regulation based on (i) its relatively large size, (ii) a high market concentration, and (iii) high and non-transitory barriers to entry.

It is estimated that as of June 2015 there were 2.7 million subscribers to this service, which highlights its importance in Liberia. The market structure is characterized as highly concentrated. Using the Herfindahl-Hirschman Index (HHI), a widely used measure of market concentration, we found that depending on the indicator used, the HHI ranges from 4627 to 5682 in the first half of 2015.

No doubt this high market concentration is influenced by the relatively small size of the market in Liberia which has witnessed some consolidation in recent years and may experience more consolidation in the future.

This relevant market exhibits high and non-transitory barriers to entry, which are structural, legal, and regulatory. Structural barriers to entry stem from the fact that this market is characterized by significant economies of scale, economies of scope, and sunk costs all of which makes it very difficult for a new entrant to enter. A new entrant by definition would have a smaller scale than the well-established firms in the market. Therefore, it would not have achieved economies of scale and as a consequence, the average cost of its services would be higher than those of its

larger scale competitors. Similarly, the new entrant's lack of economies of scope would translate into a higher average cost of service compared to larger companies offering a wider variety of services. Unable to compete, a potential entrant would not enter. This situation is exacerbated if one takes also into account the existence of sunk non-recoverable costs prevailing in this market.

In addition to structural barrier to entry, there are legal and regulatory barrier too. Although the LTA has instituted a universal (technology neutral) licensing regime<sup>1</sup> to facilitate the deployment of new services, there are still significant barrier to entry on the assignment of radio frequencies, access to passive infrastructure, or in the ability to get the required permits (or right of way) to build new infrastructure. The lack of mandatory regulation to share passive infrastructure imposes significant delays to expansion (or to new entrants) as these would need to secure the necessary permits to deploy infrastructure such as cellular towers. This can be a time consuming process that would retard the expansion of services. In meetings held in Monrovia, a current MNO mentioned the difficulty to gain access and share infrastructure such as cellular towers, poles and ducts delayed their network expansion in the past. For the aforementioned reasons we deem justifiable to define this market as a relevant market susceptible to ex ante regulations.

## **MOBILE DATA AND INTERNET ACCESS**

This market includes access to data and Internet service by individuals, private and government organizations via a wireless access network that allows users to access data and the Internet using a smartphone (or tablet) while traveling within the coverage area of the network. There are currently three mobile operators in Liberia that provide this service via a 3G/4G network. The geographic market is the national territory of Liberia.

We started our analysis by considering mobile data and Internet access offered by the three MNOs as the focal or tentative product market. Customers use this product to access their email accounts or Internet websites using a smartphone. They can do so anywhere within the coverage area of their network. The large majority of consumers buy this product unbundled from voice. They usually have voice/SMS service and add on to it data and Internet.

Clearly, demand-side substitution is very strong between the mobile data and Internet products of the three MNOs. It is common to observe users with SIM cards from more than one MNO to take advantage of promotions. This suggests a high degree of demand-side substitution between the products of the three MNOs.

We also considered whether this product market should be expanded to include fixed wireless data and Internet services. Our analysis concludes that they belong to separate markets for several reasons. First, anecdotal evidence suggests that users of mobile and fixed (wireless) Internet access this service in different ways. While users of mobile data and Internet access it via a smartphone, users of fixed (wireless) data and Internet access it via a desktop or a laptop computer at fixed locations. More important, mobile access is used for email primarily and to a lesser extent to access Internet web sites. Fixed Internet access is used more intensely to download content from the Internet. This is because the mobility features (of mobile access) imposes substantial technical demands on this service leading to substantially lower and more variable data rates for mobile than for fixed data and Internet access. This translates into download speeds that are lower and quite variable for mobile Internet access compared with fixed Internet access. Therefore, the product functionality is so different between the mobile and fixed products that demand-side substitution between these two products is non-existent or extremely weak. That is, a SSNIP on mobile data and Internet access could be maintained.

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<sup>1</sup> Liberia Telecommunications Authority. *LTA-Order-0010-01-28-15. Telecommunications Licensing Authorization Regulations (LTA-REG-001) As Amended 2015.*

Another sign indicating that the mobile and fixed products belong to different markets is the way in which these services are priced. Fixed Internet access is priced based on speed (bandwidth), with higher speed services being priced higher than lower speed services. On the other hand, mobile Internet access is sold based on data download capacity (megabytes) and not on speed. This different pricing has the effect of making price comparisons very difficult between mobile and fixed services. This in turn would attenuate any demand-side substitution that may exist between these services leading to our view that a SSNIP on mobile data and Internet access could be maintained.

The geographic market definition was analyzed also. The coverage of the three MNOs' networks largely overlap each other. Moreover, the number of based stations that are 3G capable has been growing up rapidly for all three MNOs suggesting that the nature of competition is similar across Liberia.<sup>2</sup> Thus, we considered the geographic area to be the national territory of Liberia.

Finally, we justify the identification of this market as being susceptible to ex ante regulation based on the following criteria:

- (i) Market is relatively large in size: It is estimated that as of June 2015 there were 823,921 active mobile data and Internet subscribers highlighting its importance in the context of Liberia.
- (ii) Concentrated market: The market structure is highly concentrated. Using the Herfindahl-Hirschman Index (HHI),<sup>3</sup> a widely used measure of market concentration, we found that depending on the indicator used, the HHI ranges from 4219 to 4063 in the six months ending on June 30, 2015.
- (iii) High and non-transitory barriers to entry: As with the previous relevant market, this market exhibits high and non-transitory barriers to entry, which are structural, legal, and regulatory.

## **FIXED DATA AND INTERNET ACCESS**

We started by considering that the relevant product is fixed-wireless data and Internet access. This service is offered by the three mobile operators and the six Category 2 ISPs. This market includes access to data and Internet service by individuals at fixed locations in private and government organizations. Consumers typically access this service via a router, a modem, or a dongle connect to their computer terminal.

We have incomplete disaggregated data on the number of fixed Internet subscribers from the MNOs but nevertheless, estimate a market size of close to 900 subscribers including Category 2 ISPs. The analysis of demand-side substitution made it clear that from the point of view of functionality or product characteristics, a user of fixed wireless Internet via a point-to-point link may find it indistinguishable from a fixed-wireless user via the 3G access network or some other wireless technology such as WiMAX or VSAT. Thus, a SSNIP of any of these services could not be maintained suggesting that the product market includes all fixed wireless data and Internet access supplied by the MNOs and the Category 2 ISPs. Of course this doesn't mean that prices are uniform; service providers offer a wide array of speeds and quality of service and prices vary accordingly.

We then considered whether it was appropriate to expand the market to include Libtelco's fixed Internet service supplied via fiber in Monrovia. Libtelco's customer base is estimated to be close to 100 customers (private and government organizations). Geographically they are circumscribed to a reduced section in the business center of Monrovia.

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<sup>2</sup> Generally speaking 2 out of three bases stations are 3G capable.

<sup>3</sup> In the U.S. a market with a HHI higher than 2500 is considered highly concentrated for merger reviews. See US DOJ and FTC (2010) at p. 19.

Again, although there could be differences in quality and speeds between Libtelco's fiber based Internet and another service provided via a wireless link, our view is that a SSNIP on fixed wireless Internet service could not be maintained where Libtelco is present because a non-trivial number of customers would switch to Libtelco. Hence we conclude that the degree of demand side substitution is significant between the different modes of access at fixed locations (WiMAX, 3G/4G, fiber, VSAT) and therefore, these different modes of access should be included in the same product market.

The geographic market definition was also analyzed. The coverage of the three mobile networks largely overlap each other indicating that the nature of competition is similar across Liberia. Although, competition may be slightly higher in some areas where the Category 2 ISPs and Libtelco are present, overall competitive forces appear not to vary widely enough across the country to warrant a different geographic market definition. Thus, we considered the geographic area to be the national territory of Liberia.

Finally, we justify the identification of this relevant market susceptible to ex ante regulation based on:

- (i) Market is relatively large in size: Although the total number of subscriber is not large, perhaps close to 1,000 subscribers, revenue wise, the market is important and growing. Revenue for 2014 is estimated to have been in excess of US\$7 million.
- (ii) Concentrated market: The market structure is concentrated. We estimated a Herfindahl-Hirschman Index (HHI) of 2541 using the number of subscribers and 2815 using revenue.
- (iii) High and non-transitory barriers to entry: As with the previous relevant markets, this market also exhibits high and non-transitory barriers to entry which are structural, legal, and regulatory.

# Wholesale Market Definition

## Overview

Wholesale services are those services sold to other licensees who use these as inputs in the provision of retail services. The distinction between retail and wholesale markets is particularly important for telecommunications regulators, because in order to avoid as much distortion as possible in the market, regulators will seek to find remedies to competitive problems in wholesale markets first. Ensuring fair access to bottleneck facilities, for example, may allow the regulator to rely on competitive forces in the downstream (retail) markets.

## Supply Chain for Retail Markets

Three relevant retail markets have been identified – Mobile Voice/SMS, Mobile Data and Internet and Fixed Data and Internet. It is useful to illustrate the supply chains for these services in order to identify wholesale services that might constitute markets. Retail services in Liberia are provided through networks made up of international connectivity facilities that are linked or backhauled to core domestic networks, which are in turn connected to access networks that deliver services to end-users. We note that many of the products provided to these end-users only use part of these networks. For example, a local call will traverse the access network to the domestic core network of the caller where it may pass to the core network of another operator and finally to the access network of the call receiver. In this scenario no international connectivity facilities are used.

In the figure below, we illustrate the technologies that are deployed in the supply chain for telecommunications services in Liberia. Working our way from the top down, we observe, for international connectivity, virtually all international traffic is routed through the ACE cable. Satellite facilities are maintained for redundancy purposes. We are also aware that one or more operators have used or are using microwave facilities to exchange traffic with operators in neighboring countries.

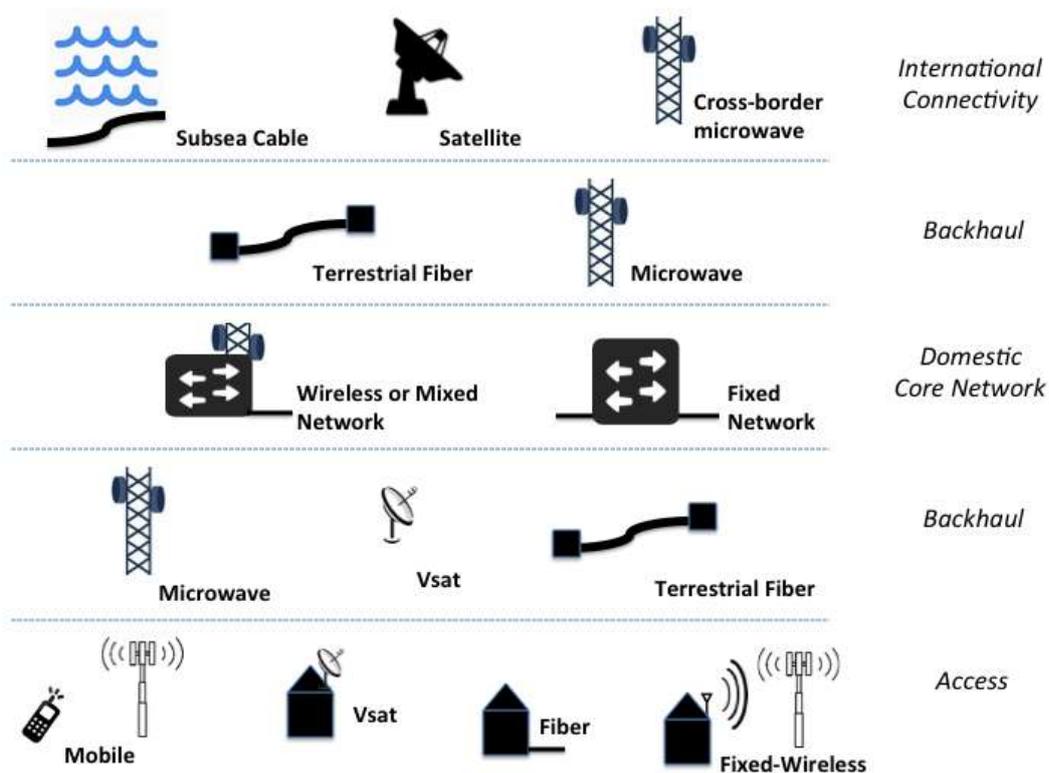
Certain licensees (Libtelco, Cellcom) use fiber to connect their core networks to the ACE cable facility. Others (Lonestar, Novafone, ISPs) use microwave facilities.

The core networks of licensees generally use microwave transmission to link their switching facilities. However, some already use fiber to connect switches to a number of towers, and the use of fiber can be expected to increase in the future. Libtelco is building a fixed core network based on fiber in Monrovia. Other licensees and potential entrants also have plans to expand fiber facilities.

To link core networks to access networks, microwave transmission is most typical in Liberia. Exceptions are the use of VSATs by the mobile operators and ISPs, and, as already indicated, Libtelco is building out fiber backhaul facilities in Monrovia and other players have plans for additional “middle mile” fiber investment.

Finally, there are several access technologies. Radio networks serving mobile subscribers are the main form of access in Liberia. Some customer sites in remote locations in the country are connected via VSATs. Libtelco is building out fiber local loops to serve larger customers in Monrovia. Finally, some operators provide fixed-wireless access.

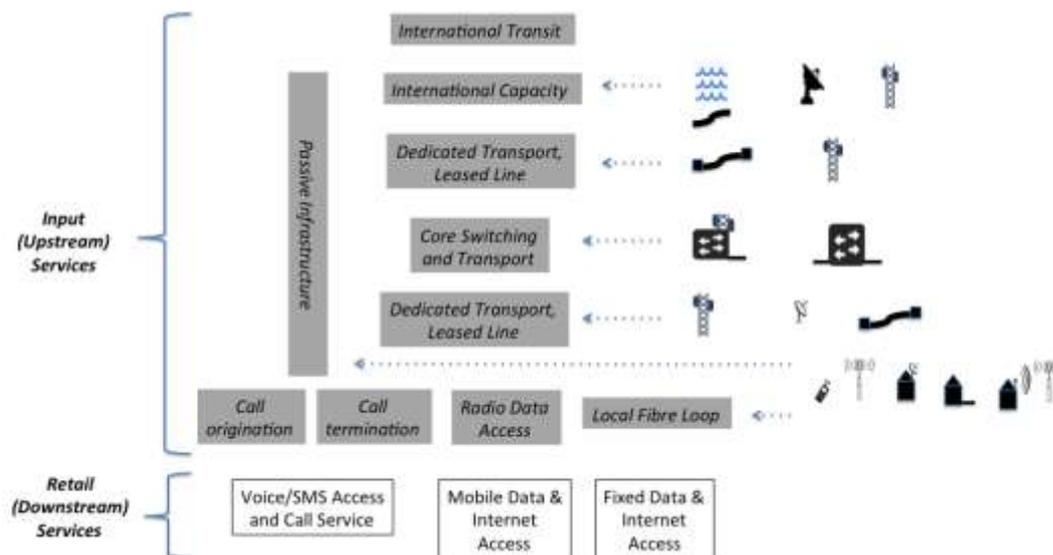
*Components of the Supply Chain for Telecommunications Services in Liberia*



With these network components of the supply chain in mind, we next examine the retail markets defined in the preceding section in terms of service inputs. As discussed in that preceding section, the voice market is served almost exclusively by wireless network operators. The inputs that make up the service can be broken down into call origination, transport to the core network (backhaul), core network transport and switching, then—in the case of domestic calls—call termination on the same network (for on-net calls) or on another Liberian licensee’s network (for off-net calls). In the case of outbound international calling, calls are routed through transport to the international facilities (backhaul), through international capacity, then handed off to foreign operators to transit to the ultimate destination. For inbound calls, the routing is in the other direction with foreign originated calls terminating with a Liberian subscriber. Passive infrastructure—towers, ducts—underlie the provision of these inputs services. See the figure below.

With respect to mobile and fixed data or Internet services, similar inputs are involved; however, three important distinctions must be made. Firstly, with the access network, Internet and data speeds require high capacity channels for service provision. In the case of mobile network, 3G and 4G radio access imply increasing channel capacity. In the case of the fixed network, point-to-point radio or fiber local loops are deployed. Secondly, depending on customer requirements, the degree of to which capacity is dedicated or contended will have to be managed differently throughout the core and international networks to ensure the appropriate type of quality of service. Finally, the international transit services will generally involve hand-off at an Internet exchange rather than a foreign operator's switched network as may be the case with the voice service.

### Wholesale Services



Source: Nathan Associates

Next, we note that some of these input services may be excluded from analysis. Firstly, the reader will recall the definition of wholesale markets: wholesale services are those sold to other licensed service providers who use these as inputs in the provision of retail services. Not all input services can be expected to find demand on a wholesale basis. For example, the call origination service is exclusively self-supplied by licensees in Liberia.<sup>4</sup> There is no market for core switching and transport network elements for mobile services as mobile virtual network operators (MVNOs) are not licensed in Liberia.<sup>5</sup>

Secondly, as the Liberian regulatory authorities do not have jurisdiction over international transit markets, we exclude this from our examination.

Thirdly, passive infrastructure (e.g., towers, ducts) is generally not treated in market analysis.

Thus, for a starting point our wholesale market analysis begins with the following eight candidate markets:

1. Call termination;
2. Local Radio Access;
3. Local Fiber Access;

<sup>4</sup> This need not be the case – carrier selection – could be offered or mandated.

<sup>5</sup> MVNOs would require radio data access as well as core network services to be offered on a wholesale basis.

4. Dedicated Microwave/VSAT Transport;
5. Dedicated Fiber Transport;
6. International Capacity – Satellite;
7. International Capacity – Fiber Optic Submarine Cable; and
8. International Capacity – Cross-border Microwave

## **Wholesale Market Definitions**

To organize our discussion of the eight potential markets identified, we group them under the headings Call Termination, Local Access (including both Radio and Fixed Access), Dedicated Transport (including Microwave/VSAT and Fiber Transport) and International Capacity (including both Fiber Optic Submarine Cable and Cross-Border Microwave).

### **CALL TERMINATION**

As discussed, the call termination service is the delivery of voice call/SMS call from the originating calling party to the called party. In the case of off-net calling in Liberia, this service is paid for by the originating network operator in the form of a mobile termination rate.

The size of the market in Liberia is indicated in the table below. The domestic termination market displays the impact of an increasingly “balkanized” market in which the recent heavy on-net price discounts have significantly reduced interconnection traffic among the operators. With respect to international traffic, there was a marked uplift in international traffic, which we believe is associated with the Ebola epidemic, e.g., the substitution of calls for travel and the elevated concern of the Liberian diaspora. We expect that international termination will return to a trend of decline from 2015 on.

We begin our analysis with a focal product of market termination on the customer’s own network.

We then ask ourselves what would be the impact of a SSNIP undertaken by a hypothetical monopolist. In fact, we are already well aware that the customer’s network is capable of raising the price of call termination to other networks. Indeed, this is why the LTA – and its counterparts in most other countries – has been driven to take the step to set termination rate ceilings. This market power arises from the fact that the calling party has no alternative to call a given phone number but to use the terminating network. There can be no substitution in demand, nor supply. It is true that the called party can choose to have an alternative phone or number, but that is not the choice of the purchaser of the service.

We then ask whether the focal product is too broadly defined, i.e., might there be sub-markets within the call termination market. As the retail services provided through this market are delivered through a single means, there is no narrower market defined through technology. In terms of geography, the call termination services are sold on the same terms irrespective of where the customer sources the service or his/her location when called. Similarly, it does not matter to the terms whether the customer is business or residential.

We therefore find that a call termination market exists for each network operator and that it is a national market with no customer segment differentiation.

### *Three Susceptibility Criteria*

We now ask whether the Call Termination market passes the three Criteria for susceptibility to ex-ante regulation. It does. Firstly, the market is significant in terms of function (any-to-any connectivity) and volumes. Secondly, the market is concentrated and does not tend towards effective competition. Although the retail market for mobile voice services is competitive, the incentive and ability of network operators to raise wholesale prices for termination provides clear evidence that the service cannot be expected to be offered on a competitive basis absent regulation. Finally, there are high and non-transitory barriers to entry in that entrants have to obtain a license and spectrum and construct in a national infrastructure.

### **LOCAL ACCESS**

Local Access is provided through radio access networks or, in a much more limited number of cases, fiber access by Libtelco at present. Radio access is self-provided by mobile operators. There are currently no plans for MVNOs, nor does there appear to be any demand for operators to lease fixed-wireless customer links from the mobile operators. Similarly, although Libtelco has fiber customers, it self-provides its loops. Libtelco has plans to lease fiber loops to others, but at present it does not do so. Despite the fact that no wholesale access is currently being sold, we believe that it is possible in the future that access will become a wholesale product, and therefore the market should be defined.

We begin with the question of whether radio access and fiber access are part of the same market for access. In terms of demand substitution, the two are very distinct. Despite the fact that mobile access speeds have increased, they are still no substitute for the kinds of access that fiber can deliver once fiber is available and competitively priced. Wireless access is still a shared medium and not capable of delivering reliably video traffic, for example. Supply substitutability is also not high: wireless access on a customer-by-customer basis take a great deal less effort and cost than running fiber infrastructure to a home. The fact that arrangements are made by wireless operators everywhere to off-load data traffic to fixed networks even at the access level is an indication of the lack of substitution between the two.

In terms of customer segmentation, we find little to distinguish markets. Although business customers are more demanding in terms of quality of service and bandwidth, the service offering for either radio access or fiber access at the wholesale level is not significantly differentiated. Supply substitution is negligible for radio access. For fiber access, depending on the deployment technology there may be some wavelength or strand provisioning differences, but nothing that poses a obstacle from shifting from a lower high-bandwidth service to a higher high-bandwidth service.

In terms of geography, we believe that radio access networks are national as mobile operators are required to roll out national networks. Fiber local access will be subnational in nature. At the moment, Libtelco has network only in Monrovia. It may well be that one or two other operators roll out fiber networks in Monrovia as well at least on a limited basis. Furthermore, whether and who rolls out fiber in other areas is yet to be seen.

### *Three Susceptibility Criteria*

The radio access market fails at least one of the three criteria. Because three network operators currently self-supply radio access and could relatively easily supply third parties, we believe there is effective competition in the market. Arguably, the barriers for entry are low as for any given existing mobile operator, it deploying additional radio access is generally relatively low cost.

However, for fiber local access, the three criteria are passed. Constructing a fiber access network is costly and time-consuming so barriers to entry are high. These barriers to entry and economies of scale ensure that effective competition will be unlikely and the market highly concentrated for the foreseeable future.

We note that it is true that the market is insignificant at present; however, the future of broadband is arguably fiber. There are a number of concrete proposals being considered to expand fiber in the country – potentially to be offered on an open access basis.

Thus, of our two access markets, we find only one -- fiber local access -- to be a relevant market.

## DEDICATED TRANSPORT

In order to transfer large amounts of traffic between aggregation points – towers, switches, etc. – from access networks to core networks or within core networks, service providers require dedicated high-bandwidth transmission capacity. We note that here we speak of *domestic* high-speed transmission capacity, not the international capacity, which will be the subject of discussion in the next sub-section below.

In a developed market one may find many different forms of this capacity – microwave, analogue or digital leased lines over traditional fixed SDH and PDH networks, satellite (VSAT) and next generation Ethernet over fiber. In Liberia, there are basically three forms of dedicated transport:

- 1) Point-to-point microwave, i.e. of the type that is currently deployed by all mobile operators and most of the ISPs,
- 2) satellite, which is deployed in Liberia to connect remote locations; and
- 3) fiber optic cable, which has been deployed by Libtelco for connectivity within the Monrovia area.

The first question we ask is whether these forms of transmission belong in the same market. We believe that they do not. In terms of demand substitution, we can immediately dispense with satellite as would not offer the quality, speed or price point that the fiber or even the microwave alternative would offer.

With respect to whether there are separate microwave and fiber markets, we would believe that there is not enough demand substitution to warrant a single market. Although microwave backbone networks are the primary form of high-speed transmission in Liberia, they are a second-best solution and only predominant because the fixed network in Liberia was decimated. Once available and competitively priced, fiber will be the means of transport of choice for service providers.

Microwave systems can be cost-effective when carrying voice and narrowband data, i.e., relatively small amounts of traffic. Fiber-optic cables have very high transmission capacity, and are preferred when voice and data traffic on a route exceeds certain volumes and especially when 3G and higher bandwidth services are introduced.

The implication of these observations is that prospectively there will be little demand substitution between high capacity and low capacity systems.

With respect to national transmission, we must look at the possibility of there being subnational, geographic markets. It is usually the case that licensees constructing backbones are providing for national transmission for their networks. This is definitely the case for microwave backbone networks. However, for fiber it is different, and the fact that there exists only one 20km fiber optic transport system highlights this.

Thus, we consider there may be subnational dedicated fiber markets and a single microwave national market.

Next we consider whether products available that provide dedicated fiber transport -- including trunk segments of leased lines and dark fiber -- constitute separate markets. These products provide different levels of functionality. For example, leased lines are conditioned for traffic, while dark fiber must have the appropriate electronics added to the circuit before it can be used to provide retail services. Despite their difference in functionality, we believe that there is a high degree of supply and demand substitution between these services so that they do not constitute separate markets.

There is one service that forms part of the dedicated fiber transport market that is worth highlighting, however. The link between the CCL and service providers' points of presence is a particular bottleneck that impacts both the domestic transmission market and the international connectivity market. This backhaul link is a critical element in the supply chain for international services. Therefore, any assessment of this market and remedies designed (in case of dominance) for high capacity domestic transmission should be sure to address this aspect of the market.

Additional considerations regarding customer segmentation, homogeneous markets and chains of substitution are not relevant.

Next we consider whether or not the three dedicated transport markets -- dedicated satellite, market and fiber transport -- are relevant with the three susceptibility criteria.

### *Three Susceptibility Criteria*

With respect to the Three Criteria Test, our conclusions closely mirror those with respect to the access market. The microwave and satellite markets fail at least one of the three criteria of the Three Criteria Test. Because three network operators currently self-supply dedicated satellite and microwave transport and could relatively easily supply third parties, we believe there is effective competition in the market, i.e., it is not concentrated. However, for dedicated fiber transport, the three criteria are passed. Constructing a fiber network is costly and time-consuming so barriers to entry are high. Effective competition will be unlikely in the foreseeable future.

Thus, of our three dedicated transport markets, we find only one -- dedicated fiber transport -- to be a relevant market.

## **INTERNATIONAL CONNECTIVITY**

In 2011, the LTA conducted a market analysis of the international connectivity market and found the following:

- Possible substitute services for Ace fiber-optic submarine cable access are are 1) Wholesale access to another international submarine cable; 2) Wholesale terrestrial international access via fiber-optic cable and 3) Wholesale international access provided via satellite;
- Of these possible substitutes, none is credible for the wholesale access to the ACE international fiber-optic submarine cable;
- this market may be expressed more generally as "the market for wholesale capacity on, and access to, international fiber-optic submarine cables"; and
- this market passes the three susceptibility criteria.

We therefore conclude that with respect to international connectivity there are three markets:

- International fiber-optic submarine connectivity
- International Satellite connectivity
- Cross-border microwave connectivity

### *Three Susceptibility Criteria*

Our analysis again is similar to that regarding domestic transmission options. The satellite and microwave options do not meet the three susceptibility criteria. With respect to Satellite, the barriers to entry are relatively low, and there is already evidence of effective competition. With respect to microwave, even though only one operator may be engaged in the practice, others could do so at relatively low cost should prices for subsea cable connectivity increase.

With respect to international fiber-optic connectivity, we believe that the LTA's analysis conducted a few years ago still holds true. The EU's Three Criteria Test is very similar to the susceptibility criteria.

### **SUMMARY**

Eight wholesale markets have been identified of which only four are relevant for analysis for ex-ante regulation based on the susceptibility criteria:

1. Call Termination
2. Local Fiber Access
3. Dedicated Fiber Transport
4. Fiber optic International Connectivity