Article can be accessed online at http://www.publishingindia.com

Business Case for a FTTX Provider in a Smart City

Senthil Ganesh Murugan*, Abhijit Nambiar**

**Ericsson Business Consultant, Lead Consultant, Bengaluru, Karnataka, India.*
E-mail: Senthil.ganesh.murugan@ericsson.com

***Ericsson Business Consultant, Consultant, Bengaluru, Karnataka, India. Email: abhijit@ericsson.com*

ABSTRACT

This paper proposes a futuristic business model, which enables the fibre data and telecom providers to partner with smart city administrators, to serve a concentrated market with soaring bandwidth needs. This model will establish a symbiotic situation for both the partners. The paper talks about how fibre broadband serves as an answer to the ever increasing digital appetite of the modern society. Various capital and operational costs associated with a FTTX roll out project for a smart city are discussed in detail, to give the reader a realistic picture. The paper also talks about the segmentation of the market, products and services. In addition to these, the various sources of revenue and a financial analysis, comparing the investment against the returns, over a period of ten years, are discussed in detail.

Keywords: PPP Model, Fibre Networks, Cost Analysis, Customer Segments, Passive and Active Networks

1. INCREASED BANDWIDTH CONSUMPTION AND KEY TRENDS

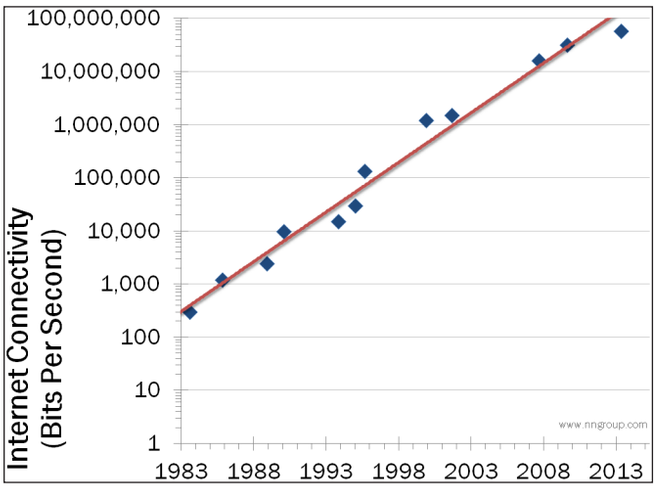
The current society is seeing an ever increase in its"digital appetite". The bandwidth is consumed in various ways such as photos sharing, HD movie streaming and video calling.

There's no definite answer to the question "How much bandwidth is enough?"Nielsen's law of internet shows that a high end user's connection speed increases by 50% per year.(Nielsen's law of internet bandwidth)

Considering these trends in mind, the Over the Top (OTT) service providers too have tweaked their business models to build products revolving on high bandwidths. DVD rental firms such as Amazon and Netflix and VoIP players such as Skype HD services are all providing customer delight products, which run on a minimum of 1Mbps connection for superior experience.

This type of "digital appetite" is basically seen from urban population who are opting for these OTT services and hence, the higher bandwidth needs. Also, the population living in the urban areas will go up to 70% by 2050. The future will see an intersection of these two trends of urbanization and rapid uptake of broadband, thereby giving rise to the concept of smart or digital cities. The smart cities are the ones where everything shall be connected, combined with digital governance, all- enabled by high speed broadband. This opens up a huge market to the broadband service providers with lucrative deals.

Figure 1: Nielsen's Law of Internet Bandwidth.



Source:Nielsen Norman Group

Doubling broadband speeds for an economy can add 0.3 percent to GDP growth. In BIC (Brazil, India and China) countries, introducing a 0.5 Mbps broadband connection increases household income by USD 800 per year. Also, upgrading from 0.5 to 4 Mbps increases income by USD 46 per month.(Socioeconomic effects of broadband speed, Ericsson, 2013)

An FTTH network can save up to 1.5% of costs in the four main economic sectors: Electricity, Transportation, Education, and Health – in addition to the direct benefits in telecommunications. FTTH has a positive impact on the environment too. 1 million users connected is equivalent to at least 1 million tons of CO2 saved.(The socio-economic impact of Fibre to the Home, FTTH Council Europe, 2011)

2. FTTX Service Business Model

This steady increase in bandwidth demands from customers has forced the legacy copper networks to become obsolete. This is where FTTx (Fibre to the Subscriber) comes into the picture. The fibre network is establishing itself as the foundation for our digital needs, bringing in prosperity and whole host of business, social and entertainment opportunities.

There are multiple models to build FTTx. The following section discusses the pros and cons of each of the models. The first one is the "Ownership" model, where the Government owns the entire infrastructure, including the active and passive. Also, the Government takes ownership and deploys both the active and passive infrastructure. This model has the highest level of involvement from the Government. The advantage of this model is that the Government has complete control over the project and there will be no integration issues. The disadvantage will be that the Government will have to take care of the high levels of investments needed over the entire course of the project. The Government has to take care of all of the operational issues during the project. Also, the changes in Government policies will have direct impact on the progressing projects.

The next one is the "Supportive" model, where the Government does not interfere directly in the ownership and deployment of the infrastructure. Here, the Government provides incentives to the companies for deploying the infrastructure. In this model, the Private sector completely owns, builds and operates the infrastructure, with aid from the Government. This model might create problems due to the lack of ownership and in the long run there can be many issues such as Rights to the land of operation, the ownership of the passive infrastructure over a longer period, the integration issues and ways of operation between the Government and companies.

An alternate model is the "Public Private Partnership" model (PPP), which is discussed in the next section.

3. Public Private Partnership (PPP) Model

PPP model is the one in which the Government owns the infrastructure. The private sector operator builds and deploys the infrastructure. Also, the operator has the responsibility of managing the wholesale services. The operator is selected by a competitive process, such as tender. This model entrusts accountability and responsibility on all of the involved parties. In this mode, while the ownership lies with the Government, the expertise of the private sector is leveraged. The operator brings in the technological innovations and financial aspects, appropriately.The Government funding acts as the catalyst to get the best telecom operators to come forward for the fibre network deployment projects.

This model helps to get the right scope, accelerated time lines, diversified risk and efficient execution, thereby best suited for large infrastructure projects.The PPP model is successfully implemented in various parts of the world. The first case is Region Auvergne, where France Telecom has designed, operated and commercialized the project to provide broadband services. The contract is for a period of 10 years. The budgeted cost is EUR 38.5 million, which is provided by the Region Auvergne. The passive and active network layers are provided by France Telecom as a wholesale service provider. The retail service provisioning is handled by various players in the competitive open market. Region Auvergne will pay for the CAPEX, OPEX and financial costs during the ten year tenure.

The next case is that of Metropolitan Networks Project ("MAN") in Ireland. The individual MANs are managed by e|net for a period of 15 years. The project cost of EUR 170 million is funded by the Government authorities and the infrastructure is owned by the State. e|net sells the active and passive services to the service providers in wholesale.

The third case is that of the Shetland SHEFA 2 Interconnect Project ("Interconnect Project"), which forms part of Shetland Island Council's ("SIC") strategy to encourage a rapid deployment of broadband networks in Shetland. The cost of the project is EUR 1.7 million, which is funded by the SIC. In this case, the wholesale active and passive network services are provided by an SPV, formed between the SIC and an established telecom

Figure 2: Role of a Fibre Network Provider in a Smart City in PPP Model

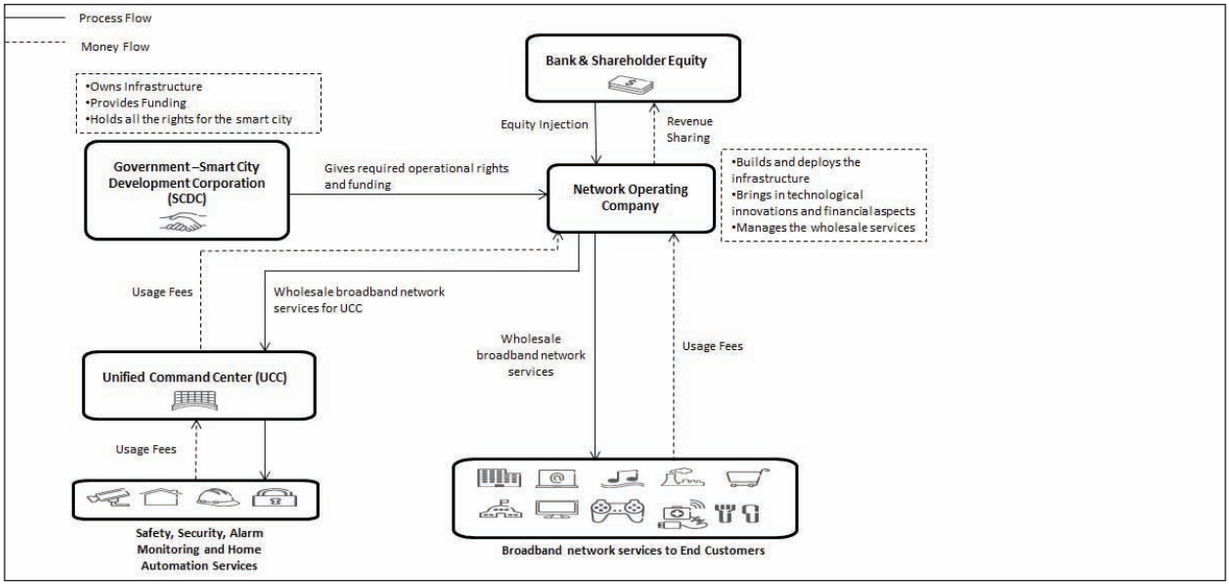
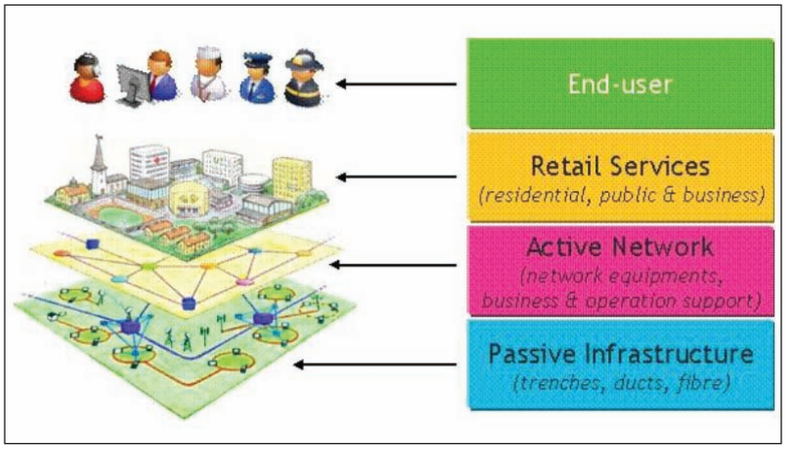


Figure 3: Network Service Layers in a Smart City.



Source: FTTH Business Guide

operator. The project runs on a rolling three year contract. (Delivering next generation access through PPP, EPEC, 2012)

Figure 2 describes how a Fibre network provider can get into the value chain of smart city, effectively. In a typical smart city plan, a smart city development corporation (SCDC) will be setup, in a Public Private Partnership. This SCDC will own all the rights for the land in which the smart city will be developed. Also, in a true sense, the SCDC is the owner of the entire smart city.

The SCDC appoints a fibre network provider to build and operate the fibre network needed for the broadband requirements of the smart city. Also, the SCDC gives all the necessary operational rights for the network provider to commission and operate the fibre network. The Build-Operate-Transfer (BOT) model can be best suited in this scenario. Here, the network provider builds the fibre network initially and then the provider operates the entire network in order to provide both wholesale and retail services.To avoid any legal hassles associated with monopoly and at the same time maintain a profit making unit, it's essential the network operator should operate both wholesale and retail businesses. While the wholesale business is completely owned by the operator, the retail business will see multiple operators offering services after leasing/buying network from the main network provider. This model has been implemented successfully in the City of Joburg – Smart City. The operator B-Wired

is a special purpose vehicle which is a joint venture between Johannesburg municipality, Ericsson and a local operator. B-Wired provides exclusive retail services to the customers inside the smart city and apart from this also leases the fibre network to other operators for them to provide retail services within the smart city, to avoid legal consequences of a monopolized market.(Bwired - Product Portfolio)

The typical contract period for the network provider could be 10 years, wherein the firm can plan for the necessary investments and devise plans to reap the revenues, appropriately. This will be a reasonable time frame for a network provider to break even and become profitable.

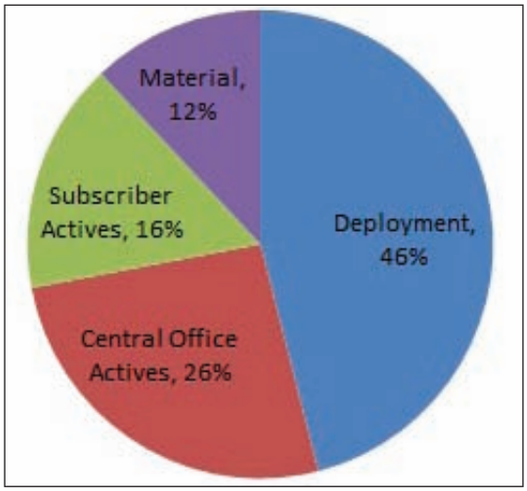
The Unified Command Centre (UCC) is a separate stream, which incurs significant investments and has the potential for huge returns. The network provider provides the necessary broadband network services to enable the high bandwidth requirements of the UCC, such as video surveillance, alarm monitoring, intrusion monitoring and automation services.

Network service layers in a smart city are represented in the Figure 3. (Network service layers in a smart city, FTTH Council)

4. Cost Analysis

Figure 4 shows the typical CAPEX apportionment for the fibre network provisioning in a smart city, corresponding to the layers mentioned in figure 3. (CAPEX apportionment, FTTH Council)

Figure 4: CAPEX apportionment.



Source: FTTH Business Guide

The following sections discuss the cost distribution:

4.1. Passive Network Deployment Costs

The passive network deployment costs and the passive network material contribute to 58% of the CAPEX. This is a huge capital expenditure to be made and the point to note is that almost half of this passive network deployment cost has to be invested in the first three years of the business. The civil work costs comprise of costs for the activities such as excavate, fill and manhole construction. These deployment costs have to be considered for rolling out the following three types of passive fibre networks: Base Fibre Ring, Distribution & Feeder Network and Vertical Built. Base Fibre ring is the fibre ring that is built throughout the circumference of the city. This Fibre ring has to be laid first, sequentially. Distribution & Feeder Network Built is the fibre that connects the Base Fibre with that of the ONTs in the Building blocks. Vertical Built is the internal connectivity that is done within the floors of the building premises.

4.2. Central Office Active Network Equipment Costs

The central office active network components are 26% of the CAPEX and are borne by the government entity. Passive optical network (PON) and Point to Point (P2P) are the two widely used architectures in fibre network deployment. P2P fibre provides symmetrical bandwidth and dedicates a single fibre for each end user. Gigabit Passive Optical Network (GPON) is a Point-to-multipoint (P2MP) technology where a single fibre is shared by several users via an optical splitter. P2P, with their dedicated lines, can suit the commercial customers, while GPON can suffice the needs of the residential customer.

GPONor P2P Central Office active network Equipments and Internet Protocol Television Head end / Video on Demand (IPTV HE/VOD) Servers have to be installed.

4.3. Subscriber Active Network Equipment Costs

Nowadays, integrated Customer Premises Equipments (CPEs) are available which perform the functions of home gateways, routers and optical converters. Appropriate CPEs have to be installed for varied customer premises such as: Single Family Units (SFU), Multi-Dwelling Units (MDUs) and Enterprises. Additionally, the Set Top Boxes (STB) and Ethernet switches have to be installed appropriately at the customer premises.

4.4. OPEX Costs

The operating expenses for a fibre network provider in a smart city consists of employee salaries, administrative expenses, customer acquisition costs, content acquisition costs, marketing and sales costs, backhaul costs, network operation and maintenance costs, IT maintenance support costs and rights of way costs.

The OPEX is lesser in the initial years and grows gradually, as the number of subscribers within the smart city increases.

5. Customer Segments in a Smart City

There are various segments of customer that a fibre service operator can come across in a smart city segmented according to the nature of the service or the bandwidth needed for each of them. Some of the broadly defined segments are:

Private Customers

- Residential
- Businesses
- Industry
- Shopping/Retail
- Recreation (Hotels & Entertainment)
- Private Clinics
- Home Automation & Security Services

Public Customers

- Public Health Services
- Public Emergency Services
- Utilities
- Public Governance Services

Wholesale Business

5.1. Private Sector Customers

In a Smart City environment where everything is connected, people, knowledge, devices and information are networked for the progress of business and society. These private customers are the major contributors to the revenue in this business model and they comprise of sub segments such as:

5.1.1. Residential

A typical residential package could be of two variants – Premium and Basic in our case. The service will consist of a High Speed Internet Access (HSIA) whose speed might range from 10 Mbps to 50 Mbps, with or without a data cap. Apart from this the resident will have access to Video on Demand (VoD) services and multiplayer gaming. If the operator owns the voice and the TV network as well, then the Triple play services can be provided.

There could be two methods an operator can charge their customers: subscription and pay per use.The subscription prices are charged at a fixed rate, monthly, while the pay per use customer would be paying as per the number of Mbs of data used. The price erosion factor has to considered, once the economies of scale are achieved.

5.1.2. Businesses and Industries

The concept of a networked society is usually based on the coexistence of varied entities such as work, recreation, retail and health. Also smart city hosts a number of business entities, who need bandwidth intensive enterprise data services. There's also a market of the small and medium enterprises (SME's), who need the enterprise data services at a lower scale.

The prime product in the service bouquet is the high speed internet access (HSIA), with speeds ranging from 25 Mbps to 100 Mbps. The basic business pack targets the SME's and the premium business pack satisfies the needs of large enterprises. Apart from these products, the enterprises would need a range of data products such as VPN, Hosting services, Business communication services, Teleconferencing services and Hosted data centres.

Also, the smart city will have manufacturing and other heavy machinery industries that would need products at a more local level. The VPN would be a local Ethernet based one and the hosting services too would be specific.

5.1.3. Shopping/Retail

The retail spaces will have their own fibre data needs for the retail centre's security, marketing and promotions. The service provider can provide access to each of the shopping units in the mall and create a local network for the transfer of information. Since, the complexity of services is less and the number of shopping units will be more, it will be a volume based business for operator.

5.1.4. Recreation (Hotels and Entertainment)

The recreation units will need services which satisfies their customers, who in turn, want basic communication services and internet services in the form of wi-fi. Also the operator can give a community antenna service for the TV content and charge the hotel a onetime fee or a subscription fee.

5.1.5. Private Clinics

The private clinics would need a reliable data connection for the advanced services they would offer to the inmates of the smart city. Services such as remote monitoring, health care management services and e-health services will need a constant bandwidth for a certain period of time without any interruption.

5.1.6. Home Automation & Security Services

The Home Automation and Security services are primarily provided by the command centre. The command centre is hugely dependent on the fibre service provider, as the services involve constant interaction between the installed devices and the centre. This uninterrupted communication is the backbone of the command centre services. The data service provider can charge a monthly or a onetime fee to the command centre for the enablement of automation and security services. The various services which come under this bouquet are: smoke detection and intruder alarms, utilities billing and metering, lighting control, video monitoring and access control systems.

5.2. Public Sector Customers

The advantages of high speed broadband need not only be reaped by the private sector, but also, it can help governments and municipalities to provide the residents of the smart city a host of intelligent governance applications. The broadband enables the authorities to effectively administer the high end services, in domains such as education, health care, traffic management and pollution control.

The services in public domain are divided into a few broad categories in this paper:

5.2.1. Public Health

A sturdy and reliable broadband connection enables advanced applications to facilitate better delivery of health services to the smart city residents. The host of services include remote monitoring, health care management, remote surgery and home care for elderly. The digital health and remote monitoring solutions not only support a hale and hearty lifestyle, but also cut down on travel and other documentation, which makes the service faster and effective. The digital health care management forms the core of the offering, by facilitating electronic reporting and booking, updating patient records, digitizing prescriptions and referrals and eliminating the need for printouts when sent to pharmacies, hospitals and laboratories.

The pricing of the service largely depends on various factors such as the per capita health expenditure, the out of pocket expenditure and the ratio of private to public expenditure on health. Each country can accordingly price these services based on the mentioned factors.

5.2.2. Emergency Services

A city faces various challenges in terms of the emergency response because of the various layers of administration involved and there's no dedicated channel to effectively relay all the information. Effective handling of emergency events with optimized distribution of resources and co-ordination between various teams can be enabled only by a centralised monitoring system. Enhanced bandwidth provided by fibre services and highly responsive systems enable the unified command centre to deliver services such as real time emergency response, location optimization, security monitoring and accident prevention. The centralised reception reports about various emergencies, events and alarms which are aided by real time video transfers to the centre and a responsive action is taken by the various teams involved.

The service involves huge infrastructure and "always on" broadband connection to facilitate it. A part of the cost could be charged from the smart city residents and since the services are about safety, the customers will be willingly parting with the amount.

5.2.3. Public Governance Services

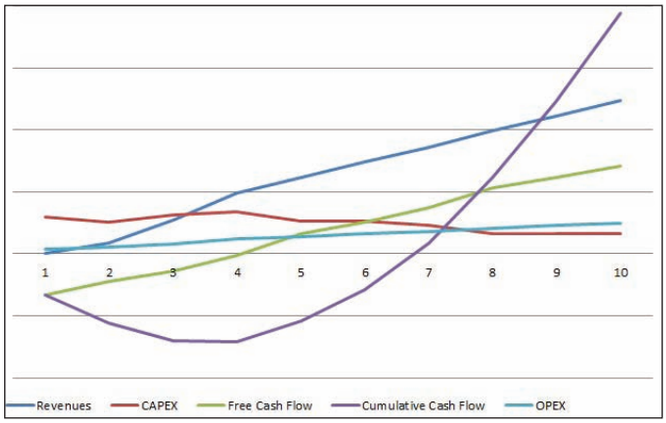
For effective governance, understanding public concerns ahead of time and mitigating them is mandatory. A command centre which bases its platform on advanced social analytics will help the government to provide effective governance. Some of the services which can be provided using this platform would be traffic management, toll road pricing, street light management, road accident monitoring and handling services. The inter-departmental

collaboration is the key here, in order to make the city safer.These services are enabled by the command centre platform and would need some applications like social media analytics and other communication tools.

5.3. Wholesale Customers

The wholesale arm of the said operator shall be responsible for leasing or sharing of networks with the other operators vying for a pie in the retail market. Since, the network infrastructure is owned by the government, it shall too get a cut out of the whole deal struck between the two operators. With pricing stability, controlled market conditions and high bandwidth consumption the wholesale arm will be a significant contributor in the revenues of the operator. The operator can lease its networks on a fixed pay kind of mode or it could charge on the basis of usage to the retail operator. The core business of the operator shall still be the retail market; the level of involvement in the wholesale business will be relatively lower for the main operator. This consolidation eventually will help create a mature market with the players solely concentrating on customer satisfaction and better services.

Figure 5: Trend of Investments and Returns



6. Financial Analysis – Investments and Returns

Figure 5 shows the trend of the investments and returns in a typical smart city model. The CAPEX is initially higher and gradually reduces, over the ten year period. The revenue increases as more and more customers take up the services of the network service provider. Proportionately, the OPEX also increases, as the subscribers increase. At year 4, the revenue clearly surpasses the CAPEX and OPEX and hence, the free cash flow (FCF) turns positive. Eventually, the cumulative cash flow (CCF) turns positive after the 6th year.

Though the FCF is positive after 4th year, the CCF takes 6 years to turn positive, due to the huge upfront investments.

7. Conclusion

As discussed in this paper, in the current scenario of cut throat competition and price wars between the broadband service providers, there's a need for these entities to keep looking for new opportunities and markets. With the increased adaptation of the concept of smart cities, these service providers can play a role much more than just that of a "dumb pipe", in the whole value chain. These providers with superior service and foresight can lead the transformation and be the change agent in the whole ecosystem. By establishing a Public Private Partnership(PPP) with the governing entity of a smart city, the broadband players enjoy not only the advantages of a dedicated high usage market with very less churn, but also avoid pooling in huge money for the project in terms of CAPEX. The PPP business model has been compared to various other existing models with their advantages and disadvantages drawn out clearly.

Financially, the business model is quantified with the estimates for the CAPEX, OPEX and the sources of revenue over a period of ten years. This analysis clearly suggests that by the end of 4th year the broadband provider sees a positive free cash flow and the cumulative cash flow turns positive after 6th year, giving the entity a good 4 years to reap the benefits. This equation will have a considerable impact on the financials of the network provider, from a small and concentrated market.

Hence, providing fibre based connectivity services to the smart city is a profitable value proposition for network providers. These opportunities will open up new revenue streams and it's time for the traditional network providers to take a look at the smart cities and grow their businesses profitably.

Bibliography

Bwired - Product Portfolio. (n.d.). Retrieved from Bwired: http://www.bwired.co.za/SmartCities.aspx

CAPEX apportionment, FTTH Council. (2010). Retrieved from FTTH Business Guide: http://www.ftthcouncil.eu/

Delivering next generation access through PPP, EPEC. (2012). Retrieved from http://www.eib.org/epec/resources/epec_broadband_en.pdf

Network service layers in a smart city, FTTH Council. (2010). Retrieved from FTTH Business Guide: http://www.ftthcouncil.eu/

Networked Society - The next age of megacities, Ericsson. (2013). Retrieved from http://www.ericsson.com/res/docs/2013/the-next-age-of-megacities.pdf

Nielsen's law of internet bandwidth. (n.d.). Retrieved from Nielsen Norman Group: http://www.nngroup.com/articles/law-of-bandwidth/

Socioeconomic effects of broadband speed, Ericsson. (2013). Retrieved from http://www.ericsson.com/res/thecompany/docs/corporate-responsibility/2013/ericsson-broadband-final-071013.pdf

The socio-economic impact of Fibre to the Home, FTTH Council Europe. (2011). Retrieved from http://www.ecoc2010.org/contents/attached/c20/WS_7_Schindler.pdf