

National Broadband Strategies and Policies: An Analysis of Technical Considerations for Developing Countries

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ABSTRACT

A number of countries have developed national broadband strategies and policies with a view to the realisation of an all inclusive information society for socio-economic benefits associated with broadband. Recent research points to the appalling broadband penetration rates in developing countries, more so in Africa where individual broadband penetration rates are below two per cent. The funding of broadband and ICT services in general in some of these countries is both fragmented and un-coordinated with every Government ministry or department implementing their own internal plans and often with no co-ordination between Government and other stakeholders. National broadband strategies and policies are therefore vital for developing countries to create a uniform, integrated, homogeneous and coordinated approach on the roll-out, optimal utilisation, and adoption of broadband. National broadband strategies and policies would generally aim at the provisioning of affordable, universal access to broadband infrastructure, and also focus on the building of the information society. A number of important aspects distinguish national broadband strategies and policies tailored for the developed economies and those for developing countries. First is the view of broadband as an ecosystem that includes its networks, the services that the networks carry, the applications they deliver, and users. Secondly, the need for Governments and ICT regulators to move beyond their traditional push role focused on broadband supply-side efforts and look at the demand side, users and applications to develop complete broadband policies or strategies. Also, unlike most developed countries which relied on fixed broadband while developing their broadband strategies, there is growing access to broadband by mobile and nomadic devices in developing countries. Finally, because of socio-economic, demographic and technological adoption differences between developed and developing countries, national broadband strategies or policies developed for developed countries may not necessarily find direct application in developing countries. It is in this context that this paper³ reviews the technical considerations for national broadband strategies and policies for developing countries and finally outlines the recommendations towards the development of a national broadband strategy or policy for a developing economy.

Keywords: *Broadband, Broadband Policy, Broadband Strategy, ICT, Developing countries.*

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1. INTRODUCTION

National broadband strategies and policies have been established as vital tools for broadband inclusion for all [1].[2] distinguishes between broadband strategies, with broad goals, vision statements, and frameworks and programs to achieve them; and broadband policies, which follow the strategic framework while implementing the program as the market evolves.

Broadband strategies and policies primarily initially focus on promoting broadband markets through a range of supply-side and demand-side policies [2]. These policies reduce market entry barriers, support infrastructure development, and help reduce the costs of broadband subscriptions for users. In the second stage, the Government exercises an oversight function through competition policy. Finally, as markets move toward maturity, the focus shifts to universal broadband access to include under-served or un-served populations and communities [2], Figure 1.

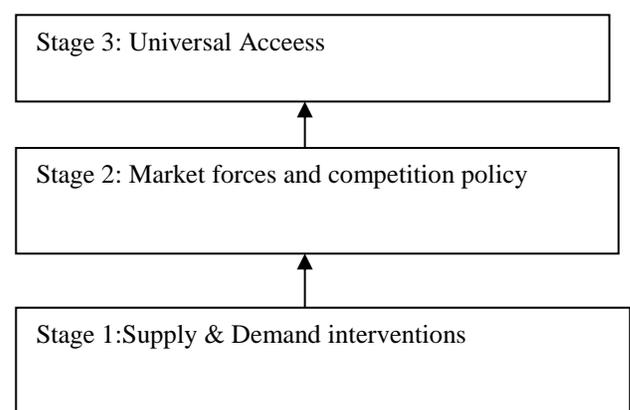


Figure 1: A general National Broadband Strategy or Policy Framework

Source: Adapted from [2]

Table1. Comparison of Key Objectives of Broadband Strategies and Policies for Selected Developed and Developing Countries

Source: Source: [2][3][4][5].

Country	USA	UK	Australia	South Africa
National Broadband Strategy/Policy Key Objectives	1. Universal deployment and access 2. Affordability and adoption 3. Maximum utilisation 4. Advancement of national purposes & public safety	1.Modernisation of infrastructure 2.Incentives,investment, and innovation in digital content, applications, and services 3. High-quality public service content, i.e news 4. Digital skills at all levels 5. Universal access and utilisation.	1.Min download speeds 12 Mbps to 98% of homes and businesses 2. National FTTx network over five year period (w.e.f 2008) 3. High quality voice, data and video applications 4. Open access competition 5. Affordable prices	1. Definition of Broadband 2. Gvt support for digital inclusion & information society 3. Role of Govt, State Owned Enterprises (SOEs) and private sector in infrastructure development 4.Universal access

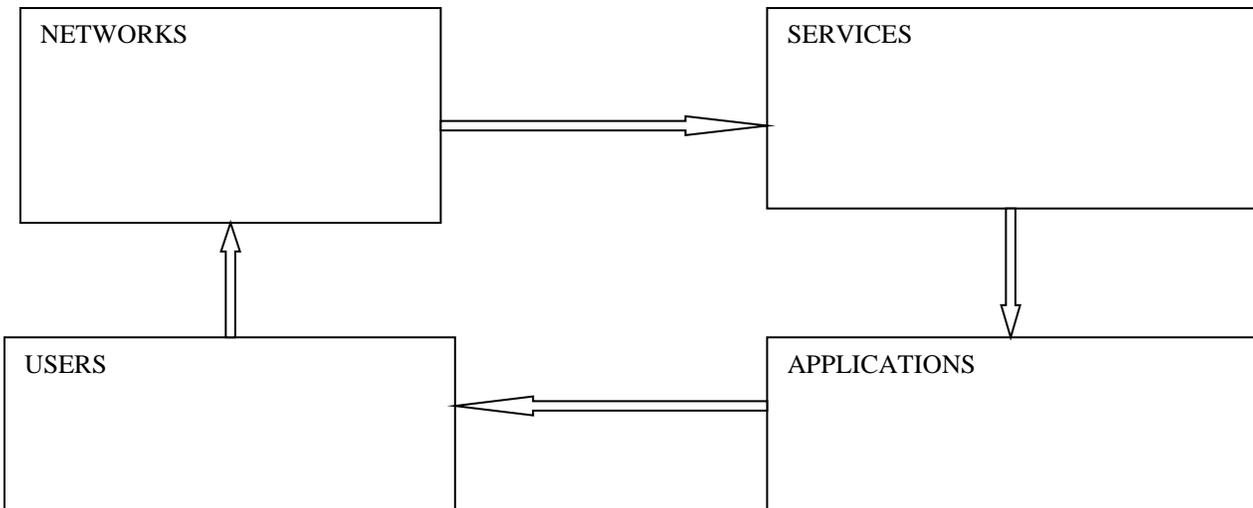


Figure 2: Broadband Eco-System

Source: [2]

2. THEORETICAL BASIS

A review of broad objectives of national broadband strategies and policies from USA, UK, Australia and South Africa for comparative purposes are summarised in Table 1.

Previously, the term “broadband” has been used to describe a range of information technologies that allow high speed high bandwidth data transmission and always-on access to the internet and other real-time services [6]. Because of the

evolving nature of broadband, the actual speed and bandwidth that constitute “broadband internet” are still a subject of international debate and countries have chosen to adopt different definitions for broadband speed [7]. However, the World Bank now suggests that broadband be defined beyond the traditional notion of a specific type of network connectivity or minimum transmission speed. Rather, it proposes that broadband be viewed as an ecosystem that includes networks, the services that the networks carry, the applications they deliver, and users [2], in what is popularly known as the broadband ecosystem (Fig. 2). This ecosystem view of broadband is gaining acceptance the world over [8][9].

It is imperative that any broadband strategy or policy embraces the four branches of the broadband eco-system, namely the networks, services, applications and users [2].

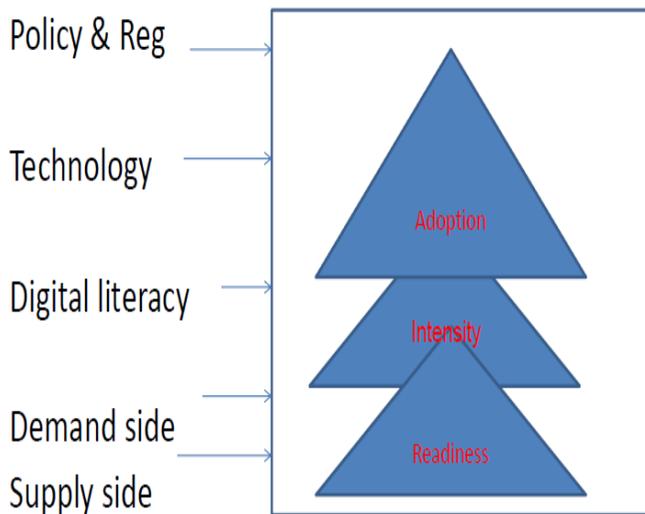


Figure 3: A Model of Broadband Readiness, Intensity and Adoption

Source: Adopted from [9]

[9] suggest a broadband framework that consists of broadband readiness, broadband intensity and broadband adoption, Fig. 3

[1] suggests a four domain model of market demand versus supply to inform a broadband strategy or policy. The model attempts to go beyond connection speed as a classification method of broadband. The model, Figure 4, is the basis of a number of policy interventions for each broadband demand-supply scenario [1].

Source: [1].

1.Low demand Low supply	2. Low demand High supply
3.High demand Low supply	4.High demand High supply

Figure 4: Market Forces based Broadband Model

Source: [1].

[10] analyse the key drivers to create a positive environment for mobile broadband, in a framework that could make valuable contribution towards the development of a national broadband strategy. Key drivers of mobile broadband adoption identified by [10] include, technology harmonization, availability and affordability of devices, network coverage, spectrum availability, service innovation, conducive policy & regulatory environment, and stimulating demand for mobile broadband. This is in agreement with recent studies which find growing access to internet by mobile and nomadic devices especially in developing countries [2] [9][11][12].

The Berkman center in a 2010 report, [13] reviews broadband definitions and targets of policy, giving a primary distinction between a focus on high capacity and focus on user experience, in particular on ubiquitous, seamless connectivity. In the high capacity domain, a further distinction is made between the focus on numeric measures prominently download speeds and applications supported [13].

The rest of this paper reviews the technical considerations for a national broadband strategy or policy formulation for developing economies based on the above theoretical underpinning and finally outlines the recommendations towards the realisation of a national broadband strategy or policy.

3. DISCUSSION

In view of the above considerations, the proposed strategy or policy must consider factors covering all or a combination of the models and frameworks discussed in (2) above. These factors will generally cover broadband networks, services, applications, and users [2] and address broadband readiness, intensity and adoption factors [9].

3.1 Networks

The networks envisaged in the proposed national strategy or policy must deliver fixed and mobile broadband to end-users via technologies such as cable (i.e xDSL), fibre, satellite and third-generation (3G) and fourth generation (4G) mobile

networks. A part from the desirable factors of broadband speed and capacity, recent research shows that broadband should be affordable [9].

Under the broad topic of networks, we discuss broadband speed, capacity, technologies and universal access and service.

3.1.1 Broadband Speed

A recent study [9] established the need to review the definition of broadband internet in Kenya. While some developing countries currently define broadband as internet speeds of at least 256Kb/s in either direction (i.e in Kenya [14]), most have no formal definition at all, and service providers have to set their own goals. The issue of advertised against delivered speeds also remains largely unresolved the world over [6]. The most commonly used term for describing future networks is “next generation access” or “super-fast internet” [13]. As a starting point, developing countries could target a universal availability of 1Mbps downstream broadband service by 2020 or thereabouts. This is too modest a goal by the standards of the highest performing countries, but is broadly consistent with the near-term goals of a typical developing country’s universal access targets [2]. There could be intermediate targets progressively improving on the connection speeds and the proportion of subscriptions, users, households, businesses and institutions clearly defined. It might be necessary to define a corresponding uplink speed target in each case.

3.1.2 Broadband Capacity

Next generation connectivity could also be defined using capacity to provide anticipated applications, rather than speed measures. For example, South Korea uses the term “ubiquity” to describe its goals. In this case, the term “ubiquity” refers to anytime, anywhere, on the move connectivity; digital multimedia broadcasting and so on [2]. Capacity could be provided via wired or wireless technologies [15]. Recent research points to the growing adoption of nomadic and wireless technologies such as 3G, Wi-Max and Wi-Fi in comparison to fixed technologies such as DSL and FTTx [9][11] especially in developing countries.

As earlier stated there is already considerable international broadband bandwidth available in some developing countries such as Kenya via the undersea cables namely, SEACOM, EAssy and TEAMS. In it’s fourth quarter 2011-12 sector statistics report, the ICT regulator, the Communications Commission of Kenya estimates that the total available international bandwidth is currently 575Mbps whereas the used bandwidth is 265 Mbps [16]. This places Kenya somewhere in the second quadrant of the Aspen Institute model, Figure 4 (Low demand- High supply) at least as far as international

bandwidth is concerned. In the hinterland, the proliferation of wireless and 3G enabled devices, their declining cost and the recent move by the Government of Kenya to develop of a national fibre backbone network connecting all county headquarters [9] are likely to put Kenya somewhere between the second and third quadrants of the Aspen Institute model, Figure 4. Recognising the role played by nomadic and wireless devices in broadband access in developing economies and the corresponding requirements for additional radio frequency spectrum for mobile service providers, the proposed national strategy or policy may require the communications regulators, to identify and roadmap targets to free sufficient spectrum for these services [9][10]. For example, the US broadband plan tasks the Federal Communications Commission (FCC) to make 500 Megahertz of new spectrum available for mobile broadband within 10 years, of which 300 Megahertz should be made available for mobile use within five years [3]. The same broadband plan urges the FCC to enable incentives and mechanisms to repurpose spectrum to more flexible uses, ensure greater transparency of spectrum allocation, and to expand opportunities for innovative spectrum access models by creating new avenues for opportunistic and unlicensed use of spectrum and increasing research into new spectrum technologies[3].

3.1.3 Broadband Technologies

Broadband technologies are evolving very rapidly. For example, Digital Subscriber Line (xDSL), Cable Modems, variations of fibre optic cable (FTTx) and broadband over power line (BPL) are all potential fixed broadband technologies whereas VSAT, Wi-Fi, Wimax, Space optics (FSO), and mobile wireless (3rd and 4th Generation systems) are potential wireless broadband technologies [7][17]. Each of these technologies has maximum transmission capacity, maximum range, advantages and limitations [15].

There is a remarkable difference in the trends in broadband technology in developed and developing countries. Whereas most developed countries relied on fixed broadband technologies such as fibre and digital subscriber line, wireless and nomadic technologies are taking root as key access technologies for broadband in developing countries [17]. For example, [9] find that wireless technologies comprising 3G & beyond, Wi-Fi and Wi-Max are the most critical for broadband access in most developing countries followed by fibre to the home/premise, (FTTx), classes of digital subscriber line, cable modem and satellite (VSAT) access. In this regard, policy considerations are necessary to promote access to 3G/4G enabled devices by way of subsidies or tax exemptions on the initial cost and or on subscriptions. Also, ICT industry regulators need to identify sufficient spectrum to cater for increased demand by mobile broadband service providers. The



roadmap to achieve the required amount of extra spectrum need to be specified in the national strategy or policy document.

3.1.4 Universal Access and Service (UAS)

Early national universal access and service (UAS) programmes targeted public and private access to basic voice telephone services [11]. As many developed countries achieved “universal” telephone service in many places, these countries re-focused their attention towards affordable broadband access. Recent advances in broadband policy formulation is to have some regulatory measures for the universal service fund administration by an independent body, and inclusion of broadband in universal access funding [9][18].

In a number of developed countries, there is a common objective in place to make broadband available on a “universal” scale, thus intrinsically linking the concepts of UAS and universal broadband availability. Further, as noted by [18], many policies related to education, health, government service provision, infrastructure development, tourism, and so on depend upon broadband and may even include specific plans for the promotion of broadband adoption.

Universal access efforts in developing economies may critically depend on mobile broadband. For example, [2] asserts that in Sub-Saharan Africa, subscriptions using wireless broadband are more than eight times those of fixed connections, suggesting the potential for wireless broadband in areas where traditional fixed connections infrastructure is lacking.

A detailed plan for inclusion of broadband in UAS is thus critical for any proposed national broadband strategy or policy. Initially, for developing countries like Kenya where broadband markets are still at infancy stage, [9] find that Government involvement in ensuring universal internet access is vital. The reasoning is that users with narrowband internet use experience would be more willing to adopt broadband than those who never had any type of internet service before [12].

3.2 Services

Broadband can be considered in terms of high speed data connectivity over “Next Generation” or IP based networks. This follows the erosion of the distinction between separate voice, data and video services as traditionally offered by telecommunication operators [2], and the emergency of services such as “triple play” (i.e broadband, video and voice) or “quadruple play”(i.e broadband, video and voice with some form of mobility usually using Wi-Fi). These services have caused considerable demand in bandwidth. [19] estimates bandwidth requirements in excess of 20 Mbps for advanced uses, such as next generation TV and e-learning, on-line gaming and so on. At a glance it may seem impossible to utilize

such kind of bandwidths on mobile devices employing 3G and similar technologies which currently have maximum capacities of about 2Mbps. However proponents of mobile broadband argue that up to seventy-five percent of the current services offered via mobile broadband require less than bandwidth capacities of 2 Mbps [10]. Currently, common mobile broadband applications include video based fleet management, location based serves, M-commerce, M-health, M-government and M-governance and so on [9]. Another important dimension of broadband service, latency—the time taken for data to reach from source to destination—is dependant on the end-to-end infrastructure and is not very critical in last mile-technologies except satellite connection, in which latency is inherently large. In order to further improve on broadband service provision, it is imperative to embrace open and interoperable standards and platforms for terminal and consumer premises equipment as well [15]. A recent study [9] established the need for Governments to take the lead in the provision of broadband services to Government institutions, health institutions and educational facilities. These efforts have to be explicitly laid down in the broadband strategy or policy.

3.3 Broadband Applications and Content

According to [2], applications are function-specific software that deliver content to users, and are becoming the centerpiece of the broadband ecosystem. Applications are increasingly used to deliver media and content to users and to generate appreciable amount of revenue for the operators in comparison with voice services whose income has been declining in the recent past [10][16]. [20] identifies three content types as follows:

International content: any information that is served in the same format around the world, regardless of location, and provided by an international developer on an international platform.

Localized content: is created for local users, but provided by an international developer or publisher and customized for local tastes, generally with the input of some locally created material.

Local content : content wholly developed for, and by, the local community, or in other words, content for a local user with relevance to local material that reflects and is obtained from their day-to-day life.

[20] further finds, international entertainment news, local news, breaking news, social networking such as face book, twitter, jobs and dating the most commonly sought after content in East Africa. [9] find development of local content key in broadband readiness in developing economies.



Another key aspect of broadband applications is the security of broadband connections [2][9]. The national broadband strategy or policy should detail innovative measures for local content development as well as measures to address security of broadband connections.

3.4 Users

Broadband users have the ability to utilise, create, and share multimedia content in a variety of formats using a growing range of powerful devices [2]. Unlike developed countries, developing countries face the challenge of digital literacy as a way of enhancing broadband readiness, intensity and adoption. [9] investigated digital literacy of the masses and the need for technical ICT expertise and found both to be “very” significant factors in explaining the variation in broadband readiness. The above study [9] recommends, among others, the need to stimulate interest in ICT related courses in institutions of learning, and equip citizens with the skills to use computers and the internet in general. It also supports the Kenya ICT Board’s private public partnerships initiatives in the development of digital villages (Pasha centres) which are meant to improve the digital literacy of the masses. However, comprehensive strategy is required to improve ICT expertise and further catalyse the digital literacy of the masses [21]. Availability of diverse content in the local languages is just one of the efforts that will bear fruit [9][22].

4. CHALLENGES IN DEVELOPING NATIONAL BROADBAND STRATEGIES AND POLICIES

[6] recognise broadband as basic infrastructure much like roads, water systems, railways, electric power and other public infrastructure. As a consequence, broadband is not spared from market failures seen in other basic infrastructure [8]. [2] identifies the persistence of monopoly-type structures in the provision of broadband infrastructure, even when no legal monopoly exists as an impediment to the development of effective national broadband strategies or policies.

[8] note difficulties in service provision authorisation in some countries. [20] further enumerate insufficient or inefficient allocation of radio spectrum for broadband, interconnection disparities, and limited capital markets as further examples that hinder development of effective broadband strategies or policies.

Recently, environmental impact considerations for broadband have emerged. [2] view broadband as both a potential cause of increased greenhouse gases (notably in the transition from dial-up service to always-on use) and a potential tool for reducing greenhouse gas emissions in other sectors of the economy as well (for instance, by reducing the need for physical movement

of people and goods). This new development poses a challenge in broadband strategy or policy formulation for developing countries.

5. CONCLUSION AND RECOMMENDATIONS

From the foregoing, any national broadband strategy or policy should firstly address broadband supply and demand related interventions. It should ensure robust broadband service competition, and maximize innovation and investment in broadband networks of both fixed and wireless nature. Further it should reform or enact legislation, laws, policies, standards and incentives to maximize the benefits of broadband in sectors government influences significantly, such as public education, health care and government operations and promote the use of innovative technologies such as cloud computing and open source software in both public and private entities. Further, with the growing adoption of mobile and nomadic broadband access devices, the Government ought to make available sufficient spectrum to broadband service providers from the digital dividend arising from analogue to digital TV migration or through efficient allocation and management techniques such as spectrum re-farming, auctions, secondary spectrum trading and so on.

Also, the current universal service mechanisms should be reformed to include independent administration of the fund and to include broadband in universal access and service (UAS) obligations. Other initial efforts should include promotion of computer and cyber security and critical infrastructure survivability to increase user confidence in broadband communications. Further, digital literacy improvement and local content development efforts should be stepped up. In the long-term, specific targets on download and upload speeds should be defined with specific geographic coverage or percentage of urban and rural population to be covered under each target. Because of the all-inclusiveness in the development of the proposed national broadband strategy or policy, the recommended approach is that of the public-private partnerships. An independent broadband task force or broadband committee may be appointed by the Government and will have to consider, among other goals, stimulating interest in the development of a national broadband strategy by all stakeholders, identifying the stakeholders in the development of the broadband strategy, identifying the resource requirements in the development of the broadband strategy and laying down the key steps in the development of the broadband strategy or policy.

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