Broadband Networks in MENA: Accelerating High-Speed Internet Access

Transport, Water and Infrastructure

MIDDLE EAST AND NORTH AFRICA

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Introduction

Many of the countries in the Middle East and North Africa region (MENA) have identified that broadband Internet will be a critical input to the broader objective of nation building and the transition to a knowledge-based economy. **There is growing consensus that broadband Internet is critical in fostering sustainable economic development and job creation, and is strategic to the goals of reducing poverty, enhancing job opportunities, and fostering trade integration**. This study assesses the status of broadband development in MENA, highlights key bottlenecks to growth, explores policy options, and offers suggestions on how to accelerate investment and diffusion of broadband connectivity. The focus of the study is on infrastructure-related actions; measures to stimulate demand for broadband are therefore only marginally addressed.

Box 1: Definition of Broadband

Broadband generally refers to a telecommunications connection that is "always on", as opposed to a "dial-up" connection via the public switched telephone network (PSTN) to activate an Internet connection, and with speed rates higher than the rates obtained with a dial-up modem. The commonly accepted definition of bandwidth rates for broadband, according to the International Telecommunications Union (ITU), is at least 256 kbps. This definition of broadband ("always on", download speed rates higher than 256 kbps) will be used throughout this study (International Telecommunications Union 2010; International Telecommunications Union 2011). There are indications that this definition may change over time. For instance, countries around the world have started to include in their national broadband plans an objective in terms of so called Fast and/or Ultra-Fast Broadband (FB, UFB). Again, the definitions of FB and UFB vary according to the specific plan and country context. So far, no common definition has been established internationally. However, FB and UFB have to do with new and evolving high-speed technologies, such as fiber optic cables, 4G, WiMAX, and so on, and refer respectively to bandwidth rates typically of about 30 Mbps and 100 Mbps and above.

Today eleven countries out of nineteen in MENA have adopted **national broadband strategies,** showing dedicated efforts to stimulate broadband market development in a systematic and holistic way with all key stakeholders. Indeed, all the countries in MENA with high penetration rates have adopted dedicated policy documents. At the core of such national broadband strategies are **targets in terms of broadband penetration or coverage across MENA**. These targets may differ across the region owing to available broadband infrastructure and to the disposable income of the population as well as to the state of government finances, especially when public funding is explored (see example of Egypt's National Broadband Plan in Box 2).

The MENA region would benefit from the adoption of a common approach to broadband development. According to Bilbao-Osorio, Dutta, and Lanvin (2013), MENA "boasts one of the most diverse performances in the world" when it comes to the Information and Communications

Technology (ICT) sector, at the core of which is broadband widespread availability. The 2013 Global Information Technology Report states that several Gulf Cooperation Council States during 2012 have sharply improved their overall performance (Qatar, the United Arab Emirates, and Saudi Arabia) and have continued their investments to make ICTs one of the key national industries that attempt to diversify and transform their economies. On the other hand, several North African (Algeria and Morocco) and Levant (the Islamic Republic of Iran) countries have either fallen – or stagnated, in the best cases – in their efforts to leverage ICTs as part of their economic and social transformation process toward more knowledge-intensive activities and open societies.

Table 1: National Broadband Policies within MENA, 2013

	Country	*Broadband policy*	*Link*
North Africa	Algeria	Yes/2008 New version planned	n.a.
	Tunisia	Yes/2012	Tunisia Broadband Strategy 2012: http://www.itu.int/ITU-D/arb/ARO/2012/RDF/.../Doc6-BroadBand.pptx%E2%80%8E
	Libya	No/Planned	n.a.
	Egypt, Arab Rep.	Yes/2011	eMisr National Broadband Plan: http://www.tra.gov.eg/emisr/Summary_En.pdf
	Morocco	Yes/2012	Digital Morocco 2013: http://www.egov.ma/SiteCollectionDocuments/Morocco Digital.pdf%E2%80%8E
Mashreq	Lebanon	Yes/2008	National E-Government Framework: http://www.undp.org.lb/programme/governance/ict4dev/eStrategy.cfm
	West Bank and Gaza	Yes/2011	National ICT Strategy 2011–2013: http://www.pmtit.ps/ar/cp/plugins/spaw/uploads/files/Trans_National_Strategy_ICT-Post_Palestine2011-2013.pdf
	Iran, Islamic Rep.	Yes/N/A	National ICT Plan: http://www.scict.ir/portal/File/ShowFile.aspx?ID=f179cbbc-a580-4285-8105-9ca0e60599e1
	Iraq	No/2014	n.a.
	Jordan	Yes/2012	National ICT Strategy 2013-201: http://www.moict.gov.jo/en-us/homepage/nationalictstrategy.aspx%E2%80%8E7
	Syrian Arab Republic	Yes/2004	National ICT Strategy 2004: http://www.arab-hdr.org/publications/other/undp/hdr/2004/syria-ict-04e-strategy.pdf
Gulf	Bahrain	Yes/2012	E-Government Strategy 2012–2016: http://www.ega.gov.bh/wps/wcm/connect/1f75f0004af9c3b2b84cb978e38c6a11/eGov%2BStrategy_Brochure_Eng.pdf?MOD=AJPERES
	Kuwait	Yes/2004	n.a.
	Oman	Yes/2012	E-Oman Strategy 2010: http://www.unescap.org/idd/events/2010_ESCAP_DESA_Roundtable_ITC/6-OMAN.pdf
	Qatar	Yes/2011	ICT Strategy 2015: http://qnbn.qa/about-us/ict-strategy-2015/
	Saudi Arabia	Yes/2010	E-Government Action Plan 2012–2016: https://www.yesser.gov.sa/en/MechanismsandRegulations/strategy/Documents/the_2nd_egovernment_action_plan_ENG.pdf
	United Arab Emirates	Planned	n.a.
	Djibouti	Yes/2004	n.a.
	Yemen, Rep.	No/2013	n.a.

* According to ITU.

Sources: Based on authors' research; Bilbao-Osorio, Dutta, and Lanvin 2013; and Broadband Commission 2013.

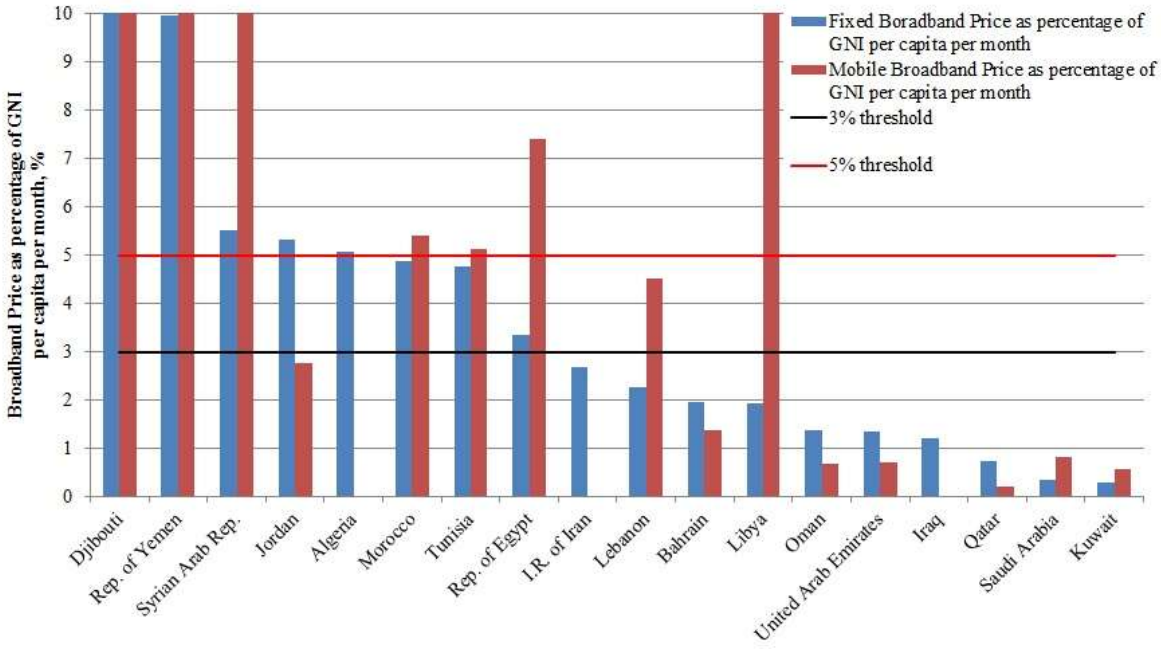
Note: Yes—country has adopted broadband policy document; Planned—country is planning to start or has started preparation of broadband policy document, status for 2013; No—country does not have a broadband policy document; n.a.—information is not available.

MENA is at risk to fall behind in terms of Broadband development

Development of broadband, like any innovation, tends to follow an s-shaped curve. The s-curve reflects the three phases in the evolution of a market as measured by the extent of broadband penetration: Introduction (or Emerging), Developing, and Mature. The emerging phase is prior to the first inflection; the development stage is between the first and second inflections; and the maturity phase is after the second inflection. Adoption is slow initially but accelerates rapidly before stabilizing as it reaches maturity. The particular shape of the curve (namely its slope and the points of inflection) will differ between countries as a result of differences in policy and regulatory framework, income per capita, the availability and penetration of substitute and complementary products, etc.

The price of broadband plays a critical role in terms of broadband penetration. According to the ITU, broadband penetration grows rapidly after the level of retail price falls below 3-5% of average monthly income, which makes it **affordable**. In MENA, fixed broadband price constitutes ~3.6% of the average monthly income per capita, while mobile broadband price stands at ~7.7%. While Djibouti, Syria, and the Republic of Yemen are significantly above the 5% threshold, a number of countries (i.e., Algeria, Egypt, Jordan, Libya, Morocco, and Tunisia) have just reached the level that makes rapid broadband takeoff possible (see Figure 1).

Figure 1: Fixed and Mobile Broadband Prices



Sources: GNI per capita: World Bank, latest available; Prices: World Bank based on operators' data.

Note: For West Bank and Gaza data are not available; Values for Djibouti: fixed BB: 22.09%; mobile BB: 77.15%; Values for the Republic of Yemen: fixed BB: 9.97%; mobile BB: 12.86%; Values for Syria: mobile BB: 13.77%; Values for Libya: mobile BB: 32.38%.

Box 2: How affordable is Broadband in MENA?

An affordability analysis looks at the percentage of disposable income that the poorer segment of the population would need to spend to afford broadband. For example, a representative household in the lowest 40 percent income bracket of Morocco would need to pay about 33 percentd of its disposable income to afford mobile broadband. That same family would need to spend about 30 percent of its disposable income to afford fixed broadband services. The situation is only slightly better for the bottom 60 percent of the Moroccan population measured by income. Mobile broadband would require about 26 percent of their disposable income, and fixed broadband would require 23 percent of disposable income. In spite of important reforms undertaken by Morocco, a leader in many respects, broadband services are still unaffordable for the majority of the population. Even so, Morocco is the best performer in this group.

The situation is worse for other MENA countries in the "emerging" broadband development phase. In Tunisia, the poorest 40 percent of the population would need to spend over 40 percent of their disposable income to afford mobile or fixed broadband. In the Republic of Yemen, the poorest 40 percent of the population would need to spend over 50 percent of their income for mobile broadband and 46 percent for fixed broadband. In Djibouti, a mobile broadband package is a multiple of the disposable income of the poorest 40 percent and 60 percent of the population, and fixed broadband would absorb roughly the whole income of the poorest 60 percent of the population. In countries classified in the "emerging" broadband development phase (Algeria, Djibouti, Morocco, Syria, Tunisia, and the Republic of Yemen), both fixed and mobile broadband services are far from being affordable for at least 60 percent of the population.

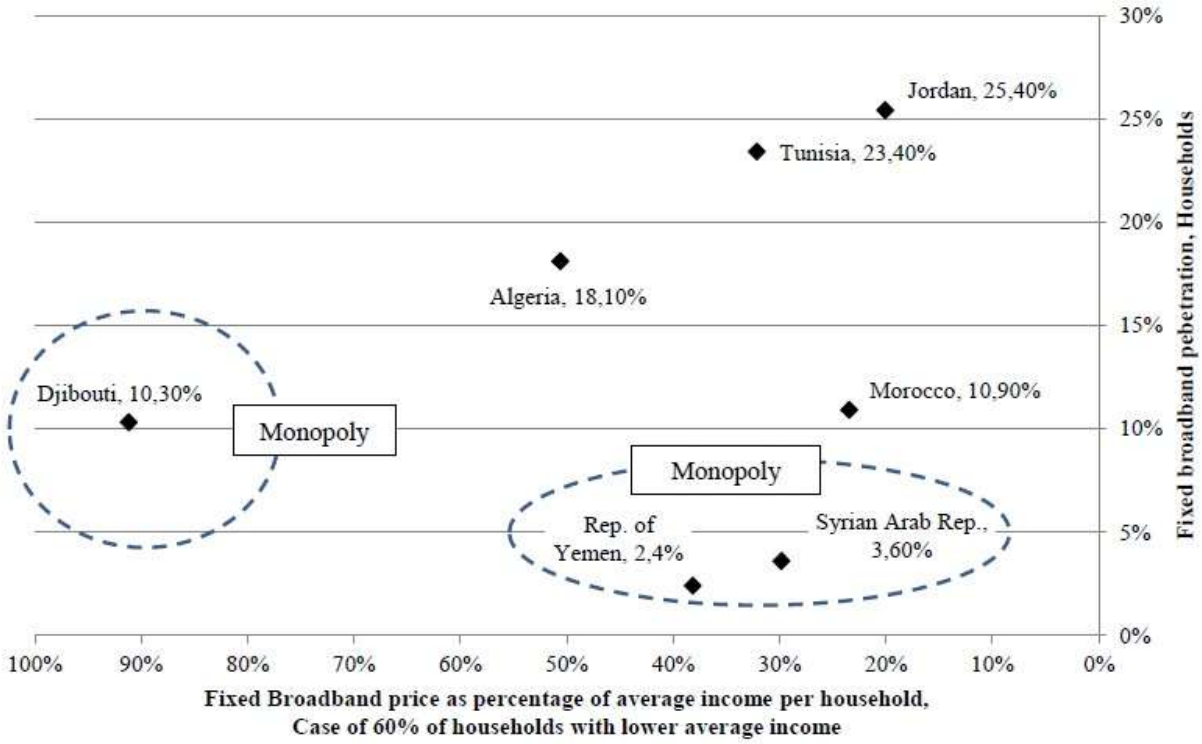
Table 2: Affordability of Broadband in Emerging Markets

Country	Mobile BB against average income of lowest 40%	Mobile BB against average income of lowest 60%	Fixed BB against average income of lowest 40%	Fixed BB against average income of lowest 60%
Algeria	-	-	63.31%	50.61%
Djibouti	407.39%	318.34%	116.66%	91.16%
Morocco	32.11%	25.94%	29.03%	23.45%
Syrian Arab Rep.	90.14%	74.59%	36.06%	29.84%
Tunisia	44.18%	34.56%	41.09%	32.14%
Rep. of Yemen	59.86%	49.18%	46.44%	38.16%

Source: Prices: World Bank analysis based on operators' data, January 2013; total income: PPP 2005, Population: World Bank, 2011, Development Data Platform (DDP); Income Distribution by Quintile: PovcalNet the online tool for poverty measurement, World Bank, DDP, earliest available information was used.

Fixed broadband markets in MENA are largely underdeveloped with most of them being in the emerging development phase. At the end of 2012, in more than half of the MENA countries the fixed broadband penetration rate was no higher than 25 percent and in only one country did it exceed 70 percent (see Figure 2). **The low penetration rate can be attributed to a number of factors, including a lack of infrastructure, weak or no competition, and high prices for services.** But most importantly, when the high take-up of 3G and 4G services across the MENA region is taken into account, the development of the fixed broadband market cannot be analyzed separately from the mobile broadband market because of a possible fixed-to-mobile substitution effect. In Algeria and Tunisia, fixed broadband is achieving higher penetration rates at relatively higher prices. In the case of Algeria, it is consistent with the absence of a fixed-to-mobile substitution effect resulting from the absence of mobile broadband in the country. In Tunisia, fixed broadband take-up at higher prices may be explained by the same reason since 3G services in Tunisia were introduced relatively recently (2010) and penetration is still quite low.

Figure 2: Fixed Broadband Penetration and Affordability, December 2012

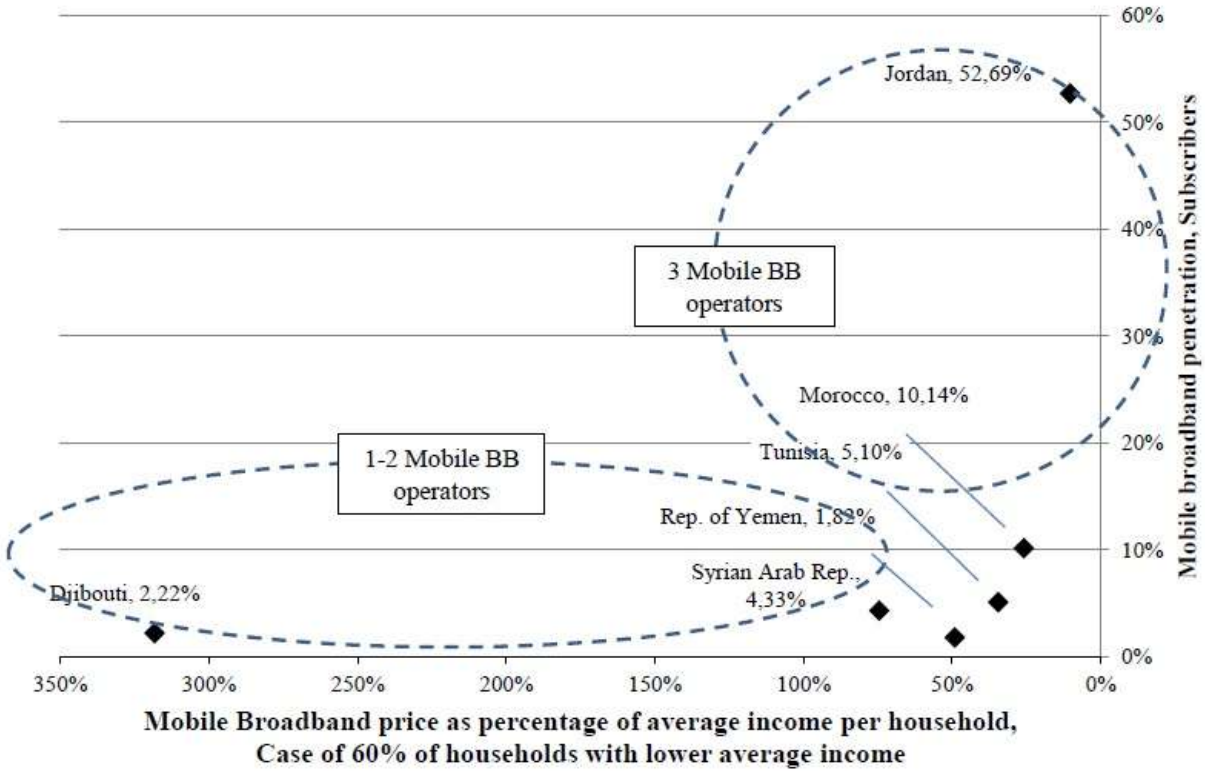


Source: World Bank analysis; Penetration: TeleGeography's GlobalComms Database (http://www.telegeography.com, data retrieved in August, 2013).

Mobile broadband markets in MENA are much more developed when compared to their respective fixed broadband markets. Most of the mobile broadband markets are in the developing phase. In most of the MENA countries at the end of 2012, penetration of mobile broadband exceeded 25% of the population, in eight it exceeded 50%, and in Bahrain the penetration rate exceeds 70% (see Figure 3). Mobile broadband is still not available in Algeria, and the West Bank and Gaza. Although 3G is officially operational in Iraq, the only 3G operator is currently restricted to the Kurdistan region and the majority of Iraqis do not have access to 3G services. 3G services are also not available to majority of the population in the Islamic Republic of Iran. In both countries penetration of mobile broadband is below 1% of the population. **A higher penetration rate is caused by a number of factors, but most importantly by a vibrant competitive market environment.** Weaker mobile broadband market development is caused by insufficient competition. Delayed spectrum auctions are the cause of the lack of mobile broadband in Algeria, while obtaining the necessary radio spectrum frequencies from the Government of Israel is the reason behind the lack of mobile broadband in the West Bank and Gaza. Further development of mobile broadband will require additional spectrum allocations. As

for December 2012, only four countries in MENA have launched commercial 4G services. Before fourth quarter of 2013 three more countries have launched commercial 4G networks.

Figure 3: Mobile Broadband Penetration and Affordability, December 2012



Source: World Bank analysis; Penetration: TeleGeography's GlobalComms Database ((http://www.telegeography.com, data retrieved in August, 2013).

Key bottlenecks to broadband networks development

International connectivity

MENA has a good potential international broadband connectivity. However, there is patchy submarine connectivity between the Middle Eastern part and the North African part of MENA. All countries (except the West Bank and Gaza economy) are currently connected with at least two international submarine cables, though the number of submarine cables per country varies widely across MENA. International submarine cables have not been primarily built to provide regional connectivity within MENA, but rather to link individual countries in MENA with Europe and Asia. The FALCON submarine cable lands in the highest number of MENA countries (12), but all of them are located in the Middle Eastern part (except

Egypt). The SEA-ME-WE4 submarine cable is the only international submarine cable reaching both Middle East (the United Arab Emirates, Saudi Arabia) and North African (Algeria, Tunisia) countries passing through Egypt. In addition, the physical location of the infrastructure is concentrated, making the Red Sea Corridor a particularly sensitive geographic area from the standpoint of network redundancy. New international terrestrial cables (JADI, RCN, EPEG) have been built across the Middle East to provide an alternative connectivity between Asia and Europe, but they do contribute to connecting the Middle East with North Africa.

There have been attempts to build coherent terrestrial infrastructure at the sub-regional level in North African countries or in Gulf countries. The GCC Interconnection Authority has been established by the six Gulf States, with the objective of linking power grids across the GCC countries and operating and maintaining the interconnection grid. It is leasing out to operators its fiber optic cable network along its regional power line network. More recently, in October 2013, Vodafone Group, United Arab Emirates-based Du and Kuwaiti companies Zain and Zajil formed a consortium called MEETS (Middle East-Europe Terrestrial System) for the rollout of a 1,400km fibre-optic cable system that will stretch from Kuwait to the UAE, via Saudi Arabia, Bahrain and Qatar. By contrast, there is only one fiber optic cable (Ibn Khaldoun) providing regional broadband connectivity between Libya, Tunisia, Algeria, and Morocco. This cable is owned and operated by incumbent operators. There is no terrestrial cross border connection between Libya and Egypt to expand optical continuity across all North African countries.

However Lack of competition and limited open access regulations pose significant constraints to the effective use of international and regional connectivity infrastructure in most MENA countries, translating into high international charges for the region. In 13 out of the 19 countries in MENA, access to international submarine cable connectivity is under the sole control of the incumbent operator. By contrast, there is one international submarine cable owned by an operator other than the incumbent in Jordan, Morocco, Oman, and Saudi Arabia. In Bahrain, there are two cables not owned by the incumbent operator. Bahrain is the only country in the MENA region to have removed all barriers to entry in the telecommunications sector. Competition for terrestrial cross border connectivity exists in only three out of the five countries (Bahrain, Jordan, Morocco, Oman, and Saudi Arabia) where there is also competition for international submarine connectivity. In addition, although access to submarine landing stations could be deemed to be covered by interconnection and colocation domestic regulations, this is usually not the case in those countries with a monopoly on this essential infrastructure.

Table 3: Competition for International Submarine Cable Connectivity

	Number of relevant countries: 19	#	Countries
North Africa	**Partially competitive**	**1**	**Morocco**
	No competition	4	Monopoly: Algeria, Egypt, Libya, Tunisia
			Monopoly:
Mashreq	**Competition**	**1**	**Jordan**
	No competition	4	Monopsony: West Bank and Gaza
			Monopoly: Iraq, Iran, Lebanon, Syria
Gulf	**Competition**	**3**	**Bahrain, Saudi Arabia, Oman**
	No competition	3	Monopoly: Qatar, United Arab Emirates
			Monopoly: Kuwait
Djibouti, Yemen	**Competition**	**0**	not applicable
	No competition	2	Monopoly: Djibouti, Yemen

*Notes:** Monopsony in the case of the West Bank and Gaza: the only buyer of international connectivity is Paltel.

Bahrain is the only country to have eliminated all entry barriers, allowing an indefinite number of operators in the market.

Source: ITU.

National backbone (including backhaul) connectivity

National backbone (including backhaul) infrastructure based on fiber optic technologies will play an essential role in the development of broadband access. In the absence of fiber backbone networks aggregating increasing data traffic and thereby reducing average costs, broadband services are unlikely to be commercially viable in anything other than the major urban areas of a country. Initiatives related to the deployment of national backbones are increasingly often an integral part of the national broadband strategies across MENA, but could benefit from fostering all options which operators should normally be given to expand backbone capacity: active infrastructure sharing, passive infrastructure sharing and deployment of own infrastructure. The first two options normally provide cheaper alternatives to increase the national backbone (including backhaul) infrastructure and could be implemented fastest, while the third option implies much higher costs and is time consuming taking into account associated procedures, such as obtaining construction permits, rights of way, and so on. All three options should be enabled under the legal and regulatory framework.

Table 4: Options for Expansion of National Backbone Infrastructure

Options for expansion		Description
1.	Active infrastructure sharing	Leasing of the capacity from backbone infrastructure provider Among potential providers are incumbent operator and utility companies
2.	Passive infrastructure sharing	Leasing of ducts (where operator could deploy its own fiber cables) or leasing of dark fiber (which could be lit by own active equipment of the operator) Among potential providers are incumbent operator and utility companies
3.	Deployment of own infrastructure	Performance of civil works and laying down own fiber infrastructure

Source: Authors.

In particular, nationwide infrastructures have great potential in addressing competition in the supply of backbone capacity facilitating the first and second options and should be fully leveraged. However, **much of the capacity deployed is either controlled by the incumbents, locked up in exclusive partnerships between utility companies and telecom operators, or cannot be made available owing to constraints of the national legal systems**. Notably, countries facing constraints in expanding national backbone (including backhaul) infrastructure also demonstrate weaker performance of the broadband market.

Utility companies with their nationwide infrastructures have a great potential in addressing competition in supply of the national backbone (including backhaul) facilitating the first and the second options. Optical fiber infrastructure is being built along near all the networks of the utility companies for internal communications and network management purposes. Excess fiber capacity could be leased to address the development of backbones, but this opportunity is not yet fully leveraged across MENA. A good example is the Moroccan public energy and water utility, the Office National de l'Electricité et de l'Eau Potable (ONEE), which is leasing fiber to a licensed mobile operator, providing both national and international connectivity. Review of the licensing regimes, pricing, and open access frameworks as well as rebuttal of exclusive agreements between utility companies and operators are key to enabling optimal benefit from the fiber infrastructure that is already in place. The role that utility companies can potentially play in addressing backbone connectivity issues in the MENA region goes beyond active or passive sharing of existing fiber infrastructure. Telecomm operators would benefit from synergies that arise from coordination of civil works with utility companies.

Frameworks for co-ordination of civil works are, however, an exception rather than common practice across MENA. So far this issue has been addressed only in a few countries, including Bahrain, but unfortunately the framework is limited to coordination of civil works between telecom operators only. Many countries in MENA are planning regulations in this area. One of the most recent examples is the partnership between Oman's state owned utility

company, Haya Water, and telecom operators. Under its ongoing water reuse project, Haya Water simultaneously covers tens of thousands of homes and offices across the Muscat Governorate of Oman and installs fiber optic cables alongside its new pipelines. From the perspective of telecom operators, such synergy provides a highly cost-effective solution for telecommunication infrastructure deployment. From the perspective of the state, this synergy reduces the impact on the environment by not having to undertake a second round of construction work in the future.

Box 3: Joint Infrastructure Deployment Framework in Bahrain

In December 2008 the Telecommunications Regulatory Authority (TRA) of Bahrain adopted a Guideline on Telecommunications Infrastructure Deployment (Guideline). The Guideline aims to facilitate the deployment of telecommunications network infrastructure through defining technical specifications and simplifying construction procedures. A joint infrastructure deployment framework was part of the facilitation process.

According to the Guideline, "Telecommunications Infrastructure Providers are required to adopt joint infrastructure installation methods when more than one provider wishes to lay telecommunications infrastructure at the same location and within a timeframe not exceeding one year from the date of notifying other providers of the intention of the first Telecommunications Infrastructure Provider's intention to carry out infrastructure works."

TRA is of the opinion that this method of joint work shall reduce the cost for constructing networks and shall help in effectively utilizing the available telecommunications corridor space.

Source: Telecommunications Regulatory Authority 2008.

Local access connectivity

Access networks (or local loop) provide the link between the domestic backbone network and end users, be they residential, business, or administrations. In terms of broadband technology mix, mobile broadband access is predominant in terms of number of broadband customers in the MENA region and is generally considered to have the greatest potential to ensure quick availability of broadband services in most of the territories. However, despite the expected increased coverage of 4G technologies (with higher data rates), the widespread availability of mobile broadband technologies is unlikely to translate as rapidly into significantly higher mobile originated data traffic. In 2012, the amount of global traffic (web and data) generated from mobile networks was small in comparison to global traffic (web and data) generated from fixed connections (about 3% of fixed traffic): this portion of traffic generated from mobile networks will increase dramatically in the coming years; however, it will still represent about 14% of fixed traffic in 2017.

Taking a forward-looking view, **fixed and mobile broadband technologies will complement each other, with a mix that will heavily depend on the kind of area (metro, urban, suburban, rural).** At one extreme, in rural areas, fixed technologies will tend to be less developed than mobile technologies. Conversely, in metro/urban areas, new and more

complementary architectures are emerging, with mobile technologies off-loading onto fixed technologies via Wi-Fi the significant traffic generated by tablets and smartphones. In the ideal situation, infrastructure deployment should go hand in hand with utilization. However, this is not always the case in MENA, and the gap can sometimes depend on the sub-region and/or the broadband technology. Three actions will accelerate access network infrastructure development: (i) **stimulate xDSL**, (ii) **develop 3G and 4G potential,** and (iii) **foster FTTx**.

The competition dynamic in the broadband market is significantly impacted by the existence of such inter-platform competition, either on the basis of WiMax technologies (e.g., Bahrain, Jordan) or via FTTx technologies (the United Arab Emirates) providing alternative broadband access to the traditional copper line of the telephone network equipped with xDSL technology. The market share of incumbent fixed operators tends to be much lower in countries with vibrant infrastructure based competition. **The path towards unleashing the xDSL potential in MENA will involve stimulating competition through opening up the xDSL infrastructure for alternative operator**s. Key reforms to stimulate xDSL are: (i) to award new licenses for fixed broadband; and (ii) to ensure an appropriate set of regulated wholesale offers (including unbundling and bitstream) are effective.

The path towards developing the 3G/4G potential in MENA will require stimulating competition in the mobile broadband market, which will foster more broadband usage on the networks in place, as the price of handsets and other mobile broadband devices will fall. Key reforms to be considered are: (i) to award new licenses for 3G/4G operators, including making the necessary spectrum available; and (ii) to introduce mobile number portability. Only Oman, Saudi Arabia, and the United Arab Emirates have introduced 4G licenses. One important element in the move from 3G to 4G will be the availability of mobile broadband enabled devices. An opportunity for countries in MENA could be to award technology neutral wireless broadband licenses, and let the operators decide the transition from 3G to 4G, as operators are best placed to decide when to undertake the necessary investment.

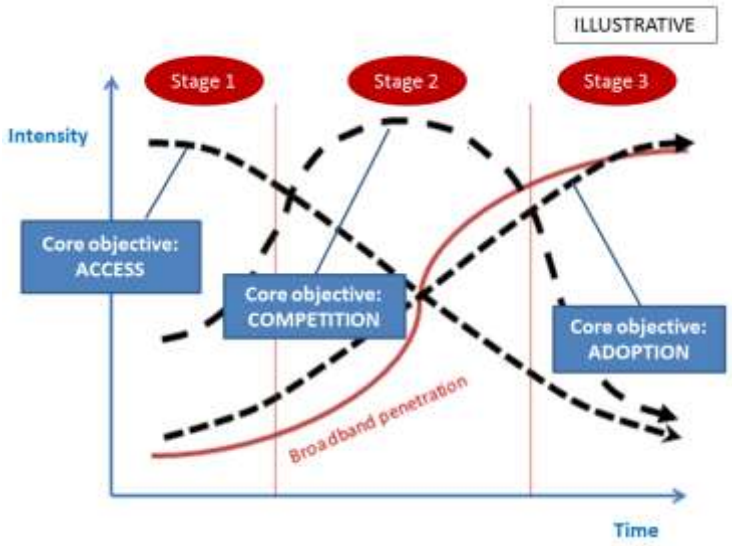
Even if FTTx is most developed in the Gulf countries, efforts to develop this technology are taking place throughout the whole MENA region. Nevertheless, the level of penetration (number of customers on homes passed) is low. This significant gap between the supply and utilization of FTTx access technology creates the risk that investments made to deploy fiber optic in the access network may not be profitable and therefore sustainable in the long term. This could have an adverse effect on the development of fiber lines in new housing areas, with a high potential for residential broadband. **This calls for a clearer strategy for setting appropriate FTTx targets (which areas to cover, and in which sequencing) and governance models (e.g., co-investments, public-private partnerships) for further FTTx deployments.** Such a strategy could possibly strongly encourage fiber development in new dwellings, as several broadband providers would be interested in serving these new neighborhoods. There has been no systematic pre-planning for new residential areas in MENA, as incumbent operators tend to limit

investments to extend the copper loop, giving priorities to mobile operations, and have not yet developed comprehensive FTTx plans in most countries.

A strategic framework for broadband sector reforms in MENA to accelerate high-speed Internet access

Each broadband development phase (**Emerging, Developing, and Mature**) can be characterized by the relative importance of three core policy objectives: **Access** (sometimes also referred to as Supply or Connectivity), **Adoption** (sometimes also referred to as Demand or Usage), and **Competition**. Specific regulatory and policy initiatives will be needed to facilitate the development of the broadband market from one phase to another. At each phase, different drivers foster broadband penetration (see Figure 4).

Figure 4: Importance of Policy Objectives Depends on the Phase of Broadband Market Development



Note: Intensity refers to intensity of policy and regulatory measures that should be dedicated to the core objective.
Source: Authors.

In the emerging phase of broadband development, opening up the market to competition as well as facilitating open access to infrastructure, along with initiatives related to decreasing costs, are crucial to creating a favorable investment climate and boosting infrastructure rollout. In addition, governments should ensure that all the sectors which may contribute to infrastructure deployment are taken into account and appropriately involved introducing a much-needed alternative and/or complement to the backbone infrastructure provided by incumbent telecommunications operators (e.g. excess capacity on fiber infrastructure of utility companies, railroads, or electricity grids deployed to sustain their own communication networks).

As the broadband market takes off and the number of market players grows, policy measures should focus on maintaining effective competition in the retail broadband market. Therefore, enhanced *ex-ante* sector specific regulation at the wholesale level (i.e. effective, non-

discriminatory, transparent open access to existing networks) accompanied by an independent regulatory authority capable of enforcing it will be essential. As broadband-specific regulation gains importance, policy interventions and an up-to-date legal framework giving appropriate powers to the independent national regulatory authority become crucial.

When broadband development approaches maturity, policy decisions should be focused on stimulating and making more effective usage of existing networks. There may nevertheless remain geographic areas where competition forces are unlikely to guarantee broadband availability owing to lack of commercial interest, i.e. insufficient social and economic conditions. In addition, broadband may be delivered at prices that make it unaffordable for certain population groups. In those areas, governments should lead the initiative on broadband infrastructure deployment in order to ensure the principle of universal access and to prevent a digital divide.

Taking an overall view of both fixed and mobile broadband markets, **10 out of 19 MENA countries are in the emerging phase**. Infrastructure deployment and development of competition are the main challenges for those countries in both fixed and mobile broadband markets.

Table 5: Clustering of MENA Countries in Terms of Broadband Market Development

Country	Fixed broadband market development stage	Mobile broadband market development stage
Algeria	Emerging	not applicable
Iran, Islamic Rep.	Emerging	not applicable
Iraq	Emerging	not applicable
Djibouti	Emerging	Emerging
Libya	Emerging	Emerging
Yemen, Rep.	Emerging	Emerging
Syrian Arab Republic	Emerging	Emerging
Tunisia	Emerging	Emerging
Morocco	Emerging	Emerging
Egypt, Arab Rep.	Emerging	Developing
West Bank and Gaza	Developing	not applicable
Oman	Developing	Developing
Kuwait	Developing	Developing
Lebanon	Developing	Developing
Jordan	Developing	Developing
Saudi Arabia	Developing	Developing
Qatar	Developing	Developing
United Arab Emirates	Developing	Developing
Bahrain	Mature	Mature

Source: Authors.

The key factors limiting the development of broadband in most countries of MENA being lack of effective competition and lack of appropriate incentives to deploy and/or fully utilize infrastructure, the following measures could be considered by the countries in the region that wish to address the existing constraints: (a) Promote facilities-based competition; (b) Develop new models of infrastructure supply; (c) Implement measures to decrease infrastructure deployment costs; and (d) Address underserved areas of the country. These four clusters of measures are not intended to be implemented in sequence. They can be implemented in parallel and can jointly contribute to the development of broadband. However, they are ranked here in terms of priority within the MENA context. Promotion of facilities-based competition, in particular, should be a top priority for broadband development.

Table 6: Supply-side Policy Measures in Accordance with Broadband Market Development[1]

	(a) Promote facilities-based competition	(b) New models of infrastructure supply	(c) Implement measures to decrease deployment costs	(d) Address underserved areas of the country
Emerging	+++	+	+++	+
Developing	++	+++	+++	++
Mature	+	++	++	+++

Note: +++ - very important; ++ - important; + - important

Source: Authors.

Promote facilities-based competition

The experience of the past decade has clearly shown that **competition, and in particular facilities-based competition, is the most important driving force for accelerated and sustainable telecommunications market development**. The experience of mobile communications, developed in most countries in a competitive environment, has allowed developing and emerging markets to reach levels of penetration similar to those of high-income countries in a short period of time. In particular, competition has an impact on the decrease of prices. The more competitive mobile broadband markets in MENA demonstrate lower price levels compared with those that are less competitive.

The promotion of competition in broadband should be encouraged not only at the user access level, but also across all of the segments of the broadband value chain (access networks, backbone, and international connectivity). A bottleneck at the backbone or international level will translate into obstacles at the access level. Conversely, competition at the backbone and international connectivity levels can greatly stimulate broadband access. These measures are in line with traditional telecommunications sector reform. In MENA, **it is**

[1] This study assesses the status of broadband development in the region, highlights key bottlenecks to growth, explores policy options, and offers suggestions on how to accelerate investment and diffusion of broadband connectivity. The focus of the study is on infrastructure-related actions; measures to stimulate demand for broadband are therefore only marginally addressed.

important to emphasize these measures because of the fundamental delay of the MENA region in introducing competition in the telecommunications sector. For example, in terms of market structure, most advanced telecommunications markets have eliminated entry barriers for all market segments, allowing a large number of operators, as many as the market can sustain. In MENA, only Bahrain and Jordan have implemented a policy of full liberalization in telecommunications. All other countries have a limit on the number of licensed operators. For example, in Tunisia, the government is obliged by law to go through an open and competitive tender process whenever it decides to award a new telecommunications license. In a fully liberalized market, it should be the market, and not the government, that decides the number of operators. New licensing tools, such as class licenses and simple authorizations, should be considered. This first set of measures needs to be complemented by other measures for competition to be sustained. In particular, other traditional reform efforts include the establishment and strengthening of independent national regulatory authorities (NRA), and the promotion of a harmonized regulatory framework that would allow investors to look at the market in MENA as an integrated regional market.

An effective regulatory framework also needs to be established to promote competition. For instance *ex-ante* regulatory provisions allow for the effective utilization of existing infrastructure. The application of *ex-ante* obligations is normally limited to one undertaking holding significant market power. In this respect, regulations that facilitate and discipline the access to already constructed infrastructure are essential. These include: Regulated access to submarine cable lending stations; Non-discriminatory and transparent access to utilities' networks; International and national interconnection regulation; Wholesale offer for the copper network (unbundling the local loop (ULL) and bitstream access); and Regulation of leased lines.

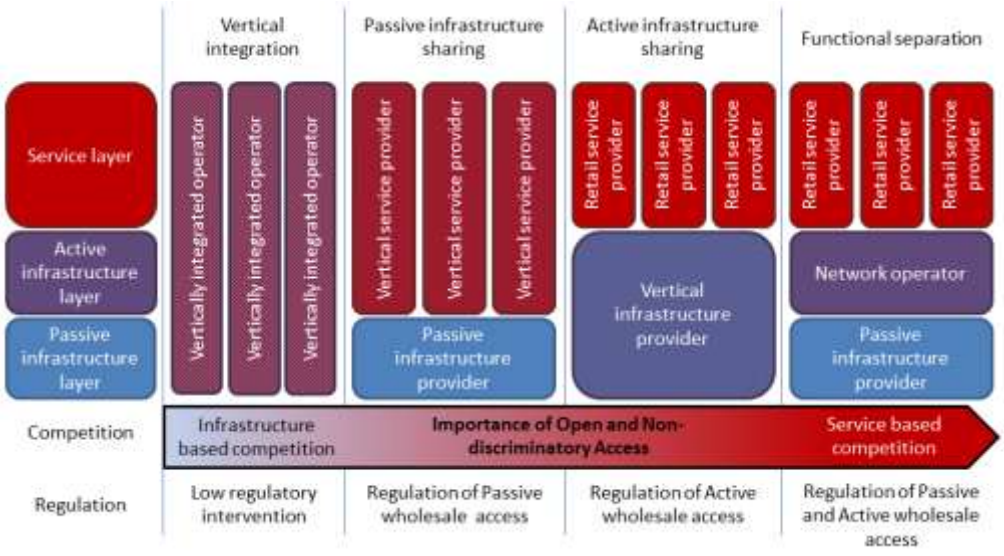
However, in MENA, enabling competition is a necessary but insufficient condition for fast broadband growth. Countries in MENA have a great opportunity to quickly deploy a broadband Internet network, leapfrogging countries with a significant "legacy" infrastructure, following the example of countries like Romania, Latvia, or Lithuania. In light of this opportunity, **the present study, while supporting *ex-ante* regulation to promote full utilization of existing networks, strongly advocates the establishment of enabling conditions to build new networks, allowing the leapfrogging of the existing infrastructure.**

Develop new models of infrastructure supply

The **new modes of infrastructure supply** are relevant for both competitive and remote areas that are economically unattractive for telecommunications operators. New modes of infrastructure supply essentially involve: Exploring new "active/passive" infrastructure models; Relaxing "aerial regulations" and upgrading the status of Internet service providers (ISPs); and Promoting "real-estate driven" and other models.

The **new "active/passive" infrastructure models** build on the opportunity to break and isolate functional separation across the network layers (see Figure 5). For instance, the Qatar National Broadband Network (Q.NBN) aimed to accelerate the deployment of FTTH, and deliver coverage in excess of 95 per cent by 2015 (100 Mbps). Q.NBN is 100 percent owned by the Qatari government and provides equal, non-discriminatory access to the FTTH network, enabling any operator to use the infrastructure to deliver services. The appeal of "active/passive" infrastructure models is related to the possibility of sharing deployment of critical infrastructure, avoiding duplication, and structuring the capital of the passive infrastructure operator to include investors with a typical passive return on the investment profile. As a result, cost of access to critical infrastructure can be reduced allowing, at the same time, full competition at active network and services levels. However, these models also carry risk, related to the complexity of the model and related regulatory requirements to avoid private investment displacement.

Figure 5: Overview of Possible New Models of Infrastructure Supply



Note: Issues pertaining to converged NGN arise mostly at the service layer.

Source: Authors.

A second way to introduce new network infrastructure is the **introduction of relaxed regulations in the area of aerial wiring in combination, when necessary, with an upgrading of the legal status of ISPs**. In some countries in MENA, in Egypt for example, some classes of ISPs have the right to reach final customers with their own infrastructure. In other countries, e.g. Tunisia, ISPs need to use the infrastructure of a licensed telecommunications operator. With regard to upgrading ISPs to full licensed operators, there is some evidence (in Eastern Europe for example, in countries like Lithuania and Bulgaria) that a relaxation of aesthetic policy to avoid "aerial" wiring can enhance broadband.

Finally, there is a potential incentive to examine infrastructure deployment models where the **real estate industry plays an active role in ensuring that broadband is provided to newly built neighborhoods and buildings**. This is a particularly important consideration for MENA, characterized by a demographic pyramid that will put tremendous pressure on new construction over the next 25 years. A first set of measures concerns the establishment of coordinated procedures and regulations for civil works. When a real estate developer reaches a new building or a new neighborhood, they should be mandated to coordinate the necessary civil works, bringing electricity, water/sewerage, and broadband as a single, coordinated effort. This is not the case in most countries of the MENA region. In addition, in the case of multi-home dwellings, it is important to make sure that there are adequate rules to build and open up existing infrastructure to telecommunications operators.

Implement measures to decrease infrastructure deployment costs

Despite the great variation in cost items, the cost of civil works (ducting, excavation, and physical infrastructure) is the dominant component in both mobile and fixed broadband deployment (with estimates as high as 80 percent for certain technologies). Faster rollout can be impeded by lengthy, non-transparent, and often cumbersome procedures for clearing rights of way and obtaining necessary permits at the national or local level. According to EU estimates, a substantial part of network deployment costs (possibly up to 30 percent) stems from inefficiencies in the rollout process (e.g., lack of coordination of civil engineering projects and insufficient re-use of existing infrastructure).

Infrastructure sharing is of particular relevance for the emerging MENA broadband markets given the demographic pressures in the region. Infrastructure sharing allows operators to avoid the expensive and lengthy broadband infrastructure construction process and make use of already or simultaneously deployed infrastructure in order to roll out their networks cheaper and faster. But at the same time this approach requires a robust regulatory framework in case of disputes between infrastructure owners and operators. There are two possible levels of infrastructure sharing: active and passive. Active infrastructure covers all the electronic telecommunication elements such as fiber, access node switches, and broadband remote access servers; access is provided at the level of signals, for instance, optical or electromagnetic. Passive infrastructure includes all the civil engineering and non-electronic elements of infrastructure, such as physical sites, poles, and ducts (and also power supplies).

However, a systematic approach to address infrastructure deployment costs is not a common component of broadband plans in MENA countries. Improvements in the infrastructure deployment process will enable not only decreasing overall costs of broadband network deployment, but also accelerating the overall rollout process particularly for access networks. Indeed, the costs can be significantly reduced by a series of simple and relatively inexpensive measures or a better coordination of civil engineering projects.

Box 4: Cutting the Roll-out Costs of Broadband Infrastructure in the EU

In June 2012, the European Commission launched a public consultation on an EU initiative to reduce the cost of rolling out broadband communication infrastructure in Europe, inviting member states, private sector, and public institutions at the national and local levels to give their opinion on possible ways to enhance the environment for high-speed network deployment in the EU.

The public consultation showed that there was little transparency on existing physical infrastructure suitable for broadband rollout and no appropriate commonly used rules when deploying broadband across the EU. Currently there is no marketplace for physical infrastructure or the potential to use infrastructure belonging to other utilities. Regulations in certain EU member states even discourage utility companies from cooperating with telecom operators. In March 2013, the European Commission (EC) proposed new rules to cut by 30% the cost of rolling out high-speed Internet. It is estimated that the new proposal may save companies €40-60 billion, given that civil engineering costs make up to 80% of the cost of a broadband network. More specifically, the estimate is based upon the following assumptions: 25% of the deployment is in existing ducts, saving 75% in Capex for this part, 10% of the deployment connects the network to new housing developments, and co-deployment with other operators/utility companies is used, saving 15–60%, and 5% of the deployment connects the network to pre-wired multi-dwelling units, saving 20–60%. In addition, the EC foresees a number of social, environmental, and economic benefits.

The proposal is built upon practices already employed in a number of EU member states and should be directly applicable to EU member states after they agree with the European Parliament and Council. So far the draft proposal tackles four main problem areas: (i) Ensuring that new or renovated buildings are high-speed broadband-ready. (ii) Opening access to infrastructure on fair and reasonable terms and conditions, including price, to existing ducts, conduits, manholes, cabinets, poles, masts, antennae installations, towers, and other supporting constructions. (iii) Ending insufficient coordination of civil works, by enabling any network operator to negotiate agreements with other infrastructure providers. (iv) Simplifying complex and time-consuming granting of permits, especially for masts and antennas, by granting or refusing permits within six months by default and allowing requests to be made through a single point of contact.

Source: European Commission 2013b; European Commission 2013c.

Address underserved areas of the country

Despite the expected development of mobile broadband penetration through simply letting market forces develop, some rural and remote areas in the MENA countries will remain underserved for broadband. This can result from socioeconomic inequalities, in terms of income, literacy, age, and/or gender (the "social digital divide") or by the existence of geographically remote and/or isolated territories, where key services are not available owing to inadequately high connection costs (the " territorial divide"). Depending on the region or country, one or the other type of digital divide may prevail. For instance, out of 19 MENA countries, seven are classified as lower middle-income countries and six as upper-middle. At the same time, countries may suffer from significant disparities in income distribution, which may contribute additionally to the development of the social divide. Gender inequality in Internet and mobile phone usage should also be mentioned as a significant contributor to the development of

the social divide in MENA. In 2012, the gender gap in Internet usage in MENA was 34%, which is the second largest regional gender gap after Sub-Saharan Africa (45%).

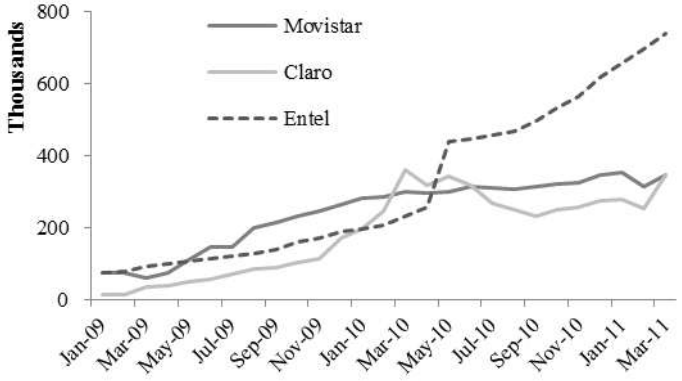
To address the residual issues of geographic reach of services, differences in Internet speed, and affordability in such underserved areas, a combination of supply and demand policies (outside of the scope of this study) may be considered. Supply side policies include: Including coverage obligations in the licenses of telecommunications operators; Using public subsidies for rural broadband network deployment; and Exploring technological options, including broadband via satellite, and compromise on the broadband speed.

Box 5: Designing Public Subsidies for Rural Broadband: the Example of Chile

Chile decided to extend telecommunications infrastructure to those living in underserved areas by providing public funding through its Fondo de Desarrollo de las Telecomunicaciones, (FDT). In order to improve efficiency and speed in delivering subsidies, the country successfully used reverse or minimum subsidy auctions to develop the mobile broadband network. In a reverse auction, the government first identifies a project and then a maximum subsidy. Companies compete for the project by bidding down the value of the subsidy. The bidder requiring the lowest subsidy wins. The reverse auction resulted in over US$100 million of government subsidy.

Coverage obligations included around 1,500 municipalities in rural areas, where no broadband service was provided. Extending coverage to these areas could result in Chile achieving a broadband coverage of 90% of the population. Minimum service conditions for broadband access (e.g. a 1 Mb downlink) and maximum prices were established. The winner of the auction, Entel Movil, started deploying mobile broadband in these areas in September 2010. The large expansion of mobile broadband services in the country has permitted Entel Movil to achieve the largest share of mobile broadband connections, surpassing its other two main competitors.

Figure 6: Mobile Broadband Subscriptions per Operator in Chile



Source: Telecoms.com, 2010,"SwedentoAuction800MHzSpectrum in February" (December), http://www.telecoms.com/23770/ sweden-to-auction-800mhz-spectrum-in-february-2011.

Box 6: Satellite Rural Broadband in Canada

In Canada, policy responses to the problem of rural broadband have come not only from the federal government, but also from the provinces and even individual cities or districts. The government has been studying the problem of providing service in remote and rural Canada since as early as 2001 and this culminated in the work of the Independent Telecommunications Review Panel, which reported in 2006.

The panel argued that the government should set a goal of providing affordable and reliable broadband services in all regions of the country by 2010. The panel mapped the availability of broadband and estimated that just under 90 per cent of Canadians would have access by 2007, leaving about three million people without access, of which for 300,000 or so living in the most remote communities, satellite would be the most practical solution. Areas that were uneconomic to serve were found to be those with fewer than 1,200 people living within a radius of more than 5 km from a broadband point of presence, and this was further affected by terrain. WiMAX might help reduce the number that could not be served economically by 1.2 million, but for the remaining 1.5 million (plus the 300,000 to be served only by satellite) some form of targeted cross-subsidy would be necessary to achieve the goal of universal broadband service by 2010. Projects are primarily generated bottom-up through the initiative and close involvement of the beneficiary communities, not top-down by the government agencies that support and finance these projects. Particular care and extensive public consultation ensure that government subsidies are not used to duplicate or compete unfairly with private sector facilities. Facilities built with public sector support must be available for use by any service provider.

Source: Telecoms.com,2010,"SwedentoAuction800MHzSpectrum in February" (December), http://www.telecoms.com/23770/ sweden-to-auction-800mhz-spectrum-in-february-2011.

Conclusion

Countries in the MENA region have a unique opportunity to bridge the gap in competitiveness and trade integration with more advanced regions through the development of a low-cost, broadband Internet infrastructure. Following the example of mobile communications, the MENA countries have the opportunity to create a vibrant competitive framework in which multiple broadband operators can serve the booming demand of a young, technology-savvy population. Broadband development can dramatically increase the production and use of digital content in MENA while bringing global knowledge to the region. Broadband enables the integration of firms and professional networks in MENA, enhancing job creation opportunities by bringing global jobs to local markets.

To reap these benefits, MENA countries should fully open up their broadband markets to competition. The gap between MENA and regions with higher broadband diffusion is mainly a gap in market structure, competition, and governance. The creation and strengthening of open markets for broadband infrastructure, networks, services, and digital content is a top priority. Countries that followed this path, e.g., in Eastern Europe and Asia, were able to quickly leapfrog more advanced countries, bypassing obsolete legacy infrastructure. A commitment to open markets means enforcing a deep regulatory reform, introducing measures to strengthen competition, eliminating monopolies, licensing more operators, tackling dominant positions, and lowering explicit and regulatory barriers to entry. This kind of reform almost always involves

addressing local resistance to change, often coming from those economic and political agents that are profiting from existing rents. This is a tall order indeed.

However, certain specific conditions in MENA can facilitate the implementation of this complex reform. First, the presence of energy and transport utilities with extensive but presently under-utilized fiber optic networks can be leveraged to strengthen domestic and international connectivity in a competitive environment. Second, there is the emergence of an urbanized, young population that will exert tremendous pressures on demand for broadband on the one hand and on demand for housing on the other. Better coordination of civil works and innovative modes of infrastructure supply can be introduced in MENA to meet this growing demand in rapidly changing urban areas. Third, the ample availability of capital in the region led the telecommunications sector to be the driving force of foreign direct investment in most countries in the past decade. If the appropriate regulatory framework at the national and regional levels is introduced, regional capital can appropriately fund a quick expansion of broadband networks in the region, laying the foundations for broadband- and mobile-led innovation and growth. It is, indeed, crucial that these favorable conditions are strategically exploited by policy makers in the region to strengthen broadband connectivity in a competitive and transparent sector context and that they are not used to exacerbate existing dominant positions in the market. If the right conditions are set, countries in MENA have an opportunity to leapfrog existing infrastructure and create the foundations for a digital economy.