BCG

THE BOSTON CONSULTING GROUP

Towards A Connected World

Socio-Economic Impact of Internet in Emerging Economies

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1. PROJECT SYNTHESIS

1.1 Introduction to the study

Although the impact of the Internet on the way people live, work and play has often been discussed, there has been a relative paucity of studies that take a holistic view of the economic and social impact that increasing Internet adoption can have in developing and emerging economies. The Boston Consulting Group was appointed by Telenor to conduct an in-depth examination of the drivers of adoption, the potential economic impact, and the possibilities for improving lives through education, healthcare, and other key levers. To be comprehensive and meaningful, a broad definition of "Internet" was used, and includes the benefits regardless of means of access (mobile, fixed, wireless, dialup, etc.) or device (computer, smartphone, etc.).

This report summarizes the findings of the study, and covers

- Synthesis of findings for developing and emerging economies
- Detailed country reports for each study country
- In-depth description of the methodology for projecting adoption and measuring economic impact

The study focused on three countries: Bangladesh, Serbia and Thailand. The selected countries span a broad geographic and developmental range. This enables general implications to also be drawn for other similar countries, ranging from the least developed to economies that are poised to join the ranks of developed economies. Additional information on the three study countries are in Exhibit 1.1.

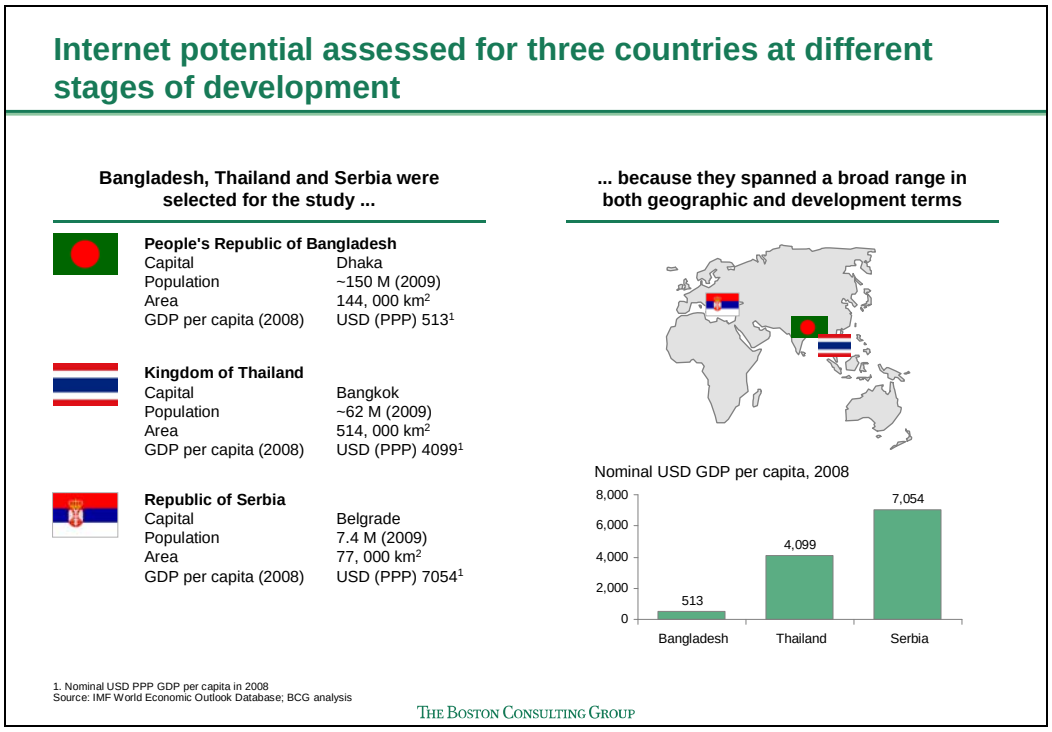

Exhibit 1.1 Introduction to study countries

The general approach to modeling adoption has been to do a bottom-up cost-benefit analysis to estimate of the number of subscribers in each segment for each year. Adoption is modeled separately for businesses and households. Costs typically include subscriptions, cost of devices, and any applicable service costs. Benefits for firms are driven by increased profits due to improved productivity. Benefits for households comprise increased income (e.g., from agriculture or household businesses), time and cost savings (e.g., online purchases), and perceived benefits of Internet usage, such as information, entertainment, social networking, etc. Additional details are in the Appendix.

From an Internet perspective, it is interesting to observe that the three study countries occupy different positions in the typical S-curve adoption profile. Currently, less than 2% of households in Bangladesh are Internet subscribers, whereas Serbia has a household penetration rate of 31%. This suggests that the Internet is still nascent in Bangladesh, while Serbia is already in a rapid growth phase. Thailand is currently somewhere in between, poised for take-off. This hypothesis is born out by the projected penetration

rates (measured here as subscribers per 100 population) up to 2020. Bangladesh only sees an acceleration of adoption after 2018, while Thailand sees rapid growth from 2014, tapering off slightly towards the end of the study period. In contrast, Serbia grows at a high but decelerating rate. Our projection sees Bangladesh reaching 10 subscribers per 100 population, Thailand 26 and Serbia 42. This brings Thailand and Serbia into the current range for OECD countries like Korea, Denmark and Norway, although these countries are expected to continue to grow further. Breaking down the overall penetration level into household and business adoption shows a very similar picture, with decelerating growth for Serbia contrasting with acceleration for Bangladesh.

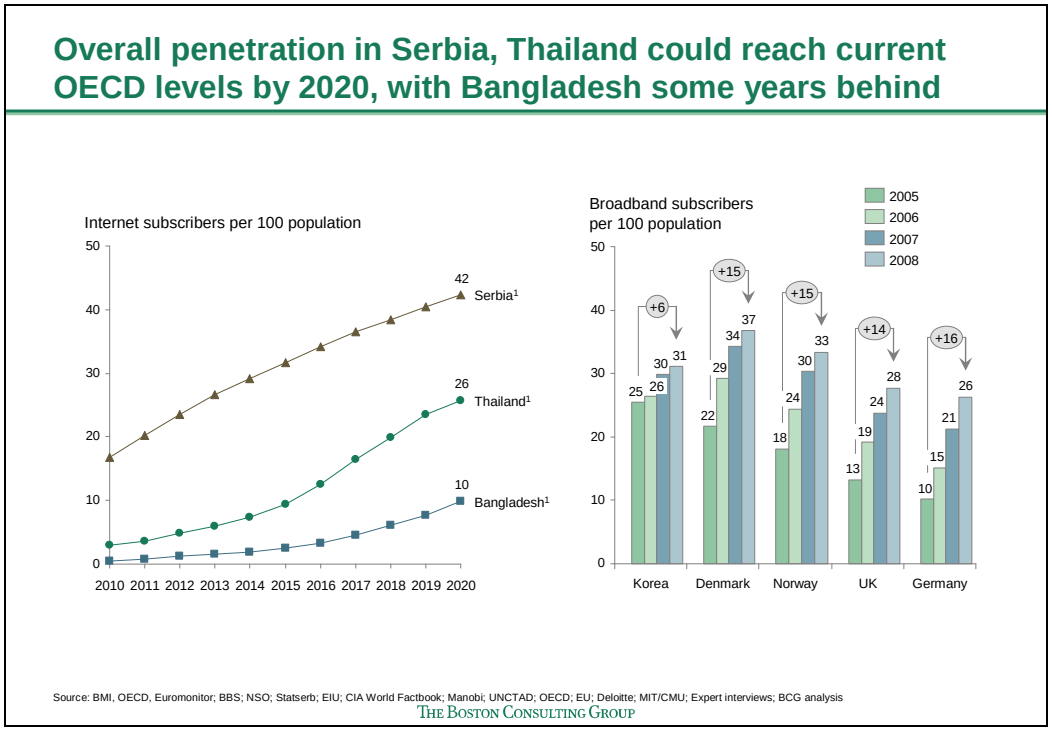

Exhibit 1.2 Projected penetration rates

1.2 Economic benefits

This increasing Internet penetration has the potential to generate significant economic benefit. In the study, economic benefits are modeled based on six main factors, as shown in Exhibit 1.3. The demand side impact captures the benefits of businesses using

the Internet, while the supply side impact measures the GDP contribution of the activities that are undertaken to produce or consume Internet services. Additional information is available in the Appendix.

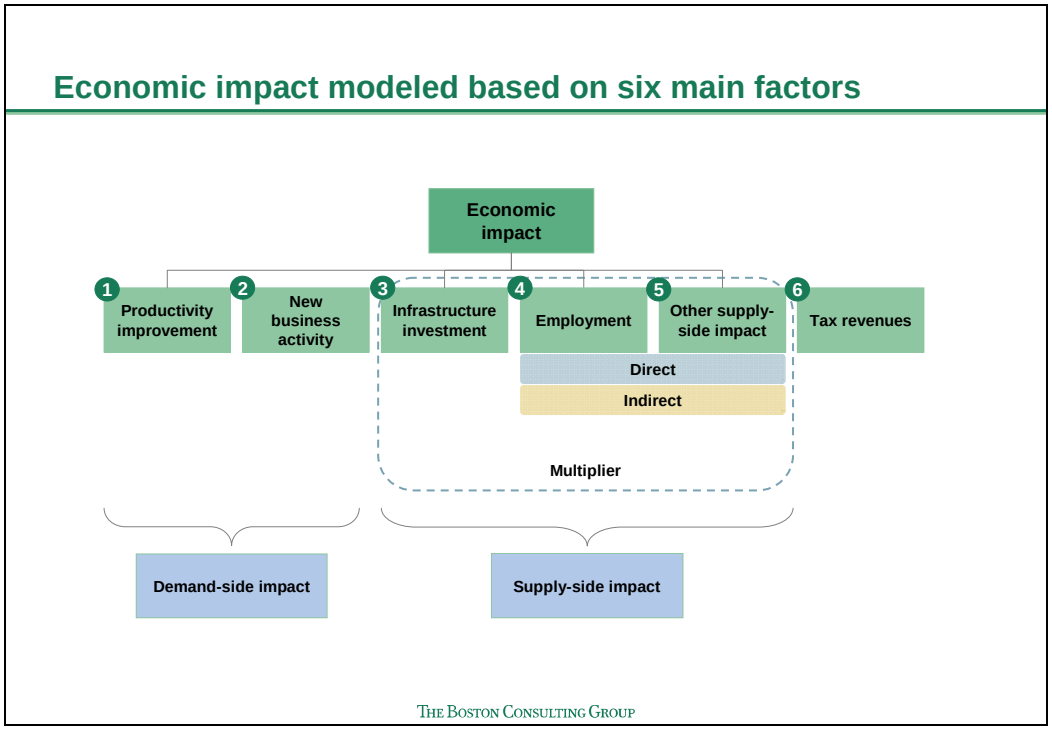

Exhibit 1.3 Elements of economic impact model

Three elements are highlighted here (further details are available in the individual country reports). In terms of overall GDP contribution, in 2020, the Internet is expected to contribute 3.8% in Thailand, 2.6% in Bangladesh and 5.2% in Serbia. The bulk of this contribution comes from the increased productivity that users of the Internet enjoy, in services, manufacturing as well as agriculture. It is almost certain that additional GDP gains will be enabled by the widespread advent of the Internet. For example, remittances from overseas workers can form a large portion of GDP for developing countries, for example, in Bangladesh, where it makes up 11% of GDP. However, in most countries, some portion of this is channeled through informal channels, and do not show up in GDP. If Internet banking provides a cheap, safe solution, it could attract a greater share of remittances, which would then be captured in official statistics. The Internet can also facilitate microfinance initiatives, which in turn stimulate business

activity. In this study a conservative view is taken, and these second-order benefits are excluded from the reported GDP impact.

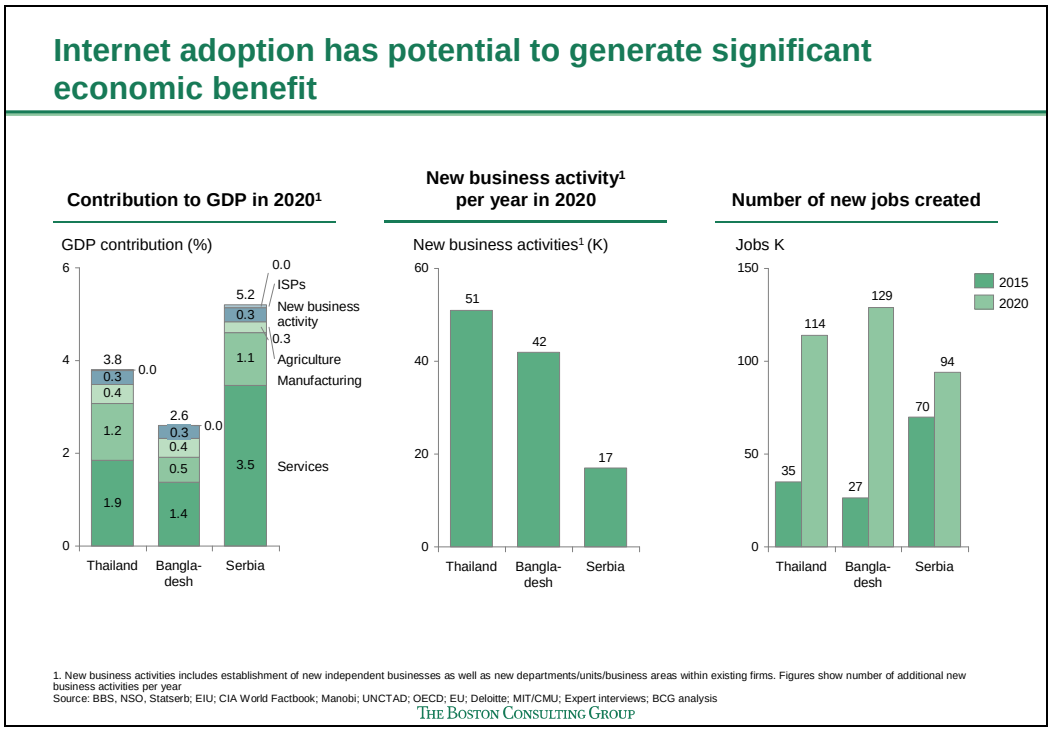

Exhibit 1.4 Projected economic benefits

Apart from GDP, Internet penetration will also spur entrepreneurship, resulting in an increase in the number of new business activities, which includes both the establishment of new companies, as well as new departments/units/business areas in existing companies. Research suggests that a 10 percentage point increase in Internet penetration is correlated with a 1% increase in the annual rate of new business formation. Apart from using the Internet as a platform to reach customers, businesses are expected to spring up to support the Internet, e.g., by providing payments processing services, web hosting, website design, and so on. This increase in new business activities is also one of the key drivers of job creation, which could reach between 94K and 129K in the three countries. The study has again taken a conservative view on job creation, and excludes potential job gains in companies that have experienced an increase in productivity per worker. Although economic theory predicts that this will encourage

them to hire more staff, further expanding employment, it is difficult to estimate the number in a robust way, and this is therefore not included in the study.

One key effect of this increased economic activity is the tax revenues that it generates for the governments. Over the 10 year period, it is estimated that the Internet could contribute 4.2% of government revenues in Thailand, 4.6% in Bangladesh and 1.8% in Serbia. It is critical to note that in all countries, more than 50% (and in Bangladesh and Thailand, almost 90%) of the tax revenues are generated by the users of the Internet, not the providers. This highlights a very important feature of Internet services, namely that it is a capital good that enables increased production across the economy. High taxes on the provision of such services, although they might be lucrative in the short run, will delay or reduce job creation, and ultimately stifle the development of the economy. Beyond what is captured here, additional revenues could be generated, e.g., from the formalization of remittances, further reducing the contribution from service providers relative to the benefits to users.

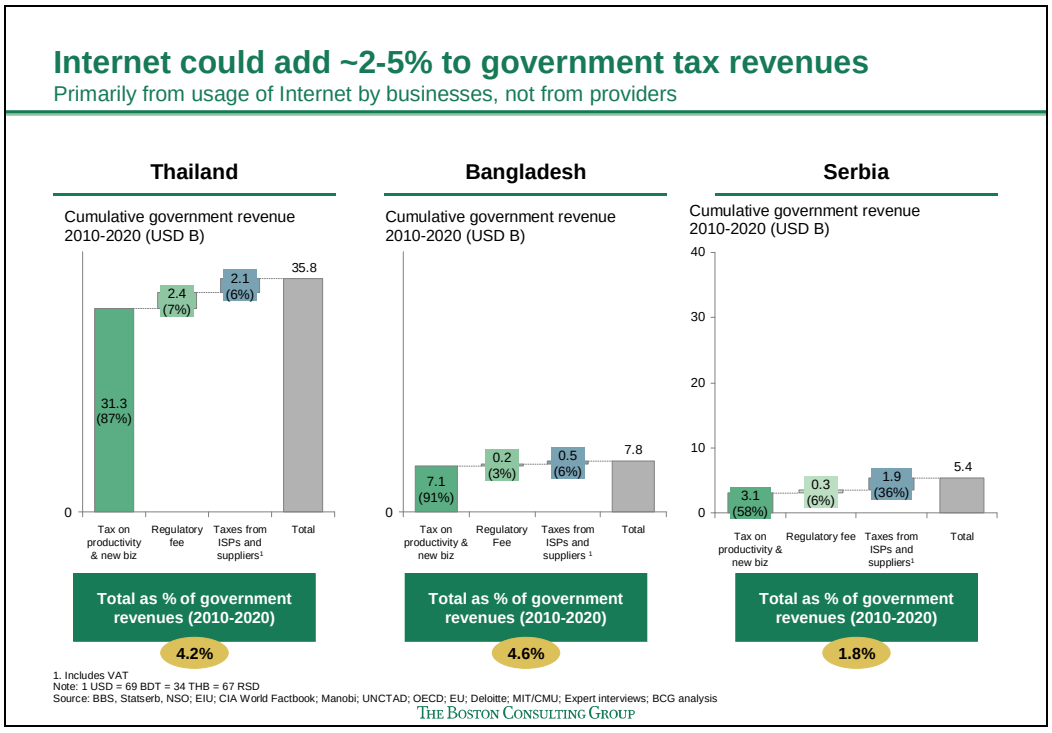

Exhibit 1.5 Projected tax revenues

1.3 Social benefits

Just as important as the economic impact are the social benefits that the Internet can bring. Across all three study countries, three issues were consistently highlighted as priority areas – education, healthcare, and rural development.

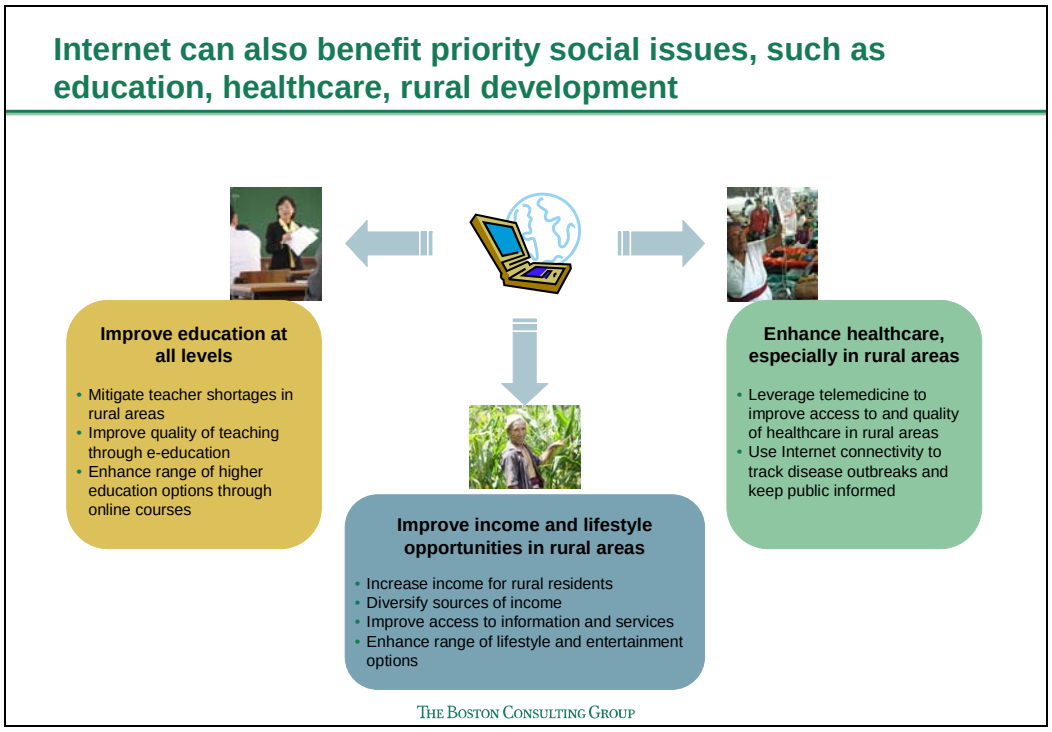

Exhibit 1.6 Overview of social benefits

1.3.1 Education

Education is a critical priority for all countries. It is an essential tool for raising standards of living, reducing poverty, and improving the quality of life for the citizens of developing countries. The Internet has the potential to improve access to education and quality of education in multiple ways, and can be applicable to a broad spectrum of countries. For example, for countries for whom access to basic education is a problem, Internet-based self-learning initiatives can be used to supplement the school system. Such systems work by providing terminals that children can use outside of classroom hours, and leverage both their innate curiosity and a system of peer-supported learning.

Studies suggest that such approaches improve academic results and help spread literacy, and, in fact, increase the level of engagement and desire to learn.

A shortage of skilled teachers in technical subjects or English, particularly in rural areas, is a common constraint faced by developing nations. In Bangladesh, for example, the student-teacher ratio at primary level is ~ 45:1, while in Thailand, the estimated student to qualified English teacher ratio is 628:1. One example of an Internet solution to this problem is to conduct lectures and lessons by video conference, using high-speed Internet connections to broadcast the session in real time to multiple classes of students. Such sessions can be made interactive, with the use of presentation material and opportunities or question and answer sessions. An added advantage is that the teacher can continue to be physically based in the urban areas while providing lessons to students in rural areas.

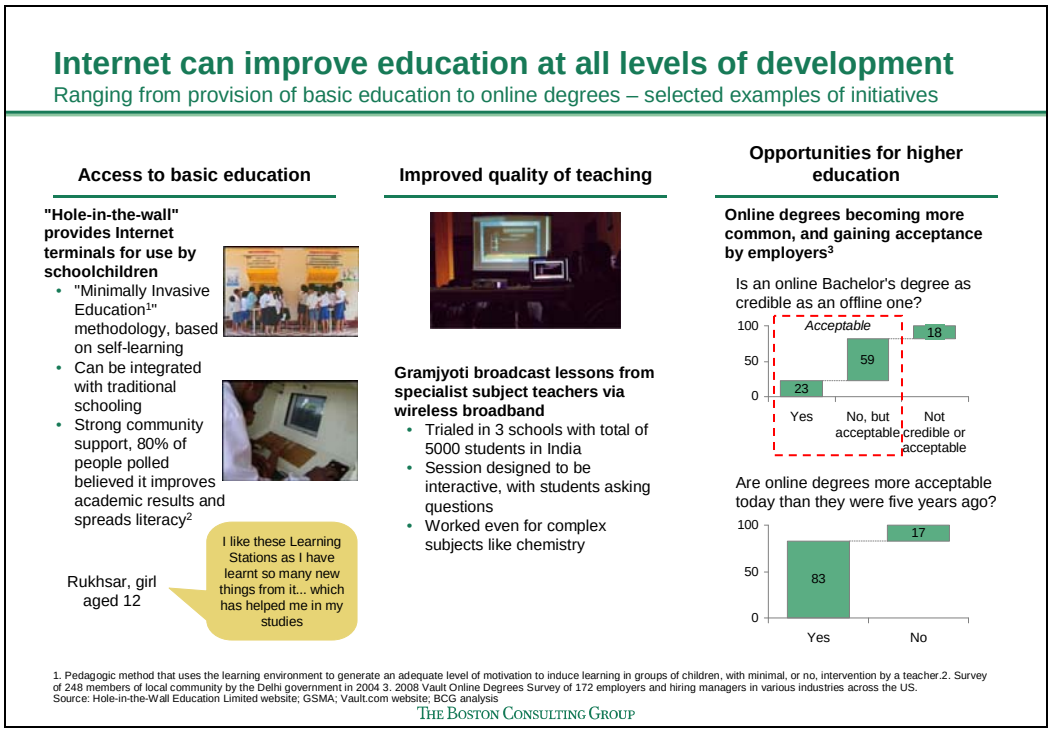

Exhibit 1.7 Internet and education

As developing economies mature, the focus in education typically moves from access to basic education to increasing tertiary enrolment rates, as the skill level of the workforce becomes an increasingly important competitive lever. The Internet can assist with this by providing affordable access to a range of online basic and advanced degrees. Research suggests that such degrees are becoming increasingly common and credible, and hence, acceptable to employers. With suitable safeguards in place to ensure that students are channeled to accredited programs of requisite quality, the Internet could help accelerate tertiary enrolment in Serbia.

1.3.2 Healthcare

Healthcare is a second area of priority for all countries, particularly developing countries like Bangladesh, where life expectancy is low at 63 years, and infant mortality is at 56/1000 live births, compared to 81 and 3/1000 respectively for Europe. A key constraint for most developing countries is the shortage of medical doctors, resulting in a patient-doctor ratio of 4000:1 in Bangladesh. While healthcare concerns may be less acute in countries like Serbia, improving the standard and quality of healthcare remains a key focus area. For example, improving the health of the youths has been identified as a key objective of Serbia's National Youth Strategy.

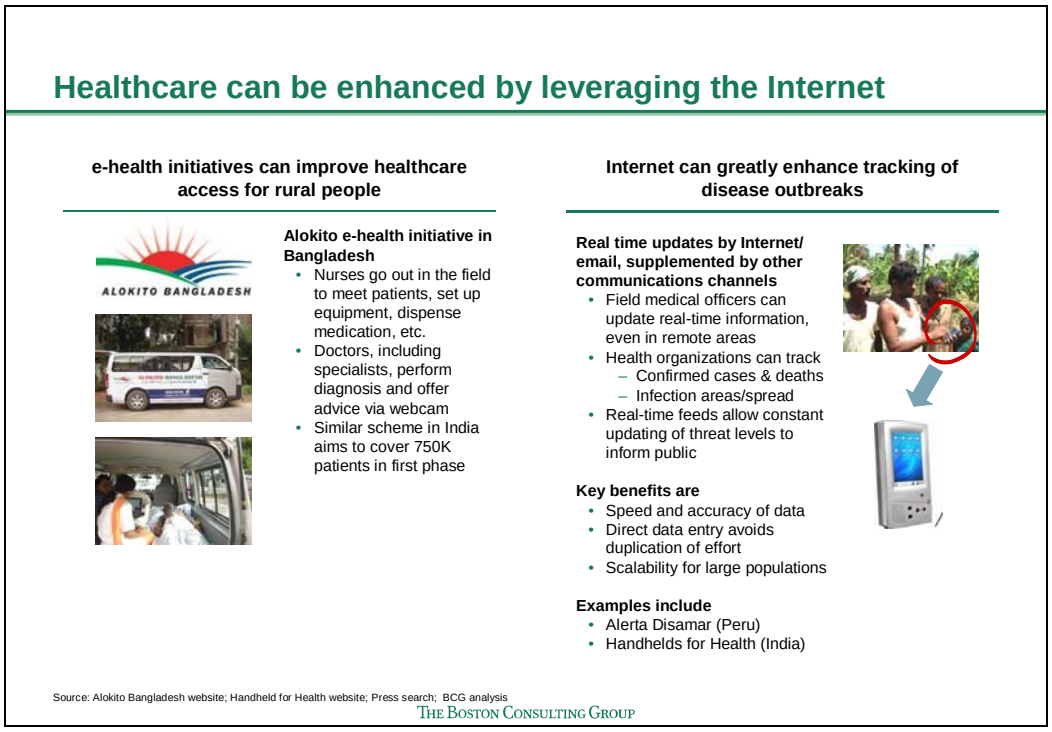

Exhibit 1.8 Internet and healthcare

Two examples of how the Internet can help mitigate these issues are highlighted here. E-health initiatives can help improve healthcare access, particularly in rural areas. One example is the Alokito initiative, where nurses go out to the field in specially-equipped vans to meet patients and perform basic procedures, such as taking blood pressure and setting up stethoscopes. The vans have a wireless broadband link to physicians in the main hospital back in the city, who are then able to see the patients, ask them questions and offer diagnoses. This significantly increases the number of patients that each physician can serve, and enables them to extend their expertise into rural areas without having to give up the comforts of urban life.

Another aspect of how the Internet can contribute to improving healthcare is in the tracking of disease outbreaks. Field medical officers can provide accurate, real-time information from remote areas using handheld computers with Internet connections, allowing local and international health organizations to track the spread of diseases. The key benefits of such a method are the speed and accuracy of data, as well as the time

and manpower savings from direct data entry, thus making it scalable for large populations. Handhelds for Health in India is one example of such technology in action. The Internet is also a powerful tool for keeping the public updated on developments, e.g., areas to avoid, measure to take to reduce risk of infection, etc., with the possibility of offering rich, interactive communications that other media cannot match.

1.3.3 Rural development

Many developing countries have large rural populations, and in general, conditions in the rural areas are more difficult than in urban areas. Incomes are on average lower than in urban areas, and are often more volatile due to a reliance on agriculture. Lifestyle and entertainment options are also generally limited. These are some of the key drivers of rural-urban migration, which in turn places great strain on the urban centers receiving these migrants. For example, in Thailand, an estimated 1M people a year move into the major urban areas looking for work and a better standard of living. Mitigating the rural-urban gap by improving rural income and lifestyle opportunities is therefore the third key priority for many countries.

The Internet can help increase income and diversify sources of income. The Internet can create alternative income opportunities. Entrepreneurs can build businesses around the Internet value chain, from providing Internet access, as with CICs/telecentres, or providing services to Internet users, such as visa applications, to serving the providers themselves, such as computer maintenance, website design, etc. Another way in which the Internet can improve income opportunities is by enabling Business Process Outsourcing (BPO) to rural areas. Rural residents can provide services such as data imaging and formatting, application processing, etc., from their homes or at designated centers, communicating with their clients electronically. Critically, such services significantly increase the returns to literacy, and therefore are likely to increase the demand for education. In more conservative countries or regions, they can also serve as a critical source of income for women, particularly for jobs that can be done from home.

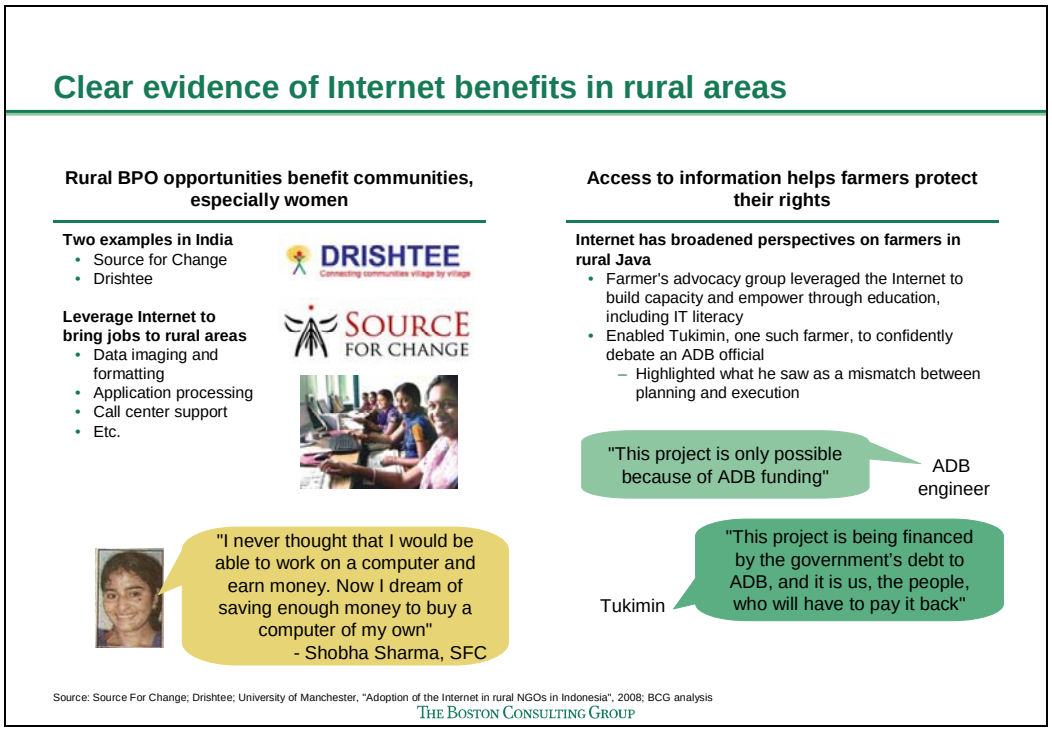

Exhibit 1.9 Internet and rural development

The Internet can also help mitigate the rural-urban digital divide, by enhancing access to information and basic services, as well as lifestyle options, such as entertainment. The digital divide has been identified as a social concern that needs to be ameliorated, and widespread adoption of the Internet in rural areas is the best way to achieve this. With better access to information, rural residents can be made more aware of their rights, and hence better able to defend them should the need arise.

The Internet can be used to cost-effectively address infrastructure gaps and enhance the provision of essential services, such as government, banking and remittances, to a large area at a far lower cost than traditional methods. This is particularly true in areas of low population density or poor transport links, which would require a very dense network of branches/outlets to effectively serve the population. Furthermore, the quality of services may not be high given the general unwillingness of skilled labour to work in rural areas. Online service provision avoids these concerns, and represent a high-quality, low-cost option that benefits all parties.

1.3.4 Other social benefits

In addition to the three critical areas, other social benefits have been identified. With increasing focus on climate change and control of carbon dioxide emissions, the environment is an area where the Internet can contribute. Even a simple idea, like reducing the number of trips required, can have significant impact. Internet connections enable people to work from home, transact with banks or governments electronically, and shop online. They can also minimize wasted trips through search services or navigational services. It is conceivable that the number of trips could fall by up to 10%, triggering significant savings on fuel costs and improving the environment by reducing emissions. For example, in Bangkok alone, up to THB 192B is spent on fuel for passenger cars each year, emitting a total of 20M tons of carbon dioxide annually. A 10% reduction translates into a saving of THB 20B (~USD 0.5B) and a reduction of 2M tons of carbon dioxide. It is in fact likely that the total savings will be greater than 10%, since the reduced number of trips should also reduce congestion at peak times, and congestion increases fuel consumption unproductively.

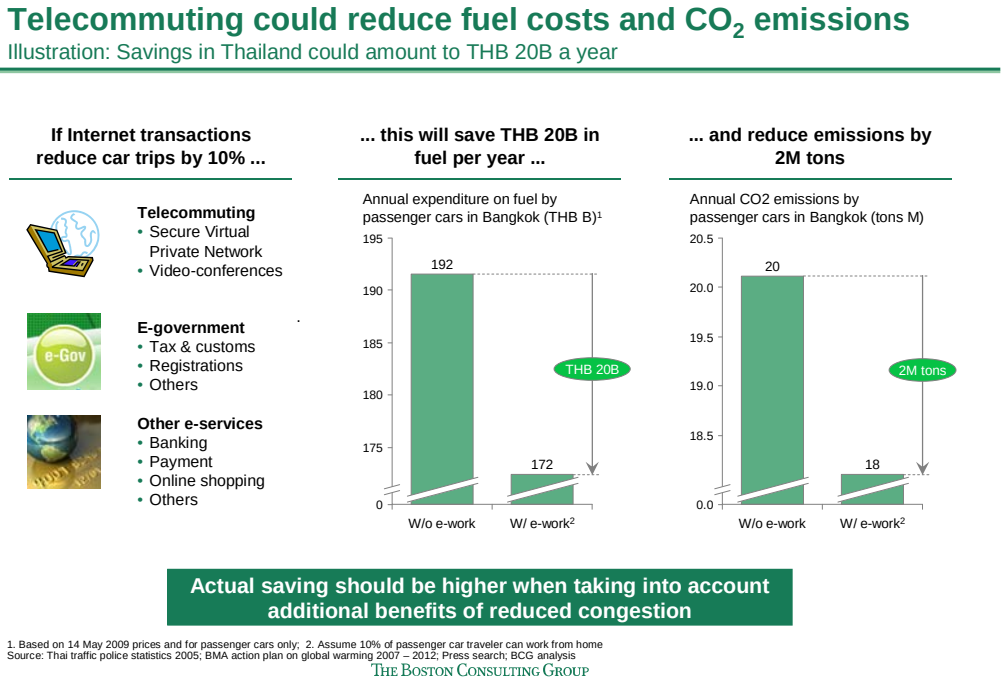

Exhibit 1.10 Internet and the environment

One key issue facing Serbia is the concern surrounding the aspirations of its youth. Surveys suggest that only 1 in 3 youths think that Serbia is moving in the right direction, and only 20% would not consider leaving Serbia. During the troubled 1990s, it was estimated that as many as 300K youths left Serbia, including many of the most highly-educated, in order to seek better futures elsewhere. The Ministry of Youth and Sports in Serbia recognized the problem, and has developed the National Youth Strategy to try to address it. The National Youth Strategy identifies 11 objectives. As can be seen in Exhibit 1.10, the Internet has the potential to facilitate the attainment of many of these goals.

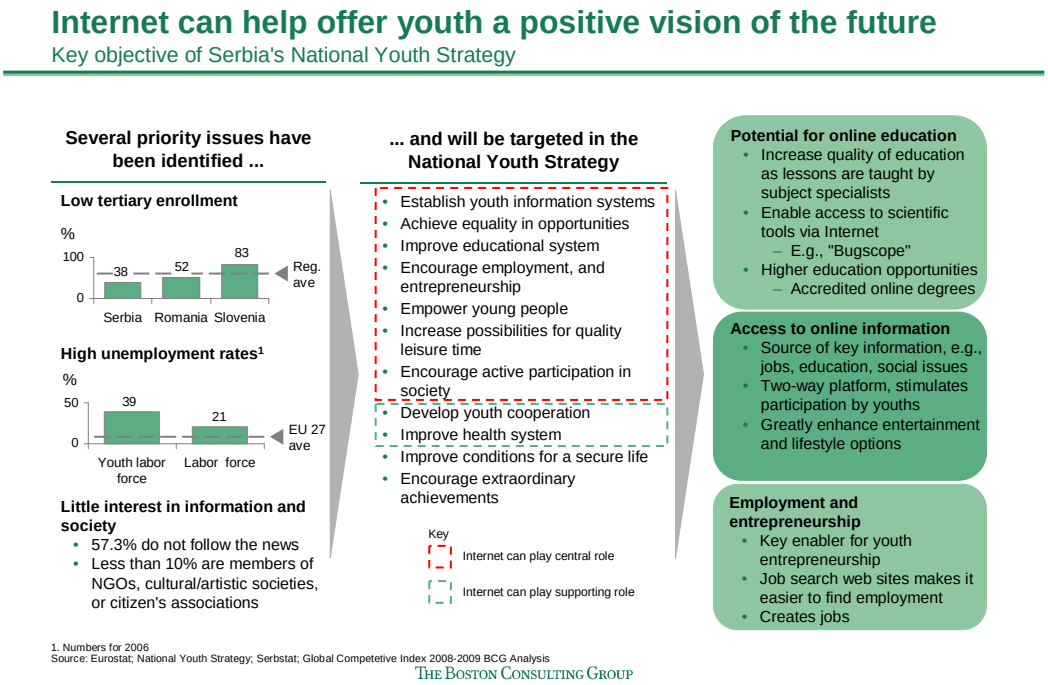

Exhibit 1.11 Internet and the aspirations of the youth

1.3.5 Mitigating new challenges

While seeking to maximize the upsides described above, care should also be taken to mitigate the potential downsides from widespread Internet usage. One key concern is access to undesirable content. A multi-pronged approach can help minimize the risk of such issues, e.g., blocking of selected websites from providers, use of parental control applications to limit access from home PCs, and greater education and awareness building activities. Education is also the key to reducing other risks on the Internet, such as identity theft or violation of intellectual property rights.

1.4 Reaping the benefits

While the benefits of the Internet are indisputable, key barriers to adoption must be addressed for them to materialize. The conditions required to increase accessibility, awareness, advocacy, facilitation and value for users may be absent in developing and

emerging economies. However, these can be mitigated through selective use of targeted policy initiatives.

Bangladesh, like many other developing economies, faces a number of critical obstacles to widespread Internet adoption. Fixed line coverage and quality are poor, particularly outside of the core urban areas. Currently, approximately 90% of fixed lines are concentrated in the urban areas, where only 25% of the population live. Until recently, access prices were also high. In 2006 the ITU estimated that the PPP adjusted price of basic Internet access (20 hrs a month) was almost USD 8, more than 3 times the equivalent in Thailand. Against the context of a GDP per capita of around USD 500, this clearly put the Internet out of the reach of the majority. However, this appears to be improving as mobile operators have started to offer cheap pre-paid packages. Awareness of the Internet and the benefits it can bring is low. In a survey in 2007/2008, almost three quarters of rural Bangladeshis surveyed admitted that they were not aware of the Internet.

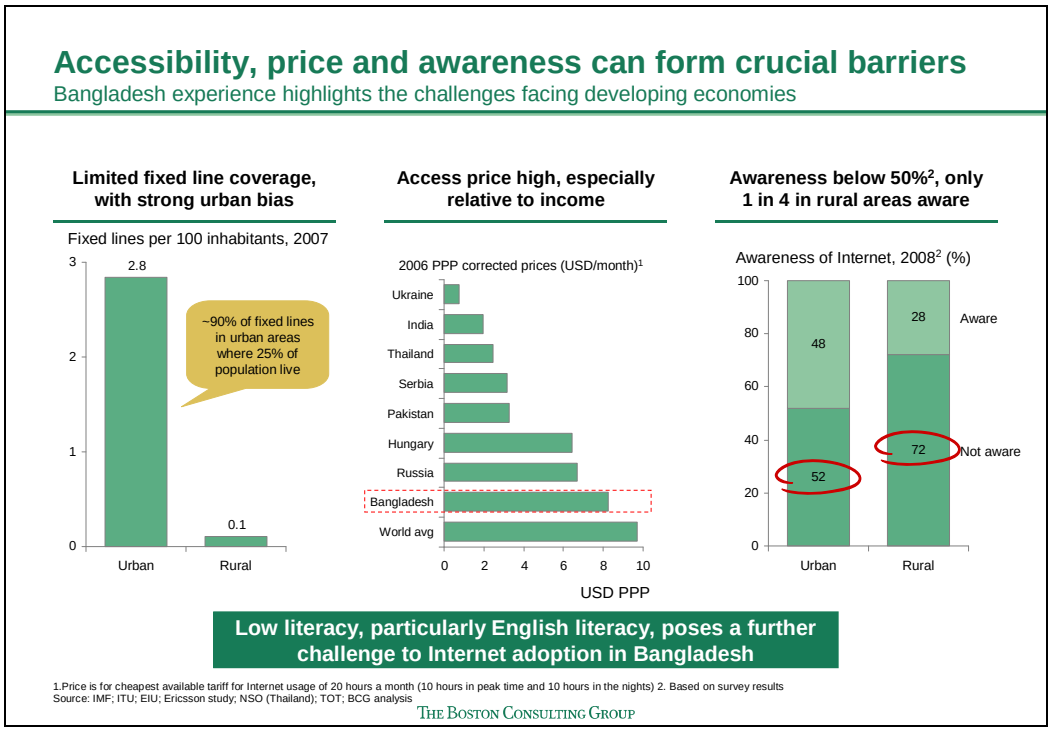

Exhibit 1.12 Adoption barriers in Bangladesh

These challenges are further complicated by the low levels of literacy in the country, particularly English literacy. Headcount literacy rates in Bangladesh are around 50%, were "literate" is defined as someone who is able to sign their own name. Based on current interfaces, this is likely to be insufficient for someone to effectively access the Internet. Although these can be mitigated by sharing of know-how within the family, or within a community, it highlights the need for relevant local content that is customized to the needs of the community, in terms of purpose, interface, functionality, etc.

These problems and challenges are not unique to Bangladesh, but can in fact by found in various combinations in most developing and emerging economies. Three possible policy responses are highlighted here. The first is to accelerate awareness building through creating community access points, which will help raise awareness in the short term, and offer local residents a low-cost entry point to experience the Internet. These centres can serve as one-stop shops offering a range of services, including basic Internet and email access, VoIP and video calls, education services, agriculture information, government services (such as applications for employment permits), etc. This will attract a wider pool of users, and, in time, build a corp of advocates who can then recommend the Internet to their friends and neighbours. With this in mind, Bangladesh has mapped out a plan to build a network of telecentres nationwide, building on the success of the ~1K existing telecentres, such as Grameenphone's Community Information Centres (CIC).

A second area of focus is providing schools with Internet access, which in many cases is the most cost-effective way to increase IT literacy and Internet awareness. The youths will generally be the most technologically savvy age group, and will also have the highest level of literacy, making them an ideal target group. Furthermore, the existing school infrastructure network provides physical infrastructure as well as teachers, although in most cases they will require IT-specific training. Governments should also seek creative solutions to lower the cost of providing equipment and resources, such as by working with NGOs and IGOs that already seek to provide schools with computers and Internet access. Attention must also be given to the development of customized

local language educational content. As an alternative to directly producing the material in-house, the government can also play a facilitating role to accelerate private sector content development. In South Korea for example, exhibitions and competitions were held to stimulate innovation.

The final and perhaps most critical area is improving infrastructure, to ensure that those who want to access the Internet are able to do so at a reasonable standard of quality. Many governments globally have announced programs to invest heavily in fixed broadband networks, led by Australia, which has committed to spend USD 30B over the next 8 years to build its national broadband network. Excluding outliers, on a per capita basis, the general trend is to spend ~USD 50 per citizen, while on a per square kilometer basis, the average is approximately USD 4K/sq km. It is clear that a nationwide high quality fixed broadband infrastructure will require significant government support to be economical, even for a small, densely populated country like Singapore.

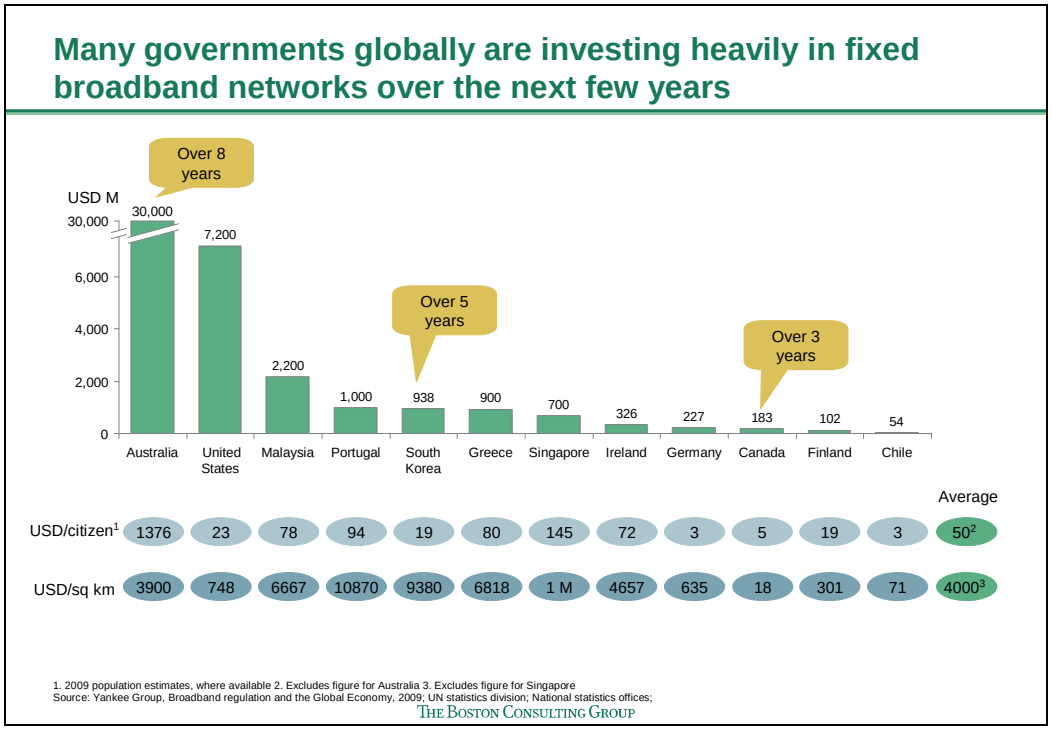

Exhibit 1.13 Government investment in fixed broadband networks

In view of the constraints with a fixed network, wireless broadband could play an essential role in improving accessibility, particularly for sparsely populated and rural areas. The primary advantages of wireless broadband are its lower construction cost, shorter timeline for rollout, and lower costs for end users. Wireless broadband has also been shown to provide an additional boost to business productivity, strengthening the value proposition for potential adopters. Although maximum download speeds are lower, relative to fixed line technologies, they are constantly improving, and should be sufficient for the vast majority of user needs. Perhaps most critically, given the budget constraints that face most developing economy governments, wireless broadband networks can be established without the need for government support or subsidies.

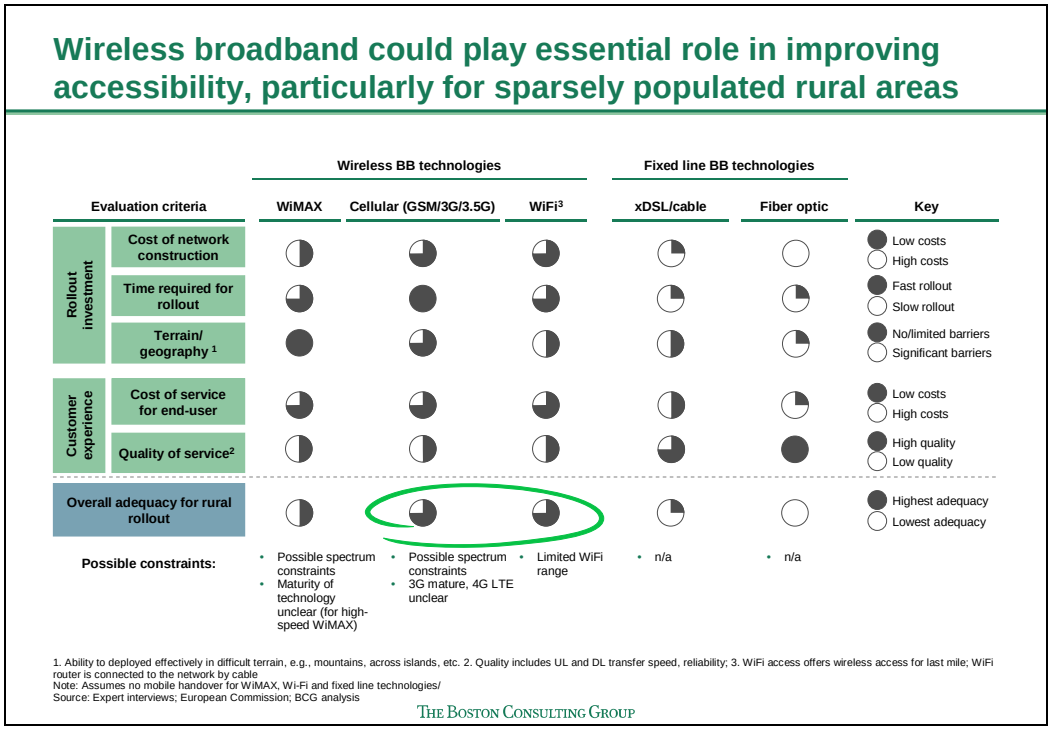

Exhibit 1.14 Evaluation of technologies for rural rollout

Beyond these specific initiatives, governments and regulators must also take steps to ensure that they have a high quality regulatory regime in place. All else being equal, uncertainty reduces investment, and therefore governments and regulators should work toward minimizing perceived regulatory uncertainty. Higher investment positively impacts adoption by accelerating accessibility, particularly in rural areas. Higher

investment should also translate into more competition, which should benefit consumers through lower prices, better quality, and greater variety. Another lever that can be used to increase adoption is to reduce direct taxes on Internet usage. Taken together, increased investment and lower taxes can significantly increase adoption, and the benefits associated with it. For example, in Serbia, a "higher cost" scenario has been modeled, where regulatory uncertainty reduces investment and a communication tax reduces adoption. Removal of these constraints (the base case) means the number of subscribers per 100 population in 2020 could increase by 4 (from 38 to 42), generating an extra 0.3% in GDP (4.1% to 4.3%), and increasing job creation by over 20%.

This highlights a crucial point in the Internet story, that governments and regulators have key roles to play to ensure that the benefits are maximized and accelerated. To achieve this, regulatory best practices will need to be implemented and adhered to, and local challenges addressed. To minimize uncertainty, governments and regulators should aim to put in place clear and credible long-term plans, a pro-investment, pro-competition regime, and a supportive environment for the entire Internet ecosystem. These can be achieved by focusing on three key operating principles: transparency & predictability, objectivity, and efficiency. 11 policy requirements have been identified as following from these three key operating principles, as shown in Exhibit 1.15. These must in turn be underpinned by two structural requirements, independence (political, institutional and financial) and a high degree of capability within the regulator.

While the overall long-term objective, to build a better regulatory environment, is clear, each country's immediate priorities will depend on their specific circumstances. In Bangladesh, for example, building better governance through improvements in transparency and predictability has been identified by some experts as a critical first step, in order to reduce uncertainty for investors. This includes establishing and complying with procedural rules such as mandatory engagement and consultation with key stakeholders. Another concrete set would be the introduction of mechanisms for appeal. In parallel, Bangladesh can improve its regulatory environment by increasing the independence and capabilities of its regulatory agency. In Thailand, investor uncertainty can most effectively be reduced by taking steps to ensure a level playing

field for all operators, moving away from the asymmetries that exist in the current regime. Enhancing regulatory capability is also critical to reduce uncertainty. Clear demonstrations of regulatory capability and intent, e.g., by taking swift action on key issues, and promulgating detailed implementation plans for complex issues, would also help address concerns. Finally, for countries like Serbia, where the regulatory regime is more mature, focusing on priority issues can help accelerate Internet development. Three issues have been identified:

- Enhancing rules and procedures to improve clarity and streamline processes
- Providing equal access to backbone for all market players in order to improve quality of service and coverage
- Efficiently manage spectrum to maximize benefits, e.g., through technology-neutral licensing regimes and giving appropriate priority to mobile broadband when switching over to digital broadcasting

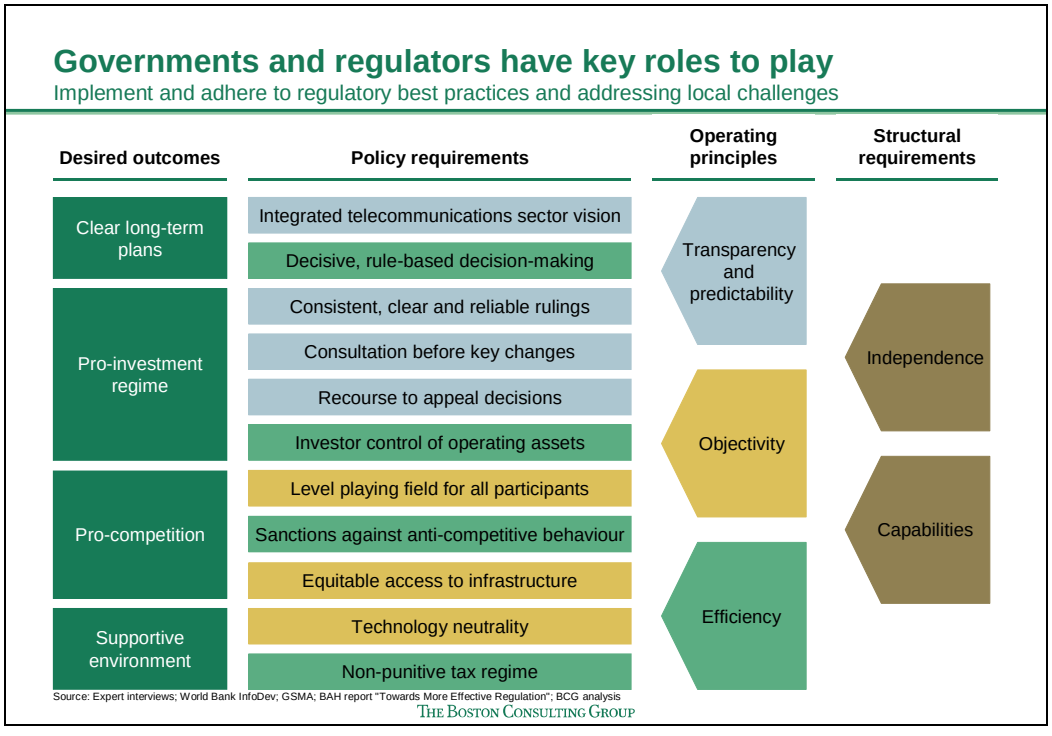

Exhibit 1.15 Policy requirements

2. BANGLADESH

2.1 Introduction

Despite rapid growth over the last 5 years, Bangladesh remains one of the most poorly penetrated countries in the world, with estimates suggesting that there is approximately 1 subscriber for every 100 people. Furthermore, growth rates already appear to be slowing.

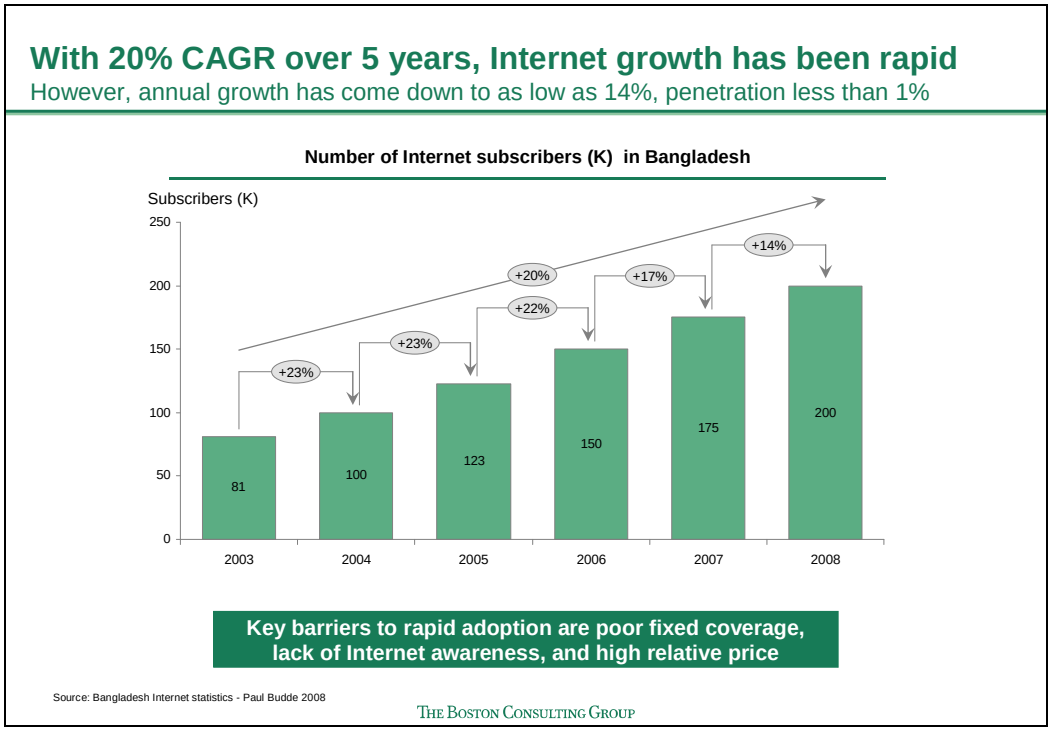

Exhibit 2.1 Internet growth in Bangladesh

Bangladesh faces a number of critical obstacles to widespread Internet adoption. Fixed line coverage and quality are poor, particularly outside of the core urban areas. Currently, approximately 90% of fixed lines are concentrated in the urban areas, where only 25% of the population live. Until recently, access prices were also high. In 2006 the ITU estimated that the PPP adjusted price of basic Internet access (20 hrs a month) was almost USD 8, more than 3 times the equivalent in Thailand. Against the context of a GDP per capita of around USD 500, this clearly put the Internet out of the reach of the

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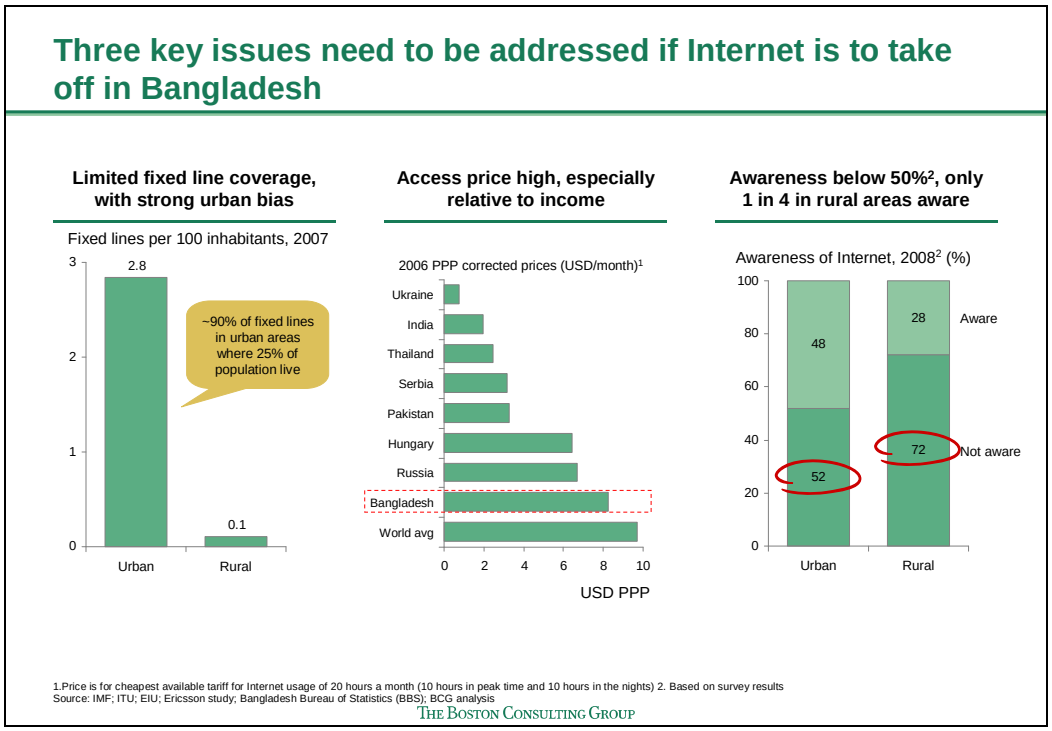


Exhibit 2.2 Adoption barriers in Bangladesh

From the people perspective, there are two challenges. One is the low awareness of the Internet and the benefits it can bring. In a survey in 2007/2008, almost three quarters of rural Bangladeshis surveyed admitted that they were not aware of the Internet. A more fundamental challenge is the lack of literacy, particularly English literacy and proficiency. Headcount literacy rates in Bangladesh are around 50%, where "literate" is defined as someone who is able to sign their own name. Based on current interfaces, this is likely to be insufficient for someone to effectively access the Internet. The literacy challenge may be mitigated by two factors. Firstly, within a family, it is likely that the younger members will be literate, and perhaps even had some exposure to IT at school. The number of households which are 100% illiterate is likely to be significantly lower than the 50% headcount rate, perhaps as low as 20%, the proportion of school-age children who are not enrolled in school. Another mitigating factor is the tradition of group sharing of resources. Illiterate households could receive assistance from literate

and connected family members or neighbours. Therefore, although literacy is a challenge to Internet adoption, it may be less severe than it appears at first glance.

These challenges, while significant, are not insurmountable. International experience has shown that wireless broadband can quickly and relatively cheaply spread the benefits of the Internet, particularly in sparsely populated rural areas. Although download speeds are limited relative to fixed line technologies, wireless compensates for this with its lower construction cost, shorter timeline for rollout, and lower costs for end users. Wireless broadband has also been shown to provide an additional boost to business productivity, strengthening the value proposition for potential adopters. A further advantage is that the additional competition provided by wireless players could accelerate the downward evolution of prices. In terms of awareness, encouraging the proliferation of community access points could help raise awareness in the short term, and offer Bangladeshis a low-cost entry point to experience the Internet. This will in time build a corps of advocates who can then recommend the Internet to their friends and neighbours.

2.2 Adoption

With the appropriate initiatives and policy frameworks in place, a bottom-up, cost-benefit analysis suggests that Bangladesh could have 18.3 million subscribers by 2020, which works out to approximately 10 subscribers per 100 population[1]. It is noticeable that the most rapid growth takes places in the later years, after 2018, when adoptions starts to take off among the lower income segments. It is likely that growth will continue to accelerate for a few years beyond the study period. At the household level, 32% will households have at least one Internet subscription, with some high income households also taking on additional wireless subscriptions. Business adoption is higher, at around

[1] Official statistics have been used in developing all projections. Although it is widely believed that household incomes and GDP are higher due to the grey/informal economy, these have not been included due to the lack of reliable statistics

66%. The Bangladesh business landscape is dominated by the very large number of small service firms, and it is the relatively low penetration levels in that segment that drive the overall penetration rates.

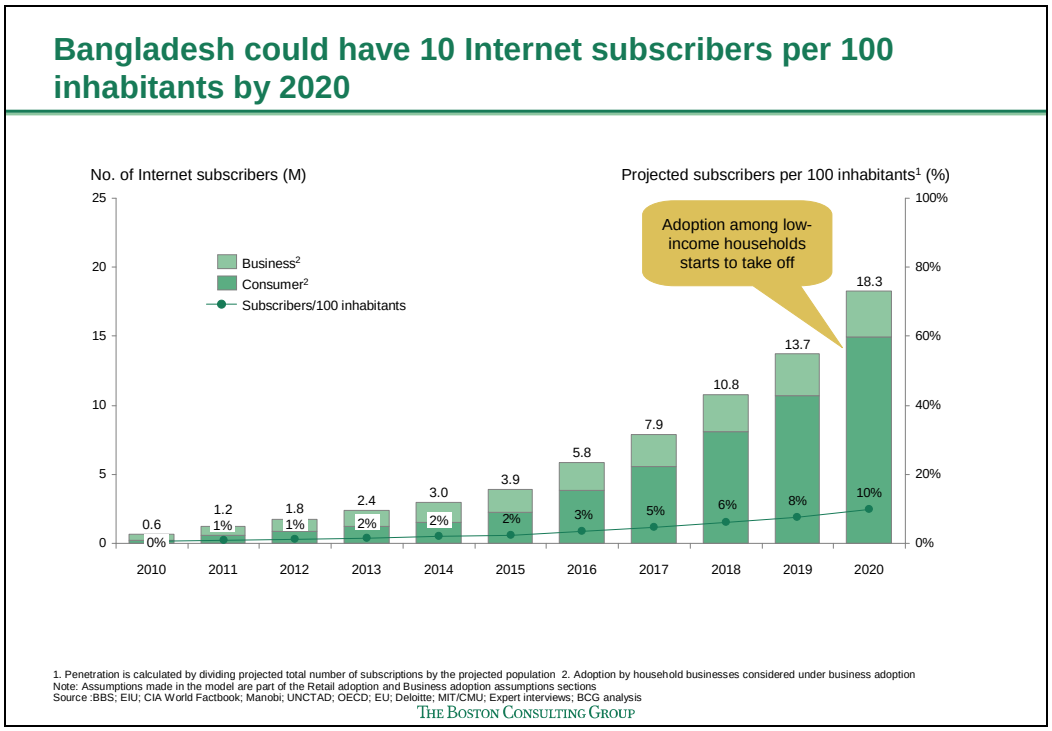


Exhibit 2.3 Projected penetration in Bangladesh

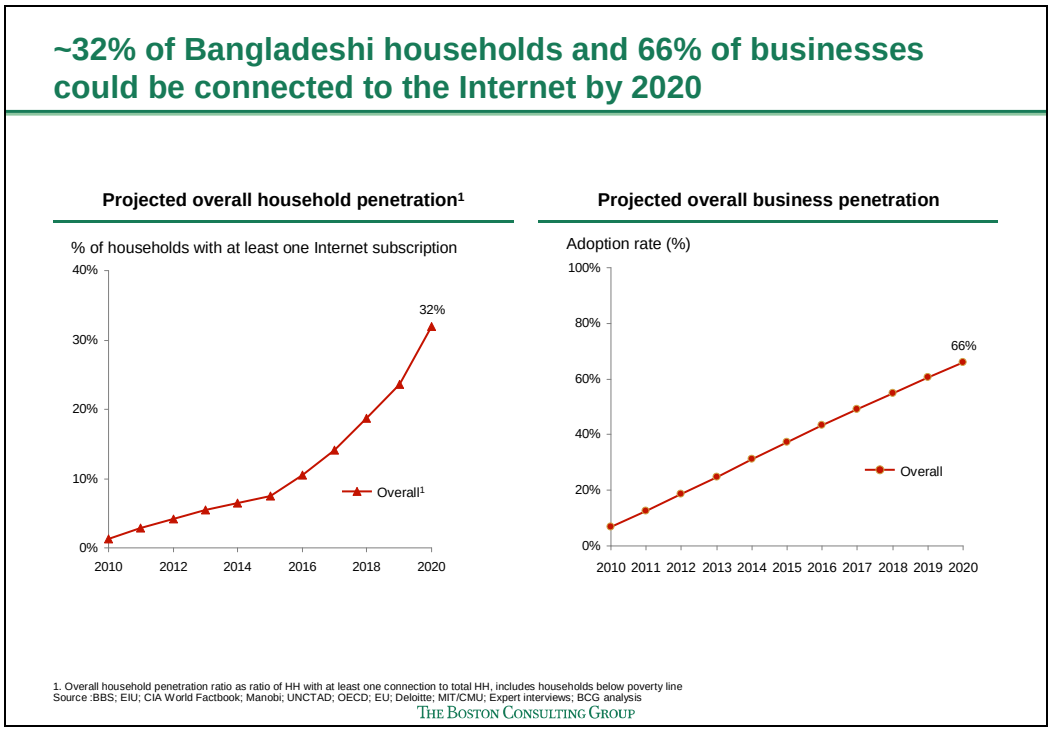


Exhibit 2.4 Household and business adoption

Experts believe that the majority of Internet subscribers in Bangladesh will be using wireless technologies as their access route. This is due to the combination of limited fixed line coverage and the poor quality of fixed lines. Even in urban areas, and among business users, it is believed that up to 70% of people will prefer WiMax or GSM solutions to fixed connections. Among rural subscribers, it is believed that almost all of them will use wireless technologies, given the lack of fixed lines in rural areas. The combined effect of these drivers is that over 90% of connections could be wireless in 2020, provided appropriate investments are in place.

2.3 Economic benefits

Significant economic benefits are projected to accrue by 2020[2].

[2] Official statistics have been used in developing all projections. Although it is widely believed that household incomes and GDP are higher due to the grey/informal economy, these have not been included due to the lack of reliable statistics

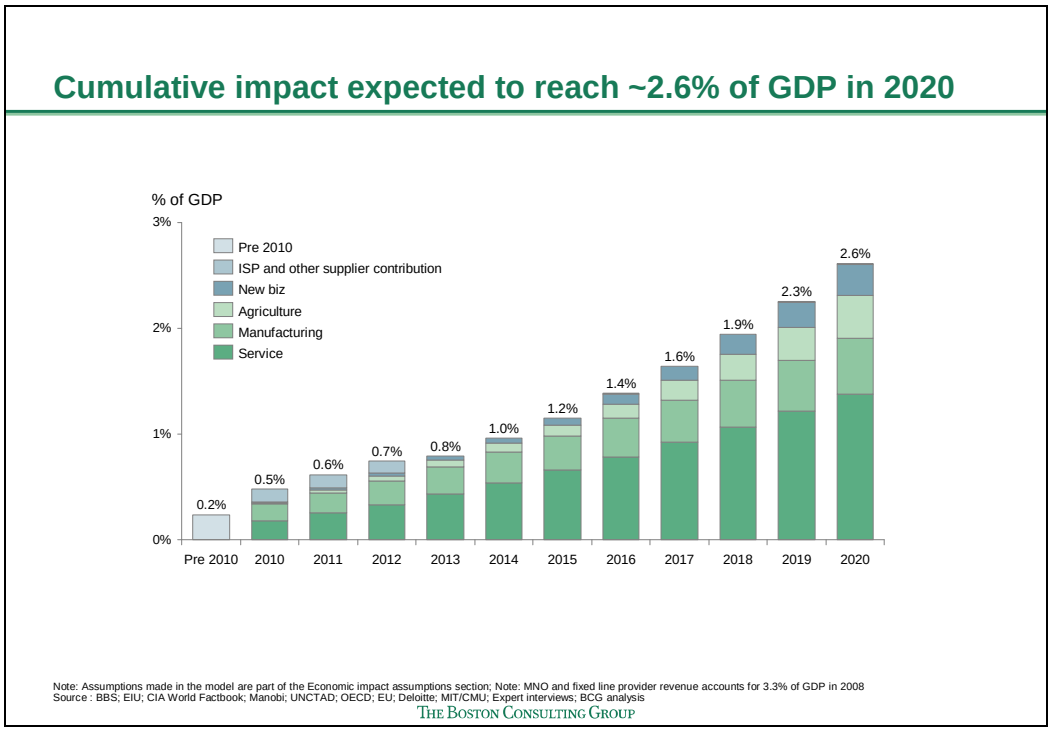


Exhibit 2.5 Economic benefits

In terms of overall contribution to GDP, the figure is expected to rise at an accelerating rate, reaching 2.6% p.a. in 2020. The key driver of this is the productivity gains experienced by business users in all industries. It is projected that service firms will experience a gradual, continual increase in productivity gains (defined as gross value added per worker, or gross profit per employee), reaching 3.5% in 2020, and manufacturing firms will gain by up to 1.8%. This allows them to contribute 1.4% and 0.5% to GDP respectively, for a combined total of 318B BDT a year by 2020. Agriculture is projected to contribute up to 0.4%. With small household farms in rural areas dominating production, there is significant scope for the use of Internet to increase value added, through providing better information on planting times, methods, use of fertilizers, etc. This output could be worth up to BDT 68B in 2020.

Rising Internet penetration should also drive an increase in new business activity. Particularly in a country like Bangladesh, the Internet can help make up for shortages in other forms of infrastructure, such as roads, by enabling people to transact across large distances. There is already evidence of new business models based on the Internet, such

as providing Internet services in rural communities, Bangladesh-focused job search sites, and many other innovative ways for entrepreneurs to harness the Internet. This could potentially increase the number of new businesses each year by up to 42K in 2020.

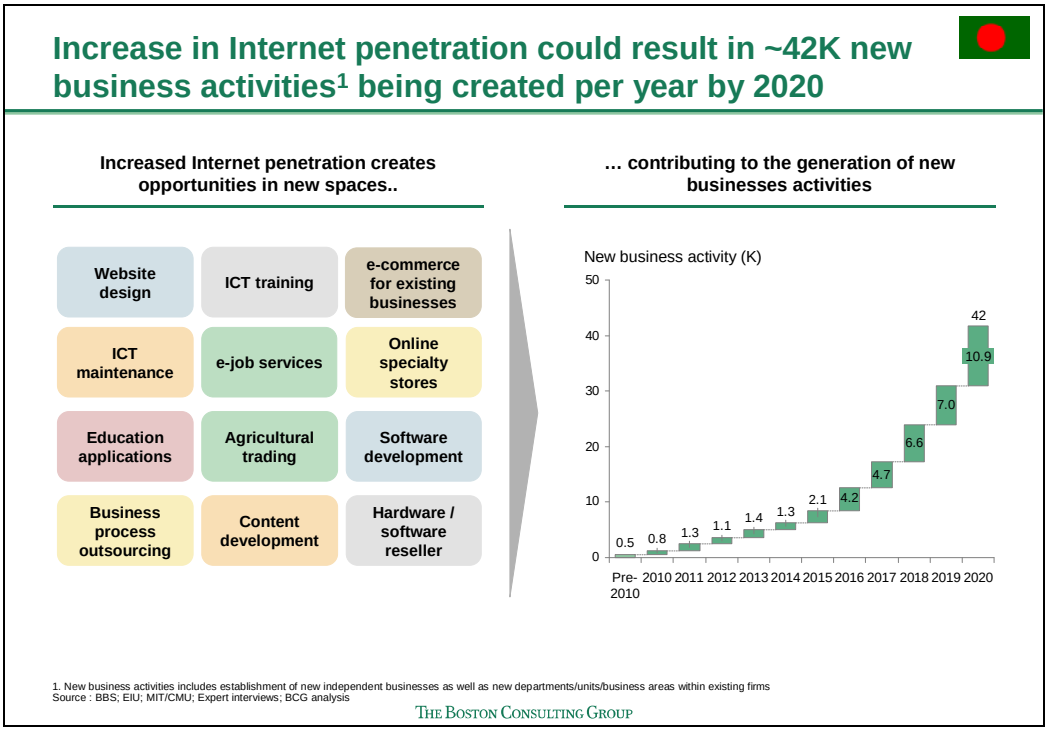


Exhibit 2.6 New business activities

This is one of the main drivers of job creation, which could, conservatively, add 129K jobs in 2020, including approximately 4000 jobs within the Internet service provider value chain. This excludes potential job gains in companies that have experienced an increase in productivity per worker, which should in theory encourage them to hire more staff.

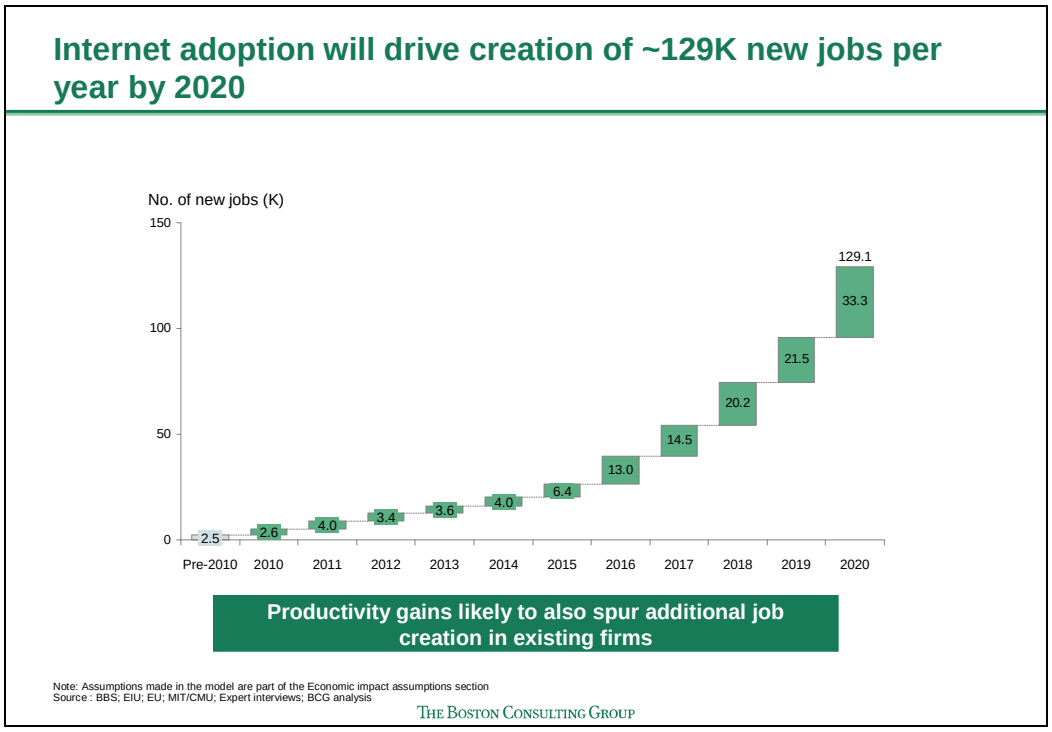


Exhibit 2.7 Job creation

All this economic activity will generate revenues for the government. Over the ten year period, this is expected to amount to BDT 539B, or approximately 4.6% of government revenues. Significantly, more than 90% of this tax is expected to come from corporate taxes on the users of the Internet, while less than 10% will come from taxes and fees paid by the providers themselves. This highlights a very important feature of Internet services, namely that it is a capital good that enables increased production across the economy. High taxes on the provision of such services, although they might be lucrative in the short run, will ultimately stifle the development of the economy.

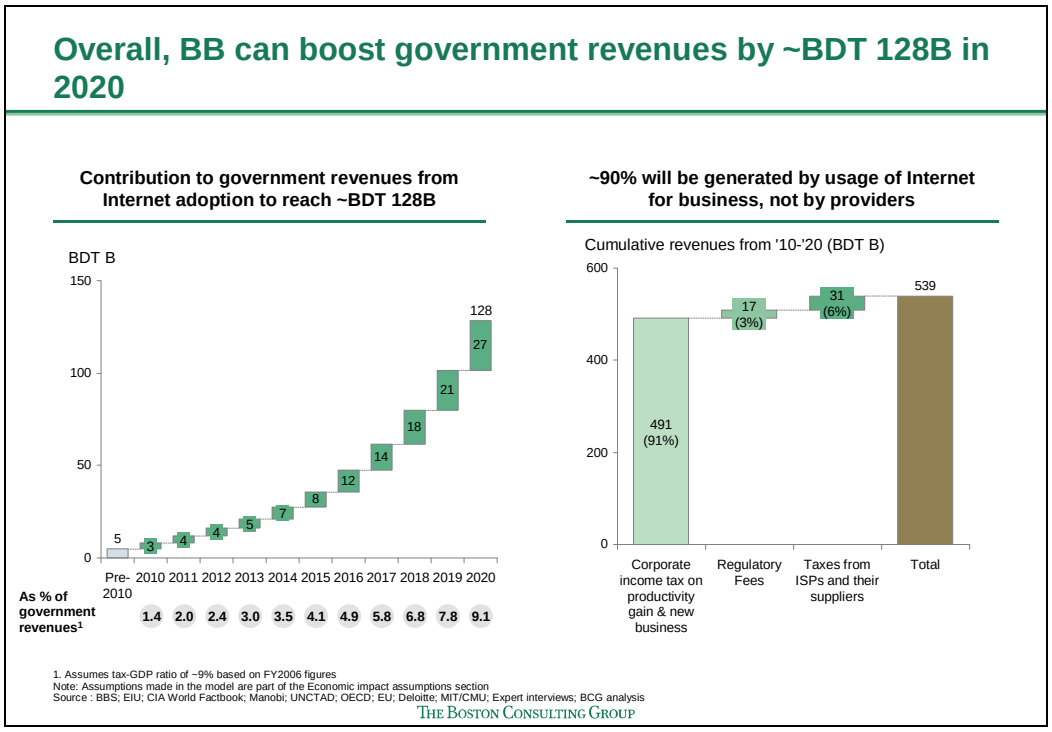


Exhibit 2.8 Tax revenues

2.4 Social benefits

Just as critical for Bangladesh are the possible social benefits that the Internet could bring. The benefits are expected to be extremely wide-ranging, with far greater impact than would be expected for a more developed country. This is because the Internet can serve as an alternative infrastructure backbone for society, making services and processes that would previously have been impossible, possible. In this study, we have focused on the impact that the Internet can have on education, healthcare and rural development.

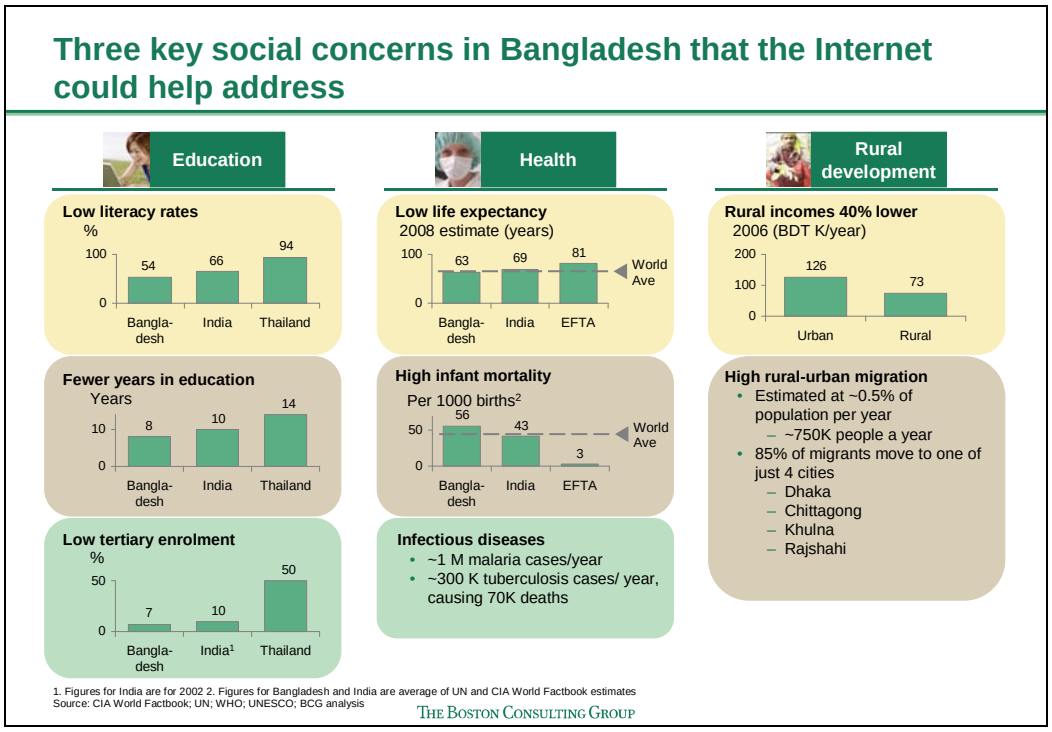


Exhibit 2.9 Overview of social benefits

2.4.1 Education

Education is clearly a high priority for Bangladesh. Almost all key metrics provide causes for concern: low literacy rates, fewer years in education, low tertiary enrolment. While a multitude of drivers converge to produce such an outcome, there are a number of key drivers that have been highlighted. Bangladesh suffers from a shortage of teachers, particularly in the rural areas. As a result, it has a very high pupil-teacher ratio at the primary level of 45 students to 1 teacher, compared to 40:1 for India, and as low as 18:1 for South-east Asia. Partly as a consequence of this, many villages do not have local schools, as there are approximately only half as many government primary schools as there are villages. This means that students will have to commute to attend school. This increases the financial and opportunity cost of students attending school, since they will have to spend money and time traveling to and from school. At the margin, this could result in some families deciding not to send their children to school, or withdrawing them from school at the earliest opportunity. As a result, only 55% of students make it to grade 5.

The Internet can help mitigate these issues in two ways. First, technology can be put in place to increase teacher leverage, i.e., increase the number of students that a teacher can address without diminishing the quality of education. This is particularly true of teachers in more technical or specialized subjects, where the depth of the teacher's knowledge and expertise can affect the quality of education. One example of an Internet solution to this problem is to conduct lectures and lessons by video conference, using high-speed Internet connections to broadcast the session in real time to multiple classes of students. Such sessions can be made interactive, with the use of presentation material and opportunities or question and answer sessions. An added advantage is that the teacher can continue to be physically based in the urban areas while providing lessons to students in rural areas.

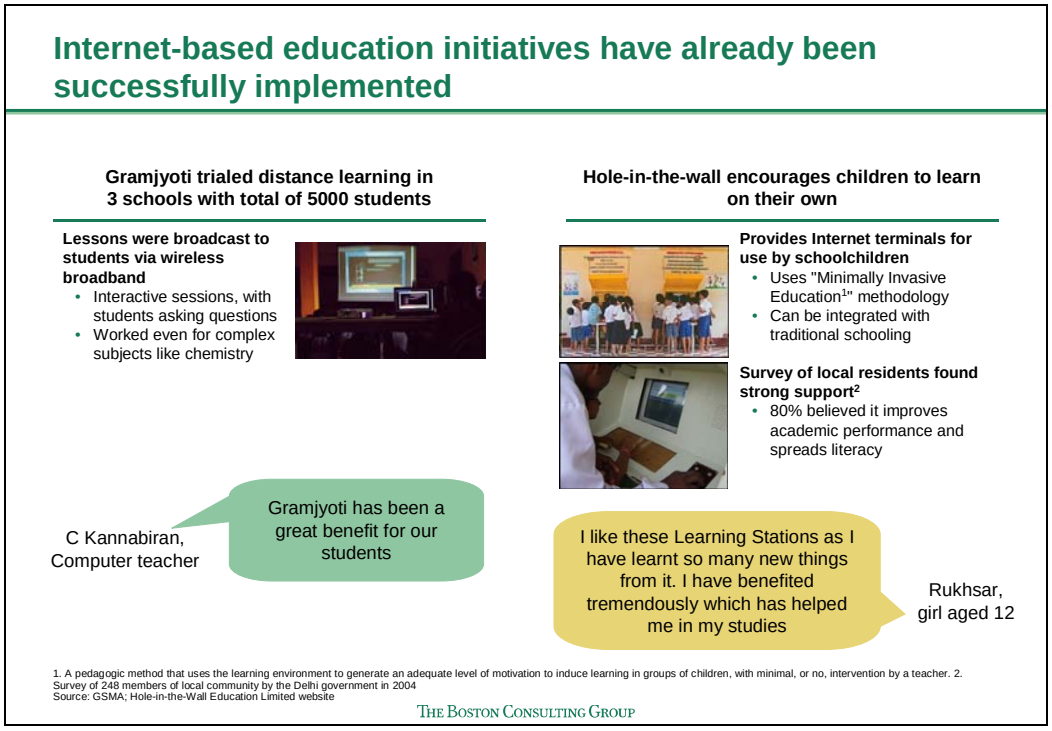


Exhibit 2.10 Internet and education

Another alternative is to provide small communities with self-directed learning opportunities which can supplement the traditional school system. This approach has been pioneered by Indian company Hole-in-the Wall Education Limited, which provides

Internet terminals that schoolchildren can access outside of school hours. Children learn primarily by exploration and research, and through peer-to-peer teaching/learning. Research suggests that such an approach has led to improvements in academic performance.

These are just two illustrations of how the Internet can assist in education. However, it is critical to avoid the temptation to believe that the mere act of providing computers and Internet access to schools is sufficient to generate benefits. Care must be taken to ensure that an appropriate ecosystem is in place to support the process. This includes the creation of customized content and applications targeted at Bangladeshi schoolchildren, regular access to computers and the Internet, and a sufficient number of trained instructors who can effectively promote IT literacy and usage, particularly in rural areas. The attainment of such a value chain requires the support of multiple parties, including the government, private sector, media, local community, and NGOs or other groups active in the area.

2.4.2 Healthcare

Healthcare, like education, is a fundamental concern for Bangladesh. On most key metrics, Bangladesh shows considerable room for improvement, be it in terms of life expectancy, infant mortality or the spread of infectious diseases. The shortage of skilled manpower is reflected in the high patient-doctor ratios in 2007 of 4000:1, compared to 1750:1 for India. This problem is particularly acute in the rural areas, where most of the population lives, as doctors prefer to live and work in the urban areas. Furthermore, the inadequacies of the healthcare system are exacerbated by chronic absenteeism by doctors. A World Bank study found that the sole doctor who is supposed to be on duty at rural health centers was absent up to 74% of the time, typically returning to the towns to treat more lucrative private patients.

Compounding this shortage of doctors, estimated at ~5.5K by some experts, is the fact that the conditions that prevail in Bangladesh are particularly conducive to the spread of disease. The combination of high population density, widespread poverty, malnutrition,

lack of access to clean water, frequent flooding and reliance on traditional medicine creates a fertile ground for the transmission of diseases, including water-borne diseases, vector-transmitted diseases like malaria (~1M cases a year) and direct-transmission diseases like tuberculosis (which kills ~70K Bangladeshis a year).

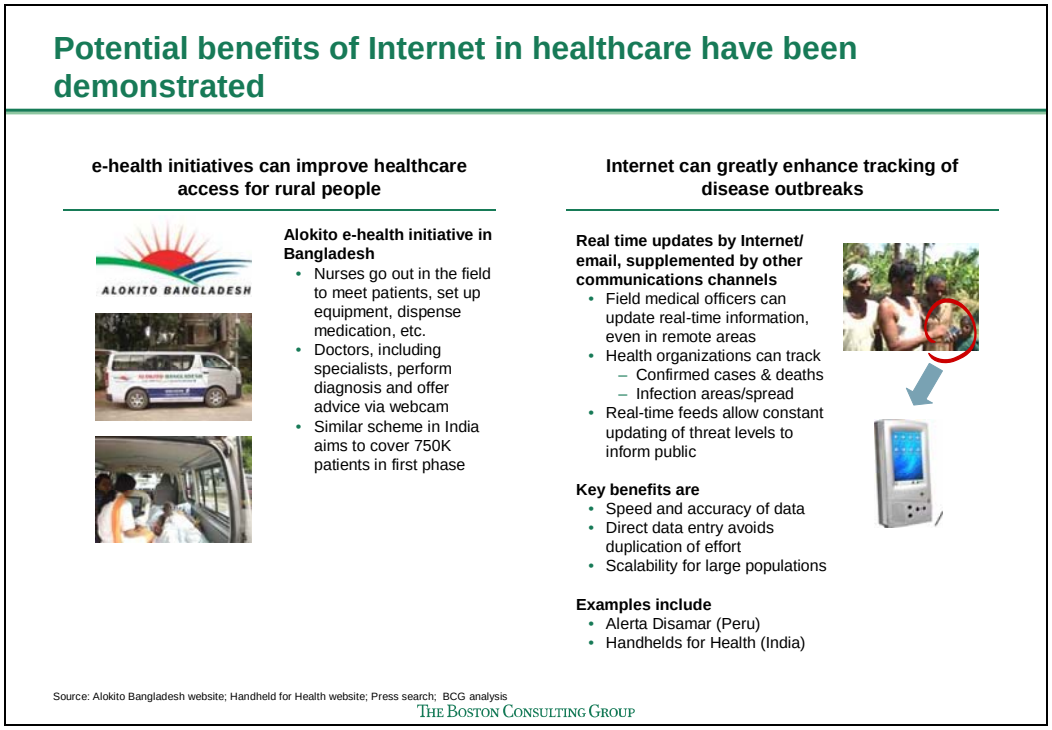


Exhibit 2.11 Internet and healthcare

Two examples of how the Internet can help mitigate these issues are highlighted here. E-health initiatives can help improve healthcare access, particularly in rural areas. One example is the Alokito initiative, where nurses go out to the field in specially-equipped vans to meet patients and perform basic procedures, such as taking blood pressure and setting up stethoscopes. The vans have a wireless broadband link to doctors in the main hospital back in the city, who are then able to see the patients, ask them questions and offer diagnoses. This significantly increases the number of patients that each doctor can serve, and enables them to extend their expertise into rural areas without having to give up the comforts of urban life.

Another aspect of how the Internet can contribute to improving healthcare in Bangladesh is in the tracking of disease outbreaks. Field medical officers can provide accurate, real-time information from remote areas using handheld computers with Internet connections, allowing local and international health organizations to track the spread of diseases. The key benefits of such a method are the speed and accuracy of data, as well as the time and manpower savings from direct data entry, thus making it scalable for large populations. Handhelds for Health in India is one example of such technology in action. The Internet is also a powerful tool for keeping the public updated on developments, e.g., areas to avoid, measure to take to reduce risk of infection, etc., with the possibility of offering rich, interactive communications that other media cannot match.

2.4.3 Rural development

Rural development is a third area of concern in Bangladesh. Two key concerns in rural areas are low and volatile incomes, and lack of access to basic services and lifestyle options. These fuel rural-urban migration, which in turn places great strain on the urban areas, as, by some estimates, more than half a million people move into the 4 main cities each year. The Internet, properly harnessed, has tremendous potential to address both drivers.

The Internet can help increase income and diversify sources of income. The impact of the Internet on agricultural incomes, for example, has already been described. The Internet can also increase the prices farmers receive for their output, by improving price information and allowing them to sell at the highest available price, or by reducing the reliance on middlemen. In addition, the Internet can create alternative income opportunities. Entrepreneurs can build businesses around the Internet value chain, from providing Internet access, as with CICs/telecentres, or providing services to Internet users, such as visa applications, to serving the providers themselves, such as computer maintenance, website design, etc. Another way in which the Internet can improve income opportunities is by enabling Business Process Outsourcing (BPO) to rural areas, which increases incomes and reduces reliance on agriculture. Rural residents can

provide services such as data imaging and formatting, application processing, etc., from their homes or at designated centers, communicating with their clients electronically. Critically, such services significantly increase the returns to literacy, and therefore are likely to increase the demand for education. They also empower women, who might otherwise not be allowed to leave their homes to work.

Wireless broadband can also help mitigate the rural-urban digital divide, by enhancing access to information and basic services, as well as lifestyle options, such as entertainment. The Internet can be used to cost-effectively address infrastructure gaps and enhance the provision of essential services such as government and banking and remittances to a large area at a far lower cost than traditional methods.

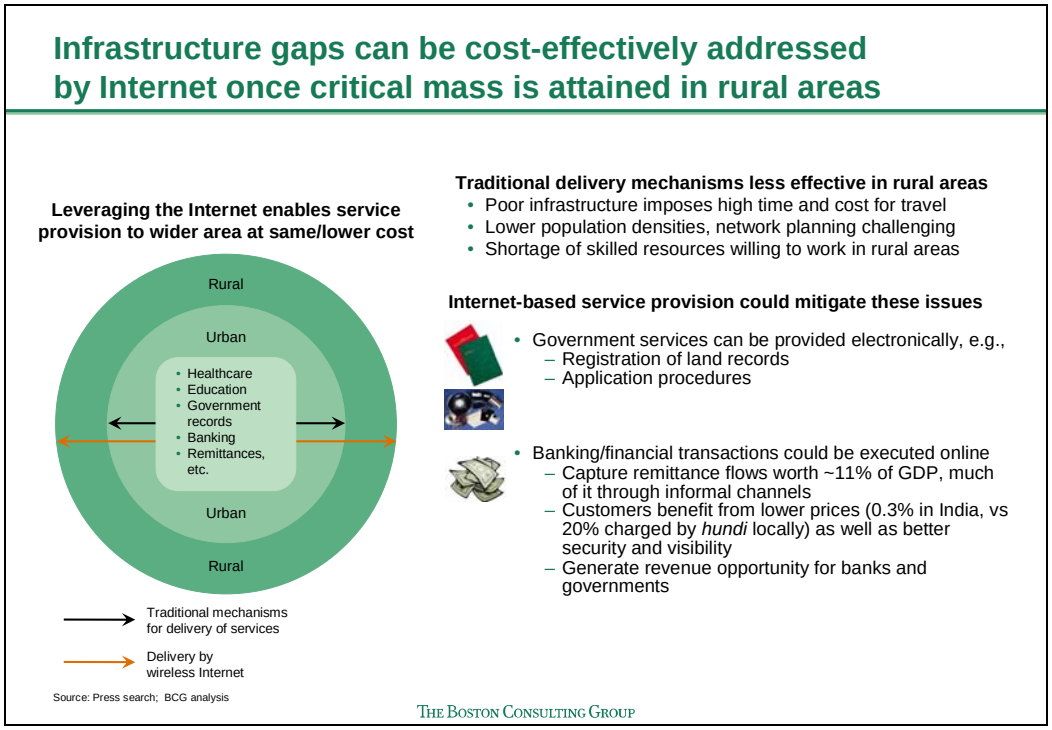


Exhibit 2.12 Internet as infrastructure

Access to information and entertainment are equally important elements of addressing the digital divide. Access to reliable information on land registration records, for example, can be critical for farmers seeking to protect their rights and prove ownership of their land. Improved access to information also improves transparency, reducing

opportunities for corruption. Communication with the large Non-Resident Bangladeshi (NRB) community is also critical to maintaining or strengthening social ties within families. The Internet enhances communication either by reducing the price point (through VoIP) or by improving the quality of interaction (through video calls). Finally, simply increasing the range of entertainment options can help improve the quality of life for rural residents. Taken together, the upside of these measures are a more equitable society and improved social cohesion and harmony.

2.4.4 Strategic partnerships

Given that a large number of NGOs and IGOs are actively working to address social issues in Bangladesh, there is significant scope to leverage them through partnerships to accelerate the attainment and delivery of benefits. Initiatives which directly leverage the Internet will clearly benefit from improved coverage and higher speeds. Furthermore, improving Internet access enhances the effectiveness and capability of all NGOs, even if they do not actively use the Internet as the primary means of delivering their services. Research in Indonesia, for example, suggests that NGOs themselves benefit from Internet access, in terms of internal organization, access to information, etc.

The other thrust should be to set up telecentres, i.e., rural community access points such as Grameenphone's CICs. As noted earlier, these help increase awareness and trial, and hence create a pool of local advocates to help spread usage of the Internet. Crucially, by providing access to education, healthcare, government and other applications, they accelerate the spread of the benefits on Internet adoption in rural areas, even if adoption remains low. The challenge is to make them self-sustaining, with sufficient revenue to earn the entrepreneurs an adequate rate of return, so that they can proliferate without the need for subsidies by governments or other bodies.

2.4.5 Mitigating new challenges

While seeking to maximize the upsides described above, care should also be taken to mitigate the potential downsides from widespread Internet usage. One key concern is access to undesirable content. A multi-pronged approach can help minimize the risk of

such issues, e.g., blocking of selected websites from providers, use of parental control applications to limit access from home PCs, and greater education and awareness building activities. For example, one option is to bring onboard the spiritual leaders in the country and demonstrate to them the benefits of the Internet, then using them as advocates of responsible Internet use. Education is also the key to reducing other risks on the Internet, such as identity theft or violation of intellectual property rights.

2.5 Scenarios

Two scenarios have been modeled. The first is the "Higher Benefits" scenario, where businesses and households are assumed to derive greater benefits from the Internet than in the base case[3]. E-business intensity gains grow at a faster rate, leading to accelerated adoption and a greater contribution to GDP. On the consumer side, households are willing to pay more for entertainment, social networking and other "soft" benefits. This leads to greater penetration, up to 1.2 additional subscribers per 100 population in 2020, which represent an approximately 10% increase in the number of subscribers relative to the base case. It also adds up to 1.1% more to GDP contribution, and increases the impact of job creation by approximately 10%[4].

Conversely, a downside scenario where users and providers face "Higher Costs" has also been modeled[5]. In this scenario, investment is reduced relative to the base case. Investment is sensitive to both the rate of return and the level of uncertainty, and

[3] Upside scenario assumes an increase in e-business intensity growth rapidity (e-business intensity grows by 2.8% instead of 1.8%) and an increase in perceived social and entertainment Internet benefit for HH due to higher transfer speeds, reliable connections and other factors all due to increased infrastructure investment (increased by 6% in 2010 and increasing to 15% in 2013)

[4] Expressed in terms of job-years. Job-years defined as number of jobs multiplied by number of years the job exists, reflecting different periods of time for which jobs would have existed

[5] Downside scenario assumes an increase in prices due to taxation (10% additional communication tax) and reduced operator competition (increasing prices by 5%), lower availability of Internet subscriptions in rural areas (in 2010-2013, 20% of rural HH unable to access the Internet, 15% thereafter), and lower social and entertainment benefit for households due to lower transfer speeds, frequent disconnections and other factors all due to lowered investment in infrastructure (lowered by 6% in 2010 and increasing to 15% in 2013)

regulatory actions could adversely impact both drivers, resulting in lower investment. This could result in

- Delaying physical access to infrastructure, particularly in rural areas
- Higher prices due to reduced competition
- Reduced quality, lowering the perceived benefits for consumers

In addition, cost for consumers can be directly impacted by sector-specific taxes, such as a direct 10% tax on Internet usage, for example. In combination, these drivers could result in a reduction in penetration of up to 1.7% percentage points relative to the base case, and a reduction in GDP contribution of up to 0.2% and a 15% reduction in job creation.

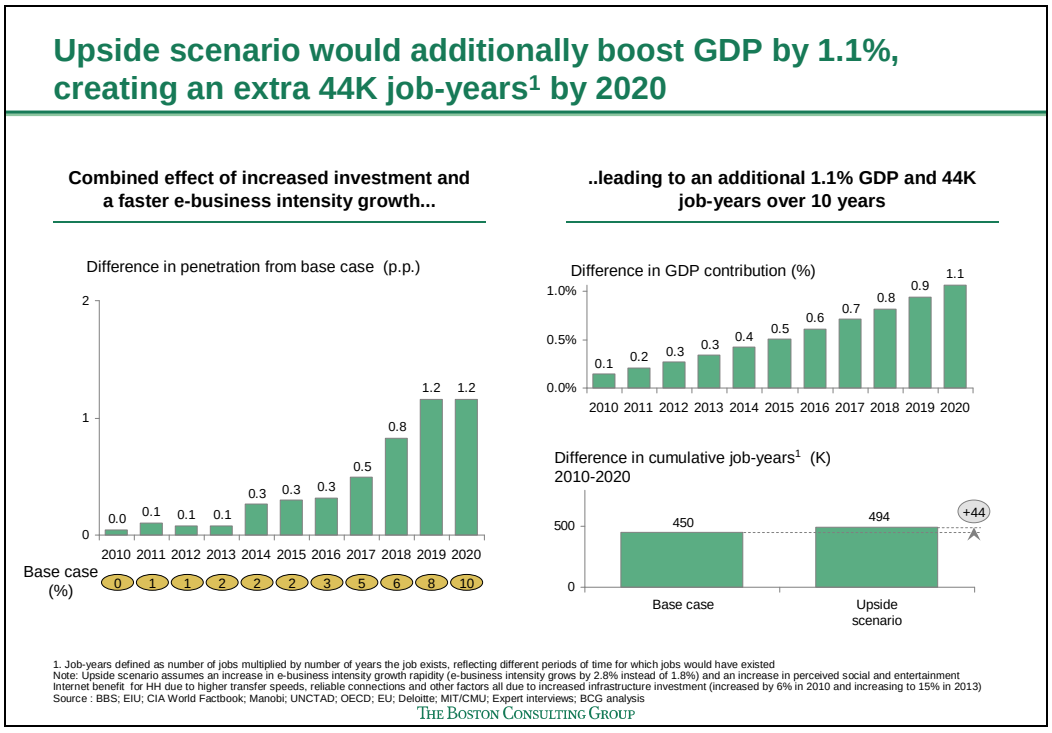


Exhibit 2.13 Upside scenario

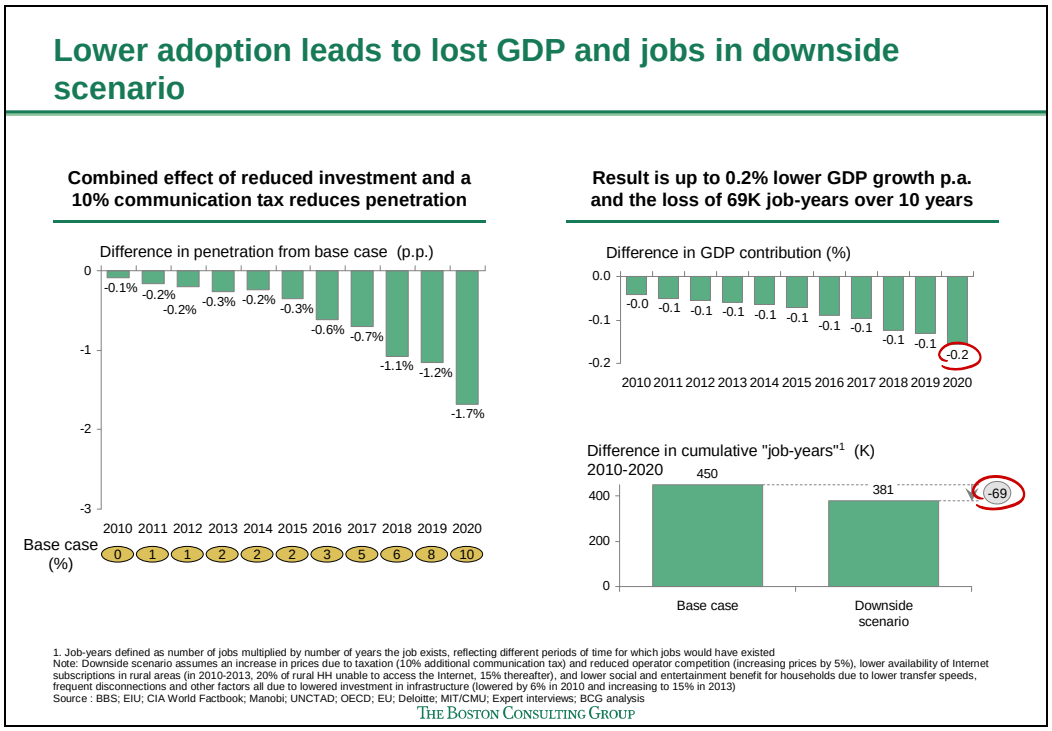


Exhibit 2.14 Downside scenario

2.6 Regulatory issues

It is clear from the discussions above that the government and regulator have a key role to play in maximizing the benefits for Bangladesh from the Internet.

Two priority focus areas have been highlighted in expert interviews. First, there is an urgent need to improve transparency and predictability through better governance, thereby reducing the uncertainty faced by providers and spurring investment. This can be achieved through measures such as

- Mandatory engagement and consultation with stakeholders before key changes
- Establishment of mechanisms for appeal, with clear guidelines for resolution by an objective and impartial panel

- Setting of limits to scope for amendment of licenses and other agreements, with clear guidelines and responsibility for BTRC and procedural checks, e.g., mandatory hearings, notification
- Simplification of licensing system to enhance transparency and reduce barriers to entry

Another strategic thrust would be to move institutional arrangements towards international best practice, by establishing financial independence for the regulator, structure staff incentives so as to induce appropriate focus on industry development, and to engage in competence building activities.

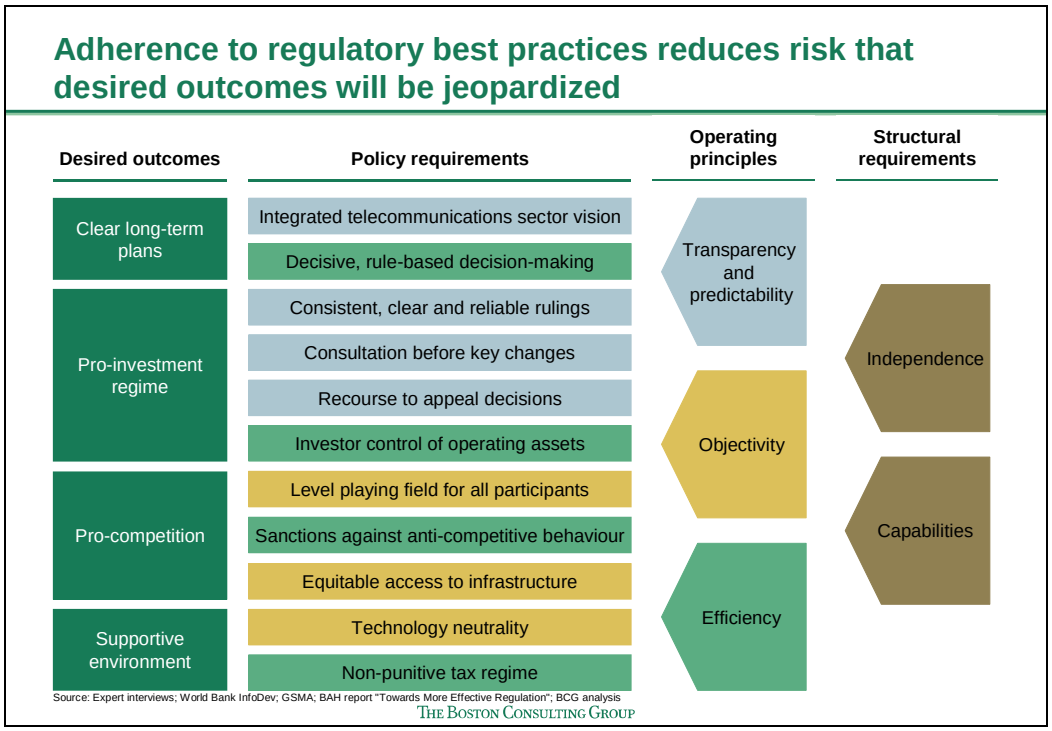


Exhibit 2.15 Regulatory best practices

3. THAILAND

3.1 Introduction

Thailand has seen rapid growth in Internet usage, increasing seven-fold over the last 8 years. However, penetration continues to lag behind regional peers. In terms of both Internet users and broadband subscribers per 100 population, Thailand lags behind fellow ASEAN members like Singapore, Malaysia, and even Vietnam, although it is ahead of Indonesia and the Philippines.

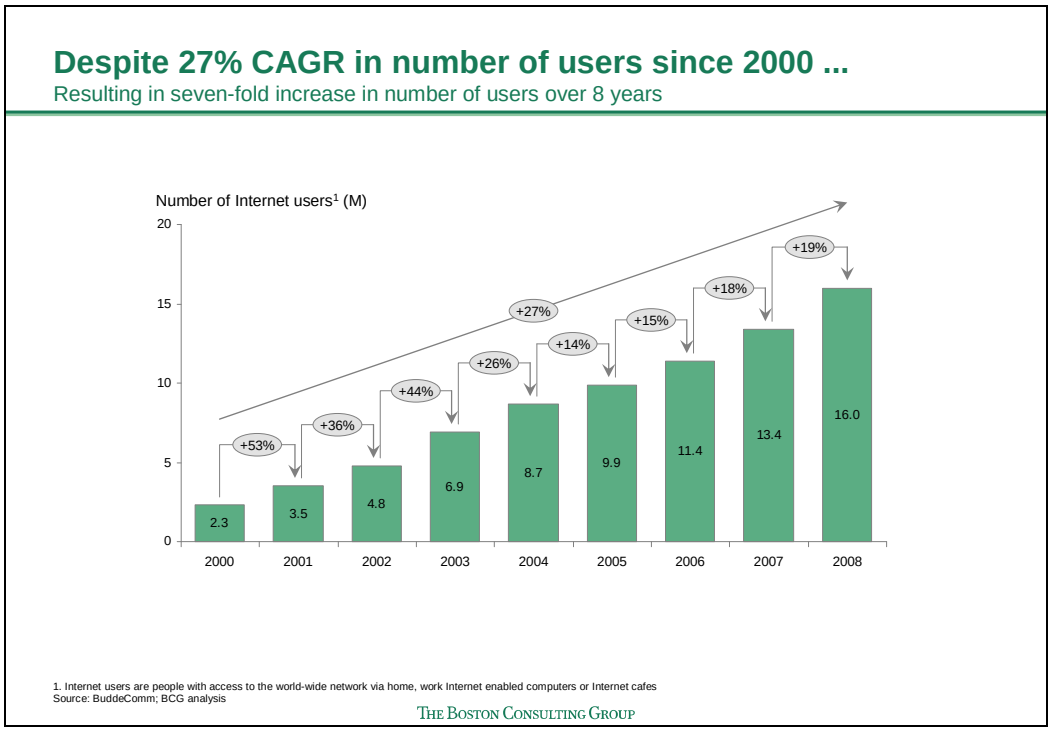


Exhibit 3.1 Growth in number of users

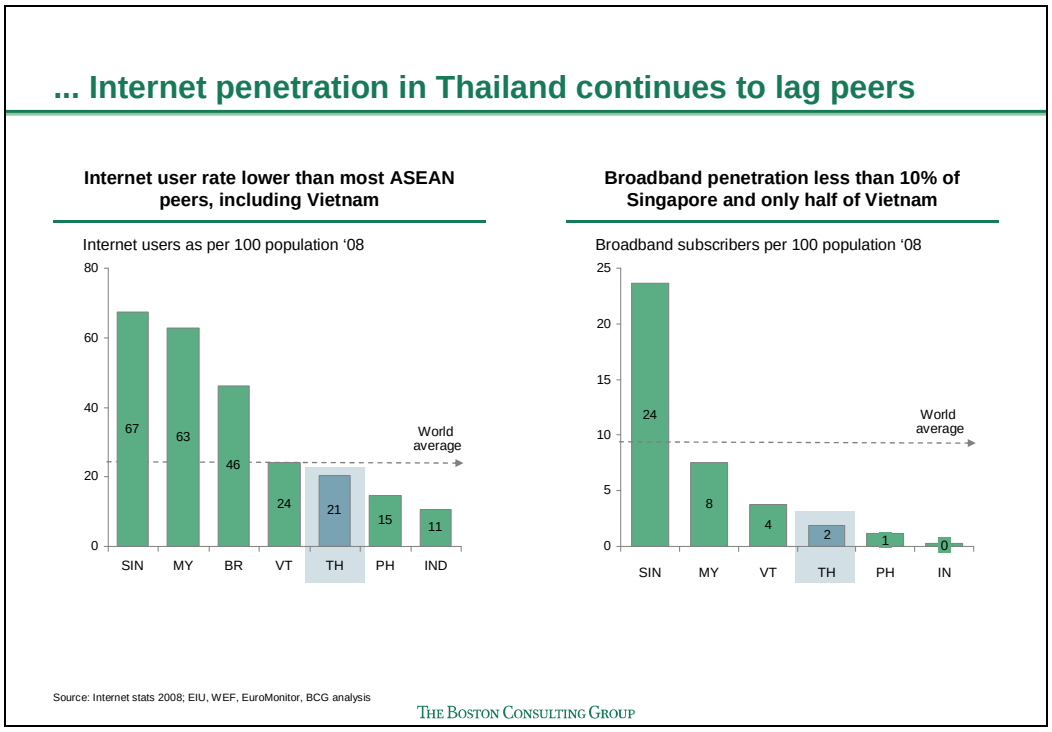


Exhibit 3.2 Internet penetration relative to peers

This is a source of concern for Thailand, which is focused on improving its economic competitiveness vis-à-vis its neighbours. The low penetration rates for Internet use and broadband subscription have been identified by the Global Competitiveness Report in 2008-2009 as a drag on Thailand's competitiveness. Thailand's ranking for technology readiness fell 21 places to 66 in 2009, which is significantly lower than its overall ranking of 34. Given that an earlier OECD study had found a correlation between Internet usage and Foreign Direct Investment, this raises the spectre of Thailand suffering a competitive disadvantage relative to its peers.

Given the current limited penetration and coverage (outside of major cities) of fixed lines in Thailand, it seems likely that wireless Internet technologies will be critical for Thailand to achieve mass nationwide Internet penetration within a short timeframe. Only 1 in 4 households nationally have a fixed line, while alternative technologies such as satellite access are prohibitively expensive. Experience from voice also suggests a much stronger growth outlook for mobile access, relative to fixed lines. International experience has shown that wireless broadband can quickly and relatively cheaply

spread the benefits of the Internet, particularly in sparsely populated rural areas. Although the download speeds are limited relative to fixed line technologies, wireless compensates for this with its lower construction cost, shorter timeline for rollout, and lower costs for end users. Wireless broadband has also been shown to provide an additional boost to business productivity, strengthening the value proposition for potential adopters.

3.2 Adoption

With appropriate initiatives and policies to stimulate investment and rollout of wireless infrastructure, a bottom-up, cost-benefit analysis suggests that Thailand could have 17.9M subscribers in 2020, which translates into approximately 26 subscribers per 100 population.

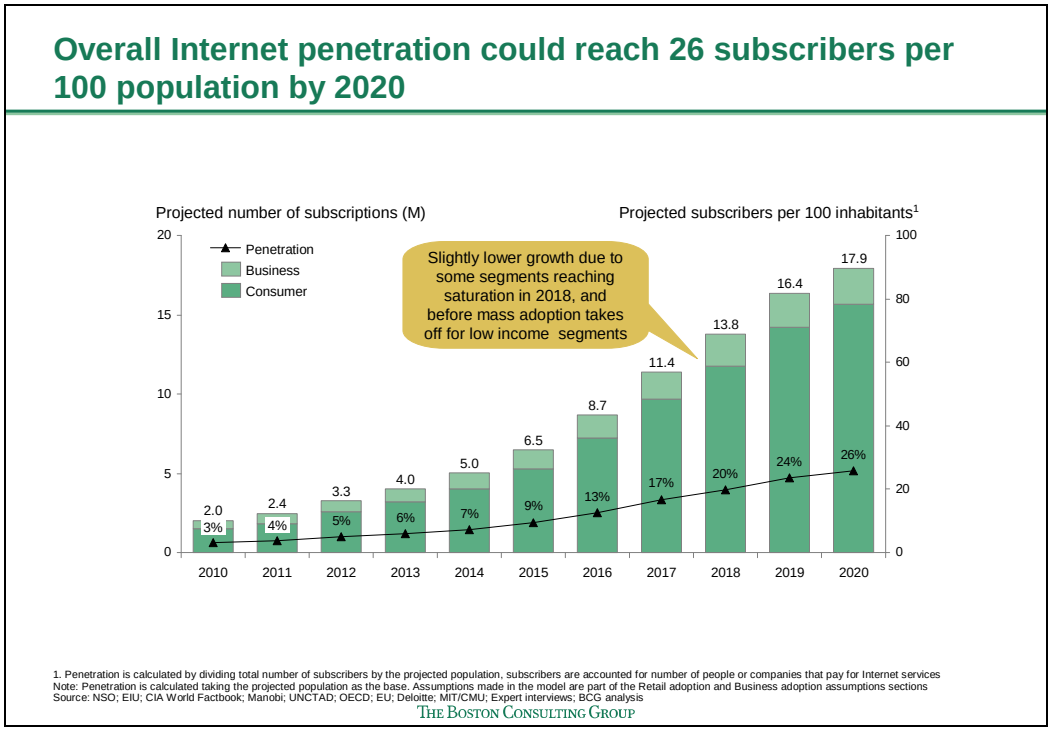


Exhibit 3.3 Projected penetration

Growth is initially driven by strong uptake in the high income segments, particularly in Bangkok and other urban areas, while adoption amongst low income groups takes off in the latter years, from 2018 onwards. Growth in 2018 is slightly lower than the 2017 or 2019 as some high income segments reach saturation in that year, while adoption in the low income segments has not yet accelerated sufficiently to make up the gap.

At the household level, 70% of households have at least one Internet subscription, with some high income households also taking on additional wireless subscriptions. Business adoption is higher, at around 91%. The Thai business landscape has a high proportion of small service and manufacturing firms, and it is the relatively low penetration levels in these segments which drives the overall penetration rate, as large businesses already exhibit very high penetration rates.

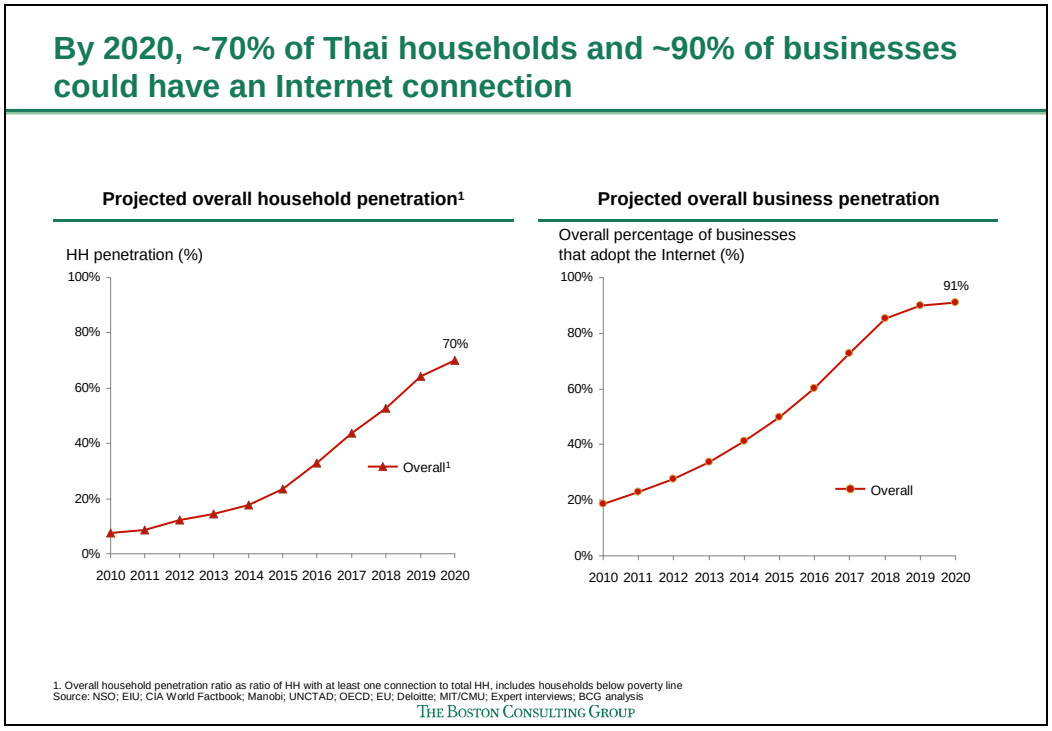


Exhibit 3.4 Household and business adoption

Experts believe that approximately two out of three Internet subscriptions will be wireless. With fixed line coverage focused on urban areas, up to 85% of rural connections are likely to be wireless, while in urban areas with fixed line coverage, it is

believed that the cost and other benefits may still induce ~55% of households and businesses to use wireless connections, even if they theoretically have access to fixed lines. Mobile workers and consumers who access the Internet on the move will also demand wireless connections. Based on these assumptions, 67% of total subscribers in 2020 will be accessing the Internet through wireless technologies.

3.3 Economic benefits

In terms of overall contribution to GDP, the figure is expected to rise up to 3.8% p.a. in 2020. The key driver of this is the productivity gains experienced by business users in all industries. It is projected that service firms will experience a gradual, continual increase in productivity gains (defined as gross value added per worker, or gross profit per employee), reaching 4.9% in 2020, and manufacturing firms will gain by up to 2.4%. This allows them to contribute 1.9% and 1.2% to GDP respectively.

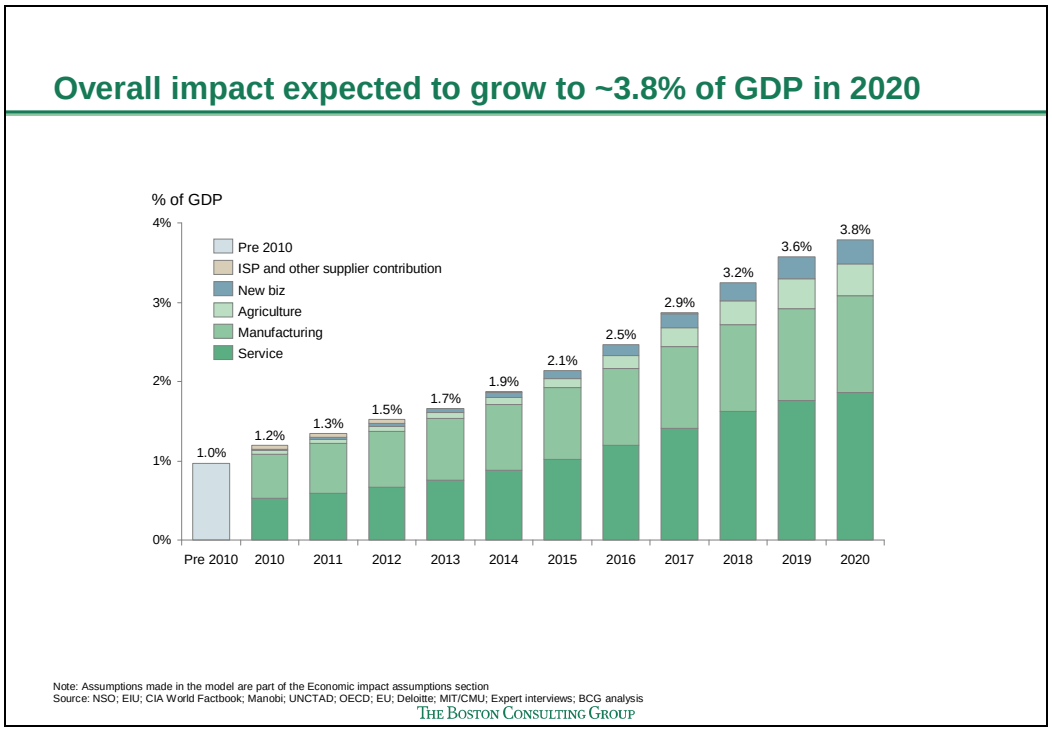


Exhibit 3.5 Economic benefits

Agriculture is projected to contribute up to 0.4%. With small household farms in rural areas dominating production, there is significant scope for the use of Internet to increase value added, through providing better information on planting times, methods, use of fertilizers, etc. This output could be worth up to THB 73B in 2020.

Rising Internet penetration should also drive an increase in new business activity. Apart from using the Internet as a platform to reach customers, businesses are expected to spring up to support the Internet, e.g., by providing payments processing services, web hosting, website design, and so on. This could potentially increase the number of new businesses each year by up to 52K in 2020.

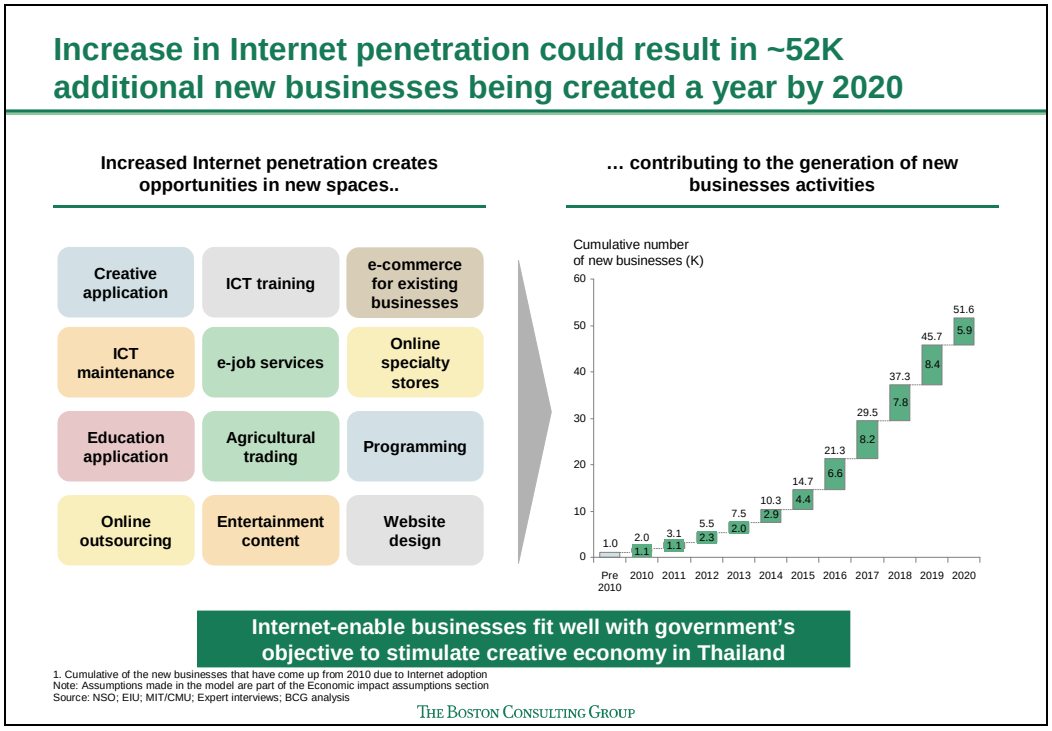


Exhibit 3.6 New business activities

New business activity is one of the main drivers of job creation, which could, conservatively, add 113K jobs in 2020. Of these, approximately 11K are projected to be created within the Internet value chain. This excludes potential job gains in companies that have experienced an increase in productivity per worker, which should in theory encourage them to hire more staff, further expanding employment. Although the

number may not seem large, at 0.27% of the current workforce, it is significant relative to the generally low unemployment rates in Thailand of 1.5-2.5%, prior to 2009. It should be further noted that the additional jobs are generated organically through greater Internet penetration, without the need for any government stimulus or expenditure to support their development.

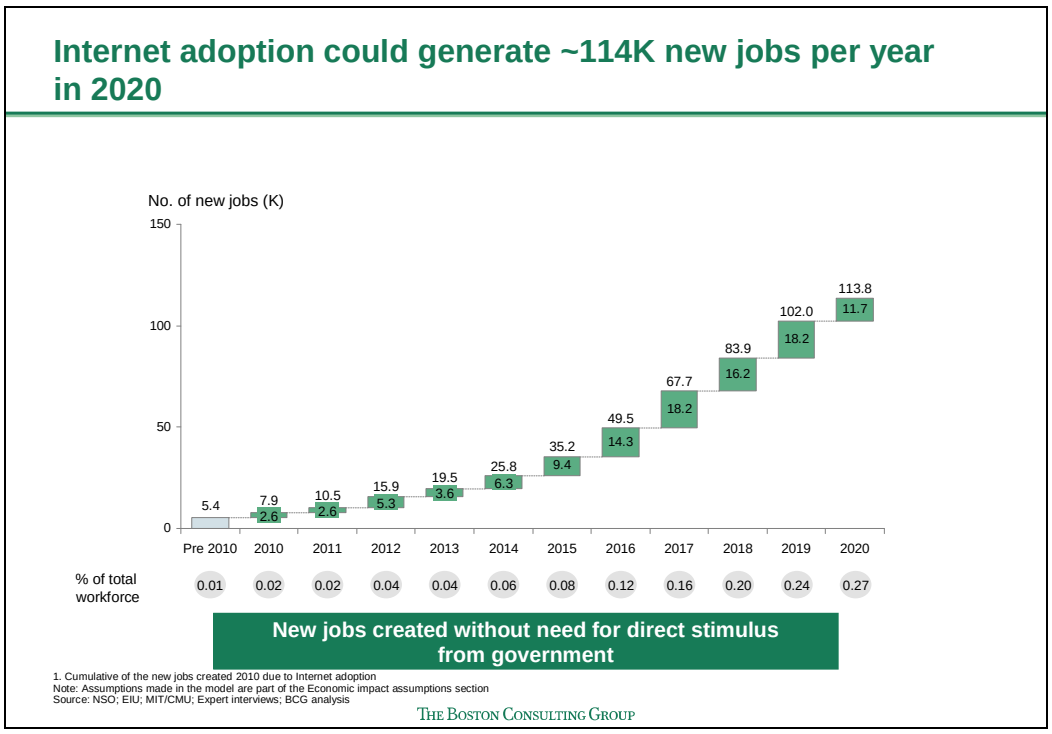


Exhibit 3.7 Job creation

All this economic activity will generate revenues for the government. Over the ten year period, this is expected to amount to THB 225B, or approximately 4.2% of government revenues over the same period based on the historical tax-GDP ratio of 17%. Significantly, almost 90% of this tax is expected to come from corporate taxes on the users of the Internet, while ~13% will come from taxes and fees paid by the providers themselves. This highlights a very important feature of Internet services, namely that it is a capital good that enables increased production across the economy. High taxes on the provision of such services, although they might be lucrative in the short run, will ultimately stifle the development of the economy.

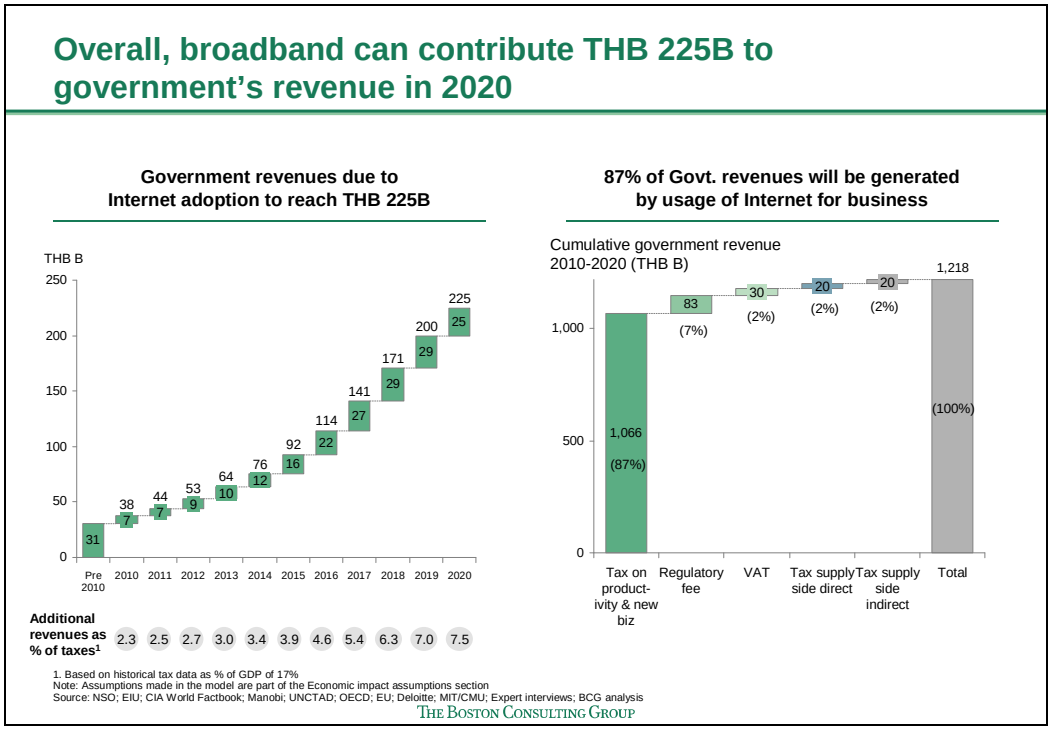


Exhibit 3.8 Tax revenues

3.4 Social benefits

Thailand has made considerable progress on a range of social issues, such as literacy, poverty reduction, etc. Nevertheless, the Internet has the potential to help push it to a higher level on key areas of concern, enabling it to compete with its South-east Asian peers. Four issues are highlighted in this report: education, healthcare, and rural development, as well as the possible environmental benefits the Internet can bring.

3.4.1 Education

Thailand has in place a sound basic education system, with literacy rates and enrolment both in the 90s. Going forward, Thailand's primary challenge is to boost the capabilities of its workforce, in order to compete with Malaysia and Singapore. Three aspects of its current education performance suggest areas for improvement. First, the quality of its

educational system has been highlighted by the Global Competitiveness Report as a potential disadvantage. Thailand's ranking of 53 shows that it has a long way to go to catch up with Singapore at 2 and Malaysia at 18. Similarly, Thailand lags behind its regional peers in Math, as measured by the Trends in International Mathematics and Science Study in 2007, as well as in English proficiency.

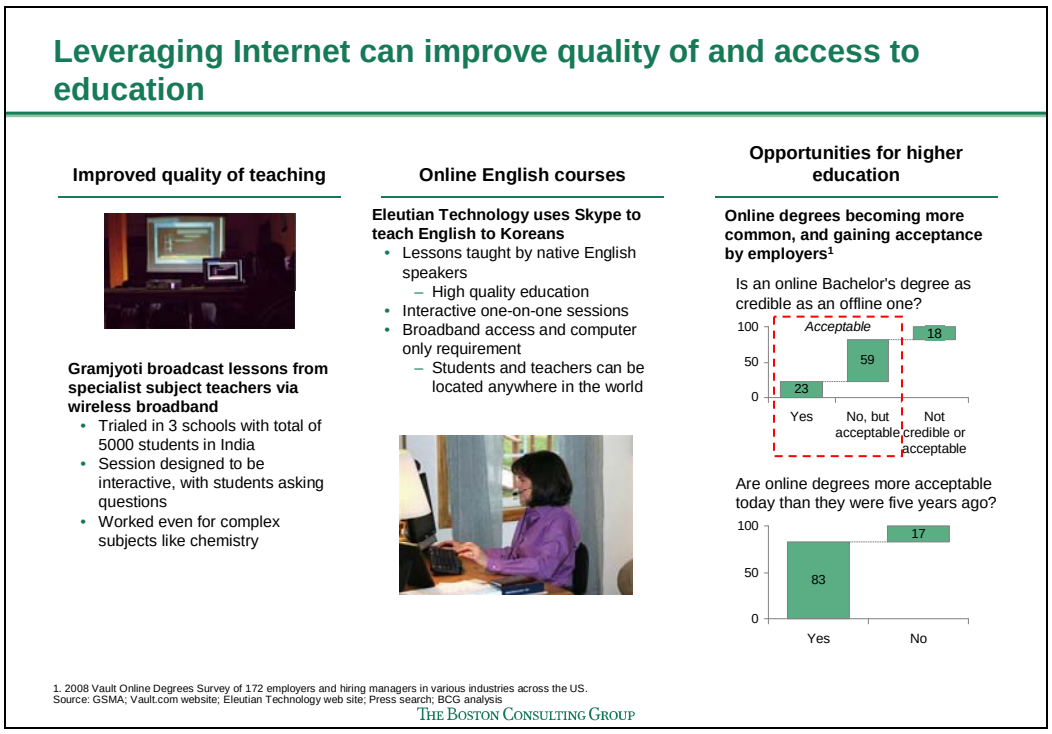


Exhibit 3.9 Internet and education

The Internet can greatly increase teacher leverage to address the shortage of qualified specialist subject teachers in Thailand. For example, 2007 estimates suggest that there are ~100K English teachers in Thailand, or 1 teacher per 628 students, and the level of fluency of the teachers themselves is subject to question. Similar concerns are applicable in math and science, where the assessed quality of education again lags peers. One example of an Internet solution to this problem is to conduct lectures and lessons by video conference, using high-speed Internet connections to broadcast the session in real time to multiple classes of students. Such sessions can be made interactive, with the use of presentation material and opportunities or question and answer sessions. An added advantage is that the teacher can continue to be physically based in the urban areas

while providing lessons to students in rural areas. Another alternative is to use VoIP or video-conferencing technologies to have, for example, English lessons taught by native English speakers based in the US. Eleutian Technologies already provides English lessons for South Korean students using American teachers.

Another key component of building a skilled workforce is increasing tertiary enrolment rates. The Internet can assist with this by providing affordable access to a range of online basic and advanced degrees. Research suggests that such degrees are becoming increasingly common and credible, and hence and acceptable to employers. With suitable safeguards in place to ensure that students are channeled to accredited programs of requisite quality, the Internet could help accelerate tertiary enrolment in Thailand.

3.4.2 Healthcare

As with its accomplishments in education, Thailand has in place a sound basic healthcare infrastructure. However, there remains scope to further improve its performance in key areas, such as life expectancy and infant mortality, as it seeks to reach developed nation status. For example, although life expectancy in Thailand at 70 is relatively close to the 74 in Malaysia and 80 in Singapore, infant mortality figures are significantly higher in Thailand, at 24, compared to 10 for Malaysia and 2 for Singapore.

A key driver of performance on the main health metrics is the patient-doctor ratio, which in Thailand is 2500:1, almost twice the figure for Malaysia and four times that of Singapore. E-health initiatives can help increase doctor leverage, particularly in rural areas. One example is the Alokito initiative in Bangladesh, where nurses go out to the field in specially-equipped vans to meet patients and perform basic procedures, such as taking blood pressure and setting up stethoscopes. The vans have a wireless broadband link to doctors in the main hospital back in the city, who are then able to see the patients, ask them questions and offer diagnoses. This significantly increases the number of patients that each doctor can serve, and enables them to extend their expertise into rural areas without having to give up the comforts of urban life.

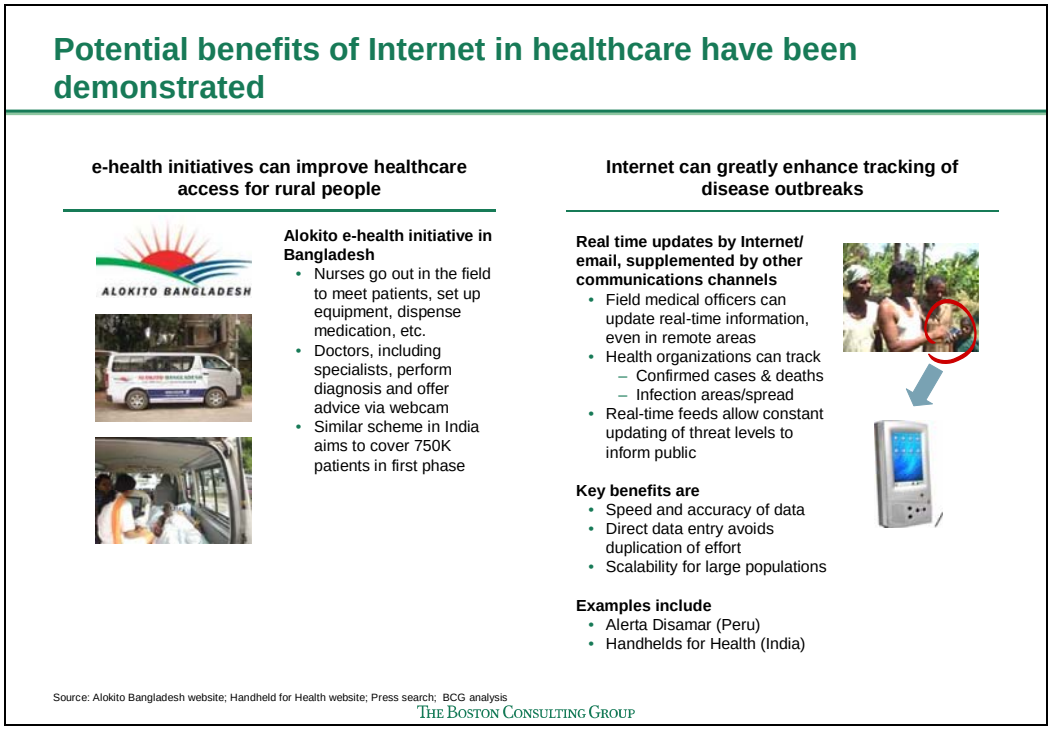


Exhibit 3.10 Internet and healthcare

Another source of concern for tropical countries like Thailand is the spread of diseases, such as malaria and tuberculosis, which can be exacerbated by poverty, malnutrition and lack of access to clean water in some of the more remote regions. Another aspect of how the Internet can contribute to improving healthcare in Thailand is in the tracking of disease outbreaks. Field medical officers can provide accurate, real-time information from remote areas using handheld computers with Internet connections, allowing local and international health organizations to track the spread of diseases. The key benefits of such a method are the speed and accuracy of data, as well as the time and manpower savings from direct data entry, thus making it scalable for large populations. Handhelds for Health in India is one example of such technology in action. The Internet is also a powerful tool for keeping the public updated on developments, e.g., areas to avoid, measure to take to reduce risk of infection, etc., with the possibility of offering rich, interactive communications that other media cannot match.

3.4.3.Rural development

Rural development is a third area of concern in Thailand. Two key concerns in rural areas are low and volatile incomes, and lack of access to basic services and lifestyle options. These fuel rural-urban migration, which in turn places great strain on the urban areas, as, by some estimates, almost a million people move into the main cities each year. The Internet, properly harnessed, has tremendous potential to address both drivers.

The Internet can help increase income and diversify sources of income. The impact of the Internet on agricultural output, for example, has already been described. The Internet can also increase the prices farmers receive for their output, by improving price information and allowing them to sell at the highest available price, or by reducing the reliance on middlemen. In addition, the Internet can create alternative income opportunities. For example, the Internet can powerfully complement the One Village One Product (OTOP) scheme by providing an international marketing platform to raise awareness and attract customers for the products. There are already a number of small web initiatives that attempt to aggregate products from different groups of craftsmen, and providing them with higher visibility than they could achieve individually. With lower distribution margins for online sales, since only one layer of middleman is required, the producers are able to realize higher prices for their output, in addition to increase the volume of product sold.

Another way in which the Internet can improve income opportunities is by enabling Business Process Outsourcing (BPO) to rural areas. Rural residents, especially women, can provide services such as data imaging and formatting, application processing, etc., from their homes or at designated centers, communicating with their clients electronically. Critically, such services play a crucial role in supplementing and diversifying income sources within a household. They also significantly increase the returns to literacy, and therefore are likely to reinforce the demand for education.

The Internet can also help mitigate the rural-urban digital divide, by enhancing access to information and basic services, as well as lifestyle options, such as entertainment. The digital divide has been identified as a social concern that needs to be ameliorated, and widespread adoption of the Internet in rural areas is the best way to achieve this. With better access to information, rural residents can be made more aware of their rights, and hence better able to defend them should the need arise. The Internet can be used to cost-effectively address infrastructure gaps and provide essential services such as government, banking and remittances to a large area at a far lower cost than traditional methods.

3.4.4. Carbon emissions

Another significant area where the Internet can help is in reducing fuel costs and carbon emissions from traffic. In Bangkok alone, up to THB 192B is spent on fuel for passenger cars, emitting a total of 20M tons of carbon dioxide. The Internet can reduce both of these by reducing the need for car trips. This can be achieved by, for example, offices allowing some staff to work at home some days of the week. Online transactions, such as banking services, government services, even shopping and entertainment, can also help reduce the number of trips made. It is conceivable that the number of trips could fall by up to 10%, triggering significant savings on fuel costs and improving the environment by reducing emissions. It is in fact likely that the total savings will be greater than 10%, since the reduced number of trips should also reduce congestion at peak times, and congestion increases fuel consumption unproductively.

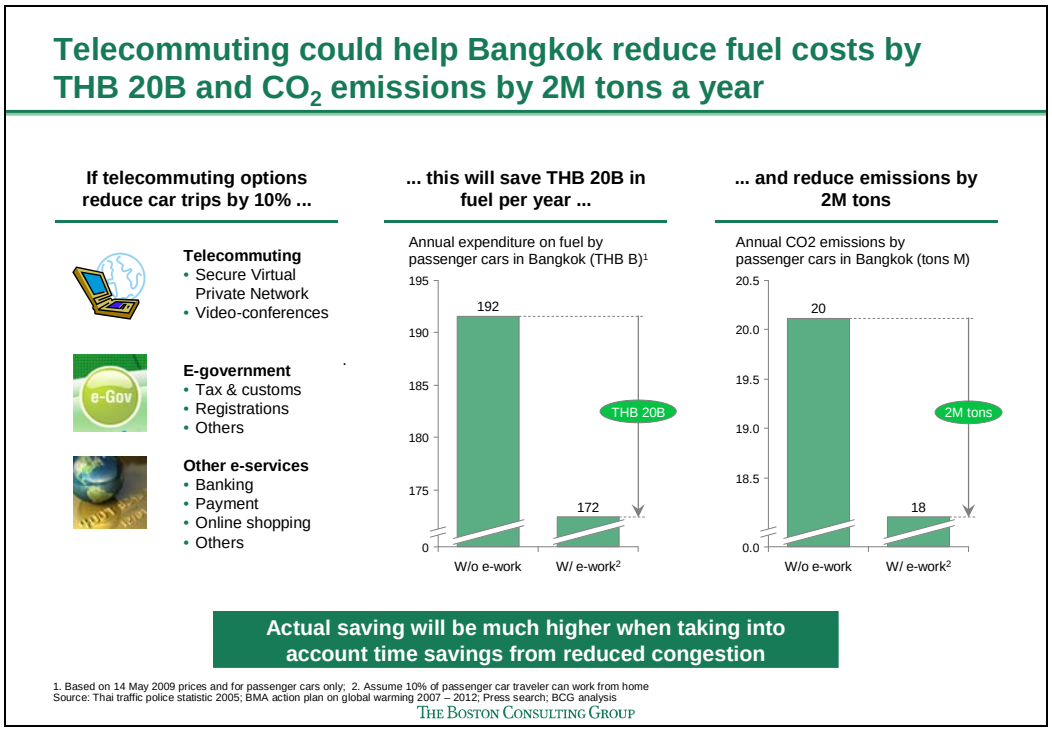


Exhibit 3.11 Internet and carbon emissions

3.4.5 Attaining the benefits

To attain these benefits, an appropriate value chain must be put in place to promote mass Internet adoption in Thailand. Steps must be taken to ensure that there are appropriate local content and applications, access to Internet-enabled computers, and sufficient trained instructors to disseminate knowhow about the Internet. This will require coordination across multiple actors, including the government, private sector, media and local communities. Some steps have already been taken in this direction. For example, the Meaningful Broadband Working Group is a coalition of regulators and operators that aims to develop broadband so that it fulfils specific public policy goals, while being commercially viable. Its members include the National Telecommunications Commission, all the major operators, and Chulalongkorn university. Apart from the working group, operators have individually already undertaken steps to increase Internet awareness and usage, e.g., TOT donated equipment and Internet access to schools in the Northeastern regions of Thailand.

3.4.6 Mitigating new challenges

While seeking to maximize the upsides described above, care should also be taken to mitigate the potential downsides from widespread Internet usage. One key concern is access to undesirable content. A multi-pronged approach can help minimize the risk of such issues, e.g., blocking of selected websites from providers, use of parental control applications to limit access from home PCs, and greater education and awareness building activities. Education is also the key to reducing other risks on the Internet, such as identity theft or violation of intellectual property rights.

3.5 Scenarios

Two scenarios have been modeled. The first is the "Higher Benefits" scenario, where businesses and households are assumed to derive greater benefits from the Internet than in the base case[6]. E-business intensity gains grow at a faster rate, leading to accelerated adoption and a greater contribution to GDP. On the consumer side, households are willing to pay more for entertainment, social networking and other "soft" benefits. This leads to greater penetration, up to 2.6 additional subscribers per 100 population, which represent an approximately 10% increase in the number of subscribers relative to the base case. It also adds up to 0.9% more to GDP contribution, and increases the impact of job creation by approximately 12%[7].

[6] Upside scenario assumes an increase in e-business intensity growth rapidity (e-business intensity grows by 3.4% instead of 2.4%) and an increase in perceived social and entertainment Internet benefit for HH due to higher transfer speeds, reliable connections and other factors all due to increased infrastructure investment (increased by 6% in 2010 and increasing to 15% in 2013)

[7] Expressed in terms of job-years. Job-years defined as number of jobs multiplied by number of years the job exists, reflecting different periods of time for which jobs would have existed

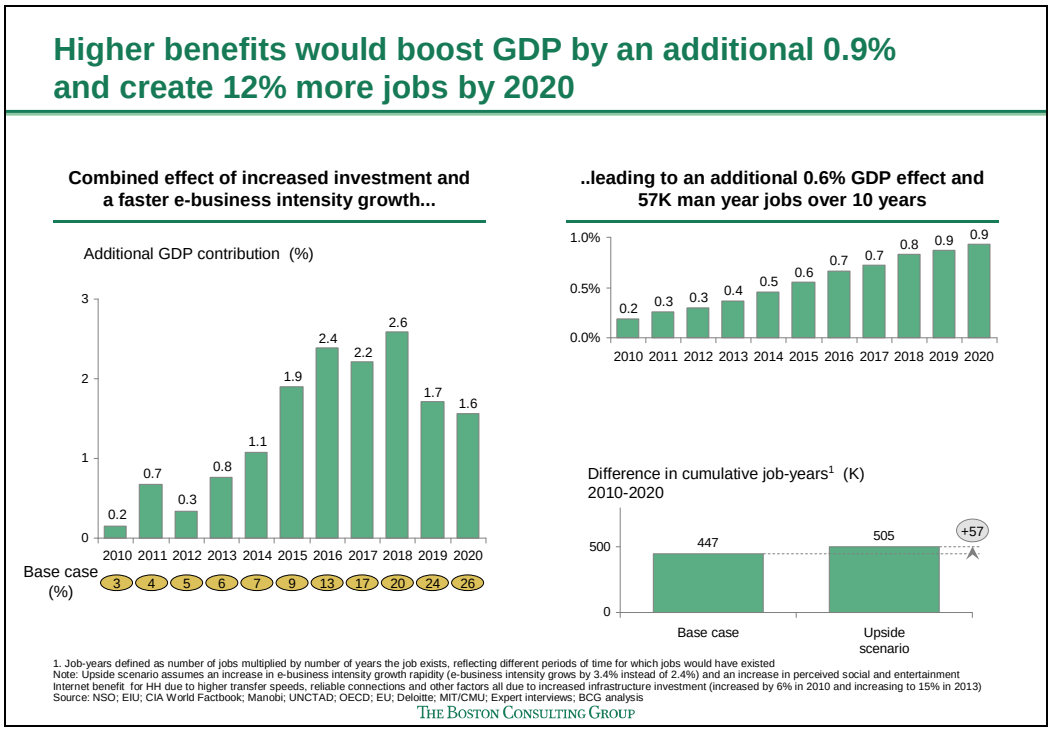


Exhibit 3.12 Upside scenario

Conversely, a downside scenario where users and providers face "Higher Costs" has also been modeled[8]. In this scenario, investment is reduced relative to the base case. Investment is sensitive to both the rate of return and the level of uncertainty, and regulatory actions could adversely impact both drivers, resulting in lower investment. This could result in

- Delaying physical access to infrastructure, particularly in rural areas
- Higher prices due to reduced competition
- Reduced quality, lowering the perceived benefits for consumers

In addition, cost for consumers can be directly impacted by sector-specific taxes, such as a direct 10% tax on Internet usage, for example. In combination, these drivers could

[8] Downside scenario assumes an increase in prices due to taxation (10% additional communication tax) and reduced operator competition (increasing prices by 5%), lower availability of Internet subscriptions in rural areas (in 2010-2013, 20% of rural HH unable to access the Internet, 15% thereafter), and lower social and entertainment benefit for households due to lower transfer speeds, frequent disconnections and other factors all due to lowered investment in infrastructure (lowered by 6% in 2010 and increasing to 15% in 2013)

result in a reduction in penetration of up to 2.7% percentage points relative to the base case, and a reduction in GDP contribution of up to 0.08% and a 12% reduction in job creation.

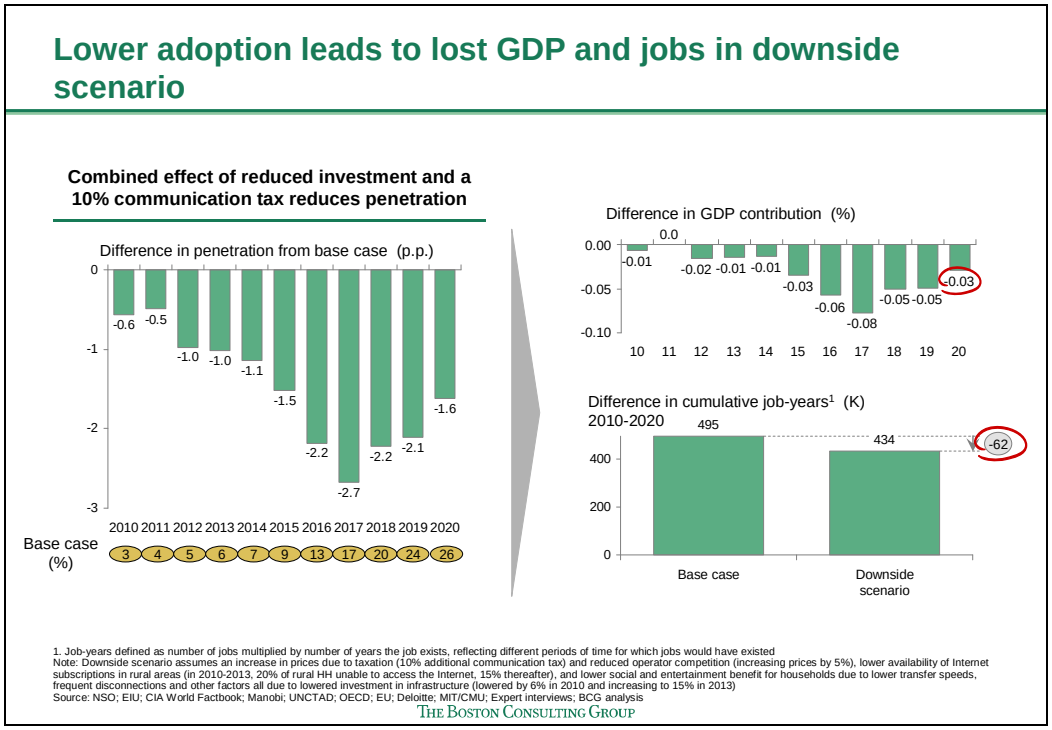


Exhibit 3.13 Downside scenario

3.6 Regulatory issues

Expert interviews and surveys done by third parties highlighted concerns that the current regulatory regime is deterring investment by increasing investor uncertainty. This is compounded by the political uncertainty that has afflicted the country over the last few years, adding to the perceived country risks. Focusing on the regulation of telecommunications, there are concerns around the regulators ability to act swiftly and decisively when necessary, stemming from a combination of concerns around regulatory capability to analyze complex issues, and perceived political “interference”. There is also the perception that clear rules and implementation guidelines have not been laid out for critical issues, such as competition regulation, and this concern is exacerbated by the tendency for legal disputes to drag on. Finally, there are potential tensions between the

current concession system and the licensing regime expected going forward, and there is a need to ensure a level playing field for all market participants during the transition process. It is a key priority that these concerns be addressed in order to realize the maximum benefits from investment in Internet infrastructure.

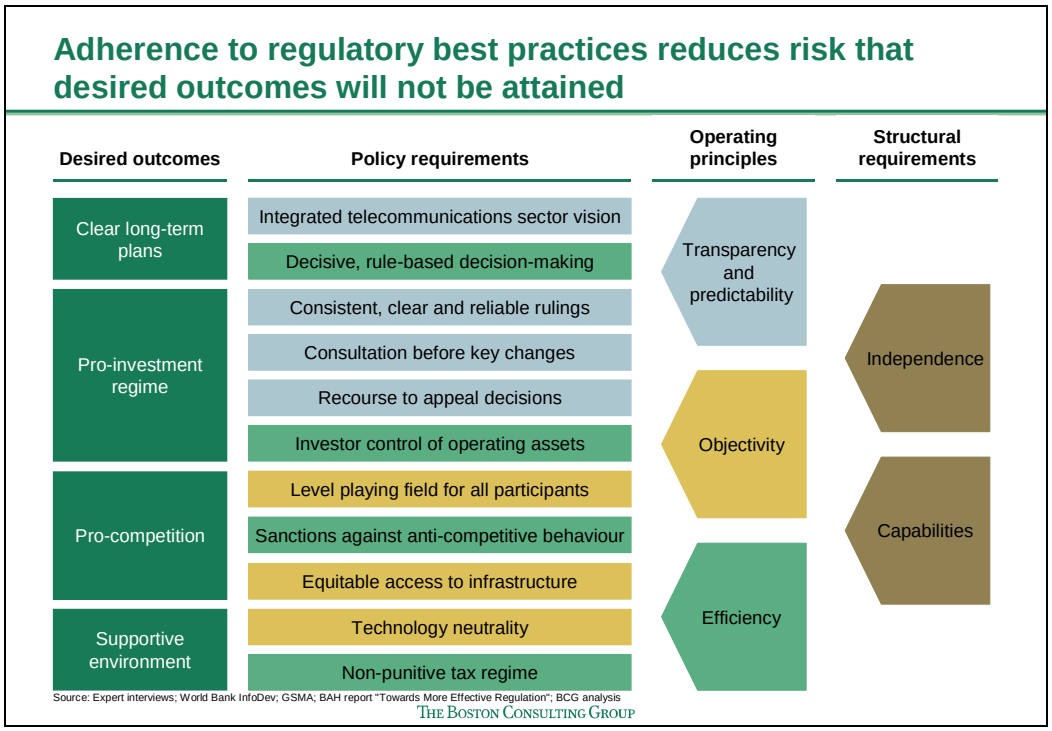


Exhibit 3.14 Regulatory best practices

4. SERBIA

4.1 Introduction

Serbia has seen rapid Internet growth over the last few years. For example, there has been a 34% annual growth rate in the number of households with Internet connections since 2006, rising from 0.5M to 0.8M over 2 years. Within this healthy overall uptrend, it is worrying to note that the annual growth rate fell from 43% in 2007 to 26% in 2008.

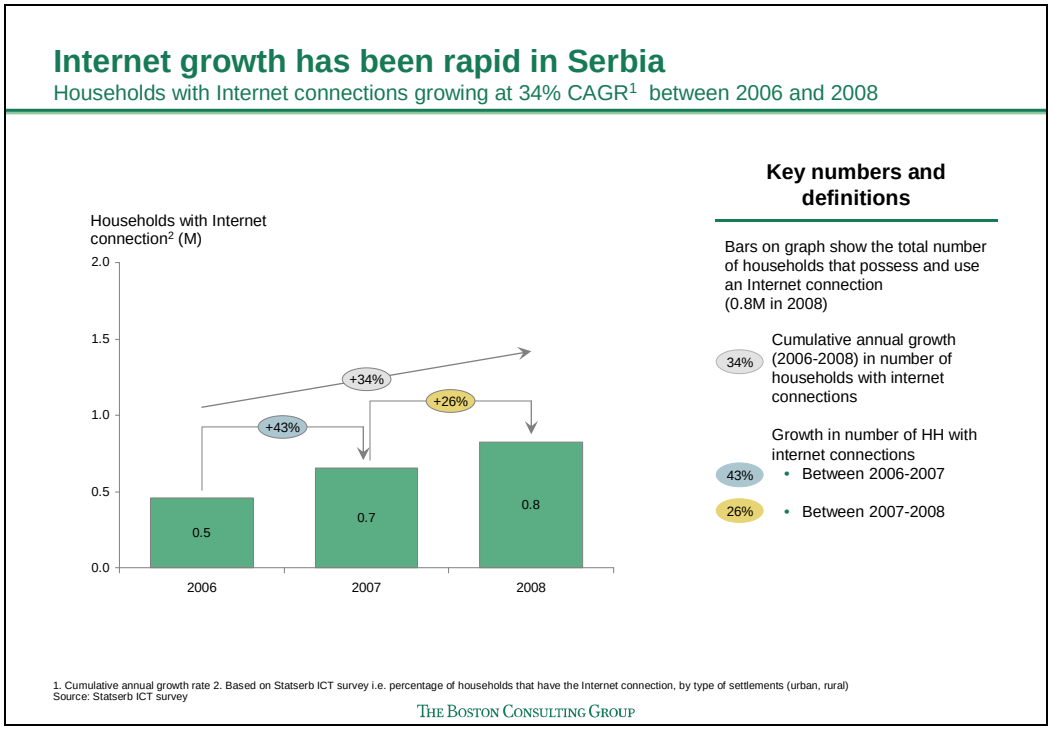


Exhibit 4.1 Household Internet uptake

This has driven the number of Internet users[9] as a % of total population up to 32%, which is broadly in line with regional peers such as Bosnia, and even Romania and

[9] Percentage of the total population that uses the Internet. This number is higher than the Internet subscriber rate, as more than one person may use a connection, and some users do not have connections (e.g., access through Internet cafe)

Bulgaria. However, it is still behind regional leaders such as Slovenia, Croatia and Macedonia, and also significantly below the European average of 49%.

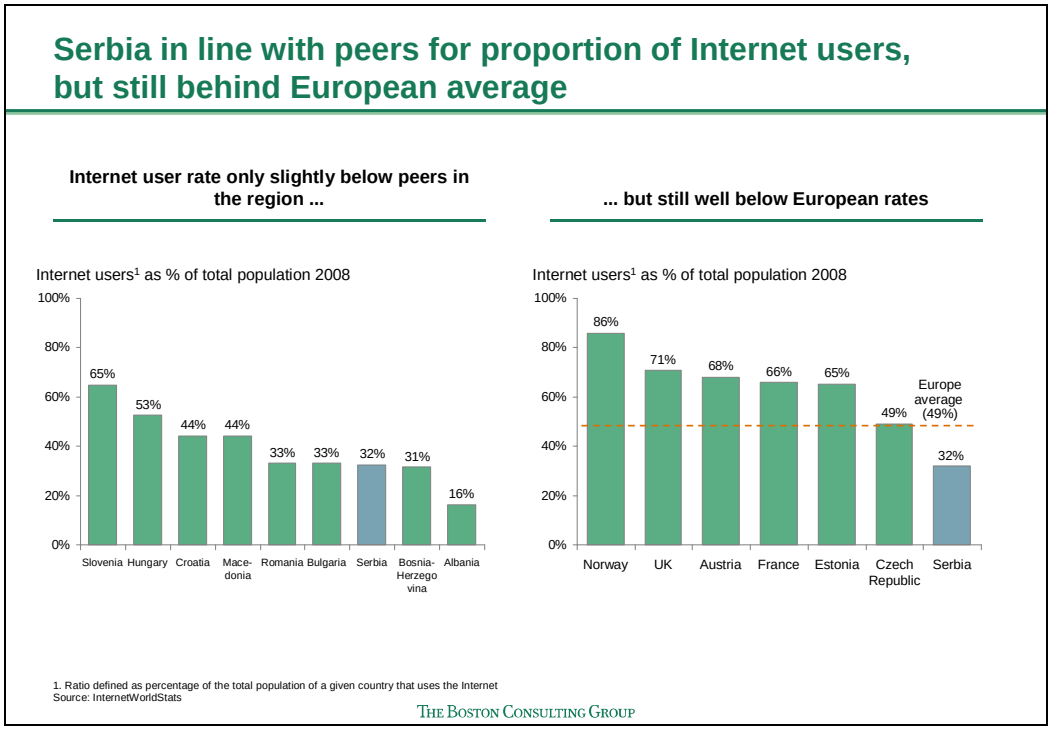


Exhibit 4.2 Comparison with regional and European peers

This growth in penetration has been fueled by increasing competition amongst a growing pool of providers, with over 200 ISPs registered in 2007. This has also driven down access prices by 13% p.a. between 2006 and 2008. However, experts believe that the limitations of Serbia's fixed line infrastructure pose a threat to continued growth, and according to some reports, there are already backlogs of up to 300K customers waiting to be connected. The incumbent, Telekom Serbia, has been operating the fixed line monopoly, and the lack of competition has reduced pressure to improve quality or reduce prices. Further enhancements to the fixed line infrastructure, in terms of quality or coverage, are likely to be held back by the high costs.

In view of these constraints, the next wave of Internet growth could be driven instead by wireless access technologies. International experience has shown that wireless

broadband can quickly and relatively cheaply spread the benefits of the Internet, particularly in sparsely populated rural areas. Although the download speeds are limited relative to fixed line technologies, wireless compensates for this with its lower construction cost, shorter timeline for rollout, and lower costs for end users. Wireless broadband has also been shown to provide an additional boost to business productivity, strengthening the value proposition for potential adopters.

4.2 Adoption

With appropriate infrastructure in place to support mass adoption, Serbia could have 3M subscribers in 2020, which approximately translates into 42 Internet subscribers per 100 population. Growth is more vigorous in the early years, and tapers off towards the end of the period, suggesting that the Serbian market would have entered transitioned from a high growth phase to a mature phase by 2020. In the mature phase, growing saturation in key segments will lead to a reduction in the rate of growth.

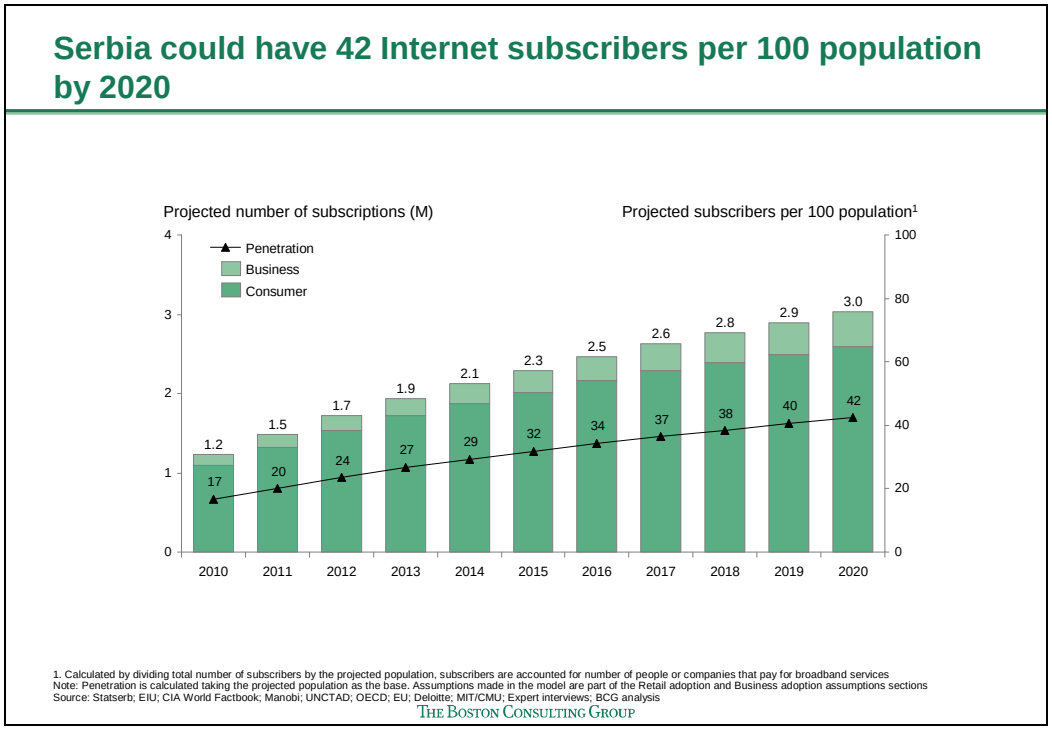


Exhibit 4.3 Projected penetration in Serbia

At the household level, by 2020, 81% of households have at least one Internet subscription, with some high income households also taking on additional wireless subscriptions. Business adoption is higher, at around 95%. The Serbian business landscape has a high proportion of small firms and businesses run by entrepreneurs, and it is the relatively low penetration levels in these segments which drive the overall penetration rate, as large businesses already exhibit very high penetration rates.

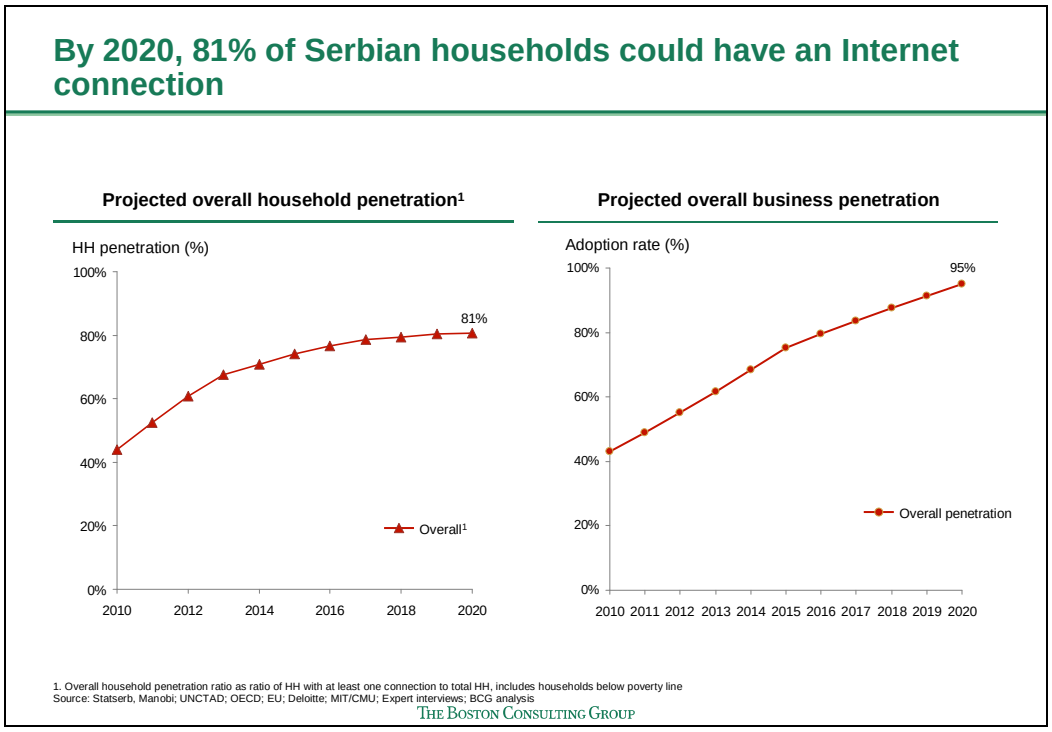


Exhibit 4.4 Household and business adoption

With full wireless rollout, 38% of all subscriptions could be wireless by 2020, up from ~9% today. Given the limitations with fixed lines, up to 60% of rural connections are projected to be wireless. Mobile workers and consumers who access the Internet on the move will also demand wireless connections, translating into a total of ~1.2M wireless connections.

4.3 Economic benefits

In terms of overall contribution to GDP, the figure is expected to rise up to 5.2% p.a. in 2020. The key driver of this is the productivity gains experienced by business users in all industries. It is projected that service firms will experience a gradual, continual increase in productivity gains (defined as gross value added per worker, or gross profit per employee), reaching 5.6% in 2020, and manufacturing firms will gain by up to 2.8%. This allows them to contribute 3.5% and 1.1% to GDP respectively, contributing RSD 190B in total in 2020.

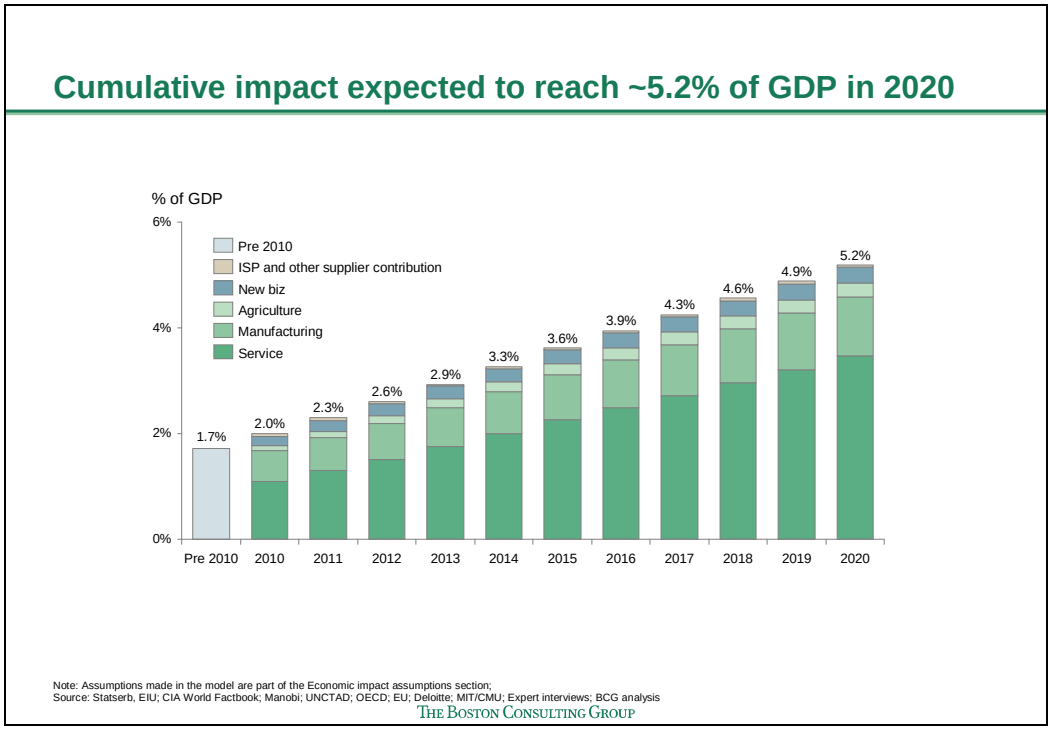


Exhibit 4.5 Economic benefits

Agriculture is projected to contribute up to 0.25%. For small household farms in rural areas, there is significant scope for the use of Internet to increase value added, through providing better information on planting times, methods, use of fertilizers, etc. Conversely, for large farms that are already run close to the efficient production frontier, the benefits are likely to be smaller. In total, taking into account the relative contribution to agricultural output of large and small farms, agricultural output could

rise by up to RSD 10.5B in 2020. Small farms are expected to contribute 90% of the increase, reflecting the greater impact the Internet has on their output and value added.

Rising Internet penetration should also drive an increase in new business activity, which includes establishment of new independent businesses as well as new departments/ units/business areas within existing firms. Apart from using the Internet as a platform to reach customers, businesses are expected to spring up to support the Internet, e.g., by providing payments processing services, web hosting, website design, and so on. This could potentially increase the number of new businesses each year by up to 17K in 2020.

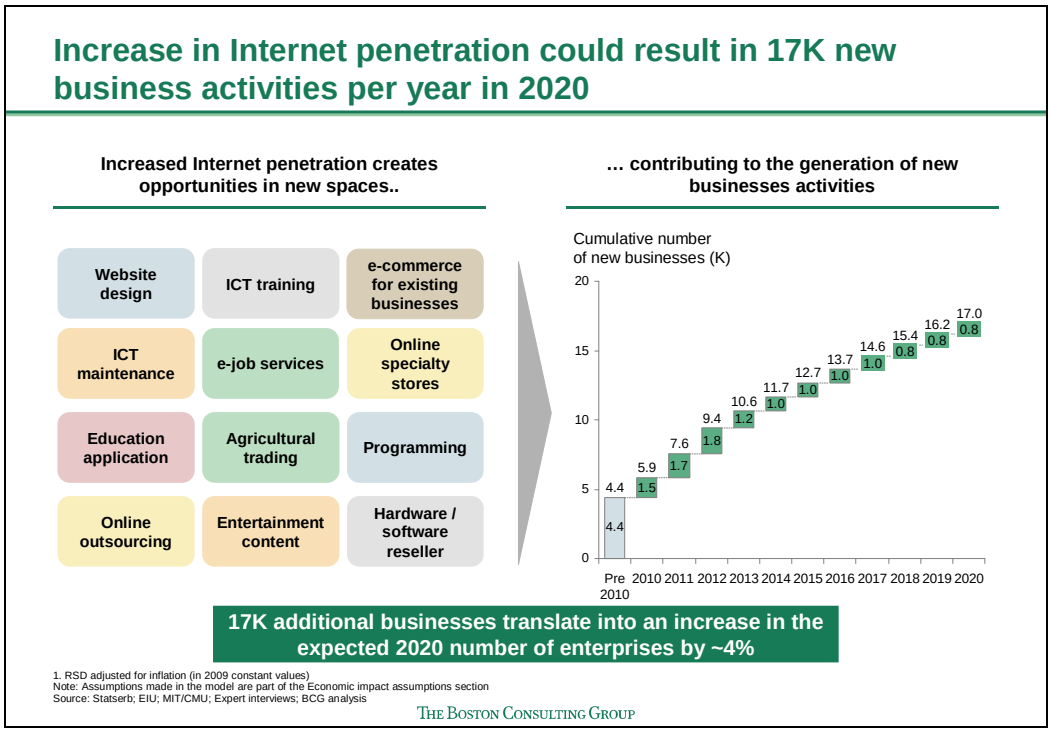


Exhibit 4.6 New business activity

New business activity is one of the main drivers of job creation, which could, conservatively, add 94K jobs in 2020. Of these, approximately 4.5K are projected to be created within the Internet value chain. To put this number in context, there are currently approximately 500K unemployed Serbians, and an additional 94K jobs in the market would mean jobs for 1 in 5 unemployed persons. The Serbian government had in 2008 estimated that it would require USD 5B of direct investment in a year, both

domestic and foreign, to generate the required number of jobs. In contrast, these additional jobs are generated organically through greater Internet penetration, without the need for any government stimulus or expenditure to support their development. Furthermore, this excludes potential job gains in companies that have experienced an increase in productivity per worker, which economic theory predicts will encourage them to hire more staff, further expanding employment.

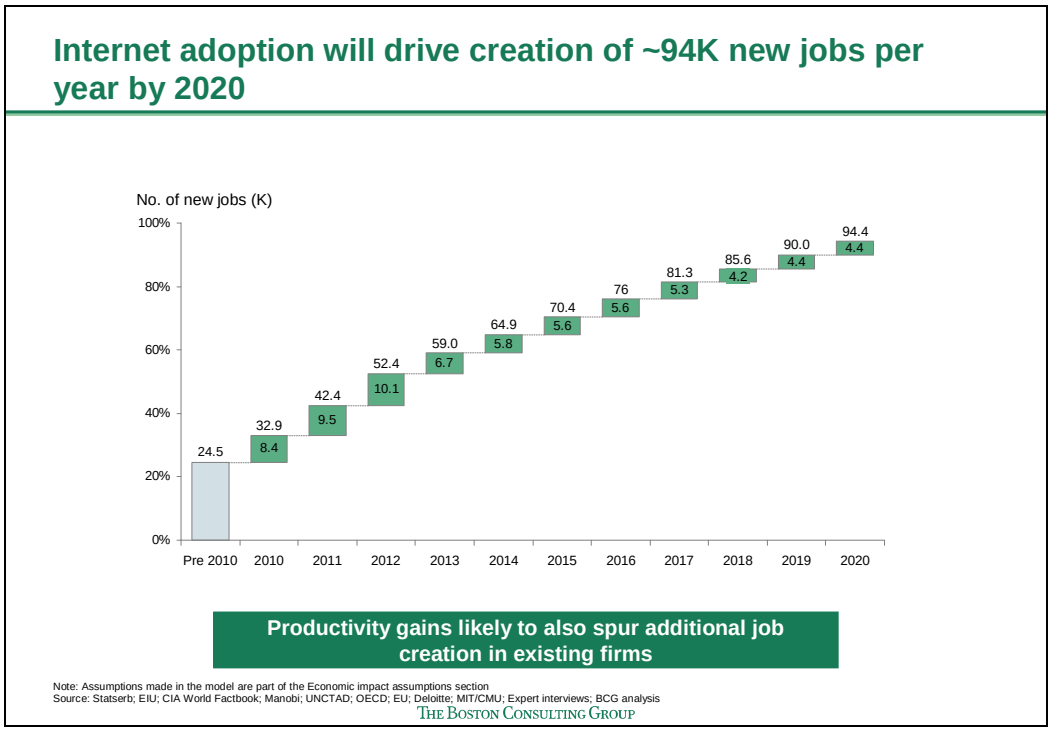


Exhibit 4.7 Job creation

All this economic activity will generate revenues for the government. Over the ten year period, this is expected to amount to RSD 54B, or approximately 1.6% of government revenues over the same period based on the historical tax-GDP ratio of 34%. Almost 60% of this tax is expected to come from corporate taxes on the users of the Internet, while ~40% will come from taxes and fees paid by the providers themselves. This highlights a very important feature of Internet services, namely that it is a capital good that enables increased production across the economy. High taxes on the provision of such services, although they might be lucrative in the short run, will delay or reduce job creation, and ultimately stifle the development of the economy.

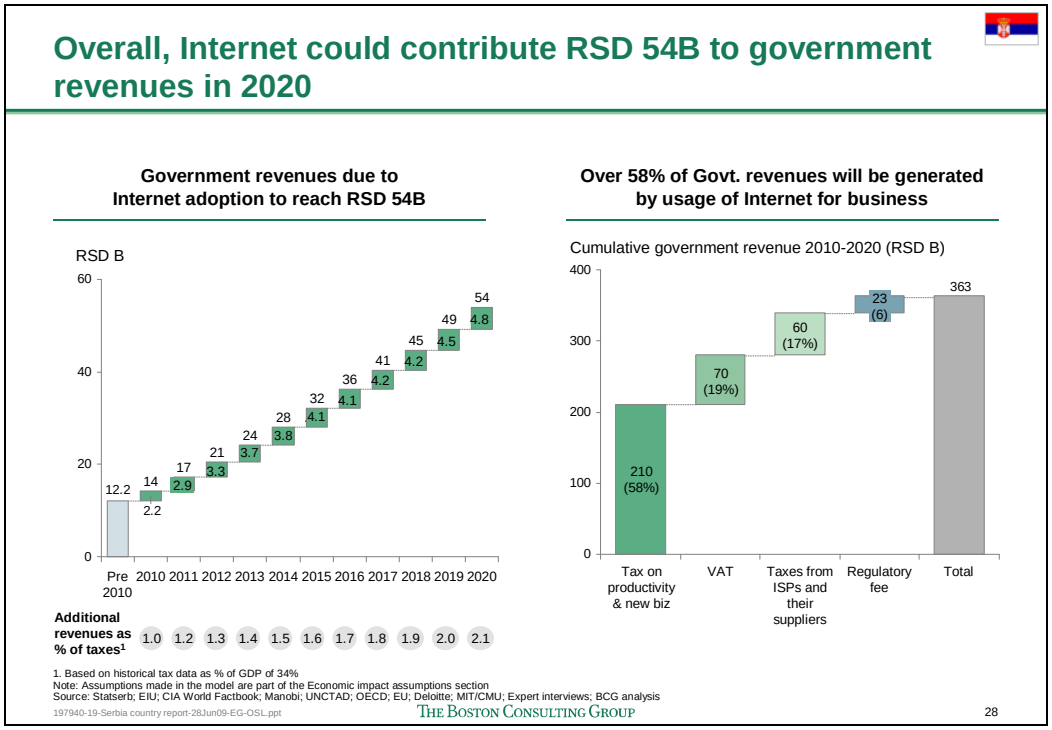
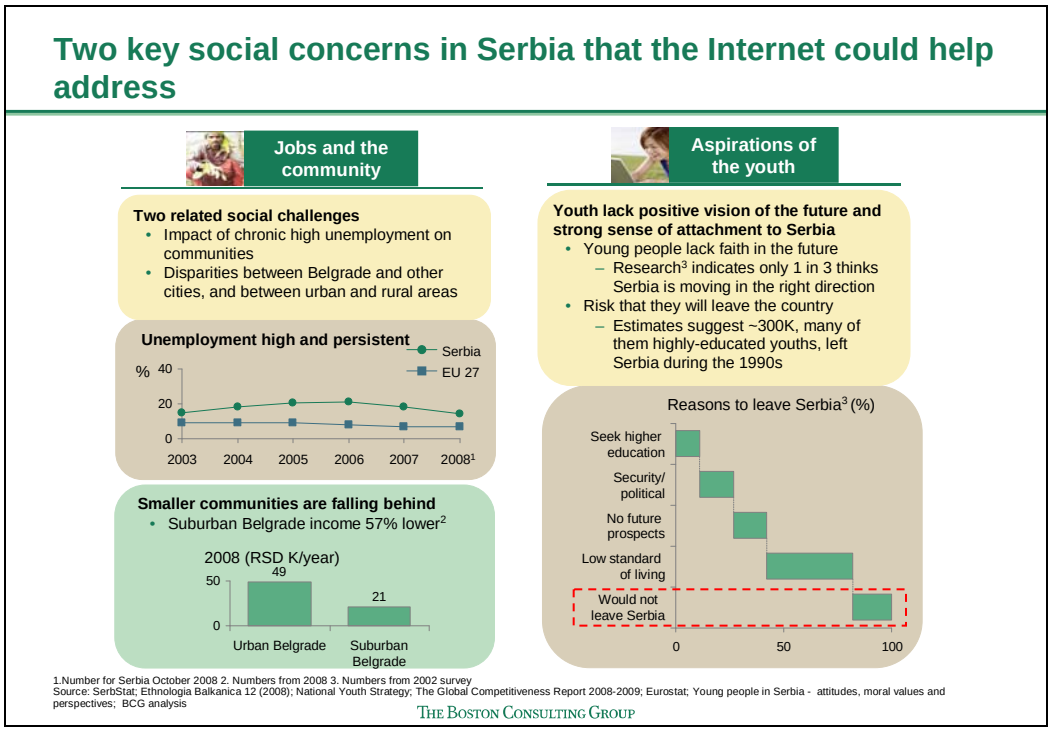


Exhibit 4.8 Tax revenues

4.4 Social benefits

Two issues have been identified as areas of concern for Serbia: jobs and the community, and the aspirations of the youths.



4.9 Overview of social concerns

4.4.1 Jobs and the community

The concerns surrounding jobs and the community arise from the interplay of two related social challenges. The first is the impact of chronic high unemployment on communities. Serbia has historically suffered from high unemployment, ranging from 14-21% over the last 5 years, which is significantly higher than the EU average. With the current global economic slowdown, this is expected to worsen in the near-term. The second issue is the disparity, in terms of income, opportunities and quality of life, between the Belgrade area and other cities, and between urban areas and rural areas in general. Even within Belgrade, incomes in the central parts of the city (e.g., Novi Beograd) are more than double the incomes in the suburbs (e.g., in Barajevo).

These issues have contributed to a number of worrying trends. Emigration from areas with high unemployment, and from Serbia as a whole, has led to the decline of communities. Only a very small percentage of Serbian communities have experienced positive population growth, with 85% experiencing zero or negative growth over the last

few years. It is of particular concern if the young and highly qualified are over-represented amongst those leaving, especially if they leave Serbia permanently. Rural-urban migration also creates problems at the destination, as new job-seekers pour into the cities looking for work. This increases the strain on cities to provide adequate work, shelter and food for the growing populations. A third concern is the impact on underprivileged groups. Minority or fringe groups are at greatest risk as they have limited alternatives. One such group is the Roma. According to some estimates, the unemployment rate among the Roma is double the national rate, and up to 2 out of 3 Roma have never held a job. Finally, the combination of these factors increases the risk of social unrest or instability, as dissatisfaction and disaffection spread throughout the population.

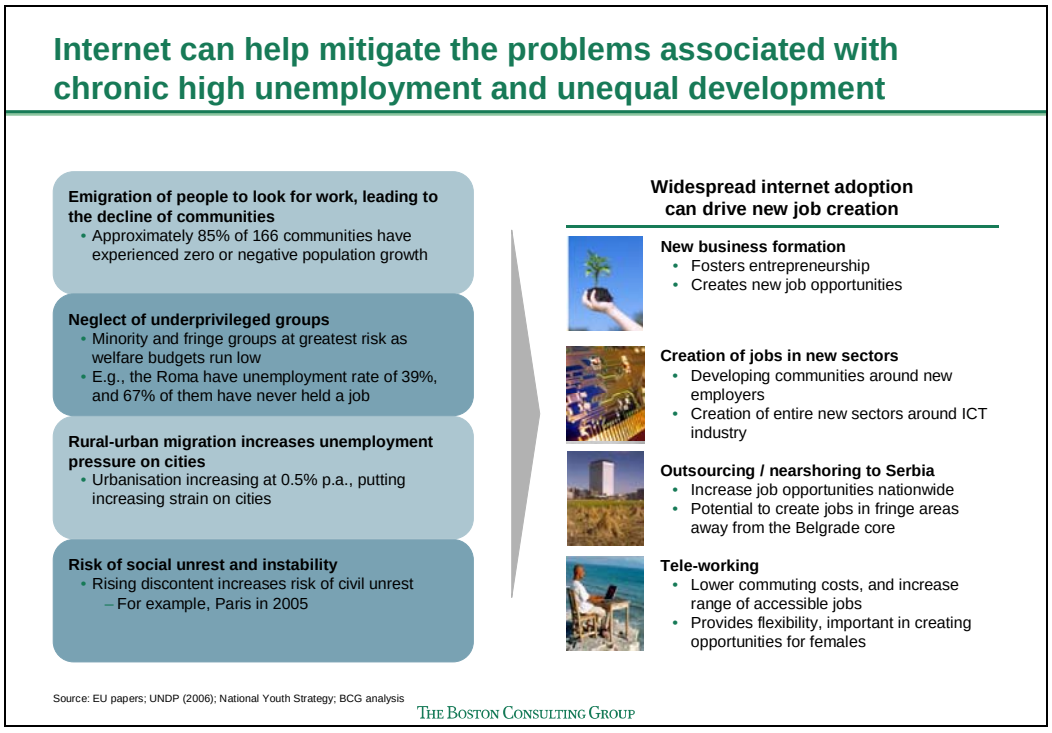


Exhibit 4.10 Jobs and the community

While the Internet is not a miracle panacea for all these issues, it can help to mitigate these concerns by creating jobs. This in turn should dampen emigration from the affected regions, and the taxes generated can help fund investments in social infrastructure, like hospitals and schools, to regenerate the area. Many countries around

the world have built high-tech clusters that leverage on ICT, including the Internet, and in Serbia, an ICT park has been planned for Indjija region which could create up to 25K jobs when fully completed. The Internet also makes it possible for Serbia to benefit from outsourcing or "near-shoring", where companies in the rest of Europe try to save costs by moving jobs to lower cost locations. This is particularly relevant for areas further away from the Belgrade core, as high-speed Internet links enable them to work seamlessly from remote locations.

At a more individual level, the Internet can stimulate entrepreneurship. The Internet can increase the returns to starting a business, while at the same time decreasing the risks. Widespread Internet penetration increases the number of customers that can be accessed online. A similar concept on a smaller scale is the option to telework, or to work from home. One driver of unemployment is that people may not be willing to move to find jobs, e.g., when one spouse has already a job in the local area. Teleworking may enable the other spouse to work from home for companies located in other parts of Serbia, or even overseas.

4.4.2 Aspirations of the youth

Another key issue facing Serbia is the concern surrounding the aspirations of its youth. Surveys suggest that only 1 in 3 youths think that Serbia is moving in the right direction, and only 1 in 5 would not consider leaving Serbia. During the troubled 1990s, it was estimated that as many as 300K youths left Serbia, including many of the most highly-educated, in order to seek better futures elsewhere. Other statistics provide further causes for concern:

- Tertiary enrolment at 38% is below regional average
- Youth unemployment is almost double the national rate, at 39%
- 3 in 5 youths do not follow the news regularly
- Only 1 in 10 youths are active members of NGOs, artistic or cultural societies, or citizen's associations

The Ministry of Youth and Sports in Serbia recognized the problem, and has developed the National Youth Strategy to try to address it. The strategic objectives of the National Youth Strategy are:

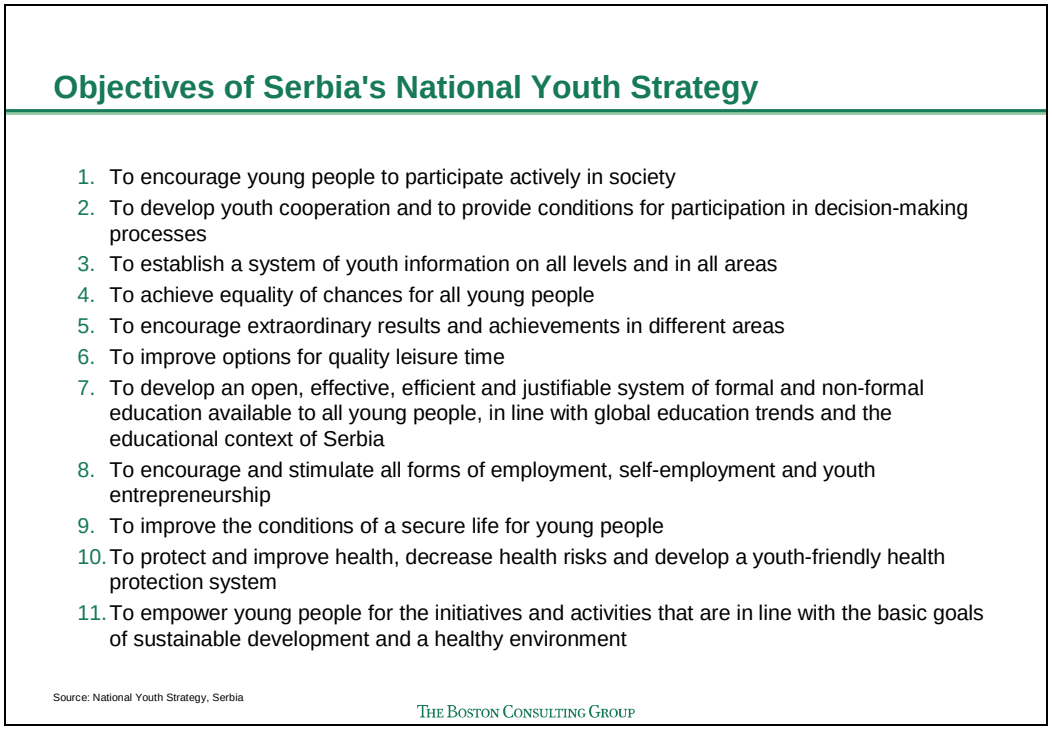


Exhibit 4.11 Objectives of National Youth Strategy

It is clear from this list that the Internet has the potential to facilitate the attainment of many of these goals. In particular, the Internet can play a central role for objectives 1, 3, 4, 6, 7, 8, 11, and a supporting role in objectives 2 and 10.

Enhancing the quality of education in Serbia has been identified as a key objective of the National Youth Strategy. One example of an Internet solution to improve the quality of education is to conduct lectures and lessons by video conference, using high-speed Internet connections to broadcast the session in real time to multiple classes of students. Such sessions can be made interactive, with the use of presentation material and opportunities or question and answer sessions. The Internet can also be used to access technical or scientific equipment that schools individually cannot afford, such as

electron microscopes. Teachers report that such sessions are beneficial for students as they demonstrate the real-life practical uses of the theory lessons.

Another key component of the Strategy is to increase the tertiary enrolment rates. The Internet can assist with this by providing affordable access to a range of online basic and advanced degrees. Research suggests that such degrees are becoming increasingly common and credible, and hence acceptable to employers. With suitable safeguards in place to ensure that students are channeled to accredited programs of requisite quality, the Internet could help accelerate tertiary enrolment in Serbia.

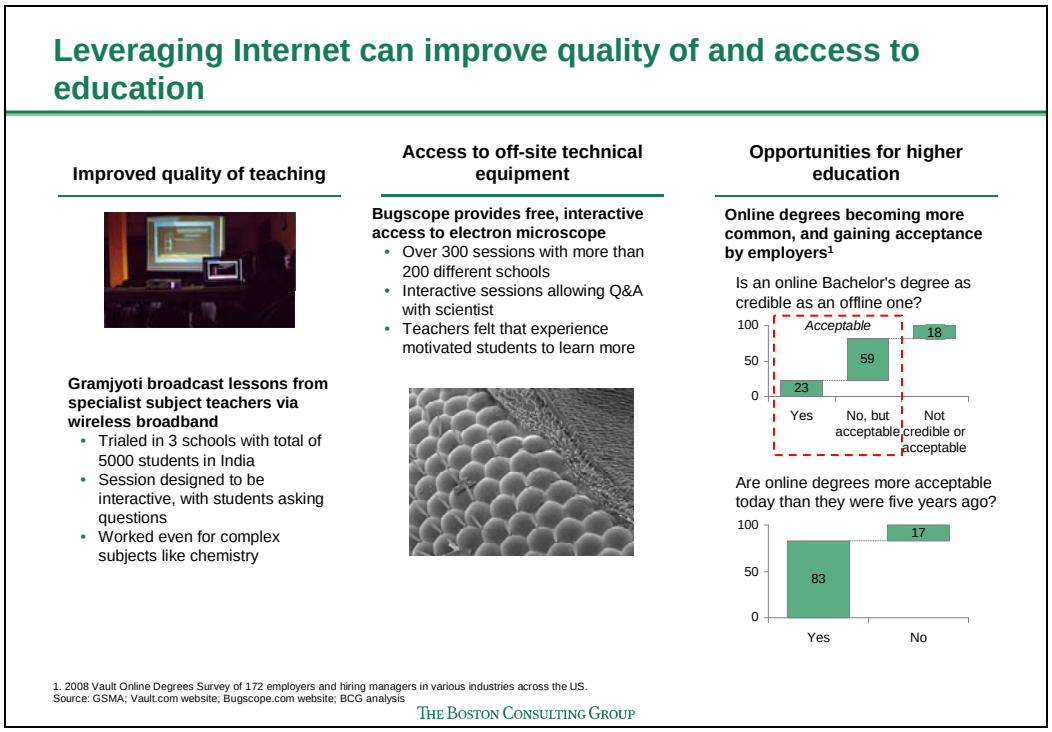


Exhibit 4.12 Internet and education

The Internet will also facilitate youth entrepreneurship by reducing the risk involved in starting a new business and increasing the potential rewards. The Internet can lower entry and exit barriers for new businesses, since an online store or website can cost just a few dollars a month, whereas a physical store or office will cost hundreds or even thousands. The Internet also makes it easier to start and run a business, with infrastructure such as payment providers and information on running a business readily

available. On an ongoing basis, running an Internet business is also cheaper, as many processes can be automated, with no need to pay staff or rent. This is particularly important for young entrepreneurs, as an automated website enables them to continue to study or work while running their businesses. Internet marketing is also cheap and global, and some of the most effective campaigns have been viral marketing initiatives that cost almost no money, relative to traditional media advertising.

The Internet also increases revenue opportunities, providing young entrepreneurs with a global customer base. It also enables new business models and new products, in particular, intellectual property products such as e-books, online games, designs, etc. For example, a short book on a niche topic of interest that may not justify the economics of publishing a physical print run could be profitably sold online through a website. The Internet is also a convenient platform to offer online services, such as web design.

The combined effect of these benefits is that the Internet makes it much more possible for young entrepreneurs to start new businesses. There are already multiple examples of such entrepreneurs succeeding, ranging from billion-dollar website such as Facebook, to small local entrepreneurs in Bangladesh selling Internet services. While not every venture will succeed, the practical experience gained can be helpful for their future careers.

One other objective of the National Youth Strategy that the Internet can help Serbia attain is improving healthcare for youths as well as society more generally. Measures as apparently straightforward as using the Internet to link up the different players in the healthcare value chain, enabling them to share information efficiently, can have a significant impact. Another aspect of how the Internet can contribute to improving healthcare in Serbia is in the tracking of disease outbreaks. Field medical officers can provide accurate, real-time information from remote areas using handheld computers with Internet connections, allowing local and international health organizations to track the spread of diseases. The key benefits of such a method are the speed and accuracy of data, as well as the time and manpower savings from direct data entry, thus making it scalable for large populations. Handhelds for Health in India is one example of such

technology in action. The Internet is also a powerful tool for keeping the public updated on developments, e.g., areas to avoid, measure to take to reduce risk of infection, etc., with the possibility of offering rich, interactive communications that other media cannot match.

4.4.3 Mitigating new challenges

While seeking to maximize the upsides described above, care should also be taken to mitigate the potential downsides from widespread Internet usage. One key concern is access to undesirable content. A multi-pronged approach can help minimize the risk of such issues, e.g., blocking of selected websites from providers, use of parental control applications to limit access from home PCs, and greater education and awareness building activities. Education is also the key to reducing other risks on the Internet, such as identity theft or violation of intellectual property rights.

4.5 Scenarios

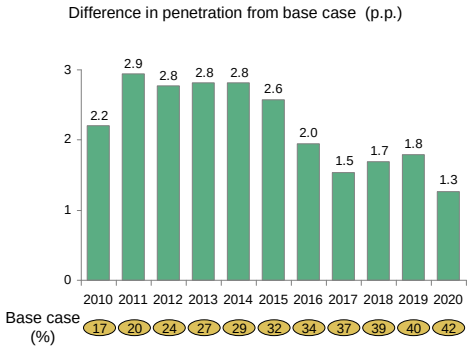
Two scenarios have been modeled. The first is the "Higher Benefits" scenario, where businesses and households are assumed to derive greater benefits from the Internet than in the base case[10]. E-business intensity gains grow at a faster rate, leading to accelerated adoption and a greater contribution to GDP. On the consumer side, households are willing to pay more for entertainment, social networking and other "soft" benefits. This leads to greater penetration, up to 2.9 additional subscribers per 100 population in the early years. It also adds up to 0.5% more to GDP contribution, and increases the impact of job creation by approximately 11%[11].

[10] Upside scenario assumes an increase in e-business intensity growth rapidity (e-business intensity grows by 4.1% instead of 3.1%) and an increase in perceived social and entertainment Internet benefit for HH due to higher transfer speeds, reliable connections and other factors all due to increased infrastructure investment (increased by 6% in 2010 and increasing to 15% in 2013)

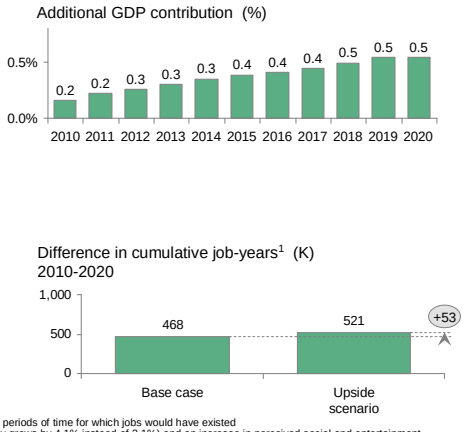
[11] Expressed in terms of job-years. Job-years defined as number of jobs multiplied by number of years the job exists, reflecting different periods of time for which jobs would have existed

An upside scenario would additionally boost GDP by 0.5%, creating an extra 53K man year jobs[1] in 2020

Combined effect of increased investment and a faster e-business intensity growth...



..leading to an additional 0.5% GDP effect and 53K man year jobs over 10 years



1. Job-years defined as number of jobs multiplied by number of years the job exists, reflecting different periods of time for which jobs would have existed
Note: Upside scenario assumes an increase in e-business intensity growth rapidity (e-business intensity grows by 4.1% instead of 3.1%) and an increase in perceived social and entertainment internet benefit for HH due to higher transfer speeds, reliable connections and other factors all due to increased infrastructure investment (increased by 6% in 2010 and increasing to 15% in 2013)
Source: Statserb; EIU; CIA World Factbook; Manobi; UNCTAD; OECD; EU; Deloitte; MIT/CMU; Expert interviews; BCG analysis

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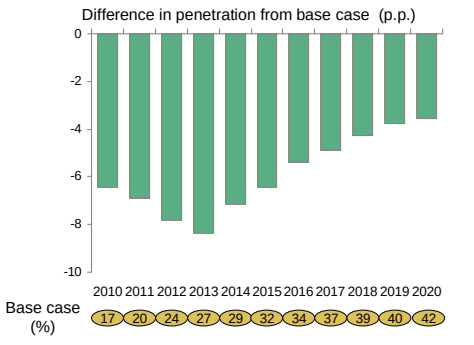
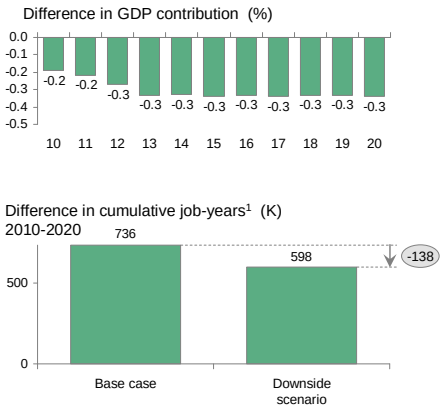
Exhibit 4.13 Upside scenario

Lower adoption leads to lost GDP and jobs in downside scenario

Combined effect of reduced investment and a 10% communication tax reduces penetration



Outcome is up to 0.3% lower GDP growth p.a. and the loss of 138K job-years over 10 years



1. Job-years defined as number of jobs multiplied by number of years the job exists, reflecting different periods of time for which jobs would have existed
Note: Downside scenario assumes an increase in prices due to taxation (10% additional communication tax) and reduced operator competition (increasing prices by 5%), lower availability of Internet subscriptions in rural areas (in 2010, 20% of rural HH unable to access the Internet, 15% till 2013 and 5% thereafter), and lower social and entertainment benefit for households due to lower transfer speeds, frequent disconnections and other factors all due to lowered investment in infrastructure (lowered by 6% in 2010 and increasing to 15% in 2013)
Source: Statserb; EIU; CIA World Factbook; Manobi; UNCTAD; OECD; EU; Deloitte; MIT/CMU; Expert interviews; BCG analysis

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Exhibit 4.14 Downside scenario

Conversely, a downside scenario where users and providers face "Higher Costs" has also been modeled[12]. In this scenario, investment is reduced relative to the base case. Investment is sensitive to both the rate of return and the level of uncertainty, and regulatory actions could adversely impact both drivers, resulting in lower investment. This could result in

- Delaying physical access to infrastructure, particularly in rural areas
- Higher prices due to reduced competition
- Reduced quality, lowering the perceived benefits for consumers

In addition, cost for consumers can be directly impacted by sector-specific taxes, such as a direct 10% tax on Internet usage, for example. In combination, these drivers could result in a reduction in penetration of up to 8% percentage points relative to the base case, and a reduction in GDP contribution of up to 0.3% and a 19% reduction in job creation.

4.6 Regulatory issues

Serbia has made significant progress towards EU best practices, but a perceived lack of a level playing field remains a source for concern, as does the threat of sector-specific taxes. Going forward, three priority regulatory issues need to be addressed. The first is to enhance rules and procedures, by improving clarity of guidelines and streamlining procedures. For example, bureaucracy or "permitology" hinders investment as the process to acquire the multiple permits required to undertake any construction can take months, or even years in some cities. The second issue is ensuring equal access to backbone, as improved access to infrastructure will be required to stimulate investment and improve quality of service and coverage. This can be achieved by the unbundling of

[12] Downside scenario assumes an increase in prices due to taxation (10% additional communication tax) and reduced operator competition (increasing prices by 5%), lower availability of Internet subscriptions in rural areas (in 2010-2013, 20% of rural HH unable to access the Internet, 15% thereafter), and lower social and entertainment benefit for households due to lower transfer speeds, frequent disconnections and other factors all due to lowered investment in infrastructure (lowered by 6% in 2010 and increasing to 15% in 2013)

local loop or access to alternative infrastructure on non-discriminatory, cost-oriented terms. The third issue is the efficient management of spectrum, in order to maximize the benefits for Serbia. To reap the full benefits of the “digital dividend”, some portion of the released spectrum should be allocated to mobile broadband operators as it is highly suited for deployment in rural areas. A technology-neutral licensing regime will also allow operators to optimize, e.g., between GSM and UMTS operations at particular frequency, which international experience has shown to be more efficient than a centrally-mandated approach.

NOTE TO THE READER

BCG has not independently verified all of the data and assumptions used in these analyses, although we have attempted, where possible, to test for plausibility. Changes in the underlying data or operating assumptions will clearly impact the analyses and conclusions.

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APPENDIX - METHODOLOGY

The methodology adopted in the report comprises four key components, as depicted below in Exhibit A.1.

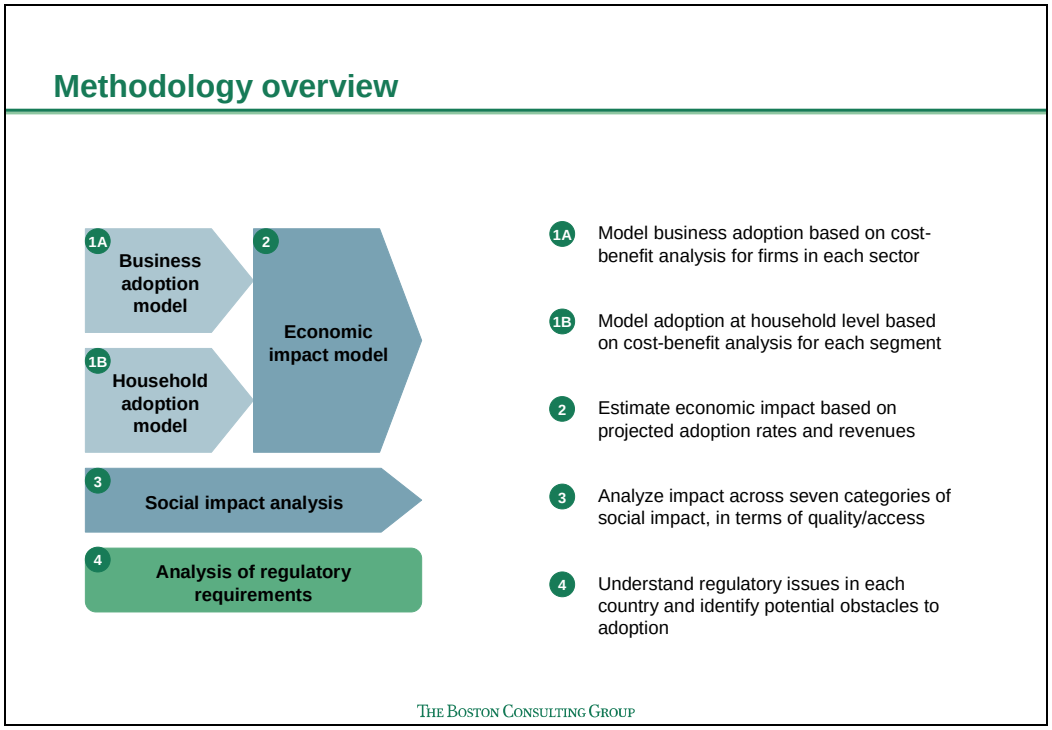

Exhibit A.1 Methodology overview

The general approach to modeling adoption is to do a bottom-up cost-benefit analysis to estimate of the number of subscribers in each segment for each year. Adoption is modeled separately for businesses and households. Official statistics have been used in developing all projections. In countries like Bangladesh, it is widely believed that household incomes and GDP are higher due to the grey/informal economy, but these have not been included due to the lack of reliable statistics. The methodology for business adoption and household adoption are described in more detail below.

1A: Business adoption model

Estimating business adoption involves three steps:

- Defining the addressable market
- Segmentation of addressable firms
- Estimating adoption based on a cost-benefit analysis.

Defining addressable market In some markets, some businesses are not computer-capable, and these have been excluded from the addressable market. This is done based on data from the local statistical offices.

Segmentation Business adoption analysis focuses on the services and manufacturing sectors[13]. Firms in each sector are divided into large and small firms based on number of employees, as firm size is observed to drive penetration as well as the type of package required. Therefore adoption is typically modeled for 4 business segments – small manufacturing, large manufacturing, small services and large services.

Estimating adoption Adoption is estimated by analyzing the costs and benefits of Internet adoption for firms within each segment. Firms for whom the increased gross profit from Internet usage exceed the total costs of ownership are assumed to adopt.

The primary driver of benefit is the increased productivity that accrues to the firm because of the Internet. Productivity in this case is defined as gross value added per worker, or in accounting terms, gross profit per employee. We have leveraged existing research on productivity impact on industry, both services and manufacturing, and, in line with those studies, have assumed an increase of up to 10% for services, and 5% for manufacturing.

Within that range, the exact benefit depends on e-business intensity, the extent to which the Internet is integrated into processes within the company. For example, a firm could initially use the Internet for internal emails, then for third party services such as e-banking or e-government, all the way up to a website with an online store. The model

[13] Agriculture is modeled separately. Given that in most study countries the sector is dominated by small family farms, agricultural adoption is assumed to track rural household adoption. For more details see Section 2 on the GDP impact model.

assumes that productivity increases linearly as e-business intensity increases, reaching 10% in service and 5% in manufacturing when intensity reaches 100%. A composite e-business intensity score for a country can be calculated by aggregating the intensities of individual companies within the country.

We have cross-referenced a number of studies to estimate the starting level and rate of change of e-business intensity in study countries.

Starting point An UNCTAD study in Thailand, using data from 2006, found that Internet adoption increased gross profits by 0.77%[14]. Out of a possible 5% increase, this implies that e-business intensity in Thailand was ~15.5% in 2006. Serbia was assumed to start at the same level as Thailand, and Bangladesh was assumed to be 2 years behind.

Rate of change The EU report grouped the European countries surveyed into 4 categories based on their level of intensity in 2006, and their rate of growth between 2004 and 2006. They found that the less developed knowledge[15] societies had grown at the slowest rate of 1.8%, "quickly developing[16]" countries at 3.1%, and the most advanced societies[17] at almost 4.1%. We have assumed that Bangladesh will grow at 1.8% in line with the less developed societies, Serbia at 3.1%, and Thailand at 2.4%, the average of the two groups.

We have assumed that these growth rates will remain linear over the timeframe of the study. It is possible that in reality, intensity growth will accelerate due to increasing network externalities as more companies in the economy adopt the Internet. However, we have chosen not to make additional assumptions around the rate of change in intensity, and prefer linear growth rates as they are more conservative.

[14] UNCTAD reported a 3.2% increase in sales per worker, which corresponds to a 0.77% increase in gross value added per worker given average gross margins of 24% in Thailand's manufacturing sector.
[15] Bulgaria, Greece, Cyprus, Latvia, Poland, Romania, Slovakia
[16] Ireland, Czech Republic, Estonia, Hungary, Malta, Lithuania, Portugal, Slovenia
[17] Austria, Belgium, Denmark, Finland, Luxembourg, Netherlands, Sweden

Putting it all together, we derive the projected productivity increases for the study countries as shown in Exhibit A.2.

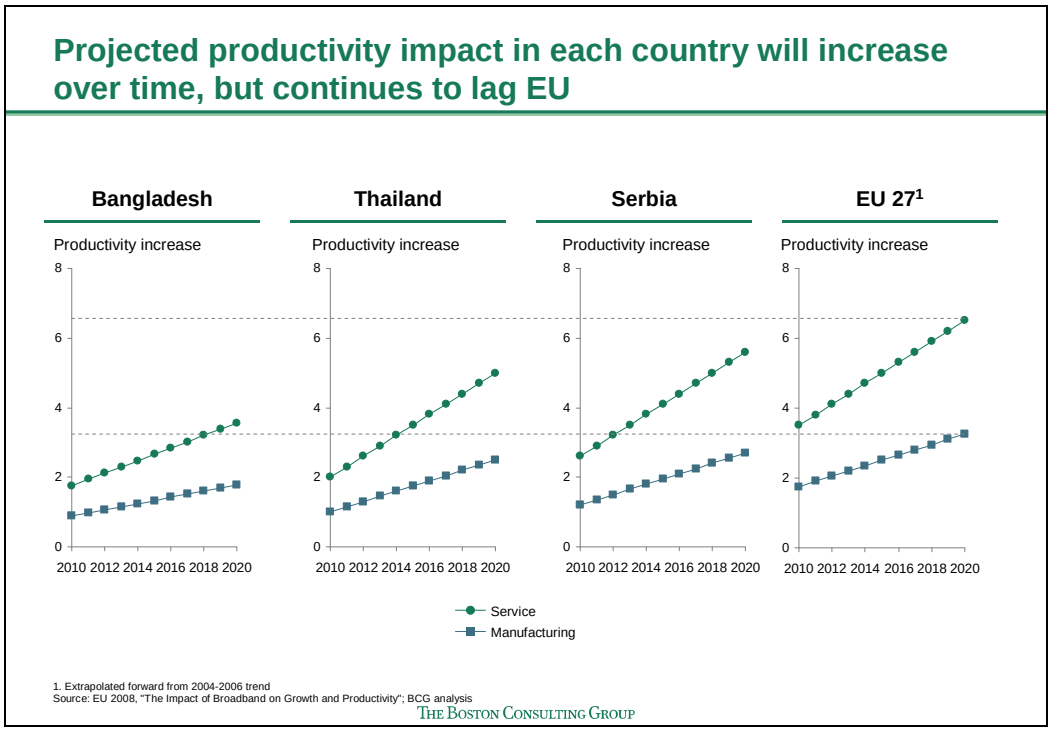

Exhibit A.2 Productivity impact

To estimate the breakeven percentile for adoption, we need to estimate the costs and benefits. We determine the cost by defining the type of package that firms in each segment (large vs small firms) are likely to adopt, and estimate the price of such packages at each point in time. We then estimate the distribution of firm revenues within each segment, starting from the lowest. The applicable productivity increase is multiplied against the estimated revenues of the firms within each segment[18] for each year to derive the benefit of Internet adoption. The lowest level of firm revenues for which the benefits equal the cost is the breakeven percentile, and all firms with revenues above that are assumed to adopt. This process is illustrated in Exhibit A.3.

[18] Revenues of firms within each segment are assumed to be distributed exponentially, with a small number of high revenue firms and a large tail of low revenue firms, This assumption is supported by the available data, such as for Thailand

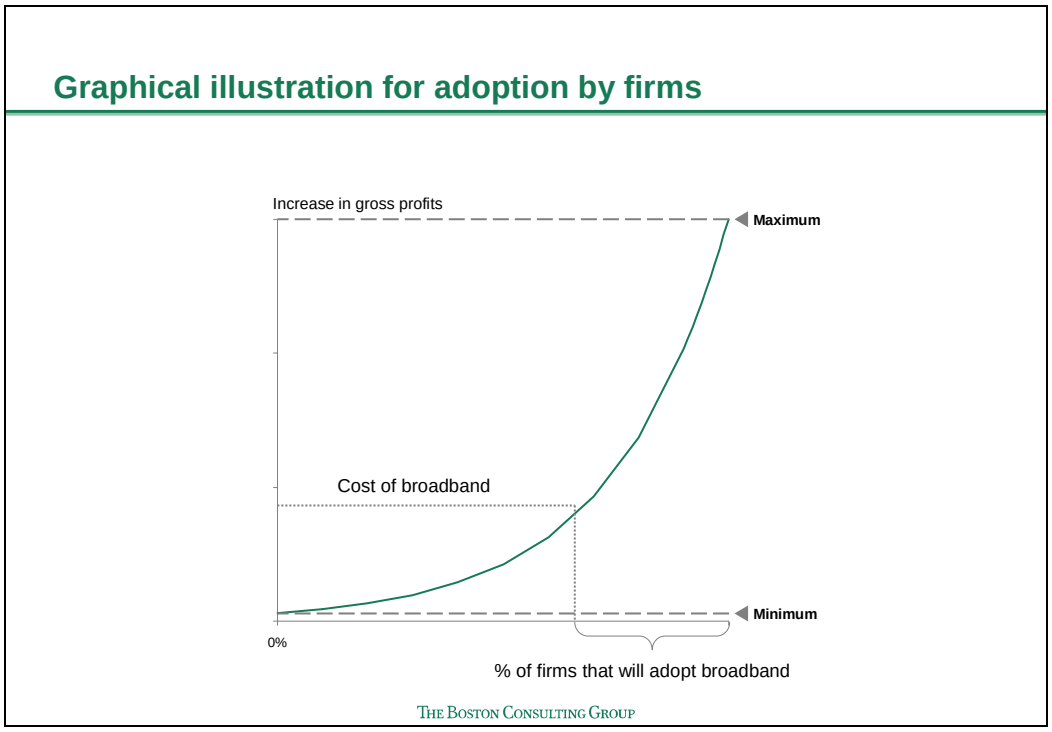

Exhibit A.3 Adoption by firms

Additional assumptions

Device costs have been excluded from the total cost of ownership for a firm. Computers generate additional benefits for the firm, even if they are offline, and adoption would likely be understated if we were to assume that the Internet must generate sufficient benefits to also pay for devices, over and above paying for itself. In most markets, computer use is already prevalent, particularly for larger firms.

The number of firms and the revenue of firms are assumed to each constitute 50% of real GDP growth. From a value added perspective, GDP is equal to the sum of value add for all firms, and hence, in aggregate, the number of firms and their revenue should track real GDP over time. Furthermore, credible projections for both figures are difficult to obtain, given that they can be volatile in the short-term.

1B: Household adoption

The methodology for household adoption is broadly similar to business adoption.

Defining addressable market Households which are below the poverty line are excluded from the addressable market. In countries like Bangladesh, households which are assumed to be 100% illiterate are also excluded. The primary school enrolment rate (80%) has been used as a proxy for household literacy[19], which should be much higher than the ~50% headcount illiteracy rate.

Segmentation Households are segmented along two axes: location and income. Consumer research suggests that location (urban vs rural) is a primary driver of likely adoption behaviour. For Thailand and Serbia, urban is further segmented into capital city and other urban, to reflect greater development and level of sophistication in the primary city. For each location, the population is divided into "high" and "low" income based on their potential to be early adopters. A household is defined as "high" income if its expenditure on communications/IT, as reported in the local household expenditure survey, is higher than the average for that population.

Estimating adoption Adoption is estimated by analyzing the costs and benefits of Internet adoption for households within each segment. Households for whom the benefits from Internet usage exceed the total costs of ownership are assumed to adopt.

Estimation of benefits for households

Benefits for households are divided into two categories: "Needs", which are expressed as a percentage of household income, and "wants", which have a fixed dollar value for each segment.

"Needs" comprise of the following

[19] Households are defined as 'literate' if at least one member is literate

- Productivity gains from household businesses, calculated by multiplying the applicable productivity gain for the country against the proportion of household income derived from business
- Productivity gains from agriculture. Studies suggest that households can increase their income by ~15% from better information and better prices, and this is multiplied against the proportion of income from agriculture for rural households
- Cost savings from online procurement/shopping are estimated based on an analysis of household expenditure. Elements of expenditure which could be spent online are identified, and multiplied against the possible savings based on available benchmarks. This is further illustrated in Exhibit A.4
- Time savings for urban segments are also factored in. Time savings can be generated through email access on-the-go, search functions to locate destinations, etc. Studies support the view that leisure time is valued at more than or equal to the hourly wage rate, and this 'perceived' value of time is included in the needs estimate.

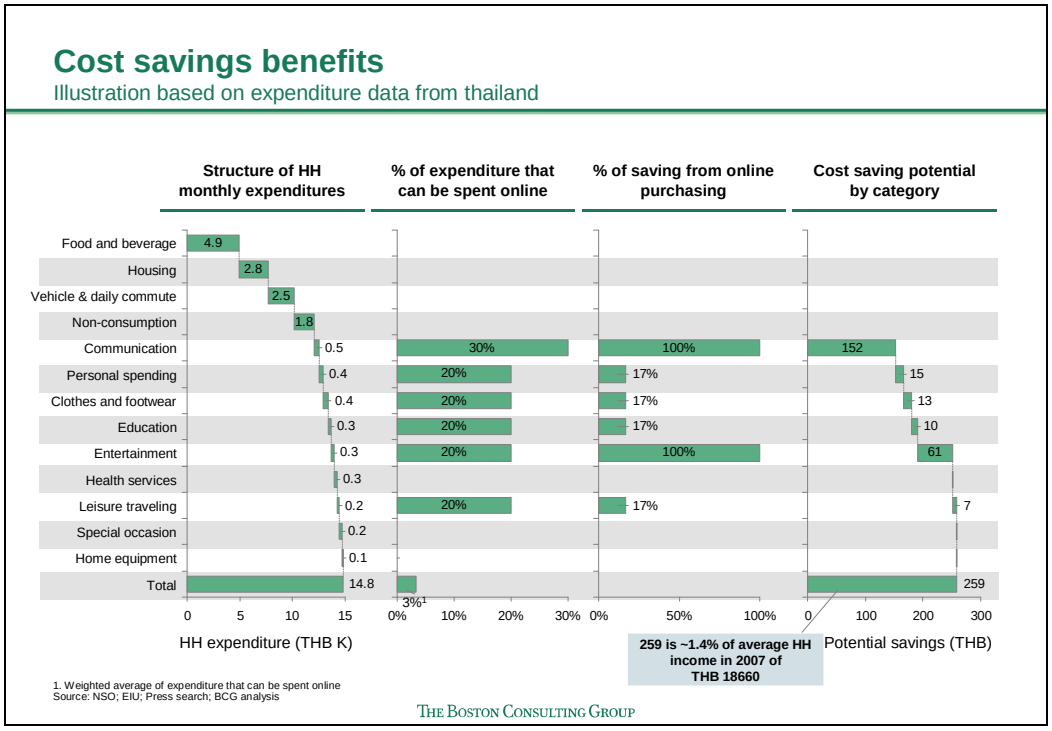

Exhibit A.4

"Wants" benefits

This captures the perceived benefits of Internet use, e.g.,

- Information search, e.g., news, websites of interest
- Entertainment, e.g., games, sports scores
- Social networking, e.g., instant messaging, online communities
- "Sophistication", keeping up with global trends

Recognising that these elements are inherently difficult to quantify, the approach taken in this report is to express consumer's willingness to pay as a multiple of Average Revenue Per User (ARPU) for mobile voice. The argument is that mobile voice can provide many similar functions, and provides us with a starting point for estimating what consumers *might* be willing to pay. Each consumer segment is assessed based on the value they are likely to place on each of the elements. In general, urban high income segments are assumed to have the highest want benefits (1-1.5x of ARPU), and rural low income segments the lowest (~0.5x of ARPU). The "wants" estimates are also cross-checked against expenditure on relevant categories (e.g., entertainment and recreation) as further a sanity check.

Estimation of costs for households

The total cost of ownership for households comprises the cost of subscription and the cost of device.

Subscription costs are estimated based on expert interviews. Typically, high income households are assumed to use a post-paid subscription or equivalent. Low income households are assumed to use pre-paid subscriptions, with a spend amount estimated based on the projected usage needs/patterns. Projections are also made on the rate of decline over time, in line with experiences in developed countries and with mobile voice.

Unlike for businesses, device costs are included for the household, reflecting the higher likelihood that households will need to acquire both at the same time. A low-end netbook or equivalent, the cheapest large-screen device available on the market, is assumed to be the entry-level device. Expert interviews in Bangladesh and Thailand suggest that small screen formats are unsuitable for driving mass Internet access as it is challenging to display the local scripts in the format. Prices for netbooks are projected to continue to decline at about 7% p.a., although it is possible that disruptive innovations such as the $100 laptop could accelerate this trend. This also narrows the price differential with high-end smartphones, which can therefore be included in the analysis.

Estimation of adoption

With the above information, the breakeven percentile for household adoption can now be calculated. The distribution of households by income can be estimated from data from the respective national statistics offices[20]. The breakeven percentile is defined as the percentile for which the total benefits ("needs" as % of income, plus "wants") just equals the total cost of ownership. Households at or above that level of income are assumed to adopt.

Additional subscriptions within the household

The possibility that households could adopt more than one connection is also addressed within the model. This could represent a family supplementing the main fixed household connection with a Blackberry subscription for the businessman father, or perhaps a mobile broadband subscription for an undergraduate child. Households are assumed to adopt subsequent subscriptions if the total "need" and "want" benefit is sufficient to cover the total cost of ownership (service and device) of multiple subscriptions. To be conservative, no incremental benefit has been assumed from the fact that the subsequent subscription is mobile. The number of subscriptions has also been capped to reflect the average household size in the country.

Addressing possible double counting

Given that small businesses could be one- or two-man family firms, which do not

[20] . This is typically reported in deciles, but can be converted into percentiles

differentiate between business and household use of the Internet connection (e.g., through a USB modem and laptop which is used both at home and at work), there is a risk of double counting. To address this risk, and to maintain a conservative approach to the projections, the number of small business subscriptions is subtracted from the number of household subscriptions

2 Economic impact model

The six key elements of economic impact are shown in Exhibit A.5

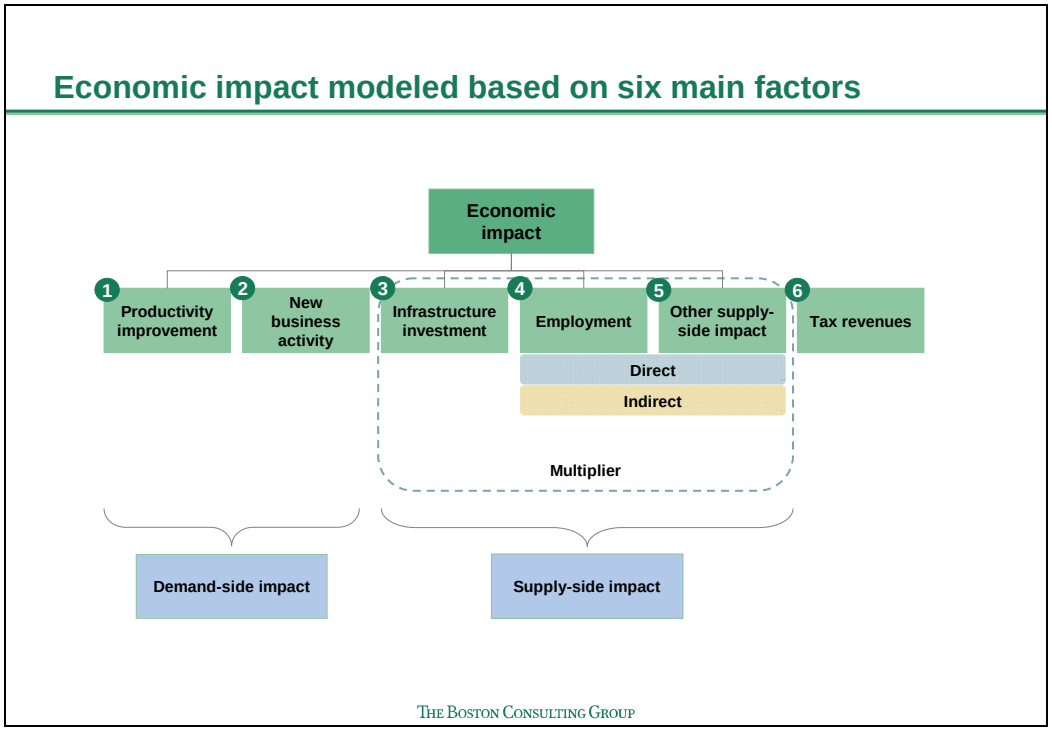

Exhibit A.5

Demand-side impact

The demand-side impact of Internet adoption is defined as the GDP contribution generated by firms using the Internet. This includes increased productivity in existing businesses, and new business activities, which can be new business entities or as new departments or units within existing businesses.

Productivity impact on GDP

As discussed above, it is argued that adoption of the Internet will improve the productivity (gross value added per employee, or gross profit per employee) of firms that integrate it into their operations. Exhibit A.6 shows how productivity gains at the individual firm level are ultimately translated into GDP impact at the economy level.

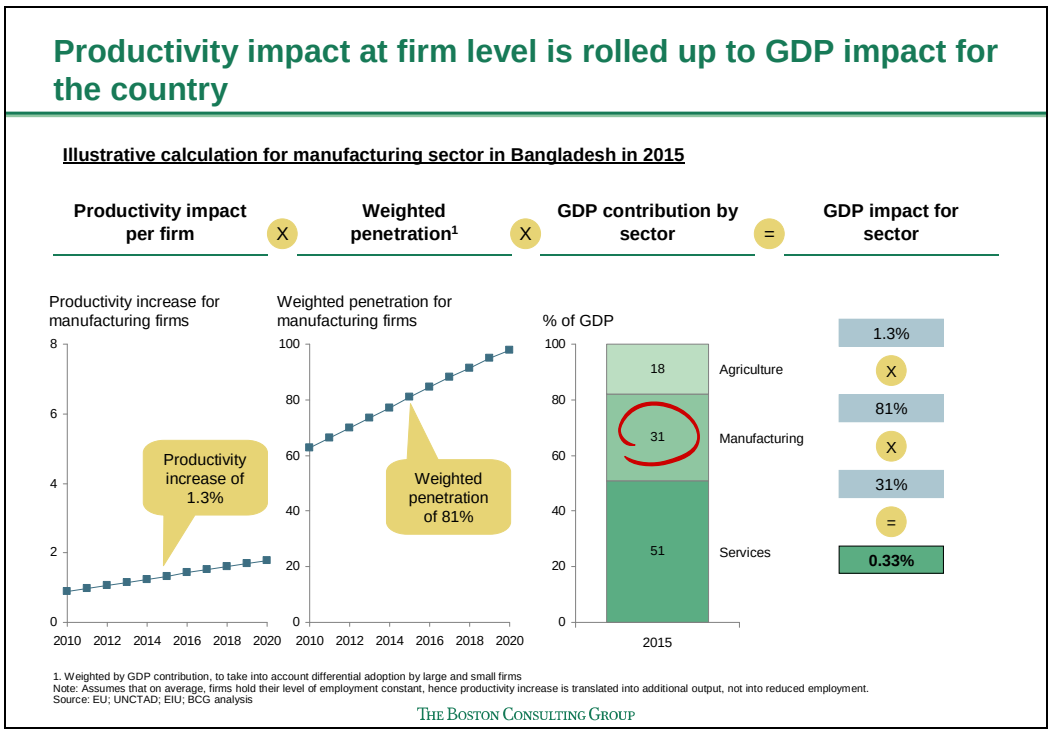

Exhibit A.6

This is done by multiplying the productivity gain at the firm level by the weighted penetration and the total GDP contribution for the sector. The productivity benefit at the firm level is assumed to be equal to the productivity gain for the country as a whole at the point in time. This is then multiplied by the weighted penetration rate. Weighted penetration rate takes into account the differential in the average size of firms in each segment, particularly large vs small firms. This is particularly important as large firms typically have a much higher penetration rate. Each large firm has the revenue of multiple small firms, but there are generally fewer large firms than small firms, and a simple penetration figure (total number of connections/total number of firms) would understate the overall GDP impact.

This method is used to calculate the contribution from services and manufacturing. As noted earlier, agricultural adoption is assumed to track rural household adoption. Accurate estimates of the GDP impact of Internet adoption on agriculture are difficult to obtain. However, studies have demonstrated clear increases in value added per unit area. A value of 5% increase in value added has been used in this report, based on disaggregating the output and price components of the 15% income gain enjoyed by households.

For countries with a significant agricultural output from large commercial farms, the value added from these holdings is assumed to be one-quarter of the manufacturing gain for that country at that time. This is based on relative benchmarks[21], and fits well with expected outcomes. The majority of the increase in value added in family farms is attributable to moving them towards the efficient production frontier, through better information on seed varieties, planting times, fertilizer, disease treatment, as well as through better prices. Large farms should already have access to these, and be operating close to the efficient frontier, benefiting from their larger scale. Therefore, it should not be surprising that the benefit of Internet adoption is relatively low for such farms.

New business activity

Particularly in developing economies, where infrastructure and communications are less advanced, the Internet creates multiple opportunities for entrepreneurs to exploit. These include, but are not limited to

- Businesses based on offering Internet access and its benefits to first-time or low-income users, such as internet cafes, digital studios
- Leveraging the Internet as a sales channel for goods or services
- Using the Internet as an information aggregator to bring together buyers and sellers, such as with an online auction site or job search services
- Providing services to other Internet businesses, such as website design, e-commerce platforms, server and storage

[21] See *ICT and productivity – an economic analysis of Australian industry,* (Department of Broadband, Communications and Digital Economy, Australia 2008)

The study assumes that a 10 percentage point (pp) increase in overall nternet penetration will increase the rate of new business formation by 1%. This means that, if there are 1 million companies in the economy, ten thousand additional new businesses will be formed each year for every 10 pp of penetration. This relationship was reported in a study in the US, and supported by an analysis of a broader dataset of countries.

These additional business activities are assumed to have the average revenues, profits and number of employees as the average small firm in the economy, thereby contributing to GDP as well as job creation.

Supply side impact

The supply side impact captures the GDP contribution of economic activities that are undertaken to produce or consume Internet services. It comprises three elements: infrastructure, employment, and others.

Infrastructure Significant investment must be undertaken to set up and maintain the networks required to support the Internet. These can be seen as an injection into the economy. In estimating the GDP contribution from infrastructure, only locally retained expenditure is included in the multiplier. Expenditure on foreign equipment and foreign expertise, which flows out of the economy, is excluded.

Employment and others In the model, consumer expenditure on Internet services is considered an injection into the economy. This expenditure forms the revenues for the Internet Service Provider value chain, comprising the ISP and its suppliers. Some of the revenues are again exported overseas, to pay for foreign goods or services, or as profits attributable to foreign owners. These are excluded, and the domestically retained portion is then put through the multiplier. The GDP impact is captured either as "employment", meaning wage payments to employees, or "others", a catch-all term that includes domestically-retained profits, expenditure on CSR activities, etc.

Contribution to government revenues

Although not a component of GDP, contribution to government revenues, in the form of taxes and regulatory fees, is an area of keen interest, and is therefore reported alongside the other economic metrics. The main components are

- Value added taxes
- Regulatory fees or other industry-specific taxation
- Corporate taxes from the service providers and their value chain
- Corporate taxes from increased productivity (which is gross profit)
- Corporate taxes from profits of new business activities

The model assumes that the current rates of taxation remain in force for the duration of the projection.

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OECD Broadband portal: http://www.oecd.org/sti/ict/broadband

Manobi Development Foundation: http://www.manobi.net

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Meaningful Broadband Working Group

Economist Intelligence Unit

Euromonitor