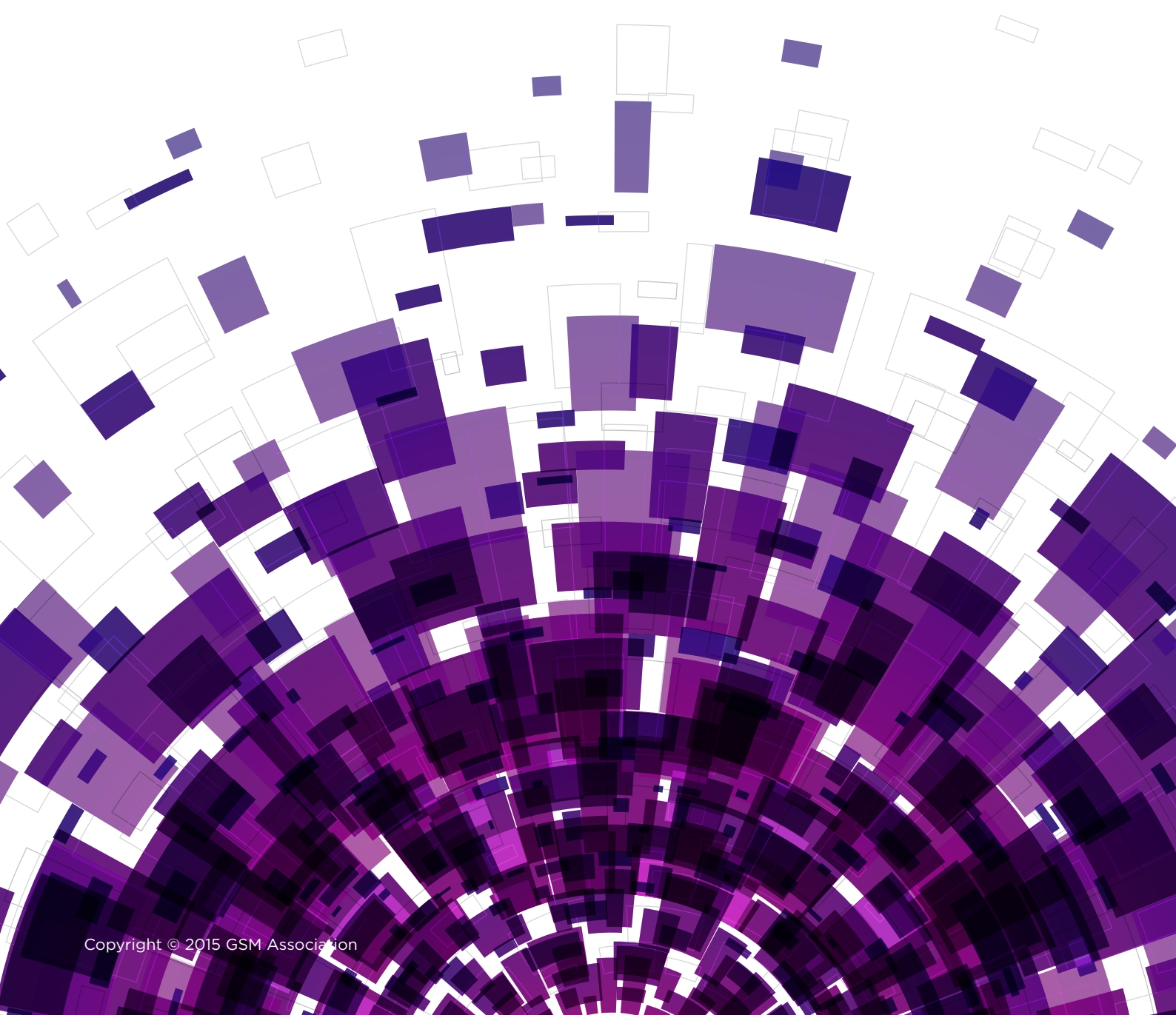




Socio-economic impact of mobile broadband in Thailand and contribution to the digital economy

April 2015





About the GSMA

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

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Executive Summary

Analysys Mason was appointed by the GSM Association (GSMA) to examine developments in the mobile broadband market in Thailand and the socio-economic benefits associated with these developments. The report also discusses how government policy in Thailand can support the realisation of these benefits, providing a significant boost to the government published goals for further development of the digital economy.

1.1 Key findings

The market in Thailand is at a crossroads: despite an initial delay, the commercial launch of 3G networks saw a substantial increase in the use of mobile data services; therefore strong demand for 4G is now widely anticipated. However, since the planned award of 4G spectrum in Thailand has been delayed, some operators have moved ahead with initial deployments of 4G within spectrum that has been re-farmed from 3G use.¹ Although the 4G spectrum award has been delayed, the government of Thailand has strong ambitions to turn Thailand into a digital economy, which ultimately depends on better broadband infrastructure – including mobile infrastructure – being available.

Mobile broadband is thus an important enabler for the digital economy and for digital inclusion. In particular, by further stimulating mobile broadband take-up, Thailand will benefit from a range of positive socio-economic impacts leading towards early achievement of the six pillars of the ‘Digital Economy Plan’ that the Government of Thailand has published. Key to this is the release of spectrum for 4G, along with policies aimed at promoting a truly competitive, dynamic, investment-led mobile sector.



Key findings from the study are as follows:

ECONOMIC IMPACT OF BROADBAND

As operators invest in deploying new mobile infrastructure, economic activity and new jobs associated with the deployment of network infrastructure is created. Spill-over effects also occur, such that the impact on the wider economy and the associated social impact can be far-reaching, improving productivity, fuelling innovation and driving the creation of new businesses as well as providing improved access to personalised healthcare, online services and facilitating smart cities.

As few empirical studies exist that investigate the socio-economic impact of mobile broadband specifically, we have estimated the impact of total broadband penetration (number of connections) on economic prosperity.² We define ‘broadband’ to include both fixed and mobile broadband connections, including the use of smartphones for data, but excluding basic mobile handsets.³

Based on the modelling we have conducted, we estimate that if the Thai authorities are able to facilitate the development of a vibrant broadband market (which will also meet the targets set by the Digital Economy Plan), broadband connections penetration in the country could increase from 52% in 2013 to 133% by 2020.

What this implies for the Thai economy is that a cumulative GDP increase of USD23 billion (THB730 billion) could be created by the end of 2020⁴. In addition to this GDP increment, the roll-out of new broadband infrastructure (including mobile broadband) is expected to create a positive impact on the jobs market in Thailand by creating new skilled jobs. This will contribute positive changes in the general population and the workforce in Thailand by developing abilities and skills to use new infrastructure and the latest emerging technologies.

A significant proportion of these benefits could come from mobile broadband specifically (compared to broadband as a whole), assuming that the legislative and policy environment in Thailand continues to support the mobile sector (e.g. in terms of availability of sufficient spectrum to enable investment in new technology and infrastructure).

1. This is using spectrum in the 2.1GHz band.

2. There is a lack of published empirical studies isolating the effects of mobile broadband from those of broadband networks more generally as a result of the relatively recent introduction of mobile broadband to the market. Hence most published studies refer to benefits generated by broadband connections of all types.
 3. Previous studies investigating the impact of broadband on the economy may not be comparable with the current study due to differences in the definition of broadband penetration (e.g. the difference between broadband penetration and broadband connection penetration, the latter exhibiting diminishing returns as users get more than one broadband connection), differences in technology mix, as well as differences in penetration forecasts.
 4. The GDP increment is expressed in nominal terms. The estimated GDP impact is not discounted (e.g. it does not take into account the time value of money). For comparison, the equivalent amount based on USD PPP (Purchasing Power Parity) – the basis used in some other reports for estimating socio-economic impacts – would be USD56billion

SOCIAL IMPACTS OF BROADBAND AND THE ROLE OF MOBILE BROADBAND AS AN ENABLER FOR THE DIGITAL ECONOMY

Although difficult to quantify in monetary terms, social benefits constitute an important part of the overall value of broadband investments. In Thailand, these social benefits are particularly relevant since the government of Thailand has published a series of digital economy goals as part of its Digital Economy Plan.

In the wider Asia-Pacific region, mobile operators have been very active in participating in this digitisation. Among the digital initiatives launched by major operators around the world, tracked by Analysys Mason's Digital Economy Readiness Index (DERI),⁵ the Asia-Pacific region stands second after Europe in terms of the number of reported initiatives, for example, with cloud-based services, mobile money (m-money) and mobile health (m-health) being key applications for mobile operators in the region.

In Thailand, operators have focused on the e-money and e-commerce fields to date but it is expected that the further roll-out of 4G infrastructure will provide a platform to significantly extend current offerings both in terms of availability and take-up as well as generating new ones. Successful applications already offered in Thailand that are well aligned with the government of Thailand's digital economy goals include the 'Farmer Information Superhighway' service from DTAC, and the 'True-Money' e-payment service from True.

POLICY CONSIDERATIONS TO SUPPORT THE REALISATION OF MOBILE BROADBAND BENEFITS

In addition to the award of 4G spectrum, there are a number of other areas where appropriate policy and regulation will be required to ensure that mobile broadband develops successfully in Thailand:

- Ensuring a level-playing field with state-owned companies.** Network competition in the mobile market and in telecoms services more broadly has been shown to provide various advantages internationally. Telecommunications policy in most markets is aimed at promoting competition at various levels, including the provision of retail services and in wholesale markets. The benefits that competition can bring about in the mobile market include incentivising further infrastructure roll-out and investment in new mobile technologies (and extending mobile network reach into rural areas). This, along with appropriate regulation in other parts of the telecoms market (e.g. in terms of wholesale access) is widely recognised to contribute to increasing take-up, falling prices and better availability of mobile services.
- Effective regulation** is needed to ensure the successful implementation of 4G as well as to oversee the effective functioning of competitive mobile markets more broadly. International experience suggests that an independent regulator – structurally and functionally separate from the government – is essential to ensure greater investor confidence and hence leads to further investment being made in new technologies. Market based approaches to spectrum assignment are appropriate when new spectrum licences are being awarded, and when demand for licences might exceed the supply of spectrum. Greater clarity in Thailand concerning the roles of the government and the NBTC will be fundamental to create a successful 4G spectrum award. In particular, the NBTC, working under the policy guidance of the government of Thailand, should be responsible for defining and implementing the 4G spectrum award – and for monitoring the subsequent network implementation against any licence conditions (e.g. coverage or roll-out requirements). Ensuring that all spectrum used for 2G, 3G and 4G services is administered via a licensed regime (rather than under concession) is also an important goal.
- While advanced 3G and 4G technologies enable mobile networks to carry mobile data traffic more efficiently, operators need to ensure that the costs of rolling out new technologies are managed in the most efficient way. **Voluntary infrastructure sharing** has been shown in other markets to be one way of achieving this, while also potentially providing other benefits such as better availability of services through further roll-out into less populated areas.
- Establish a business-friendly environment for the operators to compete in, through **transparency and open consultation to maximise certainty for investment in new technology.**
- A competitive market outcome is more likely if the currently available mobile spectrum for 4G is assigned as soon as possible, through a process involving the existing operators. This will ensure that the three largest mobile operators in Thailand can obtain the spectrum that they need to extend the initial 4G roll-out that is now underway,⁶ using spectrum that is internationally harmonised for 4G. Similarly, any spectrum that becomes available for 4G in future – such as in the 700MHz, 2.3GHz, 2.6GHz or other bands – should be assigned using an appropriate, market-based process to award spectrum licences, in line with international best practice.
- In Thailand, the existing 2G/3G networks using the 900MHz and 1800MHz bands, along with the 850MHz band, currently support millions of mobile users. These bands are therefore essential to the three largest mobile operators in Thailand to ensure continued availability of mobile services as well as to expand the availability of mobile broadband services using 3G and 4G technology, thereby supporting the government of Thailand's digital economy objectives. Thus, spectrum currently used by mobile operators for 2G/3G in these bands should continue to be available – with suitable licensing certainty to the operators – to encourage continued investment.

5. Digital Economy Readiness Index (DERI), published by Analysys Mason's Research division, is a compilation of more than 340 digital economy initiatives by 32 of the largest operators worldwide.

6. Initial 4G services in Thailand are being delivered using spectrum in the 2.1GHz band, in view of a lack of spectrum available to the three large operators in other bands.



ALIGNMENT WITH DIGITAL ECONOMY GOALS

As described above, the mobile sector in Thailand is already supporting the achievement of the six pillars of the government of Thailand's Digital Economy Plan. The contributions of the mobile sector towards achieving the six pillars of the plan are summarised in figure 1.1.



FIGURE 1.1

Mobile sector alignment with the six pillars of the government of Thailand's Digital Economy Plan

Digital Economy goal	Mobile sector contribution	Key policy enablers	Key risks
Hard infrastructure	Roll-out of new 4G mobile network infrastructure Investment in new mobile broadband technologies	Sufficient spectrum to enable effective provision of countrywide infrastructure and services Availability of sufficient fixed backhaul (e.g. fast-fixed broadband network)	Insufficient spectrum per operator affecting the roll-out of new services
Soft infrastructure	Improvements to ICT abilities and skills of the population/workforce Opportunity for individuals to be employed in skilled jobs, through building of new mobile networks and related mobile services development opportunities	Legislative support to lower cost for mobile network investment e.g. appropriate spectrum governance, voluntary infrastructure sharing, removal of barriers to consent for new radio masts and sites, etc.	Lack of accountability and fairness in spectrum allocation and assignment (e.g. lack of an independent regulator), affecting investor confidence
Service infrastructure	Access to country-wide mobile broadband services	Policies targeted at improving ICT infrastructure access and use in rural areas Release of additional spectrum to mobile (e.g. APT700 band for wide-area coverage) Government services digitisation and establishment of e-government	Lack of long-range (strategic) planning to support emerging technological opportunities
Promoting/Implementing	Increase in broadband connections penetration Substantial increment in GDP* Creation of new skilled jobs	Policies to promote a vibrant broadband market e.g. achievement of the goals of the Digital Economy Plan	Lack of long-range (strategic) planning to support development of a digital economy
Digital society	Development of m-applications to support local services e.g. education and health, as detailed in this report	Building awareness of the Internet and developing digital skills Policies to enhance digital literacy and development of local content (i.e. to encourage use of e-learning applications)	Lack of awareness and education towards the under-served to adapt to emerging mobile technologies
Digital knowledge	Development of m-applications tailored to specific sectors in the Thai market e.g. Farmer Information Superhighway, as detailed in this report	Policies to incentivise businesses to enter the mobile economy	Lack of awareness and education towards the under-served to adapt to emerging mobile technologies

*refers to broadband in general, including mobile broadband
Source: Analysys Mason, 2015

2

Introduction to the study

Analysys Mason has conducted a study for the GSM Association (GSMA) on the socio-economic impact of mobile broadband services in Thailand, and the contribution that mobile broadband services can make towards achieving the six pillars of the Digital Economy Plan that the government of Thailand has set out.⁷

7. http://thailand.prd.go.th/view_news.php?id=7549&a=2.

2.1 Background and objectives

The mobile market has undergone significant changes in recent years, with substantial increases in mobile data usage taking place in both emerging and developed nations across the globe, and the industry making a generational shift in mobile data technology, from 3G to 4G networks.

Mobile broadband is emerging as a popular choice for the delivery of high-speed broadband services, both in locations where it acts as a complement to fixed services as well as in the absence of satisfactory fixed connections. There is evidence that mobile users are increasing their mobile data usage as they gain access to smartphones and other data devices. Mobile networks have a particularly key role to play in connecting people living in remote areas.

The mobile sector therefore plays a key role in today's broadband market, which delivers large benefits to national economies. The economic impact of broadband connections – of all types – has been the subject of extensive empirical research, and this previous research has established a strong link between broadband connectivity and gross domestic product (GDP) growth both in developed and emerging nations, as well as a linkage between increasing broadband connections and job creation.

In Thailand, mobile networks witnessed a substantial increase in mobile data demand in recent years, similar to trends in many other markets. 3G networks are now well established and two of the largest mobile

operators in the market have begun 4G network roll-out, although this is currently being done using the operators' existing 3G spectrum (in the 2.1GHz band), in the absence of other suitable 4G spectrum being made available. An award of mobile spectrum in the 900MHz and 1800MHz bands, suitable for 4G use, is anticipated to happen in 2015.

As well as benefiting the national economy, the mobile sector also contributes towards achievement of the 'digital economy', encompassing a range of positive social benefits. The government of Thailand has recognised the importance of fostering the digital economy and has set out a 'Digital Economy Plan' containing six policy 'pillars', which are aimed at accelerating digital economy infrastructure roll-out, extending digital knowledge and supporting the availability of new digital services.⁸ The six pillars of the plan span a series of high-level targets associated specifically with better infrastructure availability, growth in services, digital economy promotion, digital society and the furthering of digital knowledge and information.⁹

With this in mind, and in light of substantial increases in demand for 3G mobile data services and the pending award of spectrum for 4G, Analysys Mason was asked by the GSMA to conduct this study to set out the economic and social impacts from broadband services in Thailand.

The study has two key objectives:

- To quantify the socio-economic impact of increasing broadband penetration in Thailand (in terms of GDP and jobs impact), and to identify other qualitative effects (e.g. social impact), and how these align with Thailand's Digital Economy Plan.
- To highlight international best practice to accelerate investment in mobile broadband services, in the context of ensuring that government policy – in respect of spectrum and other key inputs to the mobile market – supports the further development of 4G mobile broadband services.

8. Digital Asia One (see: <http://digital.asiaone.com/digital/news/mapping-pillars-digital-economy-thailand>); GSMA RFP.

9. Nation Multimedia (see: <http://www.nationmultimedia.com/business/Govt-unveils-themes-for-digital-economy-plan-30247713.html>).

3 The telecommunications market in Thailand

Substantial changes have taken place within the mobile sector in recent years, with significant increases in mobile data usage in developed and emerging nations across the globe, changes to market structures and a generational shift in mobile data technology, from 3G to 4G networks.

These trends are expected to continue over the next few years, as operators continue to enhance both 3G and 4G networks to provide the increased coverage and capacity required to support the massive demand that is now being witnessed for mobile broadband services. There is evidence that, even with the introduction of 4G, the use of 3G networks is continuing to rise in some markets. This rise is potentially a result of 3G networks improving the quality of their services and encouraging 3G users to consume more data, as heavy data users migrate to 4G.

In Thailand, the roll-out of 3G networks was initially delayed while the three largest operators awaited the assignment of 3G spectrum. However, once spectrum in the 2.1GHz band was licensed for 3G use, mobile

data usage has grown quickly. The operators in Thailand therefore face similar challenges to those in other markets around the world in that they are under pressure from customers to migrate from 2G to 3G, while also rolling out advanced mobile broadband technologies (3G and 4G). In particular in Thailand, the strong growth in mobile data traffic has resulted in two of the largest operators rolling out 4G (LTE and LTE-Advanced) within their 3G spectrum, a move prompted by delays to auction 900MHz and 1800MHz spectrum.

In the remainder of this section we give a brief overview of the fixed and mobile broadband markets in Thailand, which provides the context for the rest of this report.

3.1 Summary of broadband network availability

Thailand is currently on the brink of an explosion in terms of broadband connectivity. When looking at overall ICT development, Thailand scored 4.8 in 2013 according to the ICT index of the International Telecommunication Union (ITU), and is ranked tenth in the Asia-Pacific region. Thailand is at the upper end of the developing countries' group in terms of ICT maturity and it is likely that, given facilitating policies, it will pass the ICT development threshold before 2020. A brief summary of the mobile and fixed markets in Thailand in the context of broadband availability is provided below.

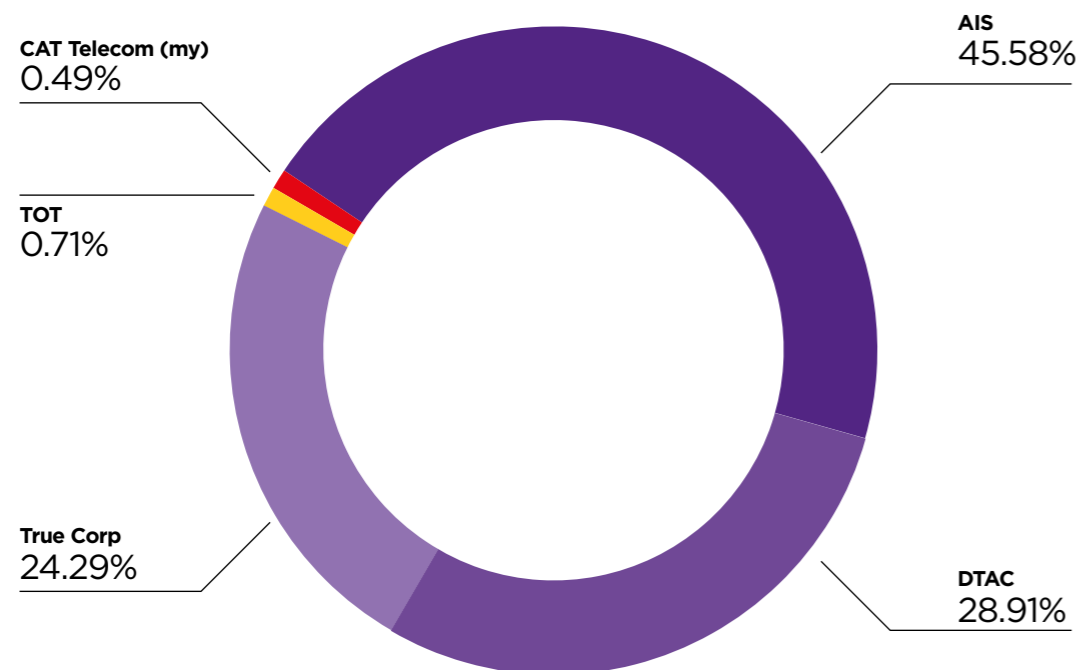
MOBILE NETWORKS

The mobile market in Thailand is dominated by Advanced Info Service (AIS), Digital Total Access Communication (DTAC) and True Corp, which together serve the majority of Thailand's mobile market. Three other operators share just over 1% of the market (the total mobile market share is shown in Figure 3.1). Two of the smaller operators, TOT and CAT Telecom, are owned by the Thai State, via the Ministry of Finance.¹⁰

The three major operators all provide 2G and 3G services using GSM, GPRS, EDGE, W-CDMA and HSPA+ technologies. Recently, True and DTAC have launched 4G services using LTE, in the 2.1GHz spectrum previously awarded for delivery of 3G services. Further 4G roll-out is expected pending award of further spectrum.

FIGURE 3.1

Total mobile market share of connections



Source: GSMA Intelligence, 2015

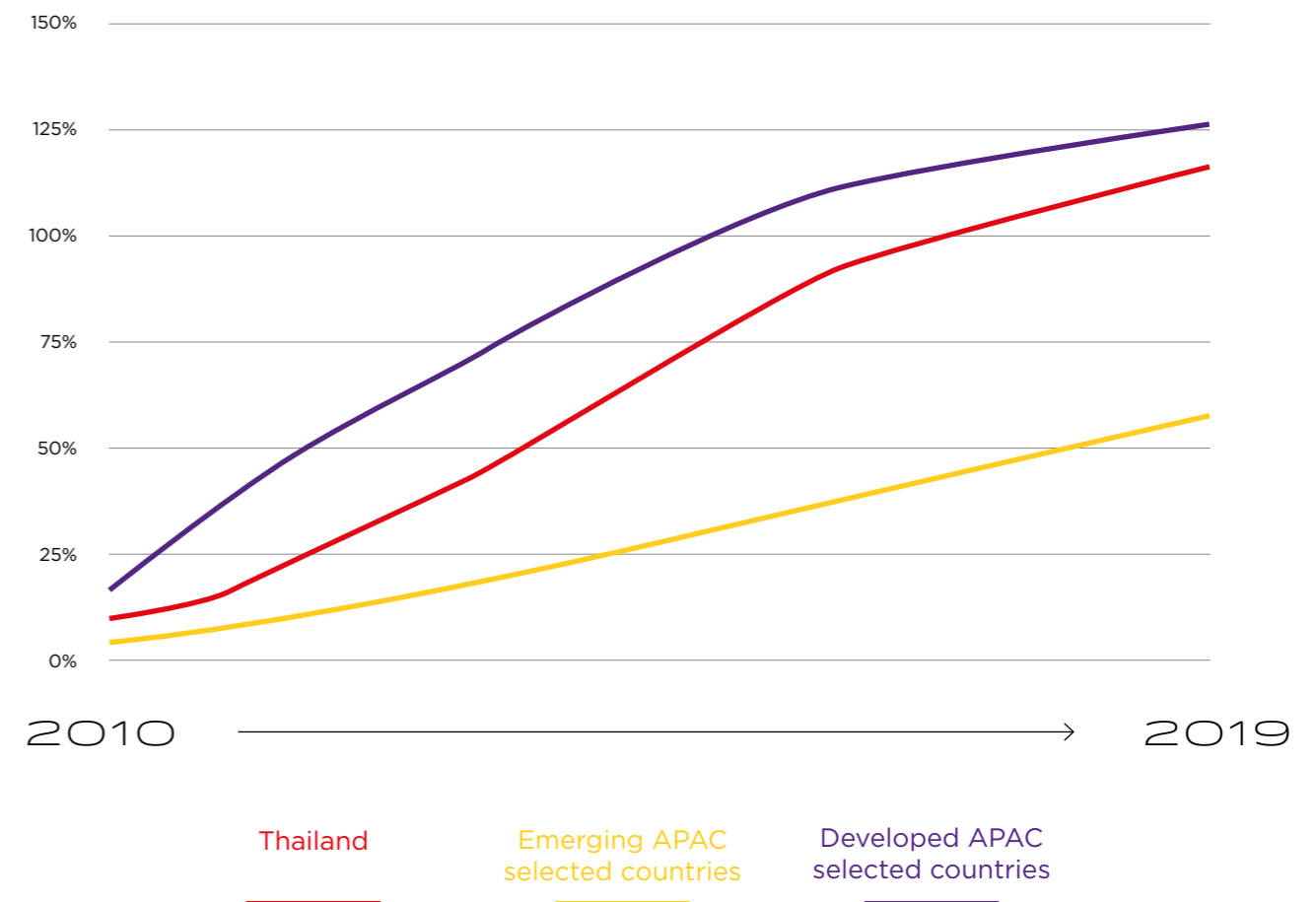
10. TeleGeography.

Mobile broadband penetration in Thailand is now growing rapidly, after a late start in the market while the award of 2.1GHz 3G licences was awaited. Figure 3.2 shows mobile broadband penetration in Thailand as compared to the average from selected emerging countries in the Asia-Pacific region. Both 2G and 3G

mobile network coverage by the three main operators in Thailand is now extensive, and AIS and True Corp provide 2G and 3G coverage to around 97% of the Thai population. 4G coverage is currently limited to specific urban areas, pending further spectrum award.

FIGURE 3.2

Mobile broadband penetration in Thailand vs. average from selected emerging and developed Asia-Pacific countries¹¹



Source: Analysys Mason, 2015

Despite a delay to the 3G launch, Thailand compares well to other emerging countries in the Asia-Pacific region in terms of the number of smartphones now in use. According to estimates from Analysys Mason's Research division, the proportion of mobile subscribers using smartphones will grow to 70-80% by 2019, which is in line with other emerging Asia-Pacific countries.

Although further 4G-suitable spectrum was to be made available in Thailand in 2014, the change in government that took place during 2014 led to delays in this process. As previously mentioned, it is hoped this further spectrum award in the 900MHz and 1800MHz bands will take place in 2015.

11. Emerging APAC includes: Bangladesh, India, Indonesia, Malaysia, Pakistan and Vietnam; developed APAC includes: Australia, Hong Kong, Japan, Singapore, South Korea and Taiwan.

FIXED NETWORKS

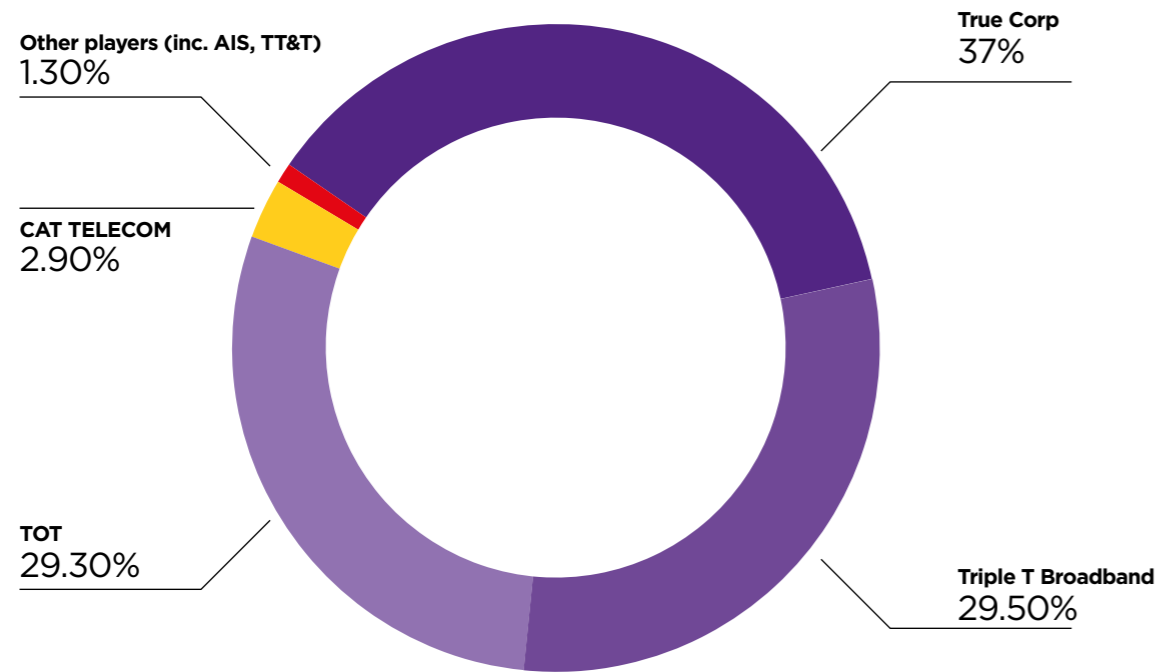
Fixed broadband services in Thailand are currently delivered over a mix of DSL and fibre networks.

The fixed broadband market in Thailand is served by True Corp, which also offers mobile services and holds the largest market share, along with Triple T Broadband and the state-owned operator TOT (which also has a minor market share in the mobile market).

CAT Telecom, another state-owned operator, has been developing its 'Hi-Net' retail brand in 2014, whereas AIS, which also provides mobile services and previously only offered business DSL services, is now deploying fibre services to cover 250 000 homes in 2015. The split of market share by provider is summarised below.

FIGURE 3.3

Share of retail subscribers in the Thai fixed broadband market



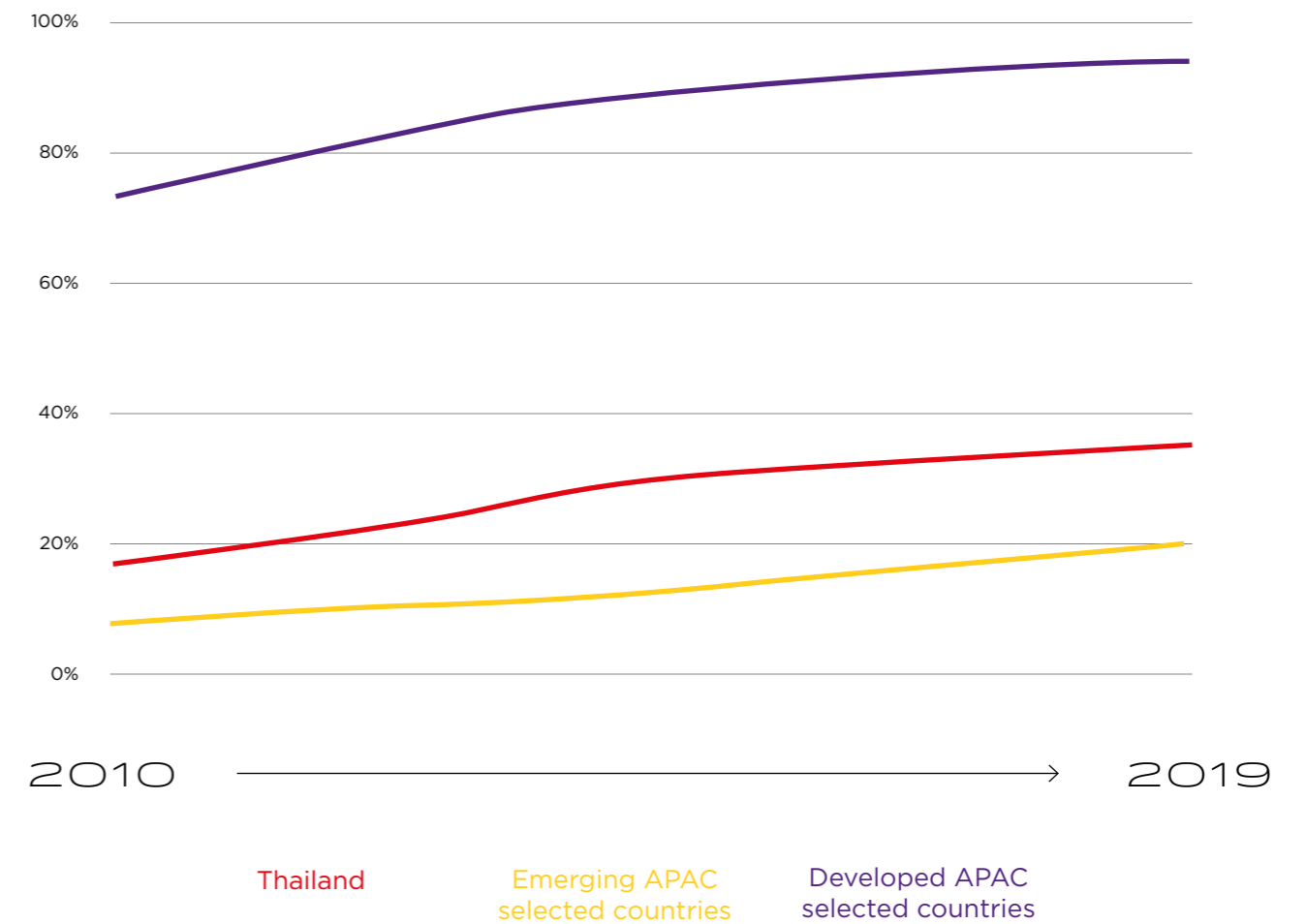
Source: Analysys Mason, 2015

Although growth in fixed broadband connections has slowed down in many markets, modest growth is still evident and high-speed broadband (e.g. fibre) is a core growth area in markets where fibre investment is planned. As shown in Figure 3.4, growth in fixed broadband connections in Thailand is forecast to be very similar to that of a number of other countries in

the emerging Asia-Pacific region, based on estimates from Analysys Mason's Research division. Operators in Thailand are aiming to increase fibre coverage, and the government of Thailand's rural broadband funding programme has been targeted to extend the reach of fixed networks into more remote areas.

FIGURE 3.4

Fixed broadband penetration of households in Thailand vs. average from selected emerging and developed Asia-Pacific countries



Source: Analysys Mason, 2015

3.2 Thailand's digital economy goals, and the role of the mobile sector

Over the last few years a number of frameworks and policies have been put forward aiming at stirring the ICT landscape in Thailand. These include, among others, the Smart Thailand 2020 project, the third ICT Master Plan 2014-2018, the USO Master Plan for Provision of Basic Telecommunication Services (2012-14) and the National Broadband Policy (2009). More often than not, the different policies and frameworks have had overlapping goals and provide a generic direction rather than concrete actionable targets.

In November 2014, the government of Thailand announced a new Digital Economy Plan aimed at increasing economic and social prosperity through

digitisation and placing Thailand at the digital forefront in the Association of South-East Asian Nations region. The plan has been positioned as a policy with high importance for the development of the Thai economy and placed under the direct leadership of the Deputy Prime Minister.

Two goals, to be achieved within a five-year period, have been set by the plan, namely 1) doubling the number of Internet users (from approx. 20 million currently) and 2) doubling the total value of ICT products and services (from approx. THB700 billion currently).

The six pillars of the Digital Economy Plan are:

- **hard infrastructure** – ICT infrastructure, including a nationwide high-speed broadband network, data centres and digital gateways, with the aim of increasing the access to and affordability of Internet services
- **soft infrastructure** – regulations related to cyber-security for the digital economy
- **service infrastructure** – services provided to businesses and individuals
- **digital economy promotion** – promoting the benefits of a digital economy to businesses and the wider society
- **digital society** – increasing the knowledge of new technologies for improving the quality of life and work environment
- **digital knowledge and information** – making accessibility easier through digitisation of services/content

Implementation of the Digital Economy Plan envisages involvement of all stakeholders – the government, regulators, businesses and individuals – in achieving the stipulated goals. If the government of Thailand is

able to fully implement the planned policies, the Digital Economy Plan has the potential to make a significant contribution to the economic and social wellbeing of the Thai population.



4 Benefits from broadband networks and services

A wide range of socio-economic benefit studies have been published in relation to telecommunications, both by the GSMA and industry parties as well as by regulators and policy makers. Most studies focus on the benefits from the availability of broadband infrastructure of all types (i.e. including mobile broadband, but also fixed and other forms of broadband connections, such as satellite).

The basis of these studies is that there are three main routes through which broadband infrastructure and services have an effect on the economy – direct, indirect and induced:

- Direct effects are usually short term and are related to the deployment of infrastructure, i.e. construction works as well as other associated economic activities.
- Indirect effects concern improvements in productivity and efficiency that are possible as new technologies allow faster and more optimised processes.
- Induced effects occur in the long term as innovations and new ideas diffuse throughout society, creating a favourable environment for new services and business models.

There is therefore a clear link between more widespread provision of broadband infrastructure – including mobile – and achievement of the infrastructure pillars of the government of Thailand's Digital Economy Plan. As described above, the economic benefits from infrastructure investment – both fixed and mobile – can also be quantified in terms of the link between broadband connections (through more infrastructure), GDP and jobs.

In the remainder of this section we set out the analysis conducted for this study into the economic impact of increased broadband connectivity on the economy in Thailand. The analysis covers GDP growth and new jobs, as well as the social benefits arising from the mobile sector in particular, and examines how these contribute towards a flourishing, well-functioning digital economy.

4.1 Economic impact

A number of methods have been used in estimating the impact of broadband on economic prosperity.¹² This report draws upon the methodology developed for a recent report prepared by Analysys Mason for the GSMA on the socio-economic benefits of mobile broadband in the Asia-Pacific region.¹³ Our estimates showed that, depending on a country's ICT maturity, a 10 percentage point increase in broadband connections penetration leads to an increase in GDP of between 0.26% and 0.92%. In terms of job creation, an addition of 1000 new broadband connections can result in the creation of up to 33 new jobs across the economy.¹⁴ Countries with a developing ICT sector see benefits mainly from direct effects, whereas nations with a developed ICT sector see benefits from indirect and induced effects. Within the Thai context, a number of adjustments have been made to take into account the specificities of the country.

Thailand is at the brink of an explosion in broadband connectivity, but has been held back from reaching ICT maturity in the past few years due to a number of factors, including:

- lack of spectrum availability for mobile broadband and the delayed award of 4G spectrum
- political change, which has induced general economic and social uncertainty in Thailand and contributed to delays in key policies such as the award of 4G spectrum
- lack of actionable broadband policy targets and related implementation efforts
- absence of liberalisation of spectrum concessions, and the continued use of build-transfer-operate arrangements rather than fully competitive processes for mobile broadband spectrum assignment.

The new Digital Economy Plan holds good prospects for boosting the economic and social wellbeing of the Thai population. For example, releasing 4G spectrum and the related infrastructure build by operators will result in direct benefits for the economy. Further, pent-up demand for data and supportive government-led demand-side policies could create favourable conditions for enhancing Thailand's ICT standing more broadly.

If the Thai authorities are able to facilitate the development of a vibrant broadband market and meet the targets set by the Digital Economy Plan, we forecast that broadband connections penetration in the country may increase from 52% in 2013 to 133% by 2020. What this implies for the Thai economy is that a cumulative GDP increment of USD23 billion (THB730 billion) could be added by the end of the period.

The GDP increment is expressed in nominal terms.¹⁵ Due to Thailand's ICT development level, higher economic benefits are expected to be realised within the initial few years of this period, with diminishing marginal benefits thereafter. In particular, our estimations show that Thailand is likely to enter a phase of ICT maturity in 2016, thereafter shifting to the ICT mature nations' group. The ICT development level is defined according to ITU's ICT development index. ITU ranks 150 countries around the world according three aspects: ICT readiness (level and access to ICT infrastructure), ICT intensity (level of use of ICT in the society) and ICT impact (the result/outcome of efficient and effective ICT use).¹⁶

In addition to the GDP increment, the roll-out of new broadband infrastructure (including mobile broadband) is expected to create a positive impact on the job market in Thailand by creating new skilled jobs. This will contribute positive changes in the general population and the workforce in Thailand through developing abilities and skills to use new infrastructure and the latest emerging technologies.

12. The main methods used to estimate the economic benefits of increased broadband penetration include: multivariate regression modelling, input/output analysis, cost-benefit analysis and the multiplier approach.
 13. See "Today, tomorrow and the future – managing data demand in Asia Pacific" at: <http://www.gsma.com/spectrum/today-tomorrow-and-the-future-managing-data-demand-in-asia-pacific/>.
 14. Further details of the methodology can be found in Annex A.
 15. The estimated GDP impact is not discounted (e.g. it does not take into account the time values of money). For comparison, the equivalent amount based on USD PPP (Purchasing Power Parity) – the basis used in some other reports for estimating socio-economic impacts – would be USD56billion.
 16. See Annex A for further details.

Benefits are likely to arise both from 'connecting the unconnected' as well as from improving efficiency and productivity through having additional connections. During the initial phase up to 2016, benefits are to be derived mainly from direct effects linked, for example, to the construction of new infrastructure related to the development of a fast fixed broadband network as well as investments in 4G infrastructure. As these effects diminish beyond 2016, indirect and induced effects, mainly in other industries (for example, industries that make use of broadband networks) will become more prevalent leading to long-term structural changes in employment and economic output. These effects may be, for example, improvement of productivity as a result of the adoption of more efficient business processes, acceleration of innovation and new business creation enabled by the high-speed broadband infrastructure. Thus in this phase Thailand will derive benefits from increased broadband penetration, which are in line with the benefits reaped by nations with a developed ICT sector.

The estimated benefits for the Thai economy depend on favourable overall developments in the country and the successful implementation of the policies set out by the government of Thailand's Digital Economy Plan.

Potential threats that may jeopardise the impact of broadband on the Thai economy, include, among others:

- political change leading to general economic and social uncertainties;
- delayed implementation of the digital economy-related policies of the government of Thailand, and most importantly the release of 4G spectrum
- failure of the government of Thailand to enact demand-side policies that aim to increase broadband adoption, for example policies enhancing ICT literacy and computer skills; incentivising the development of relevant content and applications (including e-government services and related applications) as well as incentivising businesses to enter the digital economy.

It is noted that a significant proportion of the benefits stated in this section could come from mobile broadband specifically (compared to broadband as a whole), assuming that the legislative and policy environment in Thailand continues to support the mobile sector (e.g. in terms of availability of sufficient spectrum to enable investment in new technology and infrastructure).

4.2 Digital inclusion and other social impacts

Some of the social benefits arising from broadband connectivity are well documented, having been linked to the availability of connectivity more broadly in various previous studies. In particular, improved access to public services including healthcare services, education and other online services are some of the areas where broadband connectivity is known to play an increasingly important role. These benefits are discussed in a recent report prepared by Analysys Mason for the GSMA on the socio-economic benefits of mobile broadband in the Asia-Pacific region, where it highlighted that:¹⁷

- Mobile health applications facilitate rapid diagnosis of critical conditions, improve access to specialised treatment, and act as a platform for remote monitoring and disease prevention.
- E-learning is becoming an important pillar in building knowledge-based societies and opening up education to everyone. It increases educational opportunities, acts as a platform for skill-building and promotes development in rural and remote areas.
- Broadband can improve economic opportunities in these areas and help bridge the digital divide through improving productivity, providing opportunities for non-agricultural jobs and fostering the growth of small- and medium-sized businesses.
- Environmental effects from connectivity are also significant. For example, increased broadband connectivity allows more people to work from home, reducing the need for commuting and business travel, thus decreasing carbon emissions.
- Smart electronic systems are making big steps in increasing efficiency of energy consumption, and the shift towards cloud computing may deliver significant gains in energy efficiency.

Cloud-based services can benefit from availability of the latest technologies being deployed within mobile networks, to enable better streaming of digital content and data. It is noted that better streaming capabilities within mobile networks is needed to respond to market developments occurring in Thailand as in most other countries around the world – such as in use of social media, for example, where significant amounts of data (e.g. photos and videos) are being consumed by mobile users via web services such as Facebook, Twitter and Instagram. These trends will be enabled by the latest technology advances in 4G – and in particular, LTE-Advanced, which a number of operators in other countries in the Asia-Pacific region, and globally, are now rolling out. However, while the use of LTE-Advanced enables operators to substantially improve network capacity, speed and quality, this also requires access to additional spectrum in order to keep pace with market and customer needs. It is important that the spectrum deployed for 4G aligns with internationally and regionally harmonised bands, both in terms of minimizing cross-border interference with neighbouring countries but also to benefit from economies of scale in the equipment and handsets available for those bands.

Mobile operators, equipment vendors, Internet service providers, businesses and other organisations around the world are taking advantage of increasingly ubiquitous smartphone availability, improved mobile data connectivity speeds and better network reliability to offer new services to mobile users. For example, m-money applications are a key area in which mobile operators are proactively offering new services, in partnership with financial institutions.



17. <http://www.gsma.com/newsroom/press-release/more-spectrum-for-mobile-broadband-vital-boost-economic-growth-asia-pacific/>

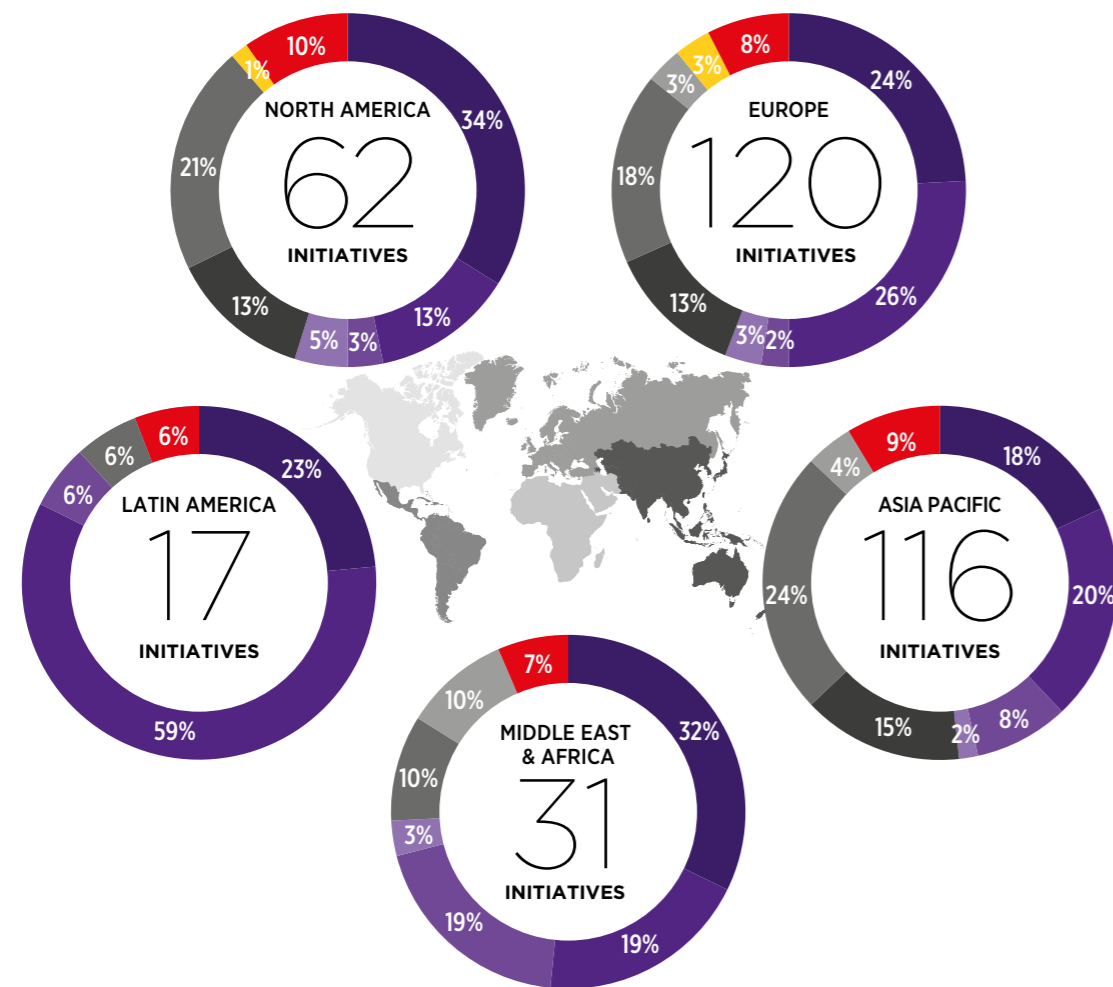
DIGITAL ECONOMY INITIATIVES UNDERTAKEN BY OPERATORS

Within the mobile sector, operators around the world are entering the digital economy, with initiatives in different markets, driven by local and regional market trends. In the wider Asia-Pacific region, operators have been very active in participating in the digitisation process. Among the digital initiatives launched by major operators around the world, tracked by Analysys Mason's Digital Economy Readiness Index (DERI),¹⁸

the Asia-Pacific region stands second after Europe with 116 initiatives (see Figure 4.1). The number and range of initiatives available in the Asia Pacific region are both as a result of the size of the region as well as the availability of advanced 4G networks that have now been deployed in a number of countries within the region. To date, cloud-based services, m-money and m-health are the key applications that operators are focusing on.

FIGURE 4.1

Overview of digital economy initiatives by region



MOBILE HEALTH	MOBILE FINANCIAL SERVICES	MOBILE EDUCATION
SMART HOMES	MOBILE COMMERCE AND ADVERTISING*	CLOUD-BASED SERVICES
MOBILE AGRICULTURE	MOBILE IDENTITY AND SECURITY	VENTURE CAPITAL - ACCELERATOR

* Mobile commerce and advertising also includes location-based services. Cloud-based services also includes OTT, mobile content, big data and software. Source: Analysys Mason's Digital Economy Readiness Index (DERI), 2015

In Thailand, operators have mainly focused on the e-money and e-commerce fields. It is expected that the further roll-out of 4G infrastructure will provide a platform to extend current offerings both in terms of availability and take-up as well as generating new ones. It is also noted that, given the vibrant digital initiative landscape in the Asia-Pacific region, operators in Thailand may look into applying successful digital initiatives already launched in other markets in their home market, once 4G networks have been established. In line with other markets around the world, it is expected that high speed mobile broadband infrastructure will become increasingly integrated with fixed infrastructure, both for consumer and business use. For example in Thailand, True Group is reinforcing

its position as Thailand's leading high-speed home and mobile Internet provider, expanding its high-speed HOME Internet network by investing Baht 33 billion to expand its fibre network (FTTx). True's objective is to reach approximately 4 million households in Bangkok and also to expand to upcountry nationwide to cover a total of 10 million households by 2016. This investment is specifically aimed at helping Thailand become a regional hub for the digital economy.

Examples of successful mobile digital economy initiatives in Thailand include DTAC's mobile agriculture initiative (see Figure 4.2) and True's m-money application (see Figure 4.3). A number of international examples have also been given in Annex C.

FIGURE 4.2

Mobile agriculture initiative - DTAC case study

DTAC empowers Thai farmers through improving farming skills and information on market trends

The Farmer Information Superhighway - a farming application has been a key digital economy initiative undertaken by Telenor. It aims to provide local content to enable farmers to obtain market information, to exchange information and to have access to a nationwide (and potentially global) community.

KEY FACTS

Description	Dtac's 'Farmer Information Superhighway' is aimed at empowering Thai farmers with knowledge on agricultural topics: <ul style="list-style-type: none"> Services delivered include useful tips on farming, access to a network of other farmers and academics for experts' consultation as well as information on climate and weather It is also a platform for comparing product prices at major markets
Digital economy alignment	Societal benefits are that it provides not only a way to farmers to reduce costs, improve productivity and increase their yield but also increases the transparency of the market and farmers bargaining power within the market
Status	Societal benefits are that it provides not only a way to farmers to reduce costs, improve productivity and increase their yield but also increases the transparency of the market and farmers bargaining power within the market

Source: Analysys Mason, 2015

18. The Digital Economy Readiness Index (DERI), published by Analysys Mason's Research division, is a compilation of more than 340 digital economy initiatives by 32 of the largest operators worldwide. Each operator initiative receives a readiness score calculated across two distinct axes: its scale or type, and its maturity. An initiative's scale or type is determined by its implementation size and characteristics.

FIGURE 4.3

M-money application – True case study

TrueMoney contributes to ease of payments, stimulating a vibrant economy

True has been leading in the e-Money space in Thailand, enabling its customers to execute payments easily and contributing to a vibrant economy. True has been at the forefront of innovation through this services e.g. introducing services such as the Touch SIM, the world’s first RFID-embedded contactless payment solution. As Thailand moves closer to a cashless society, TrueMoney and related services (such as iTrueMart for ecommerce and True iContent for content and applications) are aimed at making Thailand a ‘connected society’.

KEY FACTS

Description	TrueMoney is an e-wallet and payment service launched by True. <ul style="list-style-type: none"> • Key services include bill payments, buying, transfers and withdrawals
Digital economy alignment	Mobile payments make it easier for consumers to execute payments, bridging urban/rural divides and offering a platform for further innovation (e.g. contactless payment solutions) and contributing to a vibrant economy.
Status	Launched in 2005, TrueMoney is the leading e-money and payment collection service in Thailand, with estimated ~ 25m customers and USD1.61bn transaction volume. True Money Wallet has been the #1 app in the Thai Appstore since its launch. To further improve services for transferring money electronically, TrueMoney plans to provide a person-to-person payment service during 2015 that allows the transfer of money between customers lacking personal bank accounts.

Source: Analysys Mason, 2015

As these initiatives demonstrate, the mobile sector in Thailand is already supporting the achievement of the six pillars of the government of Thailand’s Digital Economy Plan. The contributions of the mobile sector towards achieving the six pillars of the plan can be summarised as follows:

- Roll-out of 4G mobile infrastructure will result in mobile operators in Thailand investing in the latest mobile technologies available in the market place today (i.e. potentially LTE-A). This contributes directly to the achievement of the government of Thailand’s priority for ‘hard infrastructure’ investment as the first pillar of the Digital Economy Plan. Achievement of this, for the mobile sector, relies on sufficient spectrum being available to support this roll-out.
- Wider availability of 4G services will also contribute to achieving the ‘soft infrastructure’ pillar of the government of Thailand’s plan. The build of new mobile networks will create skilled ICT jobs, providing employment opportunities for individuals and the wider availability of mobile broadband services will contribute to improvement in overall ICT skill levels and abilities.
- The mobile sector can also support achievement of the third pillar of the plan – service infrastructure – by ensuring that mobile broadband services are available to a wide proportion of the Thai population, including the rural and remote areas. Release of additional sub-1GHz spectrum to mobile (e.g. in the 700MHz band) will further contribute to this goal by reducing the cost of wide-area coverage provision. Additional spectrum in other internationally harmonised 4G bands, such as at 2.3GHz and 2.6GHz, will also be important to increase the capacity offered by 4G networks
- As described earlier in this section, the increasing penetration of broadband (in terms of both fixed and mobile connections) can be linked to a substantial increment in the GDP of Thailand, based on Analysys Mason’s estimates in this study. New skilled jobs linked to the build of new mobile networks and provision of advanced mobile broadband services will also be created, as noted above. This aligns with the achievement of the ‘promoting/implementing’ pillar of the Digital Economy Plan.
- Development of mobile applications tailored to specific sectors of the Thai market (e.g. Farmer Information Superhighway) and further development of mobile applications to support local services such as e-learning and e-health will enhance digital literacy amongst the population and build the digital capabilities of industry. This contributes to the achievement of the final two pillars of the Digital Economy Plan, in terms of ‘digital society’ and ‘digital knowledge’.

This is summarised in Figure 4.4 below.

FIGURE 4.4

Mobile sector alignment with the six pillars of the government of Thailand’s Digital Economy Plan

Digital Economy goal	Mobile sector contribution	Key policy enablers	Key risks
Hard infrastructure	Roll-out of new 4G mobile network infrastructure Investment in new mobile broadband technologies	Sufficient spectrum to enable effective provision of countrywide infrastructure and services Availability of sufficient fixed backhaul (e.g. fast-fixed broadband network)	Insufficient spectrum per operator affecting the roll-out of new services
Soft infrastructure	Improvements to ICT abilities and skills of the population/workforce Opportunity for individuals to be employed in skilled jobs, through building of new mobile networks and related mobile services development opportunities	Legislative support to lower cost for mobile network investment e.g. appropriate spectrum governance, voluntary infrastructure sharing, removal of barriers to consent for new radio masts and sites, etc.	Lack of accountability and fairness in spectrum allocation and assignment (e.g. lack of an independent regulator), affecting investor confidence
Service infrastructure	Access to country-wide mobile broadband services	Policies targeted at improving ICT infrastructure access and use in rural areas Release of additional spectrum to mobile (e.g. APT700 band for wide-area coverage) Government services digitisation and establishment of e-government	Lack of long-range (strategic) planning to support emerging technological opportunities
Promoting/Implementing	Increase in broadband connections penetration Substantial increment in GDP* Creation of new skilled jobs	Policies to promote a vibrant broadband market e.g. achievement of the goals of the Digital Economy Plan	Lack of long-range (strategic) planning to support development of a digital economy
Digital society	Development of m-applications to support local services e.g. education and health, as detailed in this report	Building awareness of the Internet and developing digital skills Policies to enhance digital literacy and development of local content (i.e. to encourage use of e-learning applications)	Lack of awareness and education towards the under-served to adapt to emerging mobile technologies
Digital knowledge	Development of m-applications tailored to specific sectors in the Thai market e.g. Farmer Information Superhighway, as detailed in this report	Policies to incentivise businesses to enter the mobile economy	Lack of awareness and education towards the under-served to adapt to emerging mobile technologies

Source: Analysys Mason, 2015



5 Supporting the development of the mobile market in Thailand

The government in Thailand underwent significant changes during 2014, with wide-ranging implications. From the mobile sector's perspective, a key consequence of these changes is that spectrum suitable for 4G services which was to be awarded during 2014 has been delayed. Although the award of 4G spectrum is now planned for 2015, this is yet to be confirmed. This has particular implications for the three largest operators in Thailand which, like many operators in the Asia-Pacific region and worldwide, are witnessing significant growth in demand for mobile

data services, and are therefore seeking to deliver higher data capacity with better coverage through the roll-out of advanced 3G and 4G technologies – for which further spectrum is required.

While the decisions that the government of Thailand makes about the award of 4G spectrum will have significant implications for mobile operators, there are a range of other policy areas where policy-led actions might be required to ensure that 4G networks develop successfully in Thailand.

5.1 Spectrum assignment

Thailand's mobile market operated only, before 2012, on a concessions model for spectrum assignment that was unique to this market. Under this model, the two government-owned operators, CAT Telecom and TOT Telecom, issued rights to the three commercial mobile players to use spectrum on a concession basis.

Since 2012, the spectrum licensing environment in Thailand has been somewhat liberalised, with spectrum for 3G use in the 2.1GHz band being the first to be offered to the three largest commercial operators on a licensed basis. However, the other spectrum used by the three commercial operators in the 850MHz,

900MHz and 1800MHz bands is still provided on a concession basis by the two state-owned operators, and hence this model still heavily influences the market today.

In particular, DTAC and True use spectrum in the 850MHz band on a concession basis from CAT Telecom,¹⁹ and AIS uses spectrum in the 900MHz band on a concession basis from TOT Telecom. The 1800MHz band is used on a concession basis by AIS from TOT Telecom, and by TRUE and DTAC from CAT Telecom. These concessions are all due to expire at various points over the next few years.²⁰

The government is now set to re-farm the spectrum in the 1800MHz and 900MHz bands for 4G. From the mobile industry's perspective, three important points are worth noting:

- Without access to 850MHz, 900MHz and/or 1800MHz spectrum it is unlikely that the three commercial operators will be able to continue to expand their 3G and 4G networks, since the 2.1GHz band alone will not provide sufficient capacity to meet their individual 3G and 4G needs in a cost-efficient way. It is therefore important that the available 900MHz and 1800MHz spectrum is assigned such that these demands can be met, and that the regulatory environment provides stability for the existing network operators to encourage 4G infrastructure investment using these bands. The new assignment of these bands should enable operators to obtain a guaranteed term of future tenure for the assigned spectrum. Best practice internationally is that a 15-year or 20-year term for mobile licences provides sufficient certainty to operators to maximise network investment, although some markets are now moving to offering perpetual licences for mobile use with an initial pre-paid period.
- The 1800MHz band has become a near-global band for LTE deployment, and the 900MHz band has scope to develop in this way, although it is more commonly used for advanced 3G (HSPA and HSPA+) services in many countries at present. Both of these bands, along with the 850MHz band, will be important for the provision of 3G/4G services for the three major operators in Thailand, as well as for the continuation of 2G services, although the precise needs of operators for spectrum in each band will depend on various factors. Technology-neutral approaches to spectrum assignment giving longer-term certainty of availability, as well as flexibility in terms of how spectrum is used by the different players based on their own demands (e.g. allowing operators to determine their own level of demand and technology needs) are therefore highly beneficial in this regard.
- Since the three major operators all provide 2G and 3G services, there is a need to ensure service continuity for those services alongside 4G roll-out until such time as 2G (and eventually 3G) services are shut down. The implication of this is that the industry needs as much as possible of the currently available spectrum (in the 850MHz, 900MHz and

1800MHz bands) to be made available for 3G/4G use as soon as possible, but will also need additional spectrum to be made available in the future to meet business needs. Certainty for the existing mobile operators that further spectrum will be available (e.g. in the 700MHz and other harmonised 4G bands) in the mid-term will therefore be highly desirable in order to support continued investment in better mobile broadband infrastructure.

In terms of what future spectrum options might exist, it is noted that many other countries in the Asia-Pacific region and worldwide have taken advantage of the transition from analogue to digital television (mainly in UHF spectrum) to release a 'digital dividend' for mobile use. A previous study published by the GSMA explored the benefits of this in Thailand.²¹ A particular benefit of the 700MHz band is its favourable propagation conditions for provision of wide-area coverage for mobile broadband services, as well as the depth of coverage that this spectrum can provide indoors. As noted in the GSMA's previous study, the 700MHz band is therefore often seen as being particularly beneficial for improving rural coverage – which is a relevant consideration in Thailand. Other relevant, internationally harmonised bands for 4G use are the 2.3GHz and 2.6GHz bands, which can both provide additional spectrum to boost the capacity of 4G networks.

It is also noted that a number of other countries in the Asia-Pacific region, as well as in North and South America, have already made spectrum in the 700MHz band available from their digital dividends. The 700MHz band therefore already benefits from being a mainstream 4G spectrum option, and its use is likely to increase over the next few years as more countries move to make this spectrum available. In particular, decisions of the ITU World Radiocommunication Conference in November 2015 are likely to bring countries within ITU Region 1 (i.e. Europe, the Middle East and Africa) in line with Region 2 and 3 countries in terms of allocation of the 700MHz band for mobile use, bringing significant benefits from the use of this spectrum in terms of infrastructure, device ecosystems and mobile roaming.²²

19. Whereas DTAC uses 850MHz spectrum on a concession basis from CAT Telecom, the 850MHz service from True is based on a wholesale-resale model whereby a subsidiary of True leases network equipment to CAT Telecom, with True reselling CAT Telecom's 3G services under its 'Real Move' brand.
20. The 1800MHz concession agreements for True and AIS have already expired.

21. <http://www.gsma.com/spectrum/gsma-urges-government-of-thailand-to-allocate-digital-dividend-spectrum-to-mobile/>
22. It is noted that 700MHz spectrum arrangements (i.e. band plans) differ between ITU Regions 2 and 3. Provisional plans for Region 1 may align countries in that region with the band plan that has been harmonised by the Asia Pacific Telecommunity for Region 3.

5.2 Effective regulation

Establishing an effective regulatory regime is a critical requirement to support the functioning of a competitive mobile market. Independence (i.e. a regulator operating with a defined mandate, free of government control) is an essential attribute for a regulator to be effective.

The structure of an independent regulator differs in markets around the world. In most countries, converged regulators now oversee regulation of telecommunications and broadcasting services. This form of regulation – undertaken by a body that is structurally separate from the government – typically ensures a greater degree of transparency and accountability in decisions governing telecommunications policy. In turn this leads to various positive benefits for the local market and for society in terms of improved investor confidence in rolling out new networks and services, creating greater availability of services for end users, and better quality of service.

An important function for independent regulators is overseeing competition in telecommunications markets, both in terms of retail services and in wholesale markets.

In relation to spectrum management, national governance arrangements do differ in different countries, however it is a common practice that the remit of many independent communications regulators around the world includes responsibility for spectrum management. Spectrum management is typically taken to include the assignment of new licences, operating under policy guidance from the national government. An independent regulator is also responsible for implementing market based approaches to spectrum assignment, which are appropriate when new spectrum licences are being awarded, and in particularly where demand for licences exceeds supply.

Given the existence of state-owned companies within the mobile market in Thailand, it will be important that spectrum assignment is managed through an independent body rather than directly by a government ministry. Greater clarity over the roles of the government of Thailand and the NBTC as the regulator is thus essential for the upcoming 4G licensing – ensuring that the NBTC is responsible for issuing licences (with appropriate licence conditions), based on policy agreed with the government of Thailand. Ensuring that all 2G/3G/4G mobile spectrum is available on a licensed basis (rather than under concession) is also an important goal.

5.3 Managing network costs

As mobile networks are used for an increasingly broad range of services and applications, the contributions made to the national economy and to society, as described in this report, should grow. However, the significant shifts that have taken place in the mobile market in recent years in terms of the rise in mobile data usage and the migration from 3G to 4G technology have also resulted in changes to the structure of the mobile industry in many markets, as operators are faced with having to deliver higher data capacity and better coverage through roll-out of advanced 3G and 4G technologies while also managing the substantial costs that these roll-outs entail.

Hence, although the demand for mobile data services in Thailand is accelerating the mobile operators' needs for 3G expansion, and for 4G roll-out, the operators will also need to manage the substantial costs that these roll-outs entail in order to ensure that their business models are sustainable and profitable, in line with other markets worldwide.

Some of the key infrastructure-related changes that 4G roll-out implies, and for which costs need to be managed, include:

- a need to increase the number of sites required per network to support higher levels of data use and to improve coverage for mobile broadband services
- a need for densification of network architecture, with greater need for many smaller (pico) cells, and the associated backhaul
- a need for additional backhaul capacity both for macro and pico cells.

One of the key ways that mobile operators have been able to manage the costs of network roll-out in other markets around the world is through infrastructure sharing. It is noted that in Thailand, there are some leasing agreements between operators to share tower space; however this does not extend to full radio access network (RAN) sharing.²³

Voluntary infrastructure sharing agreements between competing operators can potentially produce a number of positive benefits, both for the operators concerned, and for end users:

- They help operators to manage the risks associated with wide-area 4G roll-out by avoiding some of the duplication of costs that may be associated with competing networks.
- They can enable operators to extend coverage further into less populated areas than would have been achieved without infrastructure sharing. In particular, there are areas in most countries where total demand for services – and hence revenue – is not sufficient to support competing operators providing services, and voluntary infrastructure sharing can help to overcome this barrier, enabling further roll-out without impacting on the ability of operators to continue to compete either in these areas or in more densely populated areas (which, as noted in the following section, is likely to provide benefits for users, from lower prices for mobile broadband services).
- They enable sharing of certain site assets such as fibre backhaul links.

In line with international experience, it is therefore to be recommended that the operators in Thailand are able to make use of sharing arrangements (either passive, or active) to the greatest extent possible. The government of Thailand should therefore ensure that there are no restrictions in place that might prevent these arrangements from occurring as a result of commercial negotiations – notwithstanding any measures that might be considered in order to ensure effective competition (as discussed in the next section).

23. This is linked to the concessionary arrangements for spectrum, as noted previously.

5.4 Ensuring a level playing field with state-owned companies

There is much evidence to support the notion that network competition, generally through privately financed operators, has benefited telecommunications markets around the world. In particular, competition has often been shown to be an effective means of extending telecommunications coverage (both fixed and mobile), as well as providing a choice to consumers in terms of access to services. For the mobile market in particular, incentives to improve coverage are particularly important since this can lead to mobile networks providing a key means of connecting users in remote or hard-to-reach areas without other forms of broadband connection.

Other benefits from competition within telecommunications markets include the following:

- **Price** – in a competitive, investment-led market, consumers tend to benefit through lower prices for services.
- **Roll-out of new technology** – as discussed in this report, the roll-out of 4G networks is costly, but competition between operators is an effective way of incentivising privately financed operators to invest in new technology as a means of providing differentiation and delivering innovation. This also applies in the fixed market – for example in relation to the rollout of super-fast broadband networks
- **Availability** – better coverage and lower prices, both factors that can be linked to network competition in the mobile market, lead to greater availability of services, which will drive take-up and use. This has a number of positive benefits for society as described in this report, in terms of promotion of a digital economy.
- **Customer service** – in a competitive market, operators are increasingly incentivised to provide the best service to their customers to avoid loss of reputation leading to customer churn.

It is noted that, despite competition between the privately owned operators, both fixed and mobile markets in Thailand are still also influenced by the state-owned companies. In the mobile sector, the two state-owned companies each have a small market share, but their impact on the market is much greater as a result of the legacy concession arrangements for spectrum access, and resulting build-transfer-operate arrangements. These arrangements are evident in various recent market developments such as the reported infrastructure sharing agreements between CAT Telecom, True and DTAC.

Accordingly, despite their small share of the mobile market in Thailand in retail terms, there are particular policy considerations relating to the future role of the state-owned operators that should be borne in mind, both in terms of the key policy decisions that need to be taken to encourage 4G roll-out (e.g. in regard to spectrum), and in relation to other policy areas relevant to the mobile market, such as infrastructure sharing.

We provide below a summary of relevant considerations:

- **Investment in the latest 4G LTE-A infrastructure** – the cost of rolling out advanced 3G and 4G services is considerable, and commercial operators are under pressure to manage these costs, as described in the previous section. For state-owned operators, competing demands for funding within different parts of the government can risk delaying the funds available to these operators to invest in the latest mobile technologies, resulting in limited ability to invest. This risk of underinvestment, should it materialise, would affect the local users of these networks (and visitors to the country looking to use the network on a roaming basis).
- **Assignment of spectrum** – as noted above, it is important in a liberalised market that spectrum assignment should be implemented by a regulator independent of the government. The assignment process should allow each individual operator to meet its future network needs. Without this, there is a risk that the longer-term success of the existing mobile network operators is compromised if they are not able to invest in using the latest mobile technologies. Since the terms on which spectrum is made available to state-owned operators risks distorting the market in Thailand, it is important that the overall process is structured in such a way as to be open to all parties concerned. In particular, any spectrum assigned to state-owned operators should reflect the value of that spectrum for mobile use (i.e. reflect the prices paid by commercial operators for similar spectrum). This reinforces the importance of the spectrum assignment process, as noted previously.
- **Infrastructure sharing** – as noted above, upgrading networks to provide advanced 3G and 4G services is costly and operators are under pressure to manage the costs of network roll-out in the best way possible. Avoiding duplication of infrastructure through voluntary infrastructure sharing is one way this can be achieved. In this context, the terms under which any network assets are shared between commercial and state-owned operators should be such that particular operators are not able to obtain advantages over other operators by participating in a infrastructure sharing arrangement with state-owned companies. This is important both in terms of the best way to use public funds as well as how prices in downstream markets (i.e. retail of 3G/4G services to mobile users) are regulated.

6 Recommendations for mobile broadband growth

In this section of the report we provide a summary of conclusions and recommendations from the study. These are aimed at helping the mobile industry and the government of Thailand to drive the social and economic benefits from availability of mobile broadband services as described in this report, both via contributions to GDP and job creation, and in terms of accelerating the achievement of the government's goals for Thailand's digital economy.

A summary of the study's key conclusions is as follows:

- The mobile industry in Thailand contributes significantly to the national economy in terms of GDP growth and job creation. In terms of economic benefits, our modelling suggests that provided there are accommodative government-led policies to promote further investment in broadband services by the main providers of those services (including mobile broadband), broadband connections penetration in Thailand could increase from 52% in 2013 to 133% by 2020. What this implies for the Thai economy is that a cumulative GDP increment of USD23 billion (THB730 billion) could be added by the end of the period.
- A significant proportion of these benefits could come from mobile broadband specifically (compared to broadband as a whole), assuming that the legislative and policy environment in Thailand continues to support the mobile sector (e.g. in terms of availability of sufficient spectrum to enable investment in new technology and infrastructure). In addition, new skilled jobs in infrastructure and service roll-out will be created through the further expansion of 4G networks, creating opportunities for the population and workforce in Thailand to improve their abilities and skills to use the latest mobile technologies and state-of-the-art broadband services.
- As well as driving contributions to the economy in Thailand, mobile networks also generate indirect benefits through the operators' investment in applications and services that drive the digital economy, benefiting society in various ways. Furthermore, as mobile networks are used for an increasingly wide range of services, their impact on the economy, and the social benefits they provide, should continue to grow. The mobile operators in Thailand are positively contributing to the digital economy in various ways, and it is expected that further roll-out of 4G will enable them to contribute further. Section 4 in this report gives a number of examples of their contributions.
- The swift adoption of 3G mobile data services in Thailand indicates that mobile users in Thailand are interested in these services. Hence, there is likely to be demand for 4G in Thailand. Further delays to the award of 4G spectrum could mean a risk of not satisfying this demand, which would have a negative impact on the economic benefits described in this report being fully realised, as noted above.

Key recommendations are as follows:

- The estimated benefits for the Thai economy depend on favourable overall developments in the country and the successful implementation of the plan that the government of Thailand has set out for the digital economy. Potential threats that may jeopardise the impact of broadband on the Thai economy include, among others, political change leading to economic and social uncertainties, delayed implementation of government policies and failure to enact demand-side policies. For the mobile market in particular, a lack of investor confidence is likely if 4G spectrum assignment is not forthcoming. Failure to address these threats could jeopardise a significant proportion of the benefits stated in this report. For the mobile market, award of 4G spectrum as well as continued access to existing spectrum (in the 850, 900MHz and 1800MHz bands) are key priorities.
- Competition between the three largest mobile operators in Thailand should lead to further investments being made to improve the coverage of 4G services once spectrum is available, as well as incentivising the operators to invest in the latest 4G technologies. This will, in turn, contribute to the achievement of the government's digital economy goals. The government should therefore ensure that all measures necessary to encourage competition between mobile networks and more broadly for the telecommunications market as a whole are in place – most notably, in terms of the planned spectrum auction due to happen in 2015, for which there is now an urgent market need, but also in terms of regulation favouring choice and competition across the market, both in terms of retail and wholesale telecommunications provision.
- Effective regulation is also needed to ensure the successful implementation of 4G as well as to oversee the effective functioning of competitive mobile markets more broadly. International experience suggests that an independent regulator – structurally and functionally separate from the government – is essential to ensure greater investor confidence and hence leads to further investment being made in new technologies. Market based approaches to spectrum assignment are appropriate when new spectrum licences are being awarded, and when demand for licences exceeds supply. Greater clarity in Thailand concerning the roles of the government and the NBTC will be fundamental to create a successful 4G spectrum award. The NBTC, working under the policy guidance of the government of Thailand, should be responsible for issuing and administering 4G licences – and for monitoring the subsequent network implementation against any licence conditions (e.g. coverage or roll-out requirements). Ensuring that all spectrum used for 2G, 3G and 4G services is administered via a licensed regime (rather than under concession) is also an important goal.
- The award of 4G spectrum in Thailand should be designed to achieve the most effective use of the currently available mobile spectrum. An assignment process for the available spectrum that is implemented by an independent regulator should ensure that the needs of individual operators can be accounted for. The government needs only intervene in terms of conditions within this award where necessary. For example, intervention might be limited to any measures needed to ensure a level playing field in terms of access to spectrum between the privately owned operators in Thailand and the state-owned companies, noting possible conflicting requirements for the government in this regard, as noted below. Other important considerations in terms of spectrum assignment are the conditions of the spectrum awarded, which should be technology-neutral so as to promote investment in the latest technology, and to give the ability to innovate, and the licence tenure – ideally, licences should give operators long term certainty for investment in use of the spectrum (e.g. a 15–20 year term, or longer).
- In line with experience in many markets around the world, the spectrum that is planned to be awarded for 4G use (in the 900MHz and 1800MHz bands) is unlikely to be sufficient to meet the operators' future spectrum needs in full. Hence, it is important that the government considers plans for future spectrum awards as soon as is practical (reflecting the anticipated demands for more 4G spectrum to be available in the future). Re-allocation of spectrum in the 700MHz band for mobile use, in full alignment with the APT700 band plan, would be a key step towards making further spectrum available in future, along with other capacity-providing bands such as 2.3GHz and 2.6GHz. Spectrum that becomes available for 4G in the future should be assigned using an appropriate market-based process to award spectrum licences, in line with international best practice.
- In terms of managing the costs of 4G roll-out in Thailand, voluntary infrastructure sharing is emerging internationally as a means of managing network cost, in particular for roll-out in remote, rural and under-served areas. The market in Thailand should therefore be allowed to enter into voluntary commercial agreements if they wish to, in order to enable faster roll-out of mobile services. It is noted that there are potentially diverging objectives for the government as a result of sharing arrangements with the state-owned operators (as described in Section 5).

Annex A

Methodology for economic impact assessment

In this section of the report we provide a summary of conclusions and recommendations from the study. These are aimed at helping the mobile industry and the government of Thailand to drive the social and economic benefits from availability of mobile broadband services as described in this report, both via contributions to GDP and job creation, and in terms of accelerating the achievement of the government’s goals for Thailand’s digital economy.

A.1 Definition

We define ‘broadband’ to include both fixed and mobile network connections, including use of smartphones for data, but excluding basic mobile handsets.

A.2 Methodology

In order to estimate the economic benefits resulting from increased broadband connections penetration, the current report uses the methodology developed a previous report prepared by Analysys Mason on behalf of the GSM Association (GSMA) and Huawei, entitled “Today, tomorrow and the future – managing data demand in Asia Pacific”. The report examined the developments in the broadband market in the Asia-Pacific region and estimated the derived socio-economic benefits based on the multiplier approach. The latter approach uses results from published studies examining the impact of increased broadband penetration on the economy to arrive at GDP and job creation multipliers. These multipliers are then applied to the forecast change of broadband penetration in the countries of interest to arrive at the estimated benefits on the economy.

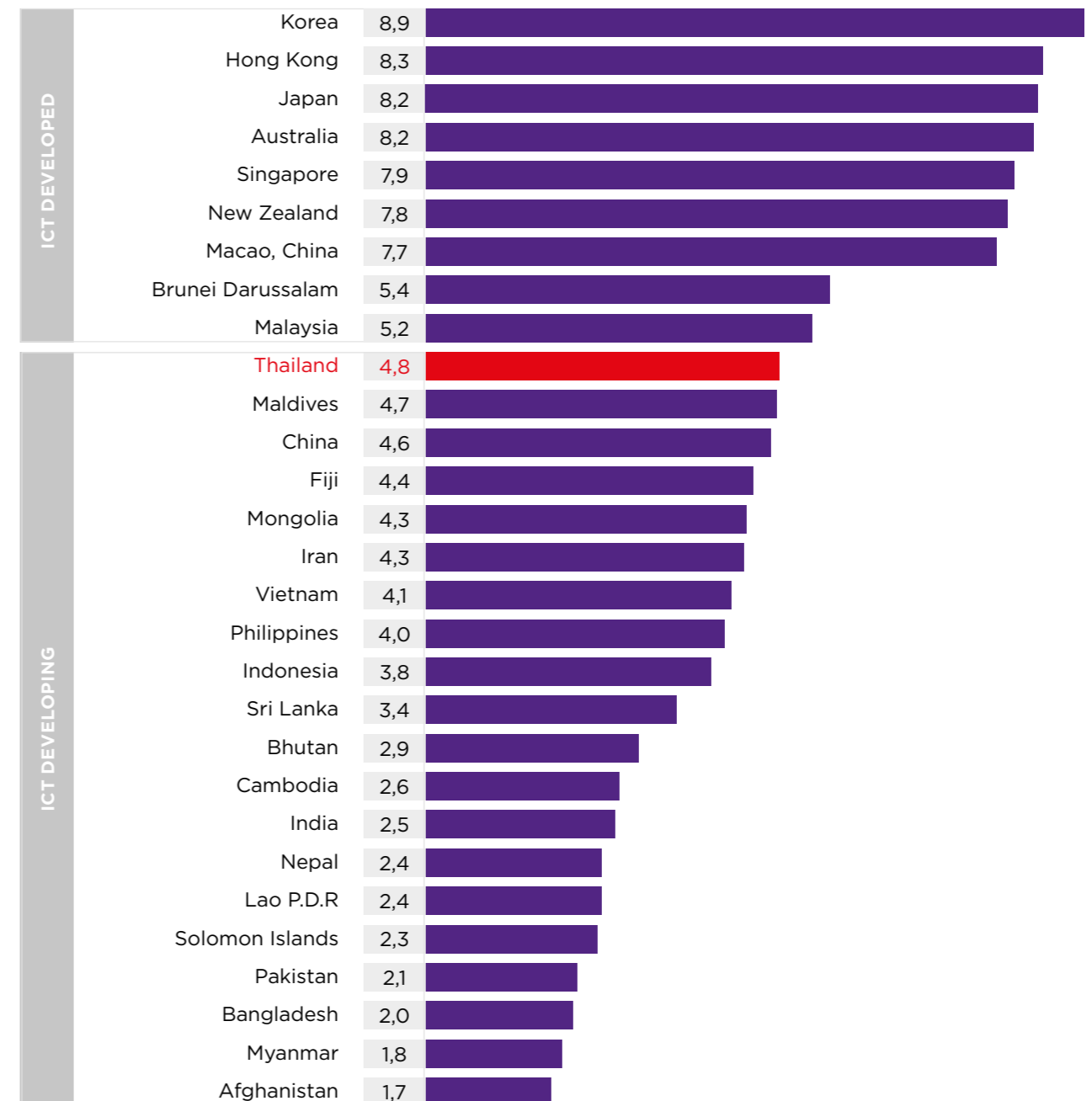
In the above-mentioned report, we made a comprehensive review of scientific papers and business reports estimating the impact of broadband on the economy. Based on the collected evidence and a rigorous process of filtering and normalisation of variables we arrived at consensus estimates. Our results showed that depending on a country’s ICT maturity, a 10 percentage point increase in broadband connections penetration leads to an increase in GDP of between 0.26% and 0.92%. In terms of job creation, the addition of 1000 new broadband connections results in the creation of up to 33 new jobs. The differentiation between ICT developing and developed nations has been done based on ITU’s ICT development index.

More details about the approach we used can be found at: <http://www.gsma.com/spectrum/today-tomorrow-and-the-future-managing-data-demand-in-asia-pacific/>.

The above methodology has been modified in order to take into account the specificities of Thailand. In particular, Thailand’s current ICT development dynamics suggests that it would reach ICT maturity within the forecast period 2013–20. In terms of its overall ICT development level, Thailand is ranked tenth in the Asia-Pacific region and stands at the upper end of the developing countries’ group. Given its position and accommodative government policies, it is likely that it will pass into the developed nations group in 2016.

FIGURE A.1

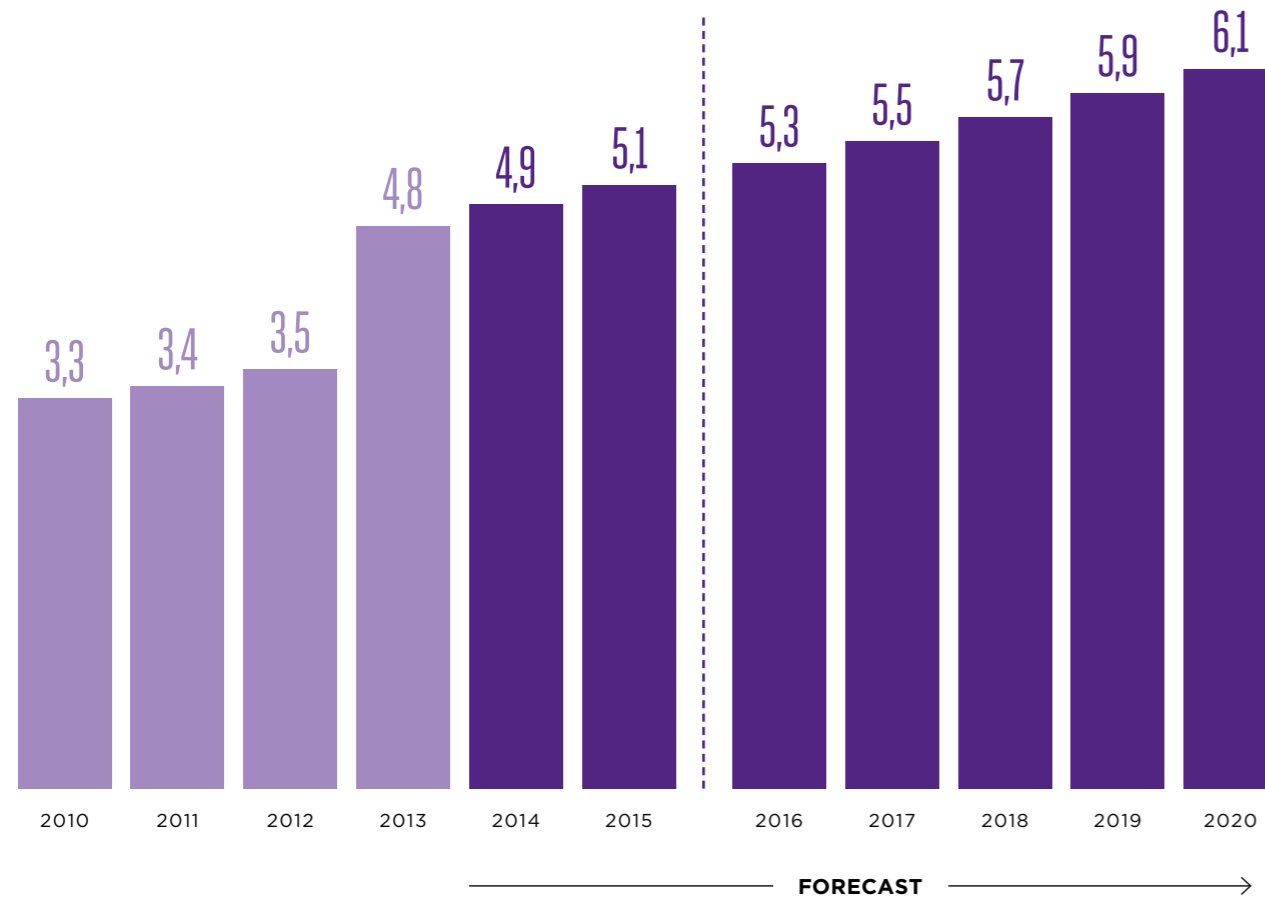
ICT development index – Asia-Pacific region (2013)



Source: ITU, Analysys Mason, 2015

FIGURE A.2

ICT development index forecast - Thailand (2010-20)²⁴



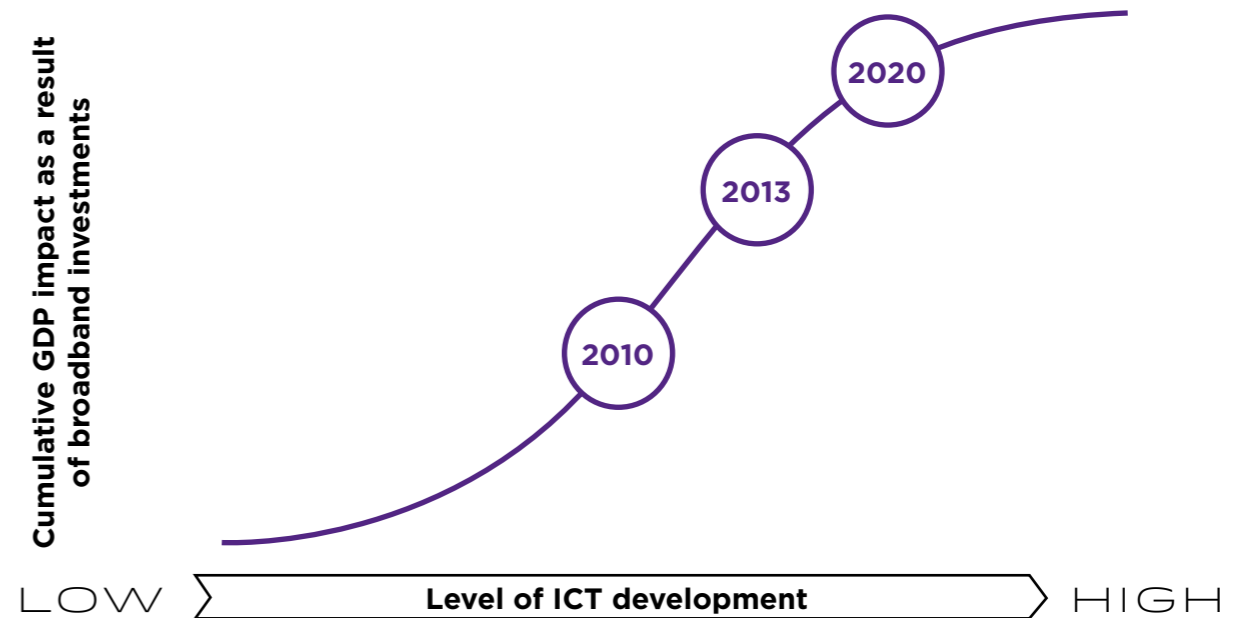
Source: ITU, Analysys Mason, 2015²⁵

This implies that as ICT maturity is reached, the expected impact of broadband on the Thai economy will slow down. As Thailand moves along the 'S-curve' and reaches ICT maturity, it will move to a phase of diminishing returns from broadband investments in terms of direct effects. However, Thailand will continue to derive benefits from induced effects, in line with the benefits reaped by other developed nations.

²⁴ Due to a change in the forecasting methodology done by the ITU in 2013, the index scores for 2012 and 2013 are not entirely comparable.
²⁵ The red line in the graph indicates where we have estimated that Thailand will switch from emergent status to developed status.

FIGURE A.3

Thailand's position on the ICT development curve

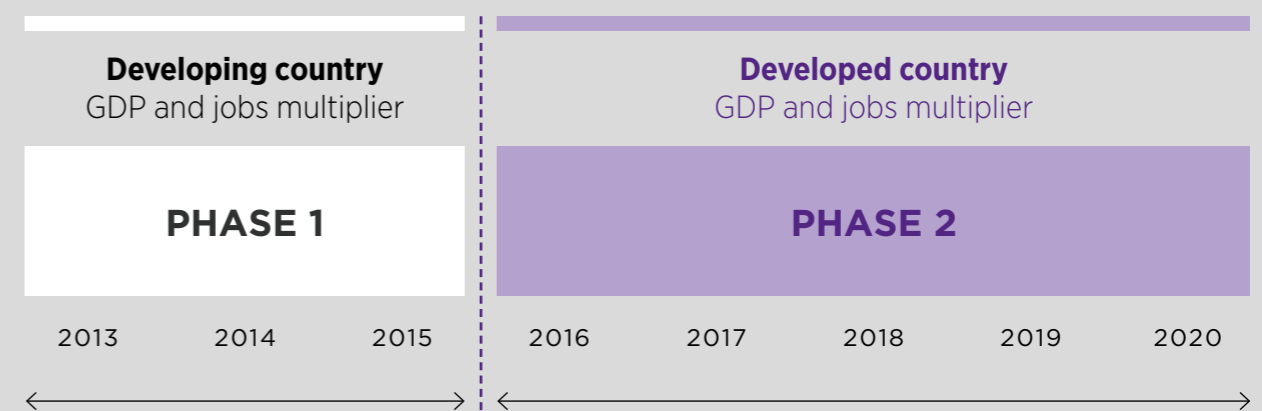


Source: Analysys Mason, 2015

In order to take into account the expected change in ICT dynamics and impact on the Thai economy, we examine two phases of the impact of broadband on the economy. In Phase 1 (2013-16) we use the emerging nations multiplier, whereas in Phase 2 (2016-20) the developed nations value is used.

FIGURE A.4

Methodology for assessing Thailand's ICT maturity and impact on the economy



Source: Analysys Mason, 2015

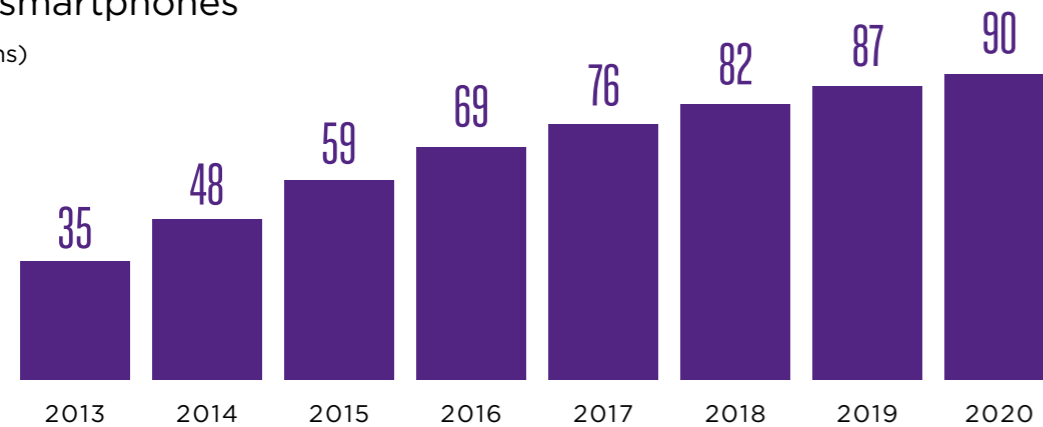
Annex B

Modelling inputs and assumptions

FIGURE B.1

Total broadband connections – fixed, mobile broadband and smartphones

(millions)



Source: Analysys Mason, 2015

FIGURE B.2

Thailand's emerging/developed economic and demographic indicators (2013 vs. 2020)

	Population (million)	GDP (billion USD PPP)	ICT index	ICT classification	BB connections/pop. %
2013	67	964	4.76	Emerging	52%
2020	68	1,487	6.09	Developed	133%

Source: Analysys Mason, 2015

FIGURE B.3

Cumulative incremental impact on the Thai economy (2014–20)

	Percentage point change in bb connection penetration 2013-2020	Cumulative incremental GDP effect (billion USD)	Cumulative incremental GDP effect (billion THB)
Estimated impact	81	23	730

Source: Analysys Mason, 2015

Annex C

International examples of digital economy initiatives

FIGURE C.1

Mobile agriculture – Bangalink, Bangladesh case study

In Bangladesh, Bangalink provides farmers with useful market information

Bangalink's mobile agriculture services have been widely highlighted as examples of how ICT can be made accessible to rural communities and used to enhance standard of living. It has empowered farmers with market information so that they can get a fair price for their goods as well as information on weather conditions and other relevant agricultural information services.

KEY FACTS

Description

VimpelCom subsidiary Bangalink has 3 mobile agriculture initiatives:

- Krishi Bazaar 2474: agricultural marketplace for farmers, providing current prices for crops, and connecting buyers and sellers.
- Krishi Jigyasha 7676: agricultural information service.
- 'Mobile-based Agricultural Information Service': weather warnings, and critical agricultural information delivered to farmers, government officials and NGOs

Digital economy alignment

Improves accessibility to ICT services for rural communities and enhances competitiveness of local farmers by gaining information on pricing and providing connections between buyers and sellers

Status

Krishi Bazaar was launched in 2011 and gained 180 000 subscribers within 3 months of launch. The call-centre based information service (Krishi Jigyasha) receives 40 000 calls per month, from 120 000 users, and Krishi Bazaar receives more than 12 000 calls per month

Source: Analysys Mason, 2015

FIGURE C.2

Mobile health – Bharti Airtel, India case study

In India, Bharti Airtel supplies healthcare information to large segments of the population

Bharti Airtel's mHealth SMS alert packs make health information readily available to the large segments of the population in India that lack Internet access. Subscribers to the service get instant access to expert medical advice.

KEY FACTS

Description	<p>Bharti Airtel has two consumer-focused mobile health initiatives, powered by a clinical decision support solution, staffed by accredited nurses and doctors.</p> <ul style="list-style-type: none"> • Mediphone: A 24/7 general medical information and advice service. • mHealth SMS alert packs: Information and consultations for specific health-related topics.
Digital economy alignment	<ul style="list-style-type: none"> • Specific advice for certain consumer sectors (e.g. women) • Services are targeted at low-income populations but more recent Medibank service is targeted towards middle and upper-income consumers, but in rural areas where access to healthcare is poor
Status	<ul style="list-style-type: none"> • Airtel mHealth SMS alert packs launched in June 2011. • Mediphone launched in November 2011.

Source: Analysys Mason, 2015



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