THE MOBILE EFFECT: HOW CONNECTIVITY ENABLES GROWTH

PREPARED FOR TELENOR ASIA

MARCH 2019

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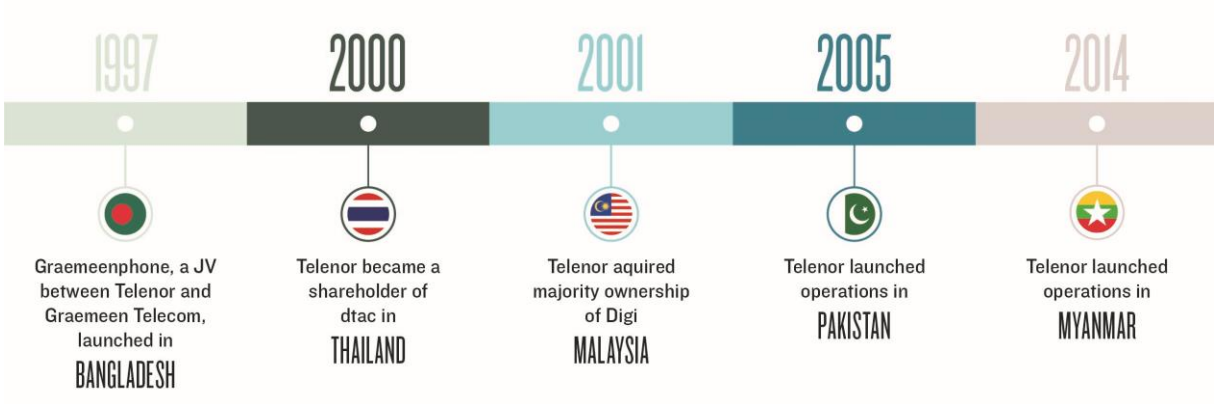
EXECUTIVE SUMMARY

Developments in telecommunications networks have reflected the adoption of digital technologies throughout modern economies. Networks that were designed to carry voice have been upgraded to support transmission of data, with mobile operators, such as Telenor, investing to upgrade their networks and expand coverage. The investments in networks have transformed the role that telecommunications has on our own personal lives. It has changed how we communicate, socialise and interact in our community groups, how we shop and how we consume. It has similarly revolutionised production and supply processes.

In the last two decades, Telenor has been at the forefront of developments in the telecommunications sector in many Asian countries. Since 1997, Telenor has invested in mobile networks in Bangladesh, Thailand, Malaysia, Pakistan and Myanmar.

Figure 1: Development of Telenor in Asia



This report sets out the economic impact that the telecommunications sector, and in particular Telenor, has in the five countries where it has operations/ presence. In particular, we consider:

- the direct contribution that Telenor has on these economies in creating, producing and supplying telecommunications services throughout the economy
- the impact that investments in telecommunications have on productivity
- the role of telecommunications in enabling economic activity in downstream markets
- the role of telecommunications in the supply of social goods and achieving social benefits

The direct impact that telecommunications, and Telenor, has on the economies

The most direct impact that telecommunications has within an economy can be measured by the value of telecommunications services produced within the country.

Telecommunications services providers are significant contributors to economic output in their own right. For example, we estimate that, that in 2017, the telecommunications sector contributed more than USD $15bn to the economies of Bangladesh, Pakistan, Malaysia, Thailand and Myanmar. On

average, this was more than 1% of GDP in each country. Telenor's contribution alone stood at USD $4.3bn.

Telecommunications services providers are also significant employers. The sector as a whole is estimated to employ around 149,000 people across the five countries, with around 8% of these jobs (12,602) supported by Telenor. These employees tend to be highly productive. Employee productivity in the sector (measured by the economic value added per employee) is around US$99,700. This is significantly above the average labour productivity in these five countries, which is around US$6,600 per employee.

Telenor has also supported the economies where it is present by investing in new telecommunications infrastructure and by contributing to government fiscal revenues. In 2017, Telenor invested almost US$1.3 billion across the five Asian countries. Telenor also directly contributed over US$1.7 billion to the fiscal revenues of these five countries.

While the level of investment can vary from year to year, taking the last ten years, Telenor invested almost US$10bn in the five countries where it is present. Almost two-thirds was in the last five-year period, as its investment in Pakistan and Thailand increased and it launched services in Myanmar.

The impact on productivity

There are a number of channels (sometimes related or interlinked) through which investments in telecommunications can improve productivity. These include:

1. More efficient management organisational structures;
2. Lowering costs of production and distribution / communication and data management / processing;
3. Supporting innovation and new services; and,
4. Enabling innovation by supporting collaboration, ideas exchange and learning between different occupations, skills, industries and sectors.

Studies[1] that have considered low and middle income countries suggest that an increase of 10% in broadband penetration results in 2.61% increase in productivity[2]; while an additional percentage point in mobile penetration results in a positive change in technical efficiency[3] of 0.4 percentage point in Asian developing countries, including Bangladesh, Malaysia and Thailand[4]. While a degree of caution should be used in interpreting these results, the last study would suggest that the increase in mobile penetration since 2013 has led to an improvement in the economy-wide productivity and economic growth.

Similarly, there is rich literature on the relationship between investment in Information Communication Technology (ICT) (of which telecommunications is part) and productivity. These studies typically compare productivity growth in countries or firms that use varying levels of ICT capital and suggest an improvement in productivity given an increase in ICT capita.

In particular, these studies show that:

[1] A large body of the literature has considered Total Factor Productivity (TFP) as a measure of productivity. TFP determines how efficiently inputs are utilised to produce outputs: an increase in TFP reflects an improvement in productivity.

[2] Zaballos et al, 2012.

[3] Technical efficiency relates to the efficiency that inputs such as capital and labour are converted into economic outputs, relative to the most efficient

[4] Ferero, 2013

- An increase in telecommunications capital stock of 10% results in an increase in economy wide productivity by 0.5 percentage points in the next three years[5].;
- A 10% increase in communication equipment capital stock is associated with a 0.5 to 0.6 percentage point increase in economy wide productivity[6].

It is difficult to infer how productivity has been affected by investments in telecommunications in the countries where Telenor is present as in low and mid income countries data on the ICT capital stock (and telecommunications capital stock) is unavailable. Nonetheless we note Telenor's US$10bn investment in its five Asian markets in the last ten years is likely to have made a significant contribution to economy wide productivity.

Telecommunications is an important enabler of economic activity

Telecommunications is an important enabler of activity across a wide number of sectors. Indeed, it is difficult to think of a single sector that does not rely on telecommunications services.

Telecommunications infrastructure has helped to transform business processes by allowing goods and services to be produced and distributed more efficiently. It has enhanced both the speed and quality of information flow, which has in turn contributed to substantial improvements in business efficiency, access to markets, communication with customers, and overall management of people and processes. Telecommunications has also led to the establishment of markets for new products and services. In this regard, the substantial growth of the 'digital economy' is particularly noteworthy. This includes the creation and supply of intangible goods, such as software, broadcasting content, books, newspapers, and music, which are now increasingly distributed over telecommunications networks.

We have identified those sectors which are particularly intensive users of telecommunications inputs across the five Telenor economies in Asia, and calculated the economic contribution of these sectors. We find that:

- Telecommunications is used as an input across most market sectors. The sectors that consistently report high use of telecommunications inputs include financial services, retail and wholesale trade, education and health, and transport.
- Sectors that are intensive users of telecommunications generally contribute a greater proportion of GVA than others. Across Telenor's Asia footprint, the 11 (out of 22) sectors that are relatively more intensive users of telecommunications networks contribute between 65-75% of GVA.
- Growth in telecommunications usage has enabled the growth of telecommunications-intensive sectors. From 2005 to 2015, the GVA of telecommunications-intensive sectors in Telenor's Asia footprint grew by 6 to 12% per annum, while GVA per capita grew by 4 to 11% per annum.

While the direct value created by Telenor and other telecommunications companies slows as mobile penetration slows, the economic benefits created by telco-enabled sectors, and the telecom sector itself, will continue play a critical role in contributing to economic growth and the transition towards a developed economy.

[5] Productivity is measured as Total Factor Productivity (TFP). A 0.5% increase in TFP implies the whole economy is 0.5% bigger as the economy is more efficient at turning a given set of capital and labour inputs into economic outputs. Goodridge et al, 2014.

[6] Similarly, productivity was measured as TFP. Frontier Economics, 2011.

Telecommunications also supports wider social goals

The internet has contributed to the achievement of social benefits which, while difficult to quantify, are no less important for the value they generate for society than the economic benefits described above. These can be in supporting the provision of what could be classed as “social goods” (such as health or education) which enable obvious welfare benefits for users who consume these goods. Furthermore, telecommunications networks enable wider social spillover or externalities. This refers to the benefits that members of society obtain from the usage of telecommunications services by third parties.

We show that telecommunications has played a large role in supporting social goals with respect to:

- **Health**, where the adoption of telecommunications technologies has reduced the costs of health delivery, expanded access to health services, facilitated continuing education for medical practitioners and, overall, contributed to improving health outcomes.
- **Social inclusion**, where the increased availability and usage of telecommunications technology has enhanced social participation, particularly for people with disabilities, such as through video conferencing facilities to assist visually impaired persons.
- **Financial inclusion**, where the uptake of mobile and internet banking services has played a large role in providing access to financial services for some previously excluded groups, particularly in developing countries lacking robust financial infrastructure.
- **Agriculture**, where increased use of telecommunications has improved productivity, profitability, food security and employment opportunities by allowing for sharing of information on market prices, farming processes, and weather conditions, access to e-commerce facilities, and use of satellite systems to monitor land usage, crop yield, pests and weeds, and soil moisture and nutrient levels.

1 INTRODUCTION

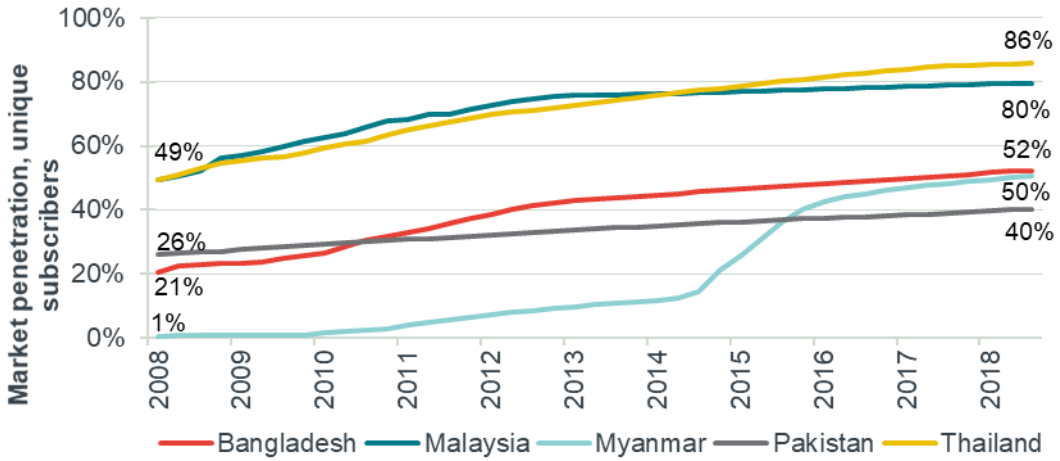
Telecommunications technology has transformative effects on economies, society and individuals. As consumers adopt telecommunications technologies they have changed how we communicate, interact, buy (and sell), and now help us manage everything from our finances to our health. Telecommunications technologies have had equally important impact on production and supply processes. There is not a single area of economic life which is not affected by telecommunications.

As governments, corporations and individuals continue to find new, innovative ways to leverage telecommunications technology for public services, business and our personal lives, the impact will be profound.

1.1 Market context

In the past decade, the telecommunications sector has grown rapidly across Bangladesh, Malaysia, Myanmar, Pakistan and Thailand. For example, **Figure 2** below shows that mobile internet penetration in each of the five countries has increased steadily from 2008 to 2018. In the more developed economies of Thailand and Malaysia penetration is high with unique subscriber penetration rates of 80%, however the rate of growth is now slowing as penetration plateaus. In the other emerging economies (Bangladesh, Malaysia and Myanmar), penetration is lower but the rate of growth in penetration is high (particularly in Myanmar). Inevitably, as penetration growth slows, telecom industry revenue growth will also slow.

Figure 2: Mobile penetration based on unique mobile subscribers by country (2008 – 2018)

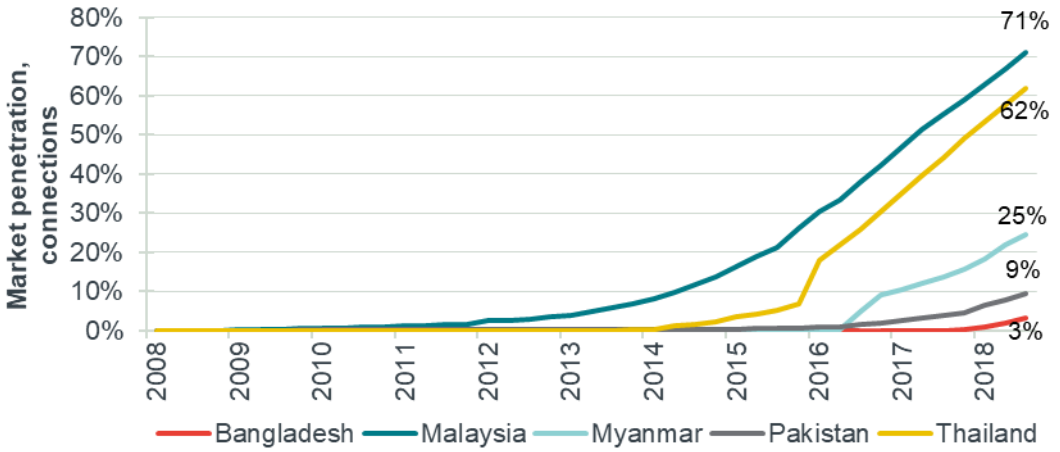


Source: GSMA data at country-level 2008-2018

Note: We have collected quarterly data from GSMA. A measure of mobile penetration based on SIM connections is likely to be higer because a single individual mobile subscriber could hold multiple mobile connections. A unique mobile subscriber refers to a single individual that has subscribed to a mobile service and that person can hold multiple mobile connections.

Similarly, as mobile operators have invested in new networks, the use of the more advanced mobile technologies has also increased. **Figure 3** below illustrates that the penetration of mobile internet 4G has grown in all of the five countries. Penetration of 4G services is very high in the more developed economies of Thailand and Malaysia, and much lower in other countries (Bangladesh, Myanmar and Pakistan).

Figure 3: 4G penetration based on number of connections by country (2008-2018)

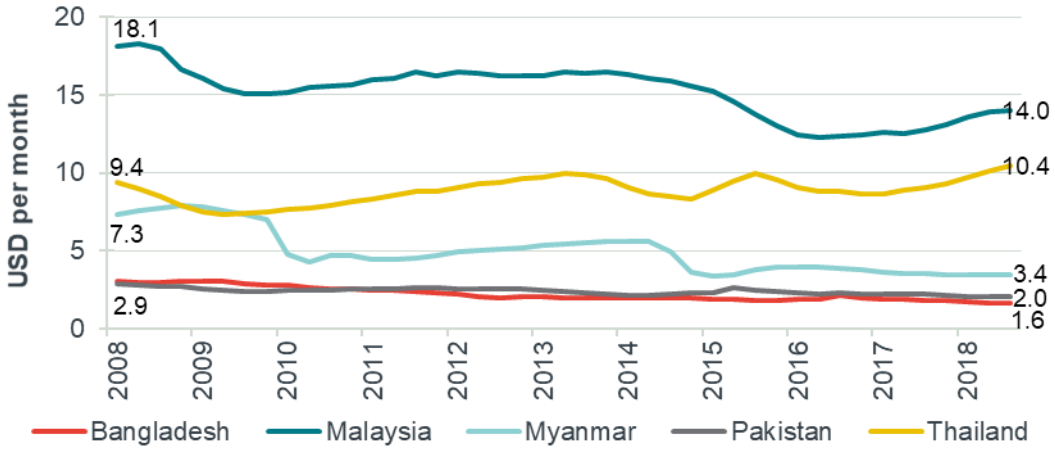


Source: GSMA data at country-level 2008-2018

Note: We have collected quarterly data from GSMA. A measure of mobile penetration based on SIM connections is likely to be higher because a single individual mobile subscriber could hold multiple mobile connections. GSMA only provides data on 4G penetration based on 4G connections.

Despite the significant investment of mobile operators in their networks and the gradual take up, the average revenue per connection has either stayed flat or decreased, in Bangladesh, Myanmar and Pakistan (**Figure 4**).

Figure 4: Average revenue per connection by country (2008-2018)

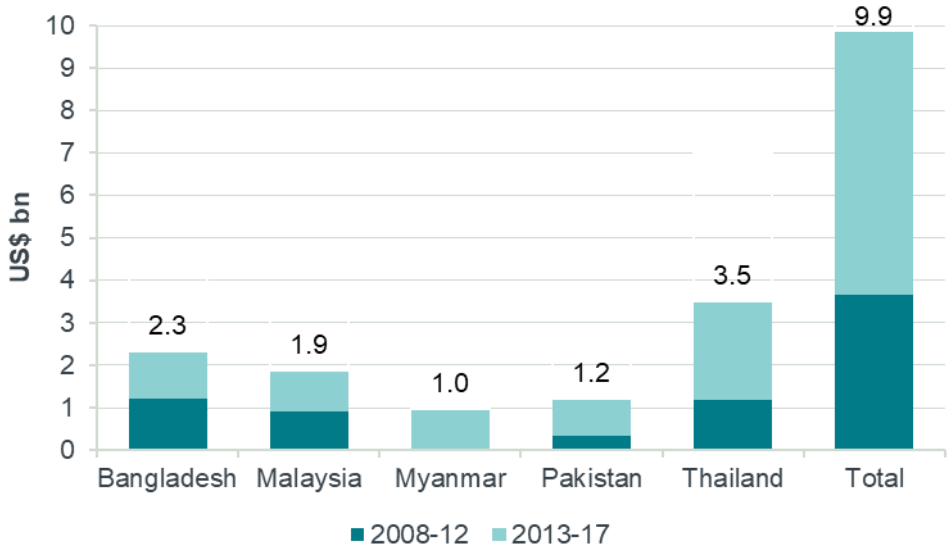


Source: *Frontier's calculation of GSMA data at country level 2008-2018*

Note: We work out the average revenue per connection per month based on the calculation of average revenue per connection per quarter. Connection here refers to all of the mobile connections in the country.

However, notwithstanding plateauing penetration and flat or falling average revenue per connection, operators including Telenor are continuing to invest in their networks (upgrading to advanced technologies, and increasing coverage) as seen in **Figure 5** below.

Figure 5: Total capex excluding investment in spectrum auction, Telenor-owned companies



Source: Telenor's data provision

1.2 Telenor's activities in five Asian countries

As a global telecommunications company founded in Norway in 1855, Telenor has been closely involved with developments within the telecommunications industry and the transformations they effect on wider society. In particular, the recent rapid development of telecommunications in Asia has coincided with Telenor's own expansion in Asia over the past two decades.

Telenor:

- launched Grameenphone, a joint venture between Telenor and Grameen Telecom, in Bangladesh in 1997;
- became a shareholder of dtac in Thailand in 2000;
- became the majority owner in Digi Malaysia in 2001;
- launched operations in Pakistan in 2005; and
- launched operations in Myanmar in 2014.

Over these years, Telenor has been a key partner in the development of the telecommunications sector in Asia, and will continue to play an increasingly important role as reliance on telecommunications technology in our daily lives evolves and intensifies.

1.3 Scope of work

Telenor has and continues to have a stake in the economic and social development of those countries where it operates. It has therefore commissioned Frontier Economics to conduct an independent study on these impacts.

This study follows several other such studies commissioned by Telenor over the years, most recently in 2016.[7] This study will focus on impacts in the five Asian countries in which Telenor operates, i.e. Malaysia, Bangladesh, Thailand, Pakistan and Myanmar.

1.4 Socioeconomic impacts considered

This report sets out the socioeconomic impact Telenor has in the five countries where it is present. In particular we consider:

- **The direct impact that Telenor has on national economies.** This captures the value created by economic activity undertaken directly by the telecommunications sector and Telenor. It will cover, for instance, the investment and expenditure undertaken, employment opportunities created, and tax paid.
- **The impact that investments in telecommunications have on productivity.** Investment in telecommunications can lead to economy-wide productivity gains by enabling production and distribution efficiencies; lowering barriers to entry and expansion; and supporting innovation.
- **The enabling impact of telecommunications in downstream markets.** Telecommunications is an important enabler of economic activity across a wide set of sectors. To illustrate this, we first identify telecommunications-intensive economic sectors in each economy and report their contribution to the economy in terms of GVA**.**

[7] KPMG, Telenor's Global Impact – A quantification of Telenor's Impact on the Economy and Society.

- **The role that telecommunications has in the supply of social goods, and on achieving social benefits.** Relative to the economic benefits above, social benefits, while difficult to quantify, are no less important for the value they generate for society. These include private social benefits – benefits that users derive from using telecommunications services and positive externalities – namely the benefits members of society obtain from the usage of telecommunications services by third parties.

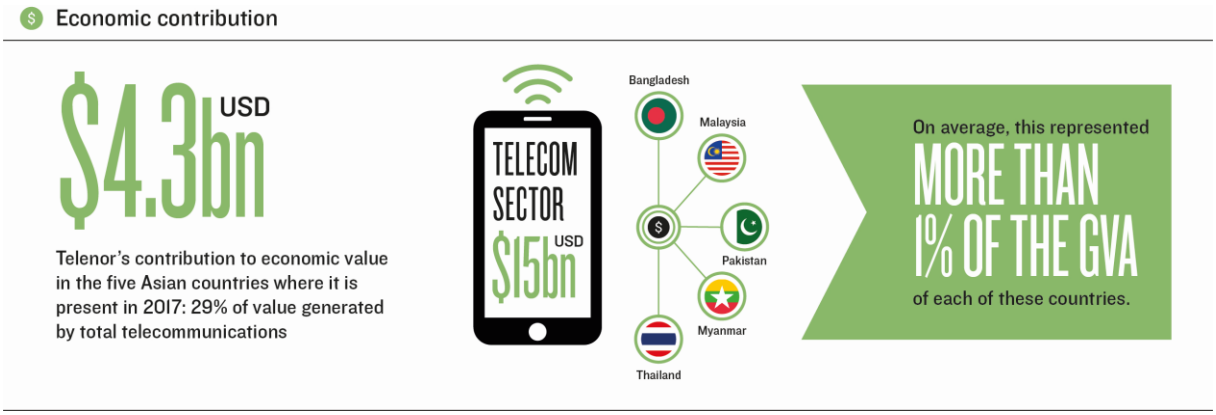
2 TELECOMMUNICATIONS MAKE AN IMPORTANT DIRECT CONTRIBUTION TO THE ECONOMY

2.1 Introduction

Telecommunications services support the entire economy. For example, telecommunications networks have directly supported the digital revolution which is changing how we consume, shop and communicate. However, the most direct impact that telecommunications has within an economy can be measured by the value of telecommunications services produced within the country.

In assessing the direct contribution telecommunications makes to the economy, we consider in turn:

- the total value of telecommunications services produced across the sector and created by Telenor;
- the total number of employed people working in the sector;
- the productivity of the telecommunication sector and of Telenor;
- the value of investments made directly by Telenor; and,
- the fiscal contribution of Telenor.



2.2 Value of telecommunications goods and services produced in the economy

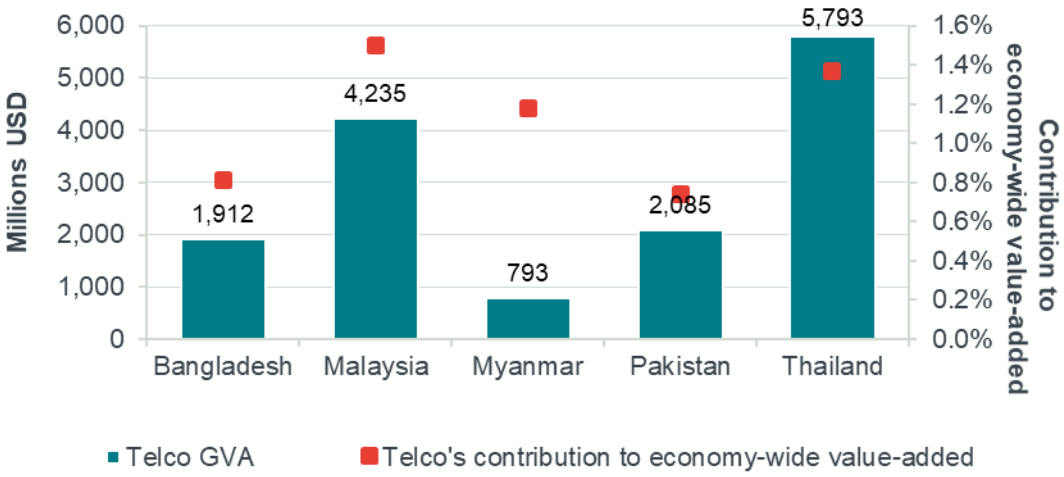
The telecommunications sector makes a significant contribution to economic output in the countries studied. The economic value of goods and services produced within the telecommunications sector can be measured by "value added"[8]. This measures the economic contribution of individual

[8] Economic value added is equivalent Gross Value Added (GVA) in economics term.

telecommunications operators or sectors within a country such that the sum of all sectors' value added (plus total product or sales taxes) equates to a country's GDP.[9]

2.2.1 Sector wide contribution

Figure 6: Economic value added of Telecommunication sector by country (2016/17)



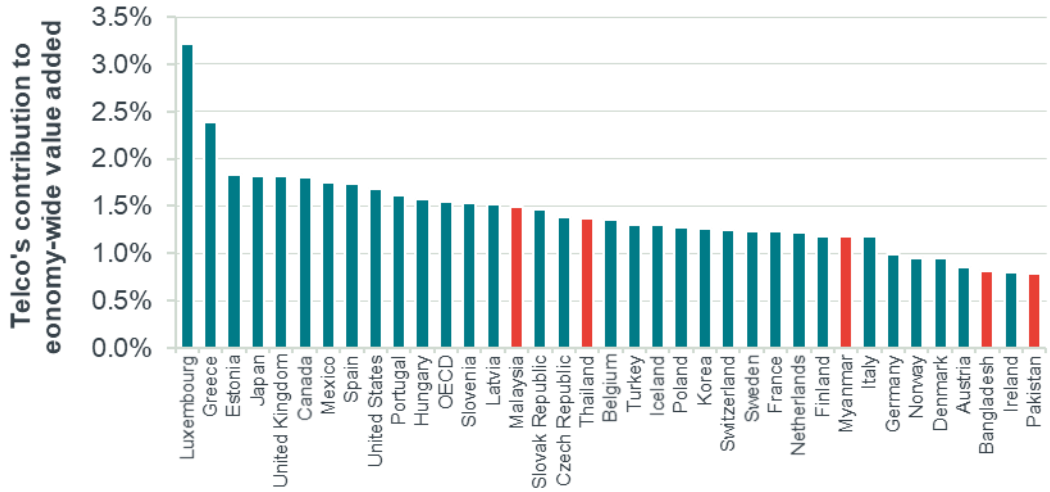
Source: Frontier's estimation based on publicly available annual reports and Telenor's data provision. On economy-wide GVA, we have used "Value added by industries at current prices (ISIC Rev.3 and ICIS Rev.4)". Data for Bangladesh, Myanmar and Pakistan are as of 2017 while data for Malaysia and Thailand are as of 2016. Both datasets are from UN.

Note: We have used the latest data available for each telecommunications operator.

The average contribution of telecommunications services to the wider economy is below the average of OECD countries (where telecommunications services providers contribute approximately 1.5% to economies). Nonetheless, the contribution of the telecommunications sector to economy wide output is not significantly out of line with OECD benchmarks.

[9] In practice, the data on "Net taxes on products" for telecommunication operators is not publicly available. As a result, we believe that GVA is a practical and appropriate measure of economic contribution of the telecommunications sector to the economy.

Figure 7: Economic value added of Telecommunication sector by country as a proportion of economy-wide value added (2015/17)



Source: Digital Economy Outlook 2017, Chapter 3, Figure 3.2 Value added of the ICT sector and sub-sectors, 2015. Non-OECD countries' GVAs are estimated based on publicly available annual reports and Telenor's data provision. On economy-wide GVA, we have used "Value added by industries at current prices (ISIC Rev.3 and ICIS Rev.4)". Data for Bangladesh, Myanmar and Pakistan are as of 2017 while data for Malaysia and Thailand are as of 2016.

Note: Data for OECD countries is as of 2015 whereas data for non-OECD countries, or the five Asian countries of interest, is as of 2016/17.

2.2.2 Telenor's direct contribution to national economies

Telenor itself makes a significant contribution to the value added by the telecommunications sector in those Asian markets where it operates. Out of the US$15 billion created by the telecommunications sector across the five economies in 2017, Telenor alone contributed US$4.3 billion. Telenor's contributions as a share of industry contributions were 60% in Bangladesh, and over 50% in Myanmar.

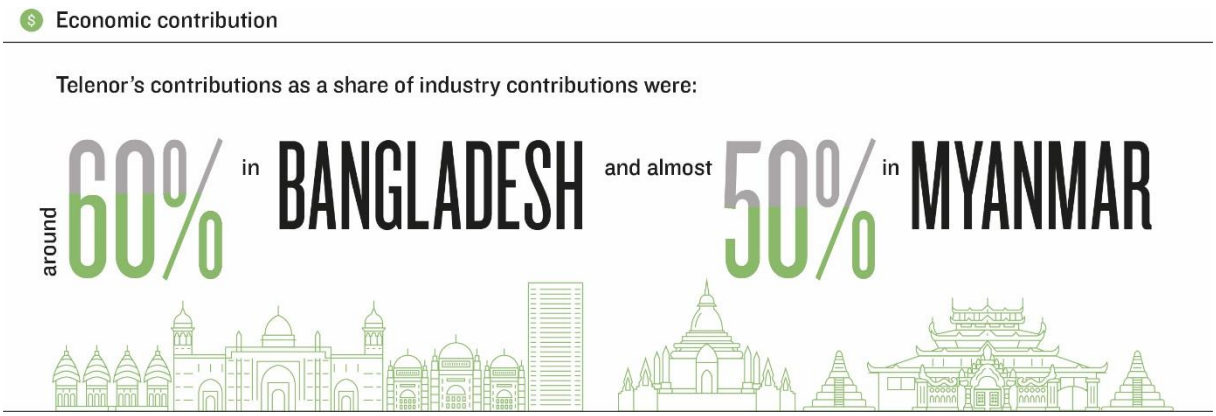
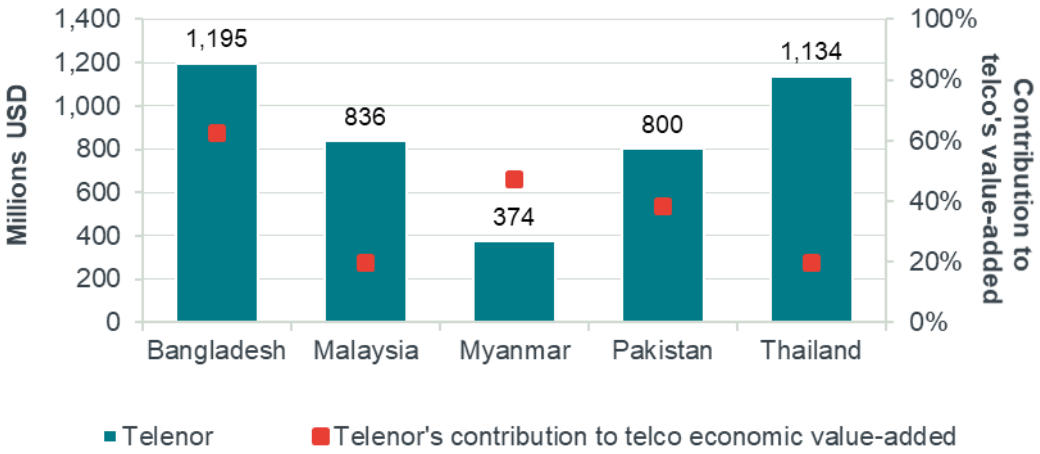


Figure 8: Economic value added of Telenor by country (US$m, 2017)

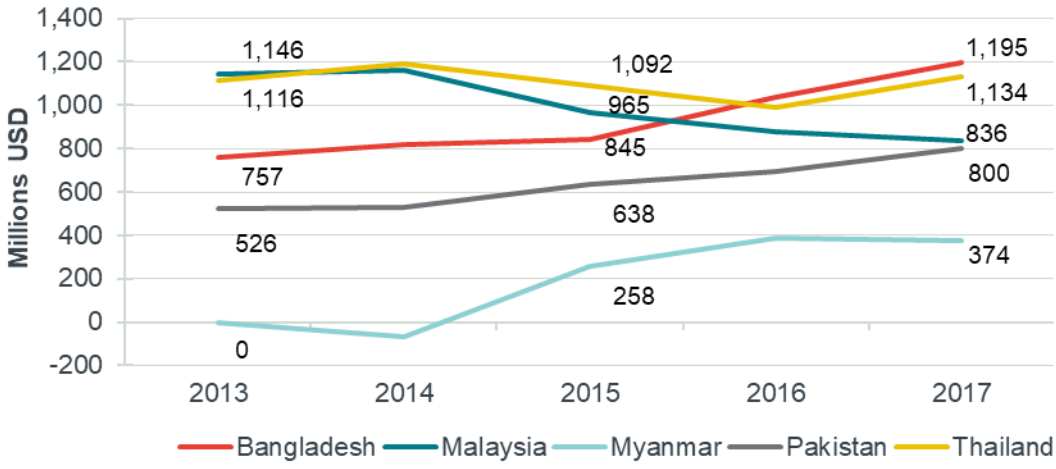


Source: Frontier's estimation based on Telenor's data provision.

Note: We have used the latest data available for each telecommunications operator.

In recent years, the value of telecommunications services produced by Telenor itself has grown significantly in Bangladesh, Pakistan and Myanmar (**Figure 9**).

Figure 9: Telenor's economic value added (2013-2017, US$ millions)



Source: Telenor's data provision

2.3 Contribution to employment

The telecommunication services sector is also an important employer in the economy. The following figure sets out estimates of the total number of employees in the sector in each country. We estimate that the sector employs around 149,000 across the five countries Telenor is present in, of which Telenor directly employs 12,602 people.

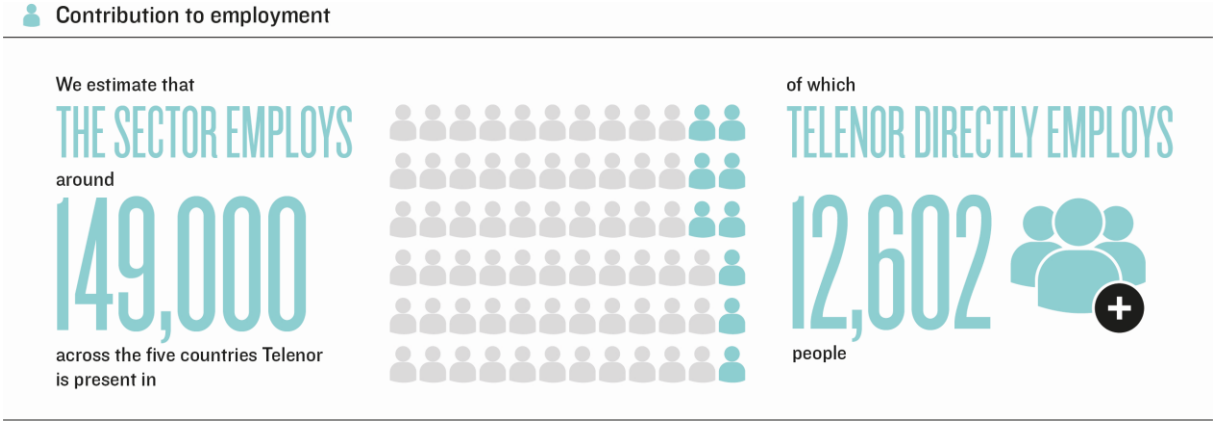
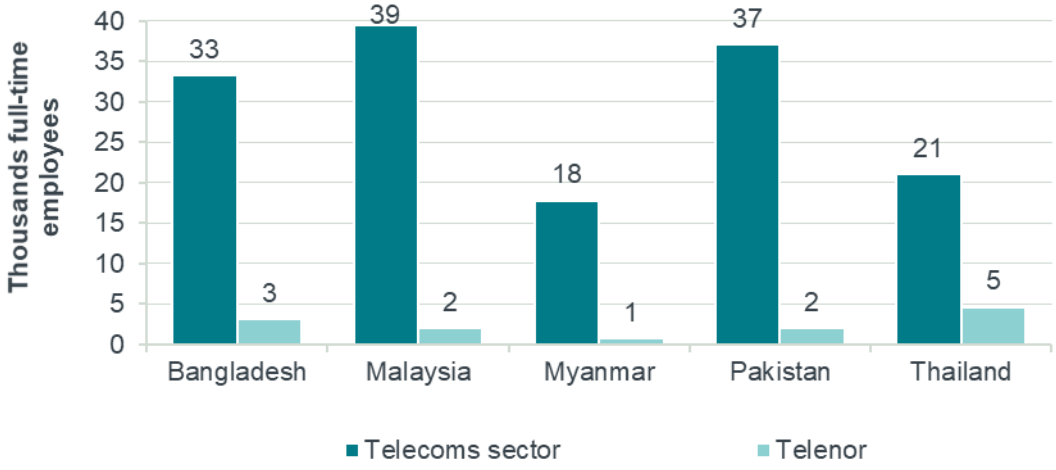


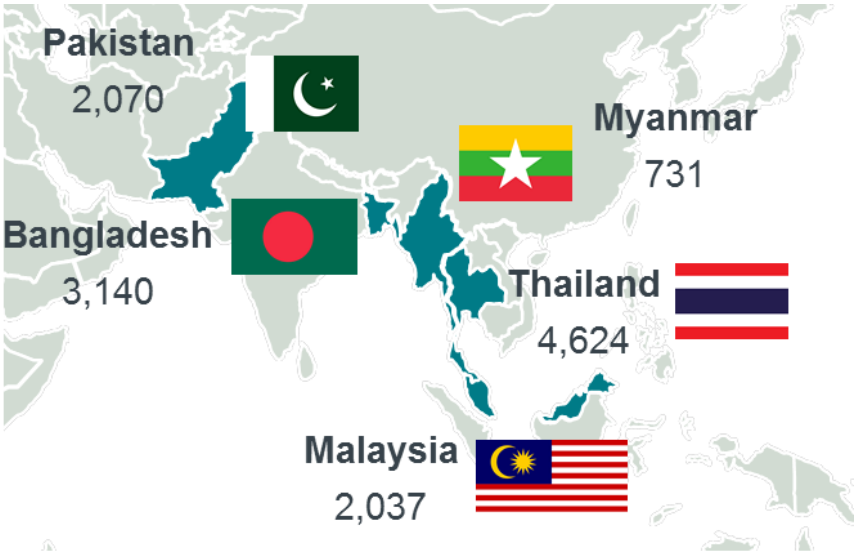
Figure 10: Number of employees (including employees of fixed and mobile operators) in telecommunication sector and of Telenor by country (2016/17)



Source: Frontier analysis of publicly available annual reports and Telenor's data provision

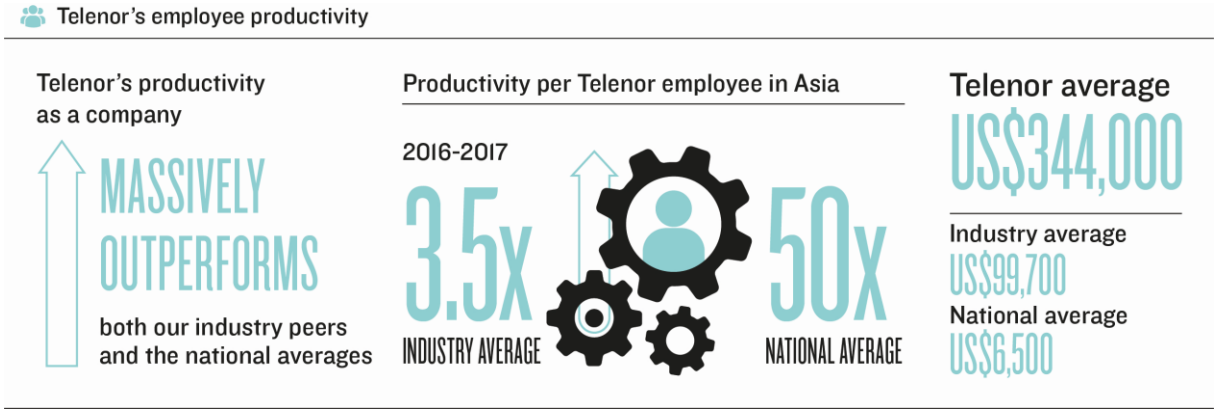
Note: We account for the number of full-time employees as far as possible. We have used the latest data available for each telecommunications operator We note that sector level estimates of employment were unavailable. Therefore, our estimates are based on reasonable assumptions.

Figure 11: Number of full-time employees of Telenor by country (2017)



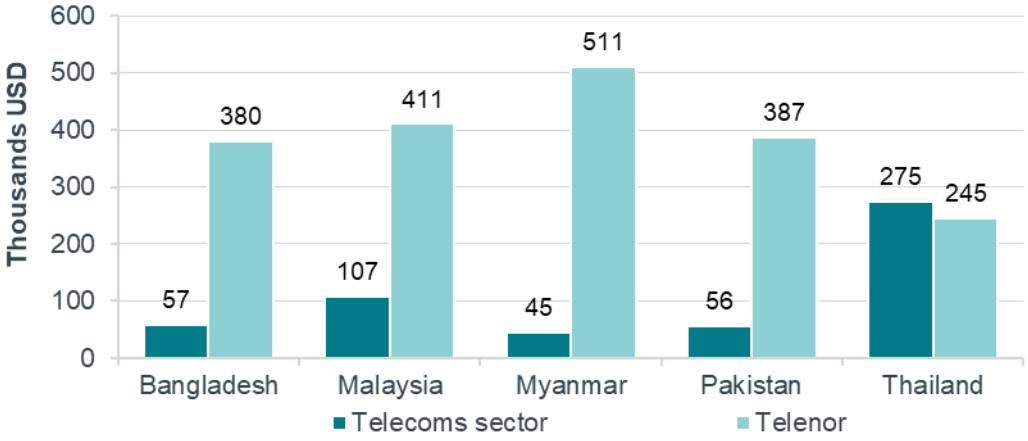
2.4 Productivity

The telecommunications sector is a highly productive sector, employing highly skilled workers from engineers to financial and legal experts. One measure of productivity of the sector is the economic value added per worker produced in the sector. We estimate that in the telecommunications sector, economic value added per employee is around US$99,700 in those Asian countries where Telenor operates[10]. This is equivalent to one third of the average productivity per Telenor full-time employee across Asia (US$344,000). Notably, each Telenor employee contributed US$500,000 to national economic value added in 2016-17, and the contribution was around US$400,000 per year in Bangladesh, Malaysia and Pakistan.



[10] This is the weighted average GVA per worker. The unweighted value (i.e. a simple average of the GVA per worker of the five countries) is US$108,000

Figure 12: Economic value added per worker (2016/17)

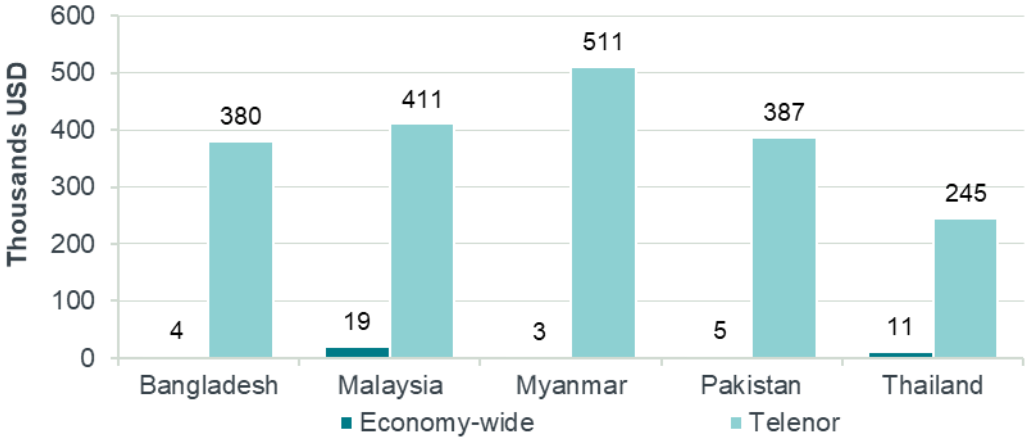


Source: Frontier's estimation based on publicly available annual reports and Telenor's data provision

Note: We have used the latest data available for each telecommunications operator.

Telenor's labour productivity is also over 50 times higher than the labour productivity in those five Asian countries, which is around US$6,500 per worker[11]. The relatively low economy wide labour productivity probably relates to the high proportion of the labour force in the agricultural sector, and the relatively low economic value added per worker in the sector.

Figure 13: Economic value added per worker (2016/17)



Source: Frontier's estimation based on Telenor's data provision. On economy-wide GVA, we have used "Value added by industries at current prices (ISIC Rev.3 and ICIS Rev.4)". Data for Bangladesh, Myanmar and Pakistan are as of 2017 while data for Malaysia and Thailand are as of 2016. Both datasets are from UN. Employment data is from ILO.

[11] This is the weighted average GVA per worker. The unweighted value (i.e. a simple average of the GVA per worker of the five countries) is US$8,400

2.5 Investment in the country

Telenor is a significant investor in the five countries where it operates. This investment supports new technologies such as roll out of 4G services (and in coming years, 5G), as well as growth in coverage of mobile technologies. Between 2014 and 2017, Telenor invested a total of US$6.2 billion (excluding investment in spectrum auction)[12]. Telenor is one of the top three foreign direct investors in all markets from 2008 to 2017[13]. During this period, Telenor was the largest foreign investor in Bangladesh and Thailand, where it invested US$2,213 and US$3,705[14] million respectively.

In the light of declining average revenue per connection as shown in Figure 4, Telenor still makes significant investments in the five economies. While capital expenditure fluctuates to a degree year on year, on average, between 2014 and 2017, Telenor invested US$1.2bn per annum, across the five economies of Bangladesh, Malaysia, Myanmar, Pakistan and Thailand[15]. The average investment in Thailand was US$500 million, the highest among the five economies.

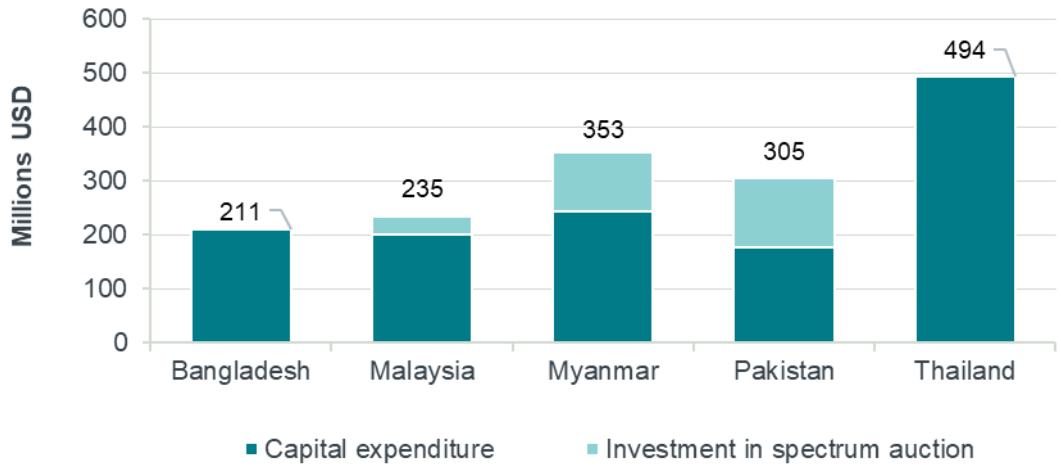
12 Investment in spectrum auction refers to one-time fees paid in the spectrum auctions (since they come with the license) are considered a capex from Telenor's point of view.

13 Source: IMF, Board of Investment (BOI), entity reporting

14 Source: IMF, Board of Investment (BOI), entity reporting, Telenor's data provision

15 Source: Telenor

Figure 14: Average annual investment of Telenor by country (2014-17)



Source: Frontier's estimation based on Telenor's data provision

Note: We define investment as the sum of capital expenditure and investment in spectrum auction, which is a one-time payment for the spectrum acquisition.

Total capital expenditure (including spectrum fees) as a percentage of revenue varies by country but is highest in growing market of Myanmar and lower in more established markets. Notably, between 2015 and 2017, 40% of all revenues in Myanmar were reinvested. This is to be expected given Telenor's relatively recent entry into Myanmar.

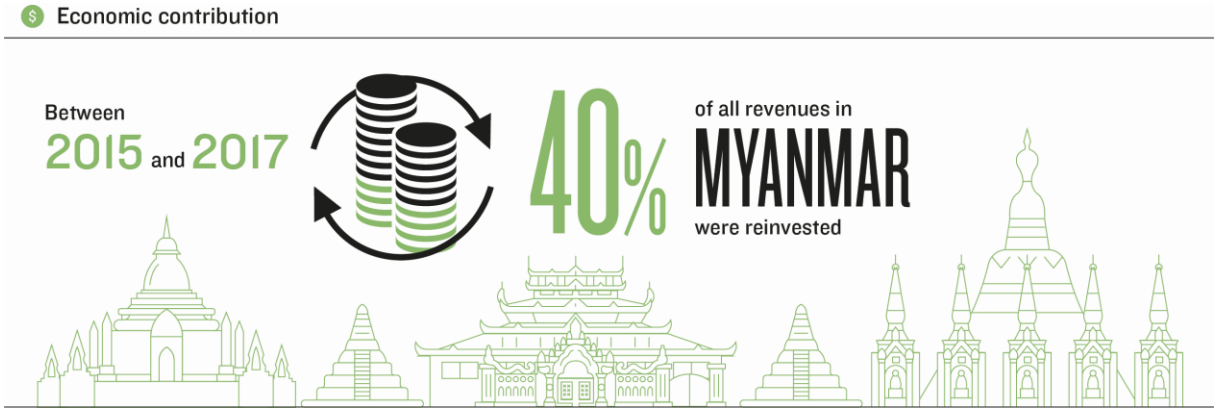
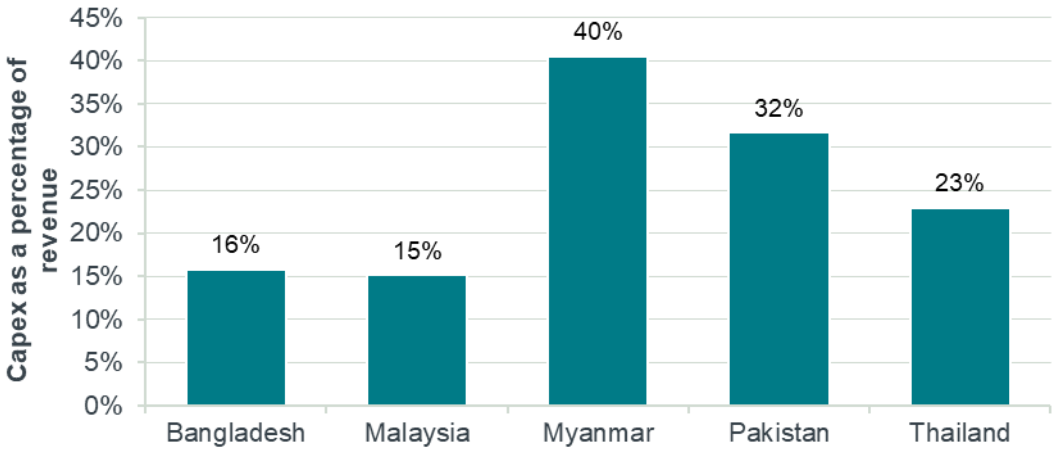


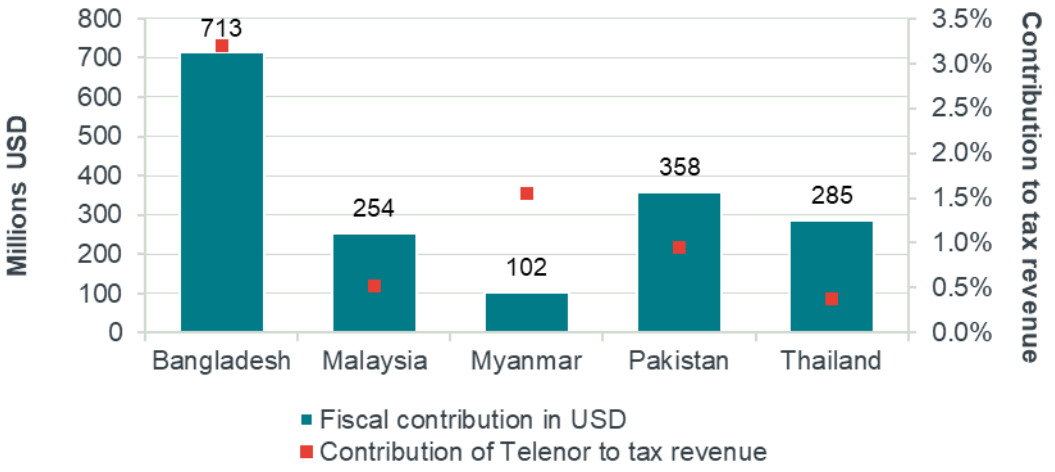
Figure 15 Capex as percentage of revenues average 2015-2017



Source: Frontier's estimation based on Telenor's data provision

Finally, Telenor's services make an important fiscal contribution to government finances, with taxes and licence fees paid by Telenor and other service providers contributing to national economies. Specifically, Telenor directly contributed over US$1.7bn to the fiscal revenues of the five Asian countries where it is present in 2017. In Bangladesh alone, Telenor contributed more than US$700 million to the exchequer, which made up more than 3% of the total national tax revenues.

Figure 16: Fiscal (tax) contribution of Telenor by country (2017)



Source: Frontier's estimation based on Telenor's data provision, IMF Government Finance Statistics & Pakistan Government website

Note: *We define fiscal contribution as the sum of corporate income tax, super tax and sector specific corporate income tax, net taxes on production and other taxes on production.*

3 TELECOMMUNICATIONS AS AN ENABLER OF ECONOMIC ACTIVITY

3.1 Introduction

Telecommunications is an important enabler of economic activity across a wide range of market sectors. Indeed, it is difficult to identify an industry that does not depend on, or benefit from, telecommunications services.

We set out above that telecommunications infrastructure has helped to transform business processes by allowing goods and services to be produced and supplied more efficiently. This is due to enhanced speed and quality of information flows, improved management of people and production processes, improved access to markets and communication with customers, and greater innovation. Not only has telecommunications infrastructure revolutionised existing markets – for instance, the introduction of ride-sharing apps such as Grab and Uber have fundamentally expanded and improved access to point-to-point transportation services – it has also led to the establishment of markets for new products and services. In this regard, the substantial growth of the 'digital economy' is particularly noteworthy. This includes the creation and supply of intangible goods, such as software, broadcasting content, books, newspapers, and music, which are increasingly distributed over telecommunications networks.

In this section, we explore the extent to which telecommunications infrastructure has facilitated growth in different sectors of the economy. In particular, we identify those market sectors which are particularly intensive users of telecommunications inputs across the five Asian economies where Telenor operates. We then calculate the economic contribution of these sectors to economic output (measured by Gross Value Added (GVA)) in order to illustrate the magnitude of the impact telecommunications services have on the respective economies.

KEY RESULTS – GVA CONTRIBUTION OF TELECOMMUNICATIONS INTENSIVE SECTORS

- Telecommunications is used as an input across most market sectors. The sectors that consistently report high use of telecommunications inputs include financial services, retail and wholesale trade, education and health, and transport.
- Sectors that are intensive users of telecommunications generally contribute a greater proportion of GVA than others. Across Telenor's Asia footprint, 11 out of 22 sectors that are relatively more intensive users of telecommunications networks contribute between 65-75% of GVA.
- Growth in telecommunications usage has enabled the growth of telecommunications-intensive sectors. From 2005 to 2015, the GVA of telecommunications-intensive sectors in Telenor's Asia footprint grew by 6 to 12% per annum, while GVA per capita grew by 4 to 11% per annum.
- While the direct value created by Telenor and other telecommunications companies stabilises, the economic benefits created by telco-enabled sectors, and the telecommunications sector itself, will continue play a critical role in contributing to economic growth and the transition towards a developed economy.

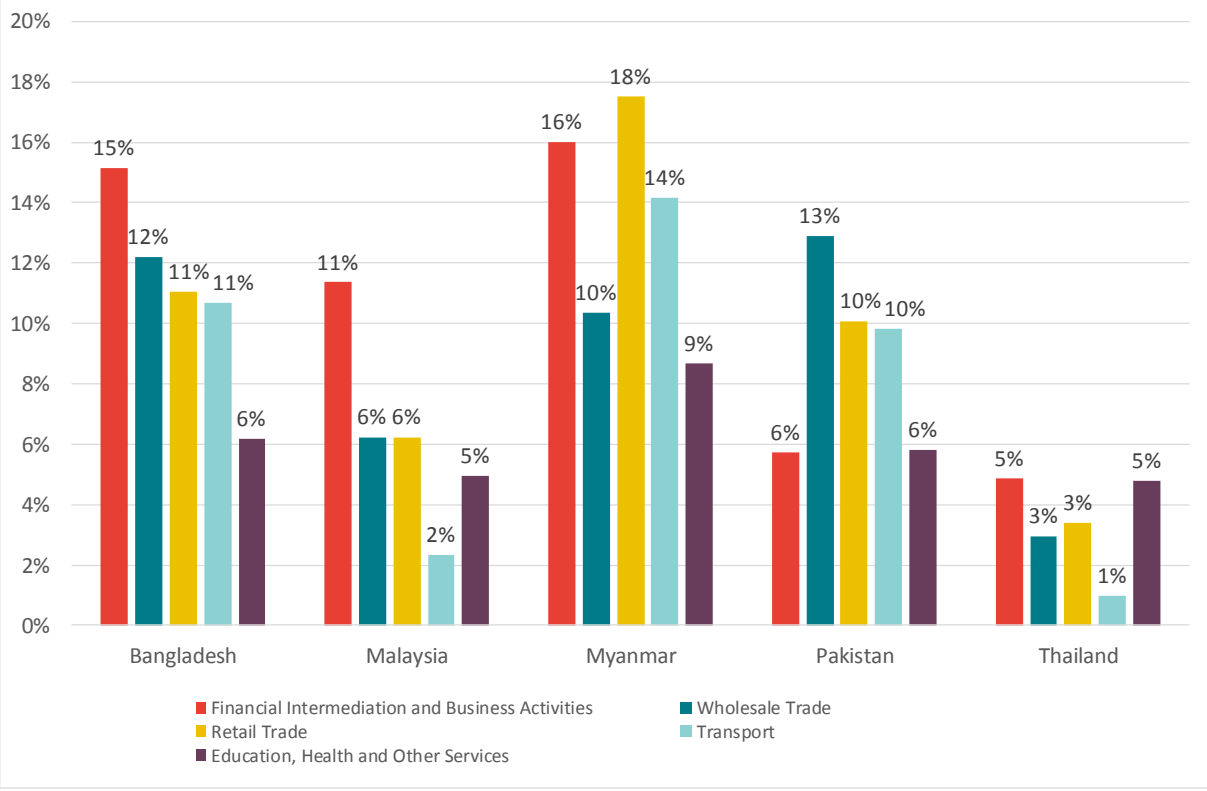
3.2 Telecommunications intensity by sector

An 'intermediate' good or service is one that is used in the production of another good or service. For instance, a business that produces vehicles may require steel from a foundry, leather from a tannery, electricity from a generator, and telecommunications inputs to transmit data and information. In order to measure how intensely a sector uses telecommunications networks, we measure the value of telecommunications inputs used in that sector, as a proportion of the total value of goods and services that are used as inputs in that sector.

We find that telecommunications networks are used to varying intensities across most market sectors in each of the five countries included in our analysis. The sectors that report relatively high levels of telecommunications intensity are financial services, retail and wholesale trade, education and health, and transport.[16]

A summary of the results of our analysis is presented **Figure 17** below, while the detailed results are set out in **Annex B**.

Figure 17: Summary of telecommunications intensity for key sectors



Source: Frontier Economic analysis

[16] Low GVA sectors such as private households (which includes the activities of households as employers of domestic personnel such as maids, cooks, waiters, valets, butlers, laundresses, gardeners, gatekeepers, stable-lads, chauffeurs, caretakers, governesses, babysitters, tutors, secretaries, etc) and the maintenance and repair sector (which includes the maintenance and repair of motor vehicles and motorcycles) are also relatively telecoms intensive. We note this observation, but do not focus on these sectors for the purposes of this report.

Our analysis shows that the financial services sector is an intensive user of telecommunication inputs in Malaysia, Thailand and Bangladesh. The financial services sector is often seen as a vanguard user of telecommunications since financial products and services can be delivered entirely in electronic form, and the sector has sufficient human and financial resources to allow for substantial investment in telecommunications technology. The impact of telecommunications is most readily seen through its role in facilitating electronic payment systems and digital transactions, which vastly reduce transaction costs, enable trades to occur at a higher speed and frequency, and facilitate transactions between buyers and sellers in different locations. The sector has also benefited from: internet banking services, which have allowed a greater proportion of the population to access financial products and services; easier storage of, and access to, financial information e.g., with respect to customer accounts; and the digitisation of the internal processes of financial institutions, which have substantially reduced costs.

The financial services sectors in both Myanmar and Pakistan are relatively less telecommunications intensive, vis-à-vis the other countries. However, growing mobile connectivity – facilitated largely through greater investment by telecommunications companies such as Telenor, and policies targeted at improving mobile uptake by jurisdictional governments and the Asia Development Bank – as well as ongoing innovation in financial e-services, suggest that the financial services sector in these countries represent substantial areas of growth for telecommunications usage.

We also find that wholesale and retail trade sectors are among the most telecommunications-intensive sectors across Telenor's Asia footprint. There are several reasons for this. In particular, the internet has made it easier for firms to advertise their products to customers and to facilitate transactions, such as through online shopping applications and digital marketing. This has, in turn, contributed to the proliferation of business models that place greater focus on the 'digital economy' and developing an online platform, thereby obviating the need for traditional 'brick and mortar' stores. Businesses can also take advantage of improved information flows to reduce costs and streamline operations, including through digitising purchasing, production and distribution processes, the use of online data hosting services, and by centralising operations. In the latter case, telecommunications infrastructure allows firms with multiple locations to centralise administrative functions, such as payroll.

3.3 Economic contribution of telecoms-intensive sectors

Across Telenor's Asia footprint, the 11 out of 22 sectors that are relatively more telecommunications-intensive contribute between 65 and 75% of GVA. We find that higher value-adding sectors use proportionately more telecommunications inputs in their operation and production processes than others.

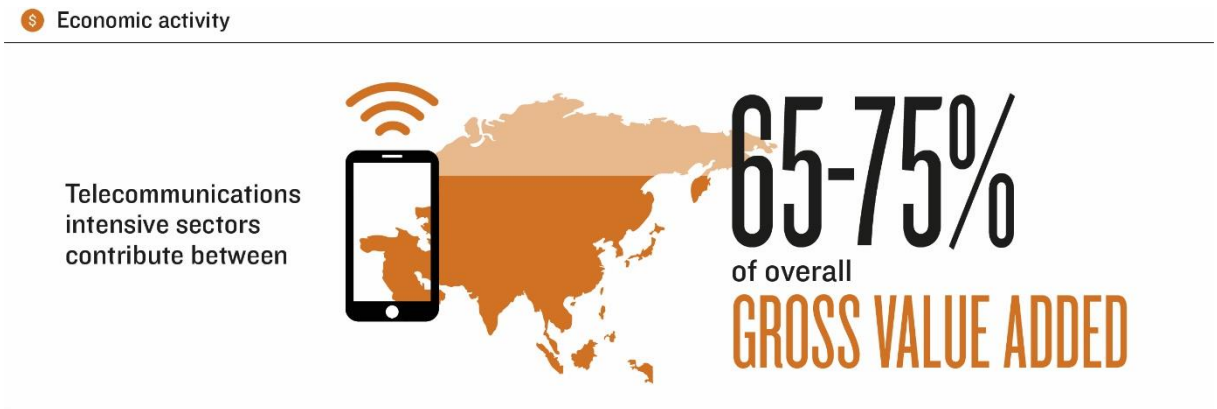
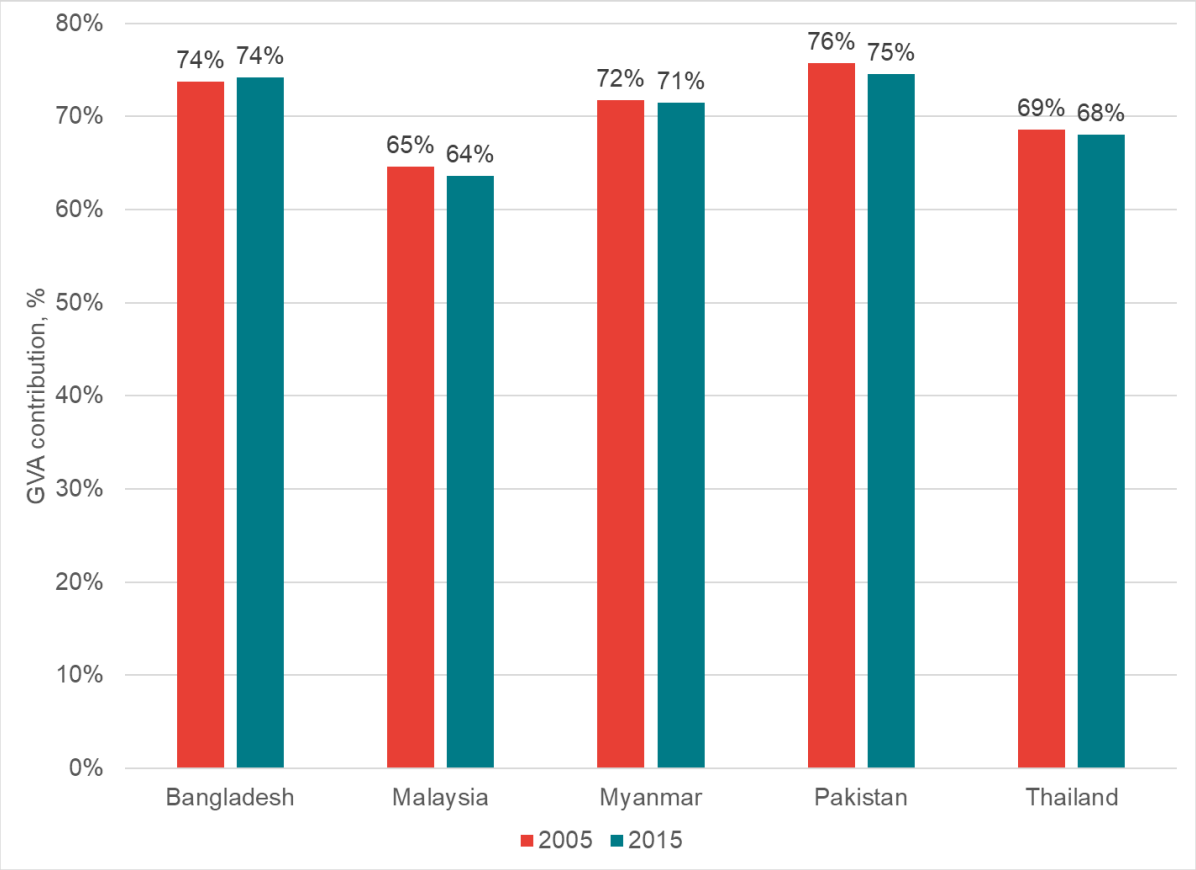
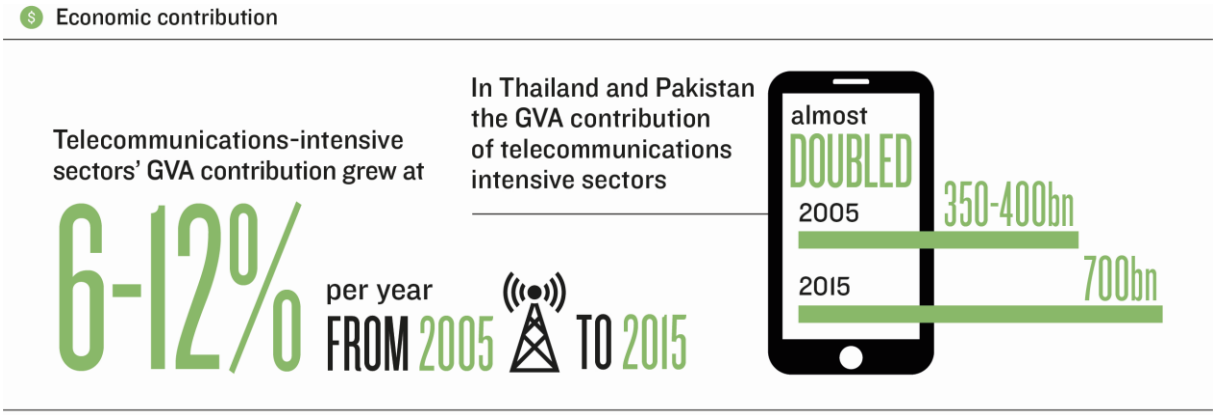


Figure 18: GVA contribution of telecommunications-intensive sectors (above median intensity)



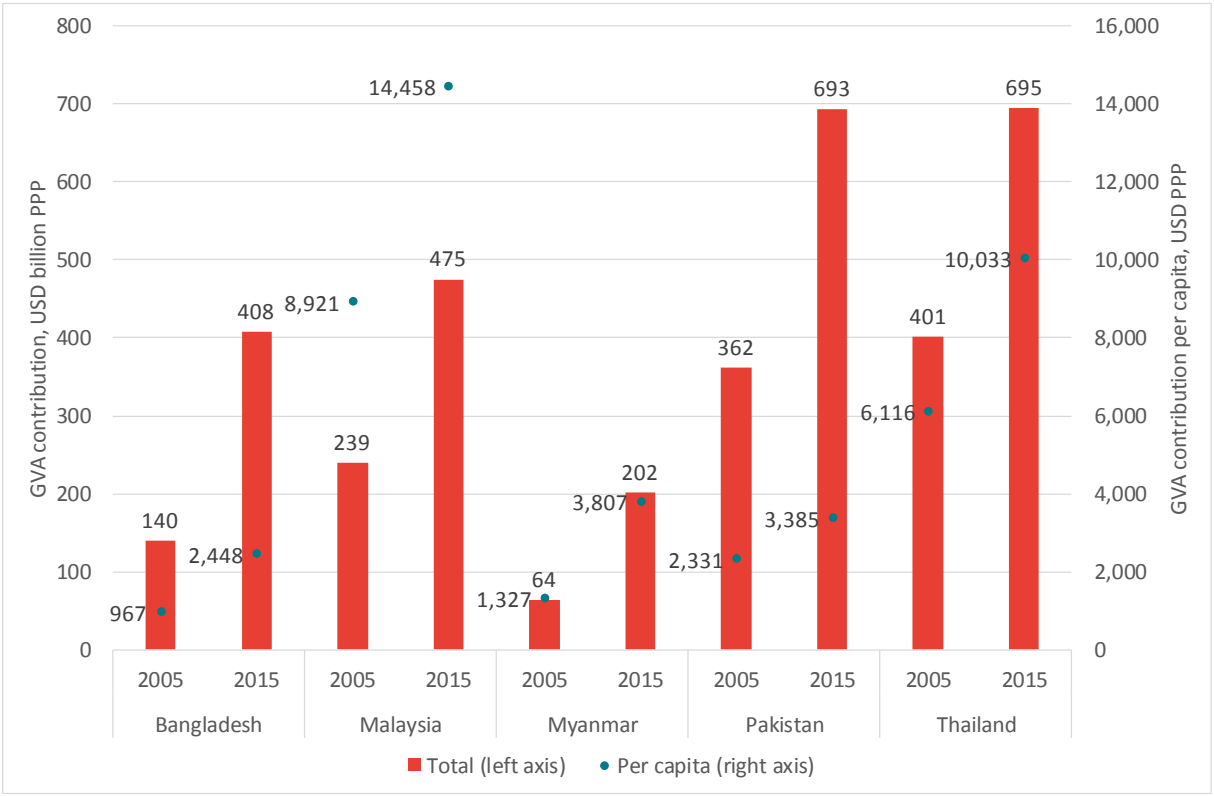
Source: Frontier Economics analysis of 2005 and 2015 EORA Input-Output tables

Substantial economic growth in each of these countries has meant that total GVA from telecommunications intensive sectors grew between 6 to 12% per year from 2005 to 2015. For example, in both Thailand and Pakistan, the GVA contribution of telecommunications intensive sectors almost doubled from around USD$350-400 billion in 2005 to almost USD$700 billion in 2015.



The GVA of telecommunications intensive sectors has also grown rapidly on a per capita basis, increasing at approximately 4 to 11% per annum from 2005 to 2015. In this case, Malaysia and Thailand are the two standout countries, where GVA per capita is between 2 and 5 times higher than other countries. This is likely due to the more developed nature of these economies, which translates into higher levels of economic growth and productive efficiency.

Figure 19: GVA of telecommunications intensive sectors - above median intensity (total and per capita, USD PPP)



Source: Frontier Economics analysis of United Nations GVA data (from either 2016 or 2017, depending on availability by country), exchange rates from the World Bank, and 2018 population estimates from the International Monetary Fund.

A closer examination of the sectors that are telecommunications-intensive and strong contributors to GVA is set out in the table below. We noted in section 1 that as the sectors mature the growth in Telenor's contribution to employment, investment and fiscal revenue across its Asian footprint is likely

to stabilise as mobile penetration reaches maximum level and the uptake of additional telecommunications infrastructure slows down. However, we can see that telecommunications networks enable a number of foundational sectors of an economy that are strong contributors to GVA, including financial services, education and health, wholesale and retail trade, and transport. As the direct value created by Telenor and other telecommunication companies stabilise, the economic benefits created by these telco-enabled sectors will continue play a key role in contributing to economic growth and the transition towards a developed economy. Actions or polies adopted by governments to encourage growth in these sectors will help to ensure that any untapped benefits from telecommunications networks are realised.

Table 1: GVA contribution by sector and country for 2015 (%)

SECTOR	BANGLADESH	MALAYSIA	MYANMAR	PAKISTAN	THAILAND
Financial services	34%	13%	21%	33%	9%
Education, health and other*	13%	6%	12%	12%	7%
Retail trade	5%	6%	7%	5%	9%
Wholesale trade	6%	3%	8%	6%	11%
Transport	3%	4%	4%	3%	4%
All telecoms intensive sectors	74%	64%	71%	75%	68%

*Source: Frontier Economics analysis of 2005 and 2015 EORA Input-Output tables. * Note that Education, Health and Other Services includes education and health services provided by the public sector but does not include other government bodies which are grouped under 'public administration' and have been excluded from this analysis.*

4 SOCIAL IMPACT

4.1 Introduction

Telecommunications technology – and the internet, in particular – have changed the ways in which we live, work and interact with the people and environment around us. As noted in the preceding sections, access to telecommunications services has created substantial economic benefits for users and society. This, however, tells only part of the story. Telecommunications technology has also contributed to the achievement of a range of social goods which, while difficult to quantify, are no less important for the value they generate for society.

The potential for information and telecommunications uses in the advancement of a wide range of social objectives has been acknowledged by governments and regulators across the globe; see, for example, **Box 1** which summarises the ICT initiatives in Pakistan to increase social welfare.

Box 1: Excerpt from the Pakistan Telecommunications Authority Annual Report 2017

Many organizations in the Government and private sector are undertaking initiatives that are directly and indirectly contributing towards achieving the Sustainable Development Goals. For **poverty alleviation**, ICTs have already proven to be a highly successful tool for funds disbursement to the needy through the Benazir Income Support Programme (BISP). For **sustainable and efficient agriculture** production, cellular mobile operators and e-Agriculture community have launched applications to provide updated weather forecasts, market prices, farm advisory etc. to the farmers. Among the **e-health** initiatives, DoctHERS and 'Jaroka' are some of the ITU award winning innovative applications that are making difference in the medical services delivery in Pakistan. In the **education** sector, major initiatives have been taken such as eLearn Punjab, virtual university, Pakistan Education & Research Network (PERN), National Digital Library, Pakistan Sign Language etc. For **gender equality and women empowerment**, the Government of Pakistan has given special attention to the IT capacity building of the girls and PTA has also conducted training for women in mobile application development. For the employment, especially for youth, the Government has set up 4 incubation centers in Islamabad, Karachi, Lahore and Peshawar, startup funding and awareness about entrepreneurship among the young graduates to make them self-sufficient. For the **safety and security** of the citizens, Safe City project is a massive step by the Government which makes extensive use of ICT solutions to keep a watchful eye on the city. To make the **Persons with Disabilities** inclusive members of the society, PTA held a competition 'Mobile App Awards 2016' where the outstanding applications to address the needs of PWDs were awarded by the Honourable President of Pakistan. To provide swift justice and crime reporting, online FIR is a revolutionary step by the Government of Pakistan in the KPK province

Source: Pakistan Telecommunications Authority Annual Report 2017, p. 18 (emphasis added)

In this section, we discuss the social benefits that telecommunications services can achieve in healthcare, social inclusion, financial inclusion and agricultural productivity. As Telenor continues to deliver telecommunications services, it will continue to improve social welfare outcomes in these and other areas.

4.2 Health

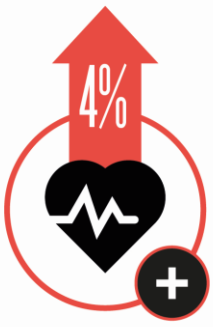
Telecommunications have enabled the use of digital communication technologies to deliver medical care, health education, public health services and health insurance at a distance. In broad terms, this is referred to as mHealth, and includes: (a) 'online' consultations between medical professionals and patients in different locations; (b) the collection and transmission of medical information; (c) remote diagnosis and monitoring of patients, including SMS alerts to enable patients to adhere to their prescriptions; (d) the provision of educational material to train healthcare professionals and to improve health awareness by the public; and (e) the provision of mobile health insurance services.

A key benefit of mHealth is that it reduces the costs of service delivery by lowering reliance on traditional "brick and mortar" models. In addition, mHealth particularly benefits the elderly, whose ailments tend to be chronic and are therefore suitable for remote monitoring. Pregnant mothers also benefit from remote monitoring and readily accessible education on their physiology. mHealth also provides significant benefits for rural locations, enhancing access to healthcare for remote patients by lowering service costs and allowing patients to access specialists located in more developed areas. Internet access also enables continuing education for practitioners in remote areas, e.g., the Australian College of Rural and Remote Medicine offers an online learning platform with virtual classrooms.[17]

> Telecommunications can reduce costs of health delivery, widen access to health services, and facilitate continuing education for medical practitioners

Better health outcomes for individuals carry over to the wider economy by, for example, improving labour productivity since healthier workers are physically and mentally more energetic and robust. It has been found that a one-year improvement in a population's life expectancy is likely to increase output by about 4%.[18] The application of telecommunications in mHealth can therefore be shown to have a positive and significant impact on economic growth, beyond the direct effect of better health on welfare outcomes.

Social impact



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IT HAS BEEN FOUND THAT A ONE-YEAR IMPROVEMENT IN A POPULATION'S LIFE EXPECTANCY IS LIKELY TO INCREASE OUTPUT BY ABOUT 4%.

17 http://www.acrrm.org.au/rural-and-remote-medicine-resources/online-learning-platform---rrmeo

18 Bloom, Canning and Sevilla, *The Effect of Health on Economic Growth: A Production Function Approach*, 2004.

Table 2: Use of telecommunications to facilitate mHealth

USE	APPLICATION
Remote monitoring: Monitoring and reporting of health data and measurements. Devices on medication packets that detect when opened and report when medications are not taken to improve treatment	Simple messaging or data transfer, not in real time.
Emergency alarms for disabled: Alert systems that can be activated by disabled people to call for help, allowing them to be more independent	Low bandwidth connection for sending alert messages
Electronic health records and viewing of medical imaging: Records distribution and ability for specialists to examine medical imaging conducted at remote local hospitals	File transfers, such as insurance reports
Health information: Patients and health workers can access information online. Improvements in health outcomes where patients take preventative measures and improve treatment behaviours	Web browsing
Communication and information sharing: Electronic information flows between care providers to improve planning, coordination and decision making	Emails and document storage and sharing
Aged care services: Services for older people that enable reduced social isolation, in home health care, mhealth, passive health monitoring, falls detection	Web browsing, video conferencing, remote sensing
Training and support: Training for health professionals, especially in remote or rural communities	Video conferencing and online interactive activities
Remote key-hole surgery: Surgery performed remotely – removes the need for patients to travel to large cities to see surgeons, requires equipment in remote locations	Secure reliable network with low latency, surgical apparatus controlled remotely
Remote consultations – Connecting regional hospitals and remote clinicians with specialists for consultations, examinations and prescriptions. For example, dentistry, rehabilitation, stroke neurology.	Requires stable, high quality connection with symmetrical bandwidth for video conferencing.

Source: National Broadband Network Market and Regulatory Report – Volume 2, 2014

There are many examples of the application of mHealth in the countries in which Telenor operates. In Bangladesh, for instance, there is a severe shortage of medical professionals and expertise – in 2015, there were only 4.7physicians per 10,000 people (compared to 43.8 in Norway)[19]. Telenor recognises this disparity and has been an active participant in the mHealth sector, contributing to the provision of health solutions through its telecommunications services. An example of its involvement in this space is through the Tonic application, which is discussed below.

[19] WHO Key Country Indicators (www.WHO.int)

Box 2: Digitalising Health in Emerging Asia

How can mobile technology make a positive social impact? Tonic is one way in which Telenor leverages mobile technology to increase access to care in emerging markets and transform costly healthcare behemoths into less expensive, prevention-based and patient-focused systems.

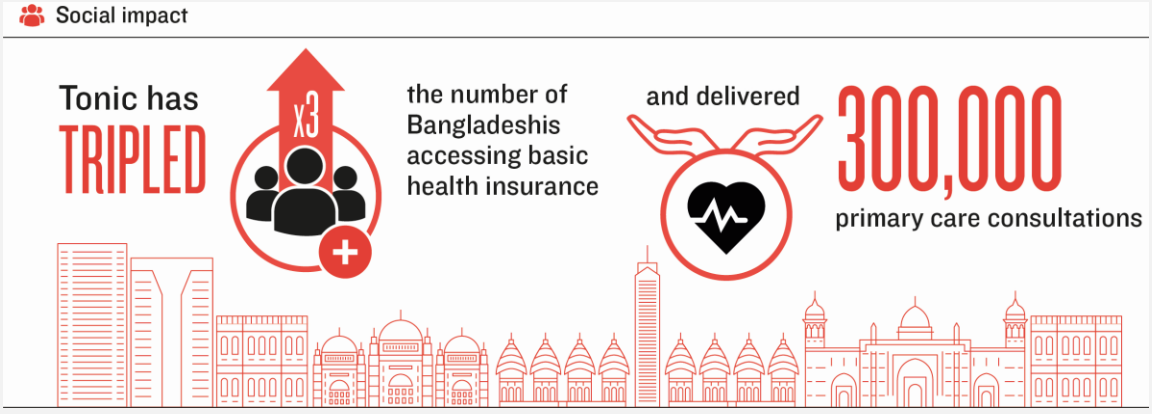
Globally, 400 million people lack access to primary care and 800 million people face catastrophic healthcare costs each year. In 2016, Telenor entered a new era of digital health in emerging Asia with the launch of mHealth service, Tonic, in Bangladesh. Aimed at subscribers of Telenor's Grameenphone service, Tonic is one of Asia's first comprehensive mobile-based health and wellness services platform, providing a myriad of digital health services such as preventative advice content, appointment booking, phone-based access to primary care, discounts on health tests and specialist care, and insurance in the event of hospitalisation. Today, it is used by 5 million customers in Bangladesh.

Delivering healthcare on mobile

To bridge gaps, Tonic leverages core Telenor capabilities such as mobile technology to lower delivery costs and tapping telco distribution models to achieve scale. For example, delivering care via telemedicine uses doctors' time more efficiently and helps to spot and manage costly non-communicable diseases earlier. Likewise, using existing airtime retailer networks and simple scratch cards – instead of cost-heavy agent and broker structures – enables cheaper go-to-market.

Ensuring affordable access to high-quality healthcare at pivotal moments can pay major social dividends in terms of health impact, enhancing livelihoods, and reducing inequalities. To date, the "Tonic Doctor" primary care service has delivered over 300,000 consultations, covering everything from lifesaving emergency advice to coaching patients on managing chronic diseases. Through thousands of health insurance payouts, "Tonic Cash" is also providing life-changing financial support by connecting those in need to medical services

These and other innovations have allowed Tonic to triple the number of Bangladeshis with basic health insurance and deliver more than 300,000 primary care consultations. It has also created a business and operating model that could bring better health to any of the five billion people in the world with a mobile phone.



Backed by Telenor Health

Tonic is created and managed by Telenor Health AS, a wholly-owned start-up launched by Telenor Group to develop a scalable, economically-sustainable model for mobile-based health in low- and middle-income countries. Telenor Health generates direct revenues from Tonic through B2B and B2C sales. Tonic's portfolio also features an array of benefit levels and modalities to reach different consumer segments, from

packages costing less than 60 cents per month to annual subscriptions retailing for more than $35. These are sold both through "traditional" telco channels like Grameenphone's 350,000 retail outlets, as well as via healthcare points of sale like pharmacies and NGO community health workers.

In addition to generating direct revenues, Tonic also has measurable impact on Telenor's core telecoms business in Bangladesh, Grameenphone. Through an innovative business model, Grameenphone subscribers are able to access a basic tier of Tonic for free, provided they continue to use their SIM cards each month.

The aim is to scale Telenor Health to other markets across Telenor's footprint

Source: Telenor

4.3 Social inclusion

Telecommunications facilitates participation by individuals in wider society. This positive impact is most noticeable for people with disabilities. The World Bank has defined social inclusion as the process of improving the ability, opportunity and dignity of disadvantaged individuals or groups to participate in society.[20] Disadvantaged groups include people of a particular race, gender, religion or disability status.

Telecommunications has facilitated enhanced social participation, especially for people with various disabilities

As shown in **Table 3** below, the increased availability and usage of telecommunications technology has enhanced social participation for people with disabilities through increasing access to media content, overcoming communication barriers, and facilitating distance education.

Table 3: Use of telecommunications to facilitate social inclusion

USE	APPLICATION
Talking books: Access to talking books for people with visual disabilities	Download of talking books
Access to electronic media for the hearing and vision Impaired: Applications to aid people with vision and hearing impairments – e.g. signing, subtitling, audio descriptions, clean audio	IPTV (combined with terrestrial services)
Video Relay Services: Allows sign language users to make and receive video phone calls through use of a VRS centre and an interpreter	Video conferencing
Service centre for deaf-blind people: People who are deaf-blind are able to ask the service centre for help with tasks at home using a combination of speech, video and text	Combination of text, video and audio communication
Communication for people with intellectual impairments: People with intellectual impairments may	Video conferencing

[20] https://www.worldbank.org/en/topic/social-inclusion

USE	APPLICATION
find ordinary telephones difficult to use and understand, video allows them to see the person they are speaking to	
Education in sign language: Distance education in sign language	Video conferencing, downloading video files

Source: National Broadband Network Market and Regulatory Report – Volume 2, 2014

Mobile technologies play a significant role in improving social inclusion. In Pakistan, for instance, mobile apps encouraging social inclusion for the disabled include the 'Tell Me' app, which is a voice guiding app that helps visually impaired people navigate their surroundings, and the 'Roll Out app, which shares restaurants and hotels that cater to mentally/physically challenged people.

Governments have also recognised the importance of mobile technologies in facilitating social inclusion. For instance, in 2017, the Ministry of Information Technology in Pakistan provided PKR 124 million (approximately USD 0.9 million) of funding for the development mobile applications by private sector firms to assist the physically and mentally disabled.[21]

More generally, studies have also shown that telecommunications facilitate more efficient delivery of public services and helps to reduce corruption by increasing transparency, facilitating monitoring of public employees, and reducing opportunities for public employee interventions that can invite corrupt behaviour.[22] Telenor elaborates on its continuing efforts in birth registration in Pakistan below.

Box 3: Giving Pakistani children an identity

How can mobile technology play a vital part in reducing inequalities and promoting social inclusion? Here's how Telenor works with partners to provide official identities for Pakistan's 'invisible' children.

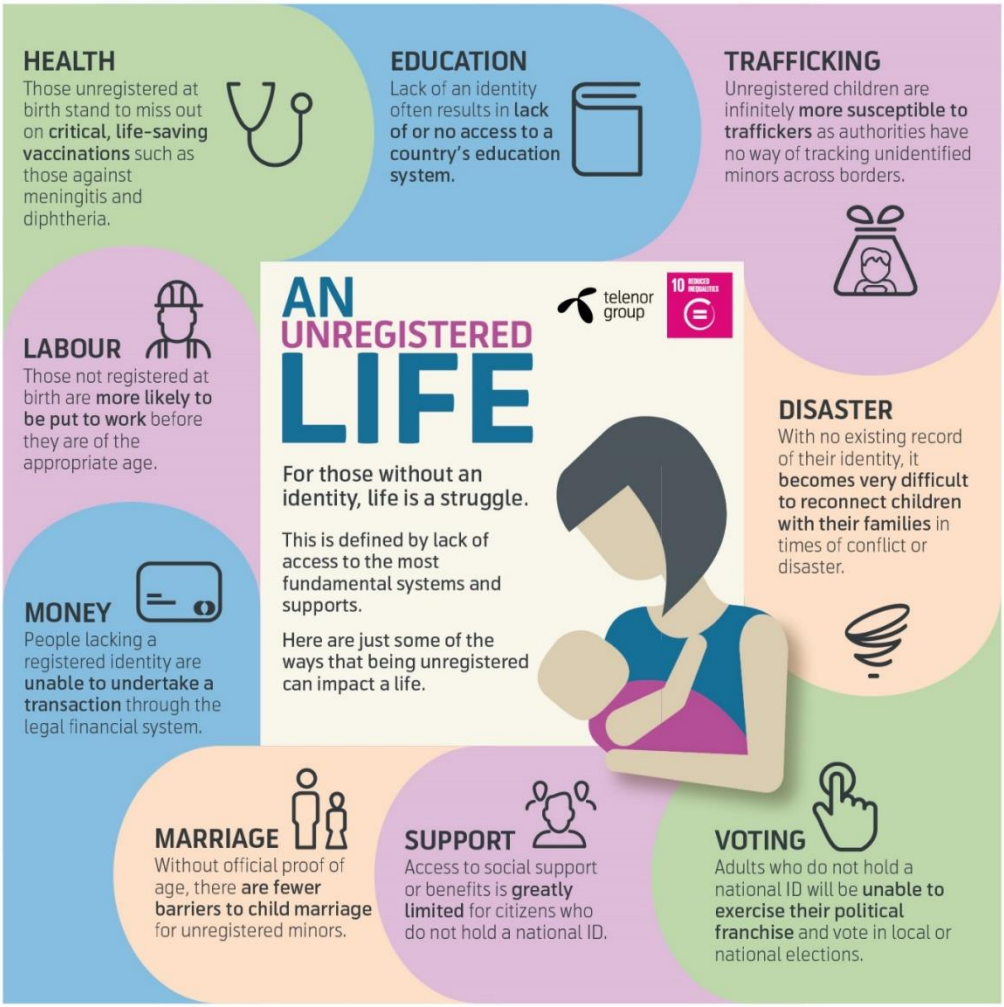
Approximately 1.1 billion people in the world today lack an official identity, 366 million of whom are children and of those, around 60 million live in Pakistan. The problem of low birth registration rates in Pakistan is due to a combination of social and economic factors. In many areas, registering a birth can be difficult, and in some cases nearly impossible – especially for children born at home, in remote locations, or in displacement.

The ability to prove one's identity is crucial to social, political and economic inclusion and enables greater access to basic services such as healthcare and education. It is a child's passport to protection against underage labour, child marriages and trafficking. It also protects children from being treated as adults in the justice system and helps them reconnect with families in times of conflict and disaster.

Typically, birth registration is a prerequisite to obtaining a birth certificate, which in Pakistan is needed for issuing national identity cards, passports and in some provinces, school enrolment. On the other hand, government also needs birth data to deliver socio-economic services such as health care and new schools. The following graphic summarises how the lack of registration at birth can lead to subsequent exclusion from modern society's support systems.

21 https://propakistani.pk/2018/03/07/pakistans-sector-moit-make-apps-disabled/

22 See, for example: Dong C. and Tae H. *Anticorruption effects of information communication and technology (ICT) and social capital*, 2009.

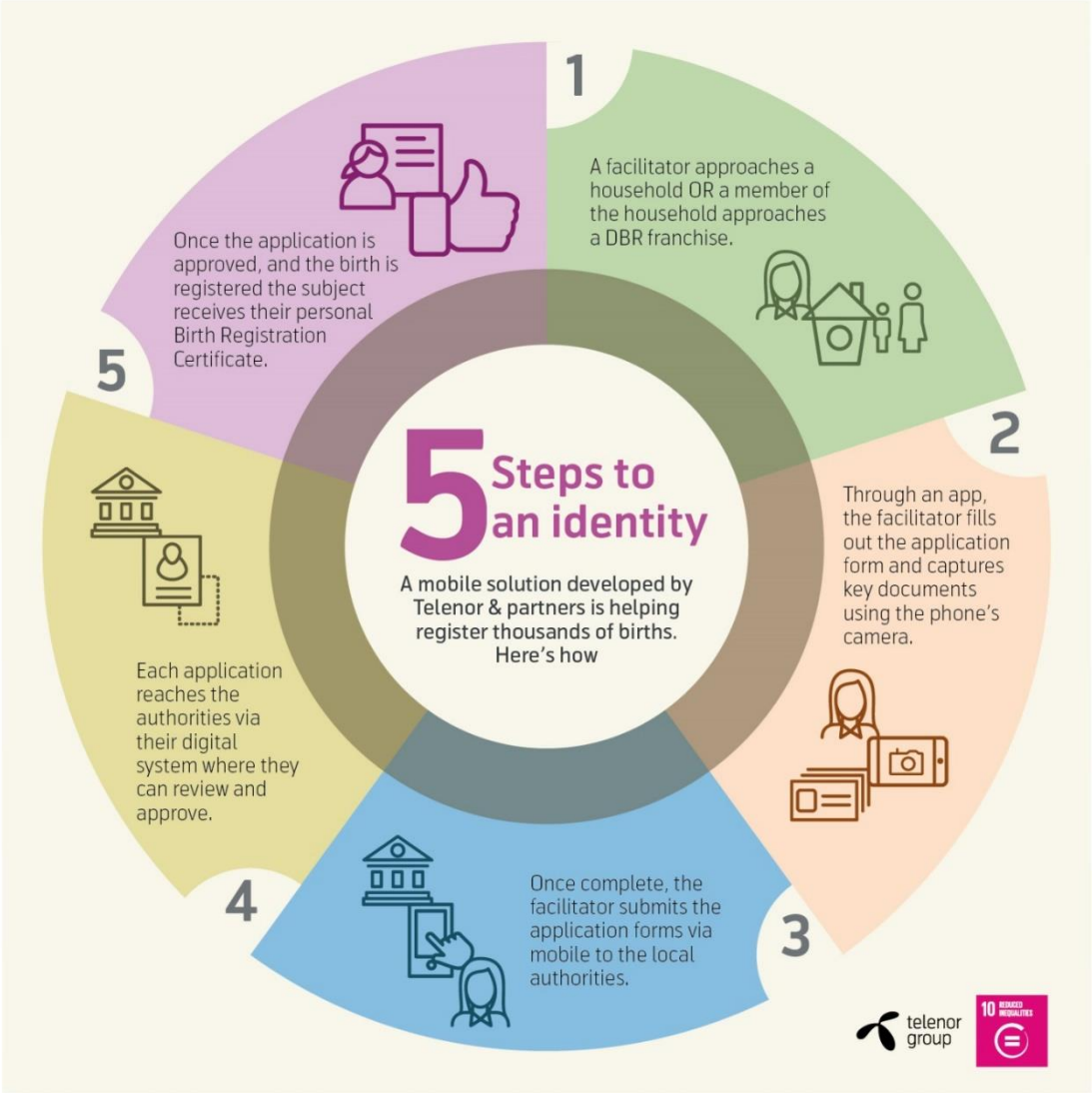


A first-of-its-kind pilot by Telenor

Digital Birth Registration is a marriage between the efficiency, outreach and ease that technology brings, with the legal and policy requirements of registering a child in Pakistan. It is not about reinventing the wheel, but about improving the existing birth registration processes through the introduction of mobile technology.

Telenor Pakistan, together with UNICEF and the Governments of Punjab and Sindh provinces, believes that the increased adoption of mobile phones in Pakistan could offer a solution to increase the number of birth registrations. In 2014, a first-of-its-kind pilot was launched with a simple solution. An app developed by Telenor Pakistan was put into the hands of authorised personnel, including health workers, marriage registrars and at Telenor distribution points. For the first time in Pakistan, a private telecommunications company is offering government services at their touchpoints.

The health workers and marriage registrars move from house to house as part of their regular responsibilities while Telenor concurrently offers the birth registration facility at targeted areas. These authorised personnel send birth-related data, along with the required documentation, to the approving authority directly via the app. Supervisors review and approve the birth registration forms and monitor the progress of the project through a specially designed dashboard.



Impact of Digital Birth Registration (DBR) in Pakistan

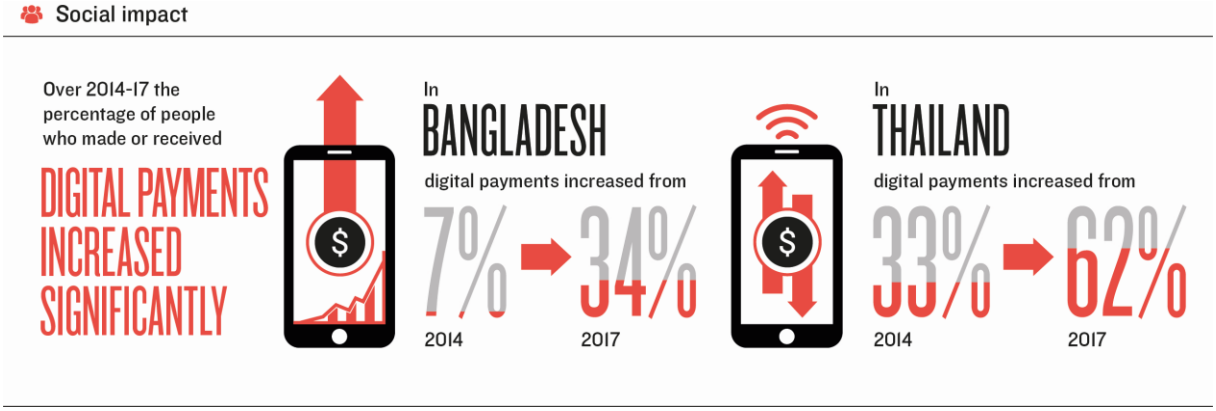
The pilot phase resulted in an increase in birth registration from 30% to 90% in just six months, and nearly 50% of the registered children were girls. To date, Digital Birth Registration has been launched in four districts within Sindh and three districts of Punjab. More than 600,000 children have been registered, and the ambition is to register more than 1.1 million children in total by the end of 2019.

Source: Telenor

4.4 Financial inclusion

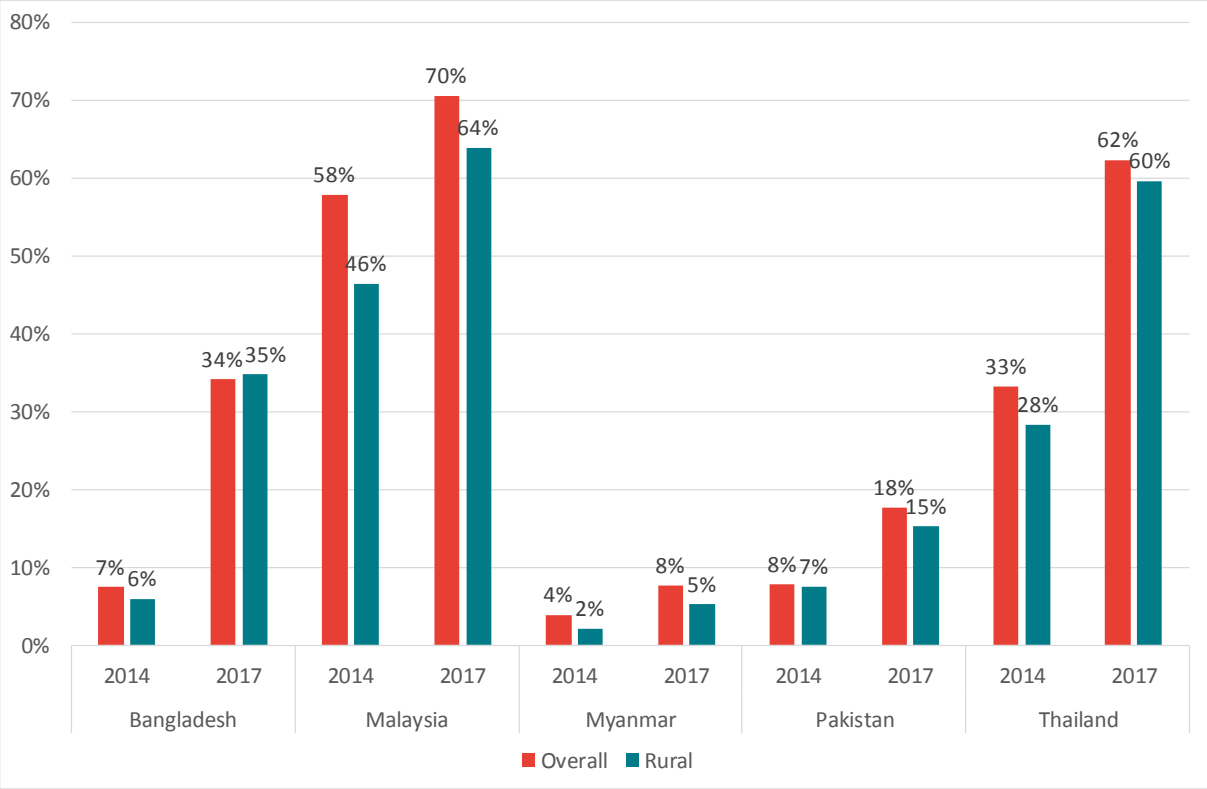
Internet banking and mobile money[23] have recently emerged as powerful enablers of financial inclusion. This is particularly true for developing countries where access to financial services through traditional channels is impeded by infrastructure deficiencies, especially in rural locations. In these countries, telecommunications has enhanced access to basic financial services, particularly facilitating the collection of financial documents, the acceptance and disbursal of cash, the monitoring of loans, receipt and sending of remittances.

As illustrated below, use of the internet to access financial services has increased significantly across each of the Asian countries that Telenor operates in. The most substantial impact has been seen in Bangladesh and Thailand where over the period 2014 to 2017, the percentage of people who made or received digital payments grew from 7% to 34% and 33% to 62%, and the percentage of people who hold a mobile wallet grew from 3% to 21% and 1% to 8%, respectively. We also note that use of digital payments and mobile wallet accounts by rural populations is comparable to the overall population in each country, suggesting that mobile financial services is helping to reduce the financial inclusion divide between urban and rural populations.



[23] Internet banking requires an underlying bank account while mobile wallets do not.

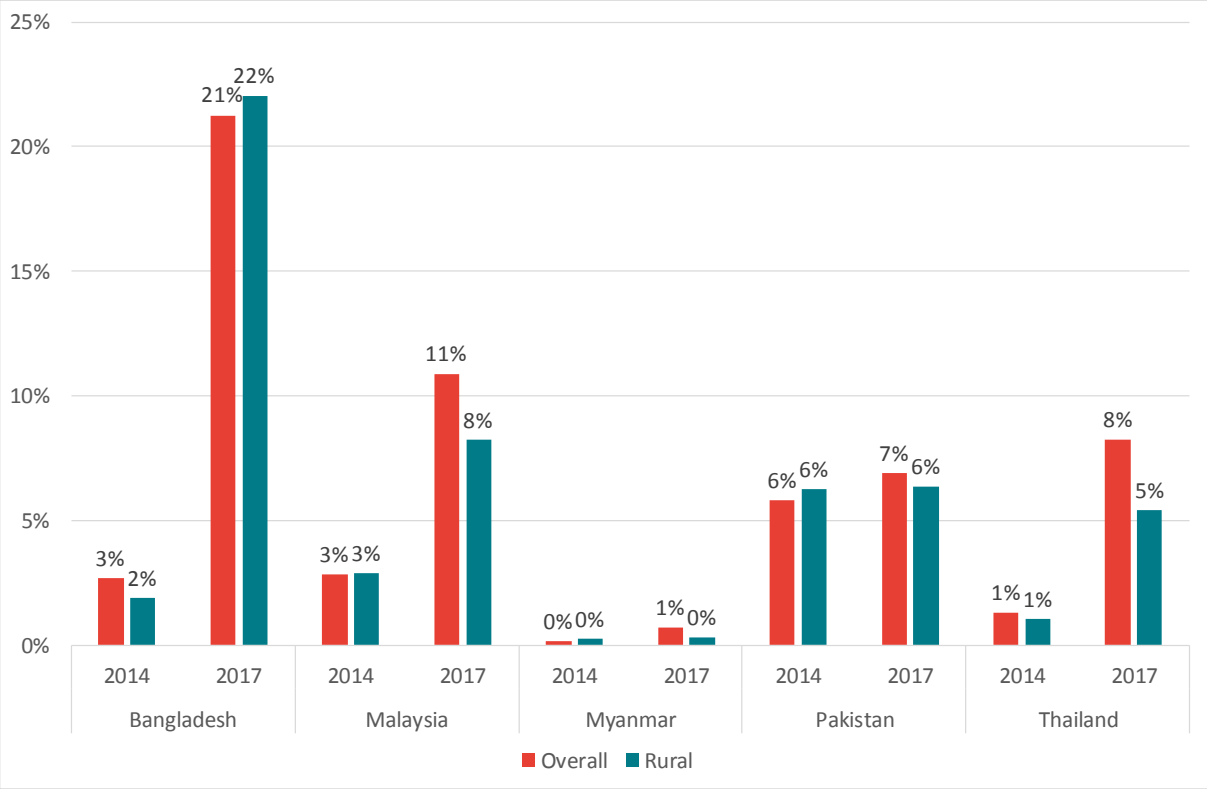
Figure 20: Percentage of population who made or received digital payments* in the past year



Note (*): Recorded figures are for respondents aged 15 and above who report making a payment from an account using a mobile wallet, a debit or credit card, or a mobile phone, or report paying bills or buying something online using the internet.

Source: The Global Findex Database 2017

Figure 21: Percentage of population with a mobile wallet account*



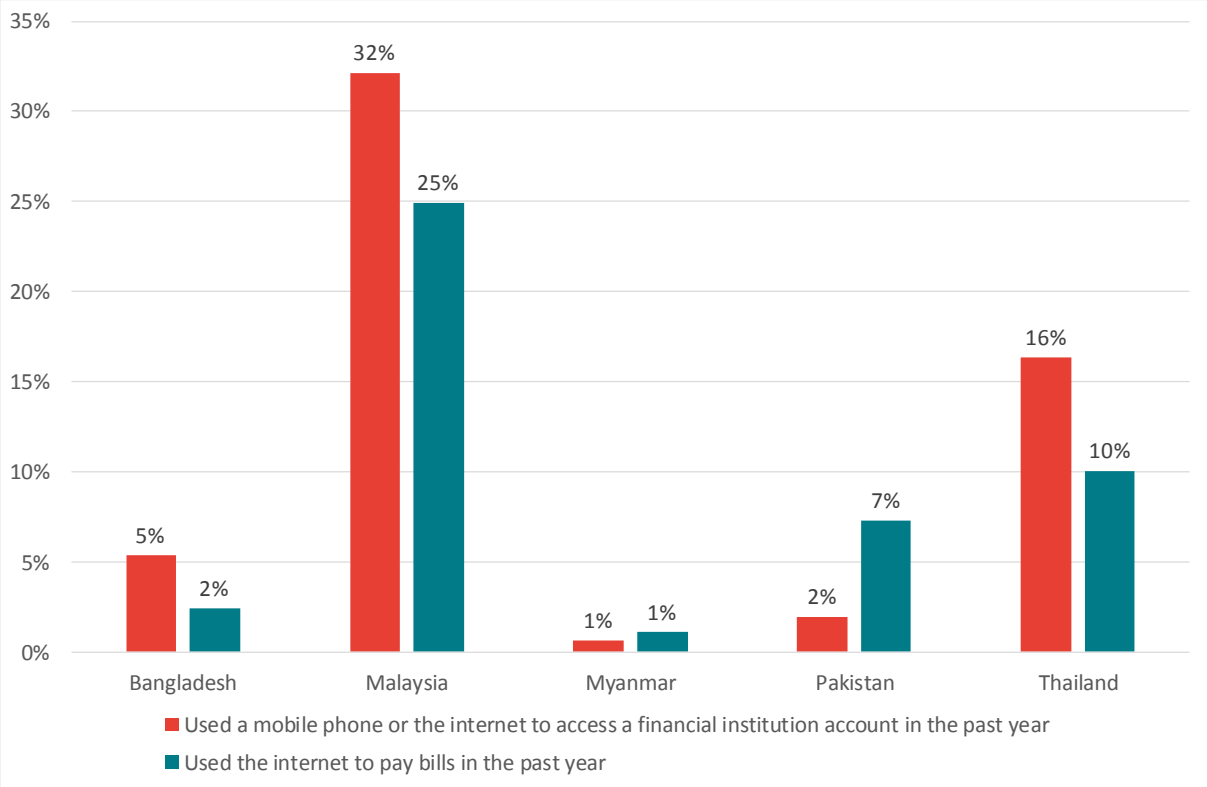
Note (*): Recorded figures are for respondents aged 15 and above who report personally using a mobile wallet service in the past 12 months. Mobile wallet accounts allow users to store, send and receive money using their mobile phone, which can either be a smartphone or a basic feature phone.

Source: The Global Findex Database 2017

However, as shown in **Figure 22**, there remain vast differences between countries when comparing the use of a mobile phone or the internet to access a traditional financial institution account. Individuals in more developed economies, such as Malaysia and Thailand, are more inclined to mix ICT technology and traditional banking. For instance, in Malaysia, it was found that 32% of the population used a mobile phone or the internet to access a financial institution account in 2017. In contrast, less than 10% of the populations of the less developed economies of Bangladesh, Myanmar and Pakistan used the internet to access a traditional financial institution account or pay a bill.

The findings in Malaysia and Thailand are consistent with a gradual progression in the integration of ICT with traditional banking; on the other hand, developments in Bangladesh seem to suggest a successful technological "leap-frog", skipping the intermediate mobile/internet-enabled traditional banking for rapid adoption of mobile wallets. This seems to suggest that mobile wallets represent an opportunity for less developed economies to sidestep challenges associated with traditional banking, such as coverage of rural areas, and rapidly increase financial inclusion.

Figure 22: Percentage of population who used a mobile phone or the internet to access a financial institution account*, and percentage of population who used the internet to pay bills in the past year



Note (*): Financial institution accounts are mutually exclusive with mobile money accounts. Hence, the prevalence of financial institution accounts and mobile money accounts may differ greatly within the same country, as they are substitutes.

Source: The Global Findex Database 2017

Telecommunications companies, such as Telenor, are only able to provide digital financial solutions to their own customers. Greater progress on financial inclusion is achieved through ongoing investment in internet-based financial services from regional governments and financial institutions.

In Bangladesh, bKash is a leading mobile financial service that allows users to deposit money into their mobile accounts and access a range of services, in particular transferring and receiving money domestically and making payments. Introduced in 2011, total registered bKash customers now exceed 24 million with roughly a third conducting at least one financial transaction per month. While bKash started off as a mobile wallet platform for transferring funds, it has since expanded its services to include airtime top-ups, bulk disbursements, foreign remittances and merchant payments. As of June 2016, there were more than 30,000 merchants accepting bKash payments, with monthly transaction volumes exceeding USD7.5 million.[24]

[24] https://globalpaymentsummit.com/bkash-bangladesh-24-million-customers-using-mobile-money/

In Myanmar, a Financial Inclusion Roadmap, adopted by the authorities in 2015, aims to bring a larger proportion of the population into the formal financial market with access to modern financial products and services.[25] A major strategy in the Roadmap is to take advantage of the rapid development of mobile telecommunication technology to overcome underdeveloped physical infrastructure for traditional brick-and-mortar banking. Mobile operators, such as Telenor, play a key role in enhancing access to mobile banking and e-payment services, sharing financial information, and improving access to markets. These initiatives are expected to increase access to financial services from 30% of the population in 2014 to 40% by 2020, and to increase the proportion of adults with more than one financial product from 6% to 14% over the same time period. Telenor provides further details on its initiative in Myanmar below.

Box 4: Banking the unbanked in Myanmar

Only 20 percent of Myanmar's population have access to a bank account. Meanwhile, financial inclusion is a key enabler to reducing poverty and boosting prosperity. It is estimated that digital finance can add 6 percent to the developing world's GDP by 2025. How can we drive digital payments in a cash-only society?

Being without bank access comes with a range of practical problems that makes everyday life hard. Crime easily springs to mind, but keeping money at home in a humid environment is also risky due to mould. Transferring money to relatives across the country also means physically sending your means off with a stranger on a scooter. Telenor saw an opportunity to draw on its experiences from providing financial services in Pakistan to set up a similar system in Myanmar.

Reducing Inequalities across Myanmar

In 2016, Telenor partnered with Yoma Bank to launch Wave Money, a service that allows for safe money transfers in a cash-based economy. Through Wave Money and the mobile, people can deposit cash in small shops around the country, which family members can then withdraw from another shop close to them when they receive the Wave Money notification on their mobile. These are mostly small, privately-owned stores that sell groceries and fast-moving consumer goods, in addition to SIM-cards and top-up for mobile.

As the mobile money shops earn commissions from every transaction they facilitate, they benefit from an additional and growing revenue stream. Unsafe money transfers are also reduced, and customers can have money stored in their mobile wallet. Wave Money also leverages its mobile money platform to facilitate humanitarian aid disbursements from World Food Program (WFP) to Internally Displaced Persons in the north of Myanmar. Not only does this massively increase efficiencies for WFP, it enables access to formal and regulated financial services that the beneficiaries would otherwise not have had.

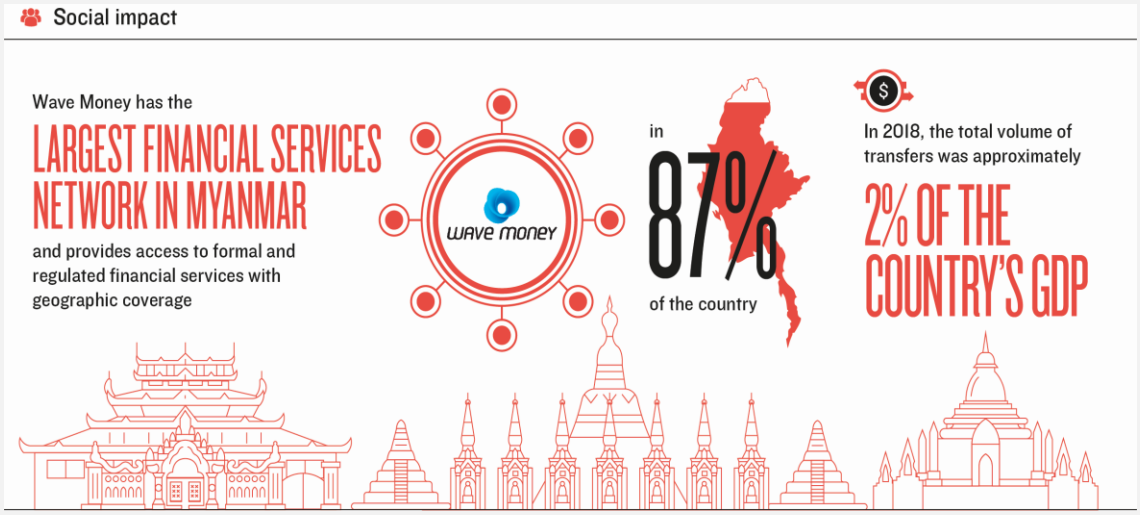
Financial literacy, especially among women, is also low. Around 70 percent of the women in Myanmar do not have access to financial services, and less than 10 percent of women between 18 and 34 years have access to a bank account. Wave Money has thus partnered with the UN Capital Development Fund (UNCDF) to develop a mobile game that teaches women in topics such as savings, budgeting, interest and insurance.

[25] https://www.mmtimes.com/news/financial-inclusion-makes-big-inroads-myanmar.html

Wave Money's Impact

By the end of 2018, Wave Money have had a significant impact on financial inclusion in Myanmar, impacting the lives of over 7 million people, or 35% of the adult population, majority of whom were previously financially excluded.

Wave Money also has the largest financial services network in Myanmar and provides access to formal and regulated financial services with geographic coverage in 87% of the country. In 2018, the total volume of transfers was approximately 2% of the country's GDP.



Source: Telenor

4.5 Agriculture

A study by the Food and Agriculture Organization of the UN States that enabling farmers to connect with knowledge banks, networks and institutions via information and communication services has substantially improved productivity, profitability, food security and employment opportunities.[26]

> Telecommunications helps to improve productivity, profitability, food security and employment in the agricultural sector.

The field of e-agriculture is still relatively new. It includes, for instance, use of ICT to deliver agriculture information and knowledge services (e.g. information on market prices and farming processes), monitor climate and weather conditions, and access e-commerce facilities for farmers to market and sell their produce at a regional or global level. More advanced applications of e-agriculture arise from the use of satellite systems to improve water management and crop husbandry. For example, use of geographical information systems (GIS), global positioning systems (GPS) and remote sensors can be used to map the layout of farms, crop placement and irrigation processes for more efficient land and water use, and provide information on factors such as crop yield, pests and weeds, and soil moisture and nutrient levels.

[26] http://www.fao.org/3/a-i5564e.pdf, page 4

As a result, the usage of telecommunications in agriculture helps in achieving the following goals:

- **Spreading agricultural best practice** – access to the internet, video chat and file sharing allows for better dissemination of information on efficient and climate friendly agricultural practices from farmers around the world, and from agricultural researchers
- **Disaster management and early warning** – real-time, actionable information can be provided to communities and governments in crisis situations, while disaster prevention and risk-mitigation techniques can also be provided during normal times
- **Enhancing market access** – telecommunications allow for enhanced market access for farming inputs and product trading, e.g., it strengthens the capacity of small-scale producers to increase revenue by improving their position on local and international markets
- **Food safety and traceability** – the digitisation and transmission of data through telecommunications networks ensures that food supply chains can be tracked more efficiently and reliably, which aides in compliance with international safety and traceability standards
- **Financial inclusion** – telecommunications increases access to financial services for rural farmers, including the provision of insurance, loans, and savings services for support agricultural practices
- **Implementing regulations** – telecommunication tools can be used to propagate government policy and regulatory changes, monitor regulatory compliance, and provide an avenue for farmers to give feedback to the government on policy and regulation[27]

With more than two-thirds of the world living in rural areas, higher rural incomes are necessary for large scale poverty alleviation. Particularly within developing countries, increasing agricultural productivity and farmer incomes is a major driver of rapid and sustainable poverty reduction.[28] Among the many tools at governments' and farmers' disposal to increase agricultural productivity, the increased availability and usage of telecommunication tools stands out as an effective solution.

In Malaysia, for instance, the Ministry of Agriculture's Third National Agricultural Policy resulted in the development of an online portal,[29] which

- allows agriculturalists to share information, or contact agricultural productivity experts
- provides technical information on Malaysian agriculture,
- lists registered agriculture service providers (e.g. fumigators),
- provides pricing information for producers,
- facilitates permit applications, and
- provides a bulletin service for advertisements and events.

In Thailand, Telenor has played an important role in using mobile technology to equip farmers with the tools they need to face challenges such as climate change, plant disease and soil moisture. This is set out in further detail below.

Box 5: Agriculture's Digital Transformation in Thailand

How can mobile technology make a positive social impact? In agriculture-driven

27 http://www.fao.org/3/a-i5564e.pdf, pages 9-10

28 http://www.oecd.org/tad/agricultural-policies/agriculturalprogressandpovertyreduction.htm

29 http://www.doa.gov.my/

Thailand, this means leveraging mobile connectivity to empower farmers and reducing inequalities through the use of technology.

In Thailand, about forty percent of the country's population work in agriculture-related jobs, but the sector's contribution to Gross Domestic Product (GDP) has fallen from 32% in 1960 to 10% in 2016. Improving productivity in the agricultural sector through access to farming information services will not just lead to significant economic benefits, but a better livelihood for a large proportion of Thailand's people.

For the disempowered, mobile internet can be a way out of poverty and the means to better education, health, economic development and security. It is, however, not enough to simply provide Internet access. To fully maximise the benefits of meaningful digital solutions, long-term commitment and strong partnerships are needed.

Empowering Thai farmers through partnerships

Leveraging high mobile internet penetration even in rural areas, Telenor's business unit in Thailand, dtac, continues to strengthen its SMART farmer project, which was first launched in 2008 as a mobile agricultural advisory service. In 2016, this programme moved beyond advisory services, to providing online training and supporting agri local start-ups. In partnership with the Thai Ministry of Agriculture and Cooperatives, dtac has run extended online marketing training courses nationwide to help farmers successfully present and sell their products online, training 20,000 farmers by 2018.

In 2017, dtac also partnered Thailand's Department of Agricultural Extension (DOAE) and the National Electronics and Computer Technology Center (NECTEC) to launch an Internet of Things (IoT)-based precision farming solution. The device, a sensor with the capability to monitor five parameters (light, soil humidity, temperature, water and wind) is linked to a router with a dtac SIM relaying this information to the cloud. The solution allows targeted advisory information to be sent to farmers based on farm-level granular data. The result is a more precise farming system that should help increase crop yields, control quality of agricultural products and reduce production costs.

Most recently in October 2018, dtac launched its newest "Farm Man Yum" service, a Precision Farming app that analyses various datasets from the farms to resolve issues in a timely manner. The service was designed to meet the needs of farmers who are reliant on precise weather forecasts to manage and plan their cultivation, increase yields and cut costs.

The service incorporates personalized weather forecasts, which show area-specific data on an hourly basis, including temperature, likelihood and amount of rainfall. It can also give a seven-day forecast with the highest plot-specific precision available in Thailand. With the help of satellite imagery, the feature helps farmers see aerial shots of their plots to locate irregularities and unhealthy plants. Finally, a Personal Assistant Service helps farmers understand and efficiently plan cultivation in each crop year with easy-to-understand infographics based on academic data from Kasetsart University's Faculty of Agriculture lecturers.

"Such partnerships encourage farmers in Thailand to adopt efficient use of technology and provide farmers with access to information they otherwise would not have. These initiatives are examples of how Telenor supports the UN Sustainable Development Goal #10 Reduced Inequalities," says Mai Oldgard, SVP and Head of Telenor Group Sustainability.

Source: Telenor

5 ANNEX A: THE IMPACT OF TELECOMS ON PRODUCTIVITY – LITERATURE REVIEW

As mentioned in Section 3.2, there is rich literature that has explored the relationship between the use of telecoms services and productivity. In our review of the published materials, we focus on the following two aspects:

- The relationship between the take-up of telecoms services and productivity, and
- The relationship between investment in Information Communications Technology (and in some cases telecoms specifically) and productivity.

We have selected 12 articles from peer-reviewed and academic journals which cover a large number of developed and developing countries. Wherever possible, we have also considered studies related to low and middle income countries. Due to data limitations in these countries, there are relatively few studies which include any of the five countries of interest. More specifically, the number of studies which examine the relationship between telecoms investment and productivity in developing countries is limited. In contrast, there exist a large body of the literature on the impact of telecoms penetration on productivity in these countries. In some of the studies, the five Asian countries where Telenor is present are included in their samples.

5.1 The impact of telecoms penetration on productivity

Most of the previous empirical studies conclude a positive impact of telecoms penetration on productivity in developed and developing countries and at both country and firm levels over the period from 1995 to 2011.

Czernich et al (2009)[30] estimate that among OECD countries, a 10 percentage-point increase in broadband penetration results in 0.9-1.5 percentage-point increase in annual GDP per capita growth rate (using data from 1996 to 2007). Zaballos et al (2012)[31] estimate that an increase of 10% in broadband penetration increases Total Factor Productivity (TFP) by 2.61% based on data from 26 Latin American and the Caribbean between 2003 and 2009. In a more recent study, Jung et al (2017)[32] analyse 27 Brazilian states (2007 to 2011) to estimate the factors that lead to differences in the regional productivity. The study estimates that a 10% increase in fast broadband penetration increases regional TFP by 0.17%.

Ferero (2013)[33] and Thompson et al (2007)[34] analyse the effect of mobile penetration on "technical efficiency" of countries with varying levels of income. In both studies, technical efficiency is defined as

30 Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011). "Broadband infrastructure and economic growth." *The Economic Journal*, *121*(552), 505-532.

31 Zaballos, G. A., and Lopez-Rivas, R. (2012), "Socioeconomic impact of broadband in Latin American and Caribbean countries", Inter-American Development Bank

32 Jung, J. and Lopez-Bazo, E. (2017). "On the regional impact of broadband on productivity: the case of Brazil", AQR–Working Papers, 2017, AQR17/04 (2017)

33 Ferero, M. (2012). "Mobile communication networks and Internet technological drivers of technical efficiency improvement", Information Economics and Policy 25 (2013), pp. 216-141

the ratio of actual observed output to maximum feasible output. A ratio of "1" implies that the country is operating at its maximum feasible level of output given its endowments of physical capital, labour inputs and human capital. The higher the ratio, the more technically efficient the country is. Ferero (2013) use a sample of 41 countries which includes three out of five Asian countries of interest, namely, Bangladesh, Malaysia and Thailand. The author concludes that an additional percentage point in mobile penetration is associated with an improvement in technical efficiency by 0.4 percentage points. This means that a 10% increase in mobile penetration would increase technical efficiency by 4 percentage points in Bangladesh from 0.52 to 0.56; in Malaysia from 0.75 to 0.79; and in Thailand from 0.73 to 0.77. This implies that each country could significantly increase economic output by increasing technical efficiency.

Thompson et al (2007) estimate a percentage point increase in mobile penetration leads to a 4.6 percentage point increase in technical productivity. The discrepancy in the magnitude is due to the fact that the sample of Asian countries used by Thompson et al (2007) include high-income countries such as Japan, Hong Kong and Korea whereas Ferero (2013) considers low-income countries. Despite the difference in the magnitude, both studies suggest the positive impact of mobile penetration on productivity. Thompson et al (2007) also conclude that mobile penetration has a causal effect on productivity in low-income countries but not in high-income countries.

In addition to country-level effect, there is also a positive impact of broadband penetration on firms' productivity. This is shown by Bertschek et al (2013)[35] who examine the effect of broadband penetration on firms' productivity in German firms. Their findings demonstrate that a 10% increase in the share of employees using broadband results in a labour productivity growth of 1% but the study does not conclude on the causal relationship. The result on the role of broadband penetration is examined by Grimes et al (2012) [36] who conclude that the speed of internet access is considered a "productivity-enhancing factor". The authors identify a firm-level productivity gain of 11.1% arising from adoption of "slow broadband" relative to no broadband. The gain is estimated to be between 9.1% and 12.1% from adoption of "fast broadband" relative to "slow broadband".

Table 4 below summarises the studies which have been reviewed relating to the impact of telecoms penetration on productivity.

[34] Thompson, H. and Garbacz, C. (2007). "Mobile, fixed line and Internet service effects on global productive efficiency", Information Economics and Policy 19 (2007), pp. 189-214

[35] Bertschek. I. and Niebel, T. (2013). "Mobile or more productive? Firm-level evidence on the productivity effects of mobile internet use at the early stage of diffusion", No. 13-118. ZEW Discussion Papers

[36] Grimes, A., C. Ren, and P. Stevens (2012). The need for speed: Impacts of internet connectivity on firm productivity. Journal of Productivity Analysis 37 (2), 187–201.

Table 4: Summary of evidence for telecoms penetration on productivity

SOURCE	JURISDICTION	TIME PERIOD	FINDING
Czernich et al (2009)	25 OECD countries	1996-2007	An increase in broadband penetration by 10 percentage points results in GDP per capita growth rate by 0.9-1.5 percentage points.
Zaballos et al (2012)	26 Latin American & the Caribbean countries	2003-2009	An increase of 10% in broadband penetration would increase TFP by 2.61%.
Jung et al (2017)	27 Brazilian states	2007-2011	Disparities in the regional productivity are driven by differential broadband penetration, A 10% increase in broadband penetration improves regional TFP by 0.17%.
Bertschek et al (2013)	German firms	2010	A 10% increase in the share of employees using broadband results in a labour productivity growth by 1%, The effect is unlikely to be causal.
Grimes et al (2012)	7,000 New Zealand firms		Speed of Internet access is a “productivity-enhancing factor”, The firm-level productivity gain is 11.1% arising from adoption of slow broadband relative to no broadband. The gain is estimated to be between 9.1% and 12.1% from adoption of fast relative to slow broadband.
Ferero (2013)	41 countries, including Bangladesh, Malaysia, Thailand	1980-2009	An additional percentage point in mobile penetration is associated with a 0.4 percentage point increase in technical efficiency in Asia.

SOURCE	JURISDICTION	TIME PERIOD	FINDING
Thompson et al (2007)	93 countries, including Bangladesh, Malaysia, Pakistan, Thailand	1995-2003	An additional percentage point in mobile penetration is associated with a 4.6 percentage point increase in technical efficiency in Asia, The effect is causal in low-income countries but not in high-income countries.

5.2 The impact of telecoms investment on productivity

A large body of the literature explores the impact of Information Communication Technology (ICT) investment on productivity in developed countries. The literature on telecommunication element of ICT in Asia or developing countries is limited. The majority of prior research has suggested a positive and significant effect of ICT investment on productivity in a number of developed countries. However, there are a limited number of studies that focus on communications technologies specifically.

In the literature, productivity could be measured by Total Factor Productivity (TFP) on aggregate level or firm productivity on micro level. TFP is defined as the residuals from the production function not explained by the amount of inputs. The metric is often used to imply the efficiency of input usage.

Rincon et al (2004)[37] analyse the short and long run contribution of ICT investment on TFP in US and four European countries, namely UK, Germany, France and Netherlands for the period 1991-2001. Their results provide support for the existence of a positive ICT spillover in the long run in all the countries of interest. In particular, a 1% increase in aggregate ICT capital results in approximately a 0.7% increase in companies' productivity in Europe. The long run effect is higher for the US, where a 1% increase in aggregate ICT capital is expected to produce a 1.5% increase in firms' productivity.

In one of the more recent studies, Van Reenen et al (2010)[38] use a panel of 19,000 European firms across 13 countries for the period 1998-2008 to estimate the contribution of ICT capital on firm productivity. Their results show that a 1% increase in ICT capital per worker is associated with 2.3% increase in firm productivity using their preferred estimation approach. The authors also found an increase of 2.0% in productivity given a 1% increase in ICT capital per worker using another US firm-level panel data covering the period from 1996-2008. A further finding is that in both Europe and US, ICT-intensive industries have an elasticity of productivity with respect to ICT capital about twice the size of the non-ICT intensive industries.

Carrado et al (2014)[39] who analyse a dataset of 8 European countries separately for two periods: 1995-2002 and 2003-2010. The authors estimate that between 1995-2002, a 1% increase in ICT capital growth rate results in 0.1% increase in TFP growth rate. The effect is found to have increased significantly to 1.2% in the period 2003-2010.

Since ICT covers a broad range of components such as computers, video and communication equipment and the aggregate estimated impact from ICT may not fairly reflect the individual contributions of telecommunications as one of its components. As noted by Goodridge et al (2014)[40], there is less investigation of the relationship of investments in telecommunications and productivity. The authors estimate the contribution of telecoms capital deepening to aggregate growth in TFP in the UK from 1990 to 2008. They find out that an increase in telecoms capital growth rate by 1% leads to an increase in TFP growth of 5.22%[41].

37 Rincon, A. and M. Vecchi (2005). "The Dynamic Impact of ICT Spillovers on Companies' Productivity Performance", National Institute of Economics and Social Research

38 Van Reenen, J., Bloom, N., Draca, M., Kretschmer, T. and Sadun, R., (2010). "The Economic Impact of ICT", Enterprise LSE

39 Carrado, C. and Jager, K. (2014). "Communication Networks, ICT and Productivity Growth in Europe", Economics Program Working Paper Series, The Conference Board

40 Goodridge, P., Haskel, J. and Wallis G., (2014). "The "C" in ICT: Communications, Capital, Spillovers and UK Growth"

41 If the change in telecommunications capital includes investments in spectrum rights then the model predicts that a 1% increase in the telecommunications and spectrum rights leads to a 4.98% change in TFP. .

Shanks et al (2008)[42] also consider the impact of investment in communication infrastructure on productivity in Australia. They exclude information technologies from their definition of communications infrastructure. Their estimates indicate that a 1% increase in investment in communications network infrastructure used by the communication services industry raises productivity by 5%.

Table 5 below summarises the studies which have been reviewed relating to the impact of ICT/ telecommunications investment on productivity. Previous studies have almost exclusively focused on developed countries where firm-level data is more available and accessible. In contrast, the five Asian countries of interest are not included in the studies on the impact of telecommunication investment on productivity.

[42] Shank, S. and P. Barnes (2008). "Econometric Modelling of Infrastructure and Australia's Productivity", Internal Research Memorandum, Cat No: 08-01

Table 5: Summary of evidence for telecoms investment on productivity

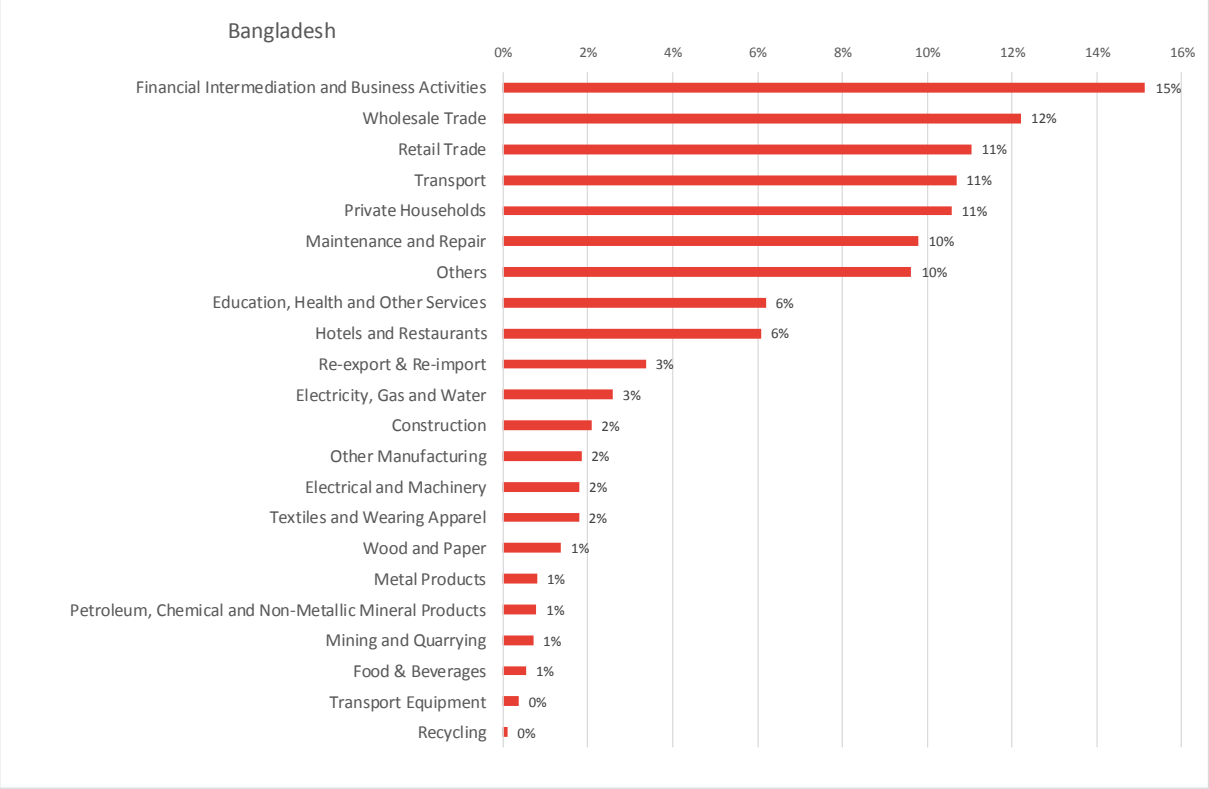
SOURCE	JURISDICTION	TIME PERIOD	FINDING
Rincon et al (2004)	US and four European countries (UK, Germany, France and Netherlands)	1991-2001	The results conclude an increase in firms' long-run productivity of 0.7% and 1.5% for the four European countries and US respectively given a 1% increase in ICT investment. There is a positive spillover in the short run for the US but not in the European countries considered.
Van Reenen et al (2010)	13 European countries	1998-2008	A 1% increase in ICT capital per worker is related to 2.3% and 2.0% increase in firm productivity in European firms and US firms respectively. ICT-intensive industries have an elasticity of productivity with respect to ICT capital about twice the size of the non-ICT intensive industries.
Carrado et al (2014)	8 European countries	1995-2002 and 2003-2010	A 1% increase in ICT capital results in 0.1% and 1.2% increase in growth rates of TFP in 1995-2002 and 2003-2010 respectively.
Goodridge et al (2014)	UK	1990-2008	An increase in telecoms capital by 1% lead to an increase in TFP by 5.22%. The effect is 4.98% given a 1% increase in the combined investment in telecommunications and spectrum rights.

SOURCE	JURISDICTION	TIME PERIOD	FINDING
Shanks et al (2008)	Australia	1974-75 to 2002-03	A 1% increase in investment in communications network infrastructure used by the communication services industry raises productivity by 5%.

6 ANNEX B: TELECOMMUNICATIONS INTENSITY BY SECTOR FOR EACH COUNTRY

The figures in this annex show the level of telecommunications intensity 22 sectors within each of the five countries that we analysed, ranked in descending order.

Figure 23: Telecommunications intensity by sector in Bangladesh



Source: Frontier Economics analysis of EORA Input-Output tables

Note: There are no significant changes in telecommunications-intensity between 2005 and 2015.

Figure 24: Telecommunications intensity by sector in Malaysia

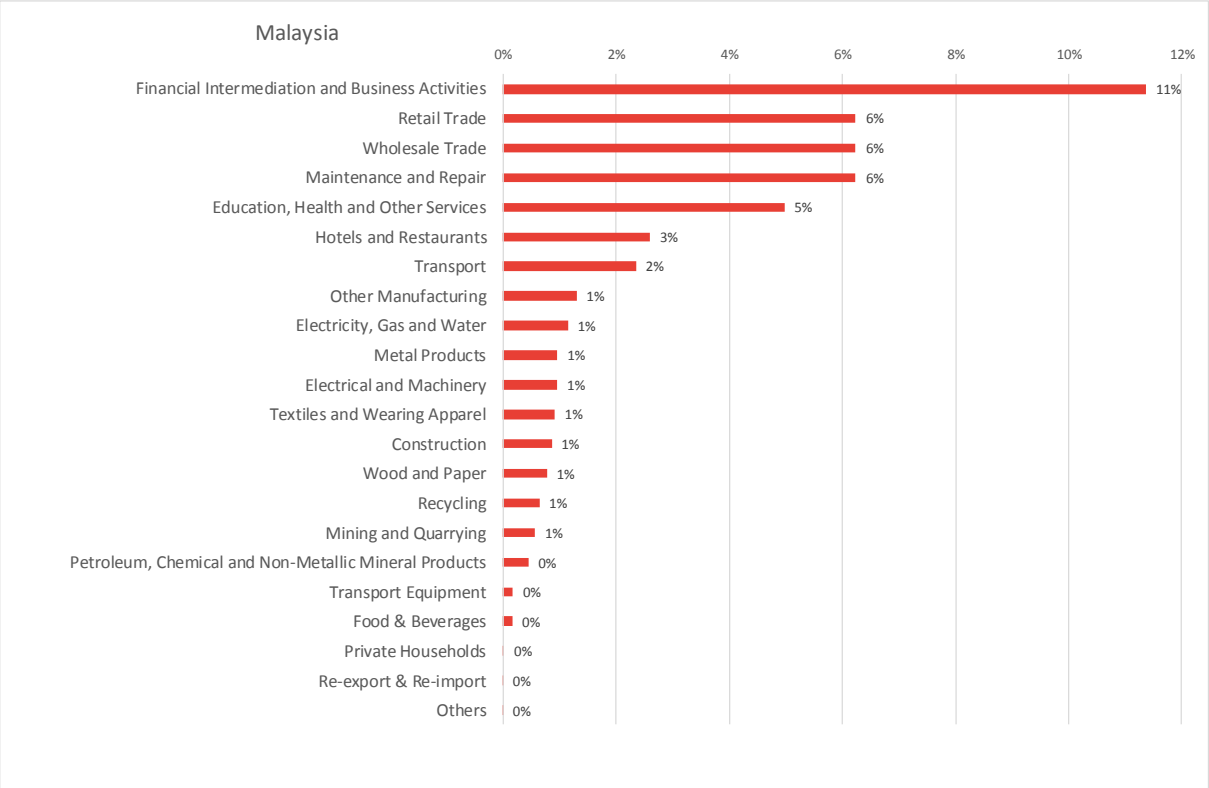


Figure 25: Telecommunications intensity by sector in Myanmar

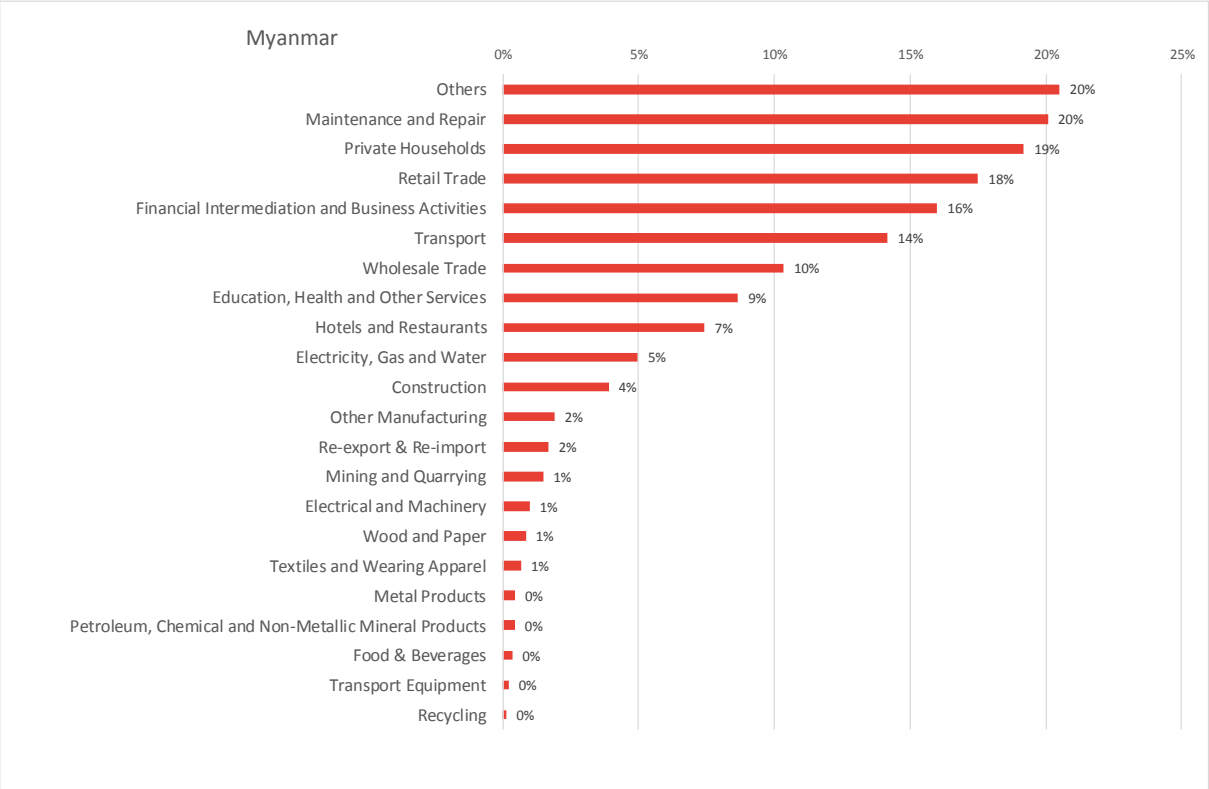


Figure 26: Telecommunications intensity by sector in Pakistan

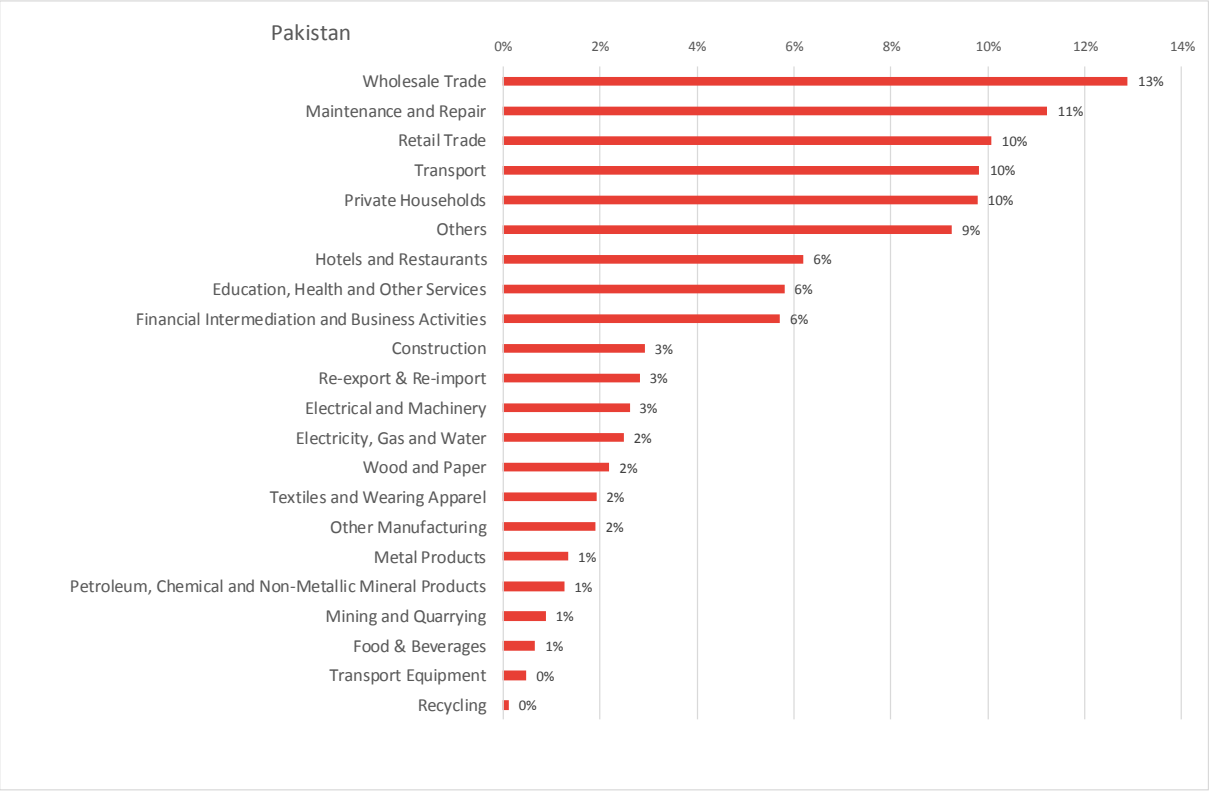
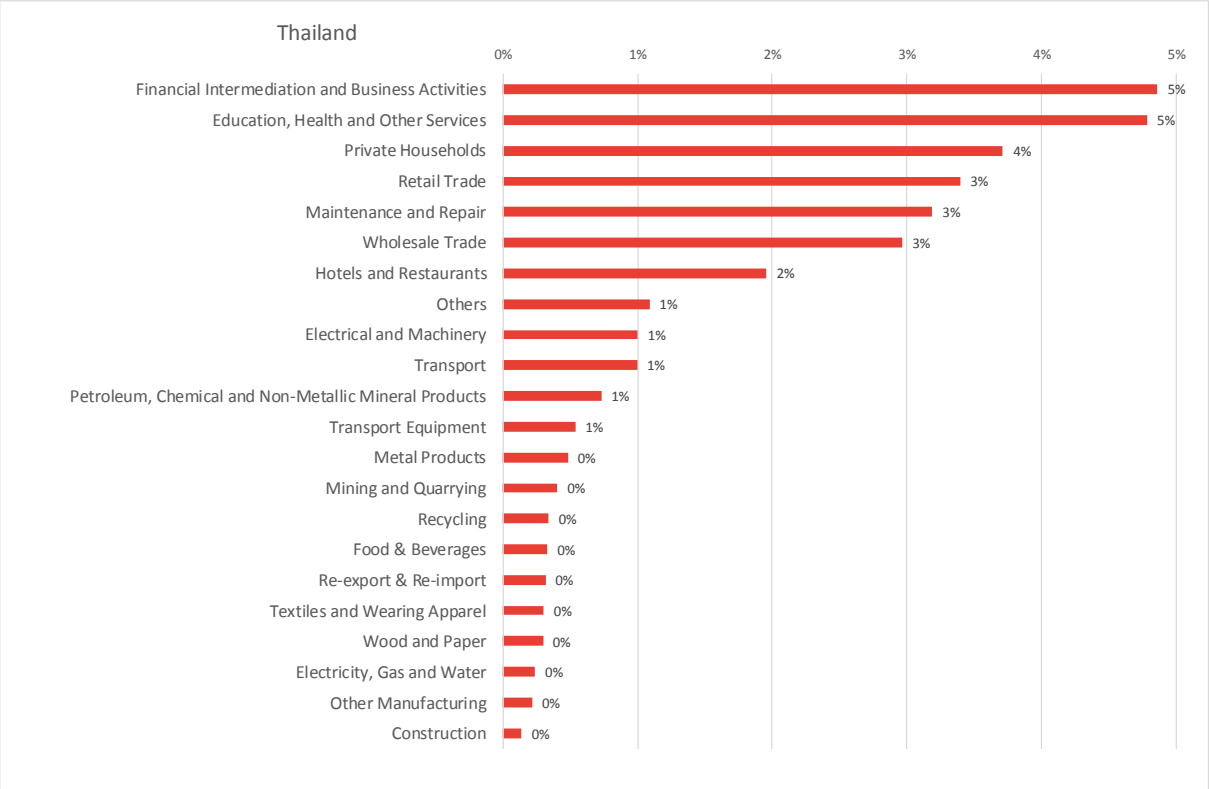


Figure 27: Telecommunications intensity by sector in Thailand



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