Staff working note

Vizualizing ICT Indicators

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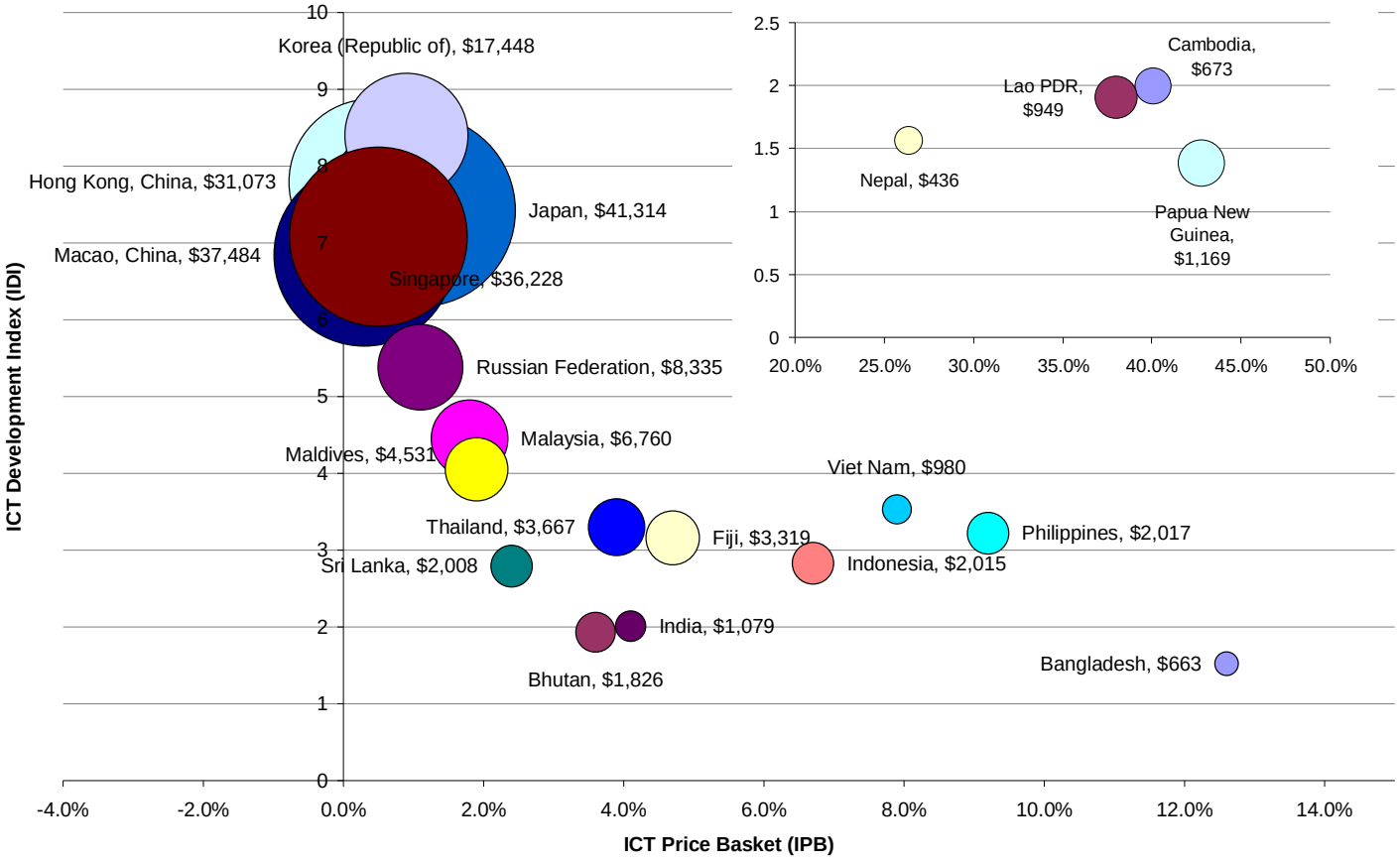
The Asia-Pacific region is becoming a significant driver of global economic growth. In 2010, the region's developing countries grew at a rate of 8.8 per cent compared to 2.7 per cent for the world's developed economies. In the region, mobile telephony and broadband internet in particular are bringing unprecedented digital opportunities that are transforming societies. However, a number of gaps, particularly in infrastructure, need to be addressed to ensure that these digital opportunities do not engender a digital divide, thereby accelerating regional inequities. The graphs below seek to provide a way to visualize the effect of factors such as ICT skills and infrastructure, ICT prices and access, and average income, on the development of ICT in the Asia-Pacific region.

1. Prices, ICT development, and income per capita

While the region benefits from having the most advanced country in the world in terms of ICT infrastructure and skills - the Republic of Korea [according to the ICT Development Index (IDI) in 2011], closely followed by Hong Kong (China), Japan and Singapore - it also has countries such as Papua New Guinea which rank among the lowest.

Fig. 1 Relationships between connectivity, usage prices and income for selected economies



The size of the bubble refers to GNI per capita, $US current, 2009. Source: ESCAP. Data on GNI per capita from the ESCAP Statistical Yearbook 2011, data on IPB (2010) and IDI (2010) from the International Telecommunications Union, Measuring the Information Society 2011. http://www.itu.int/ITU-D/ict/publications/idi/2011/;

Notes: The ICT Price Basket (IPB) is a composite basket based on the user prices for fixed-telephony, mobile-telephony and fixed-broadband Internet services, calculated as a percentage of average income.

The ICT Development Index (IDI) is a composite index combining 11 indicators related to the level of networked infrastructure and access to ICT, the level of ICT usage in society, and the level of ICT skills.

Relationships between variables

- IPB & IDI = The ICT Price Basket (IPB) and the ICT Development Index (IDI) are inversely proportional: as the IPB rises, the value of the IDI falls radically. A one per cent increase in the IPB causes a decrease in the value of the IDI by 53.5 per cent - calculated without the outlying countries (Cambodia, Papua New Guinea, Lao PDR Nepal and Bangladesh) in the inset of figure 1. The cross correlation coefficient for these two variables is -0.597, if calculated with outliers. If calculated without outliers, it becomes slightly stronger at -0.680.

- IPB & GNI = The ICT Price Basket and the Gross National Income also have an inverse relationship: higher values of IPB are found in countries with lower income per capita. In this case the cross correlation coefficient is only -0.446. This is because income fluctuates considerably, and only at very low levels of IPB does the GNI reach significantly high values. The cross correlation coefficient without outliers reaches -0.678.

- IDI & GNI = The ICT Development Index and the Gross National Income have a direct and positive relationship and in this case the value of the correlation is very high: 0.885. This value is reduced if we exclude the outliers from the calculation.

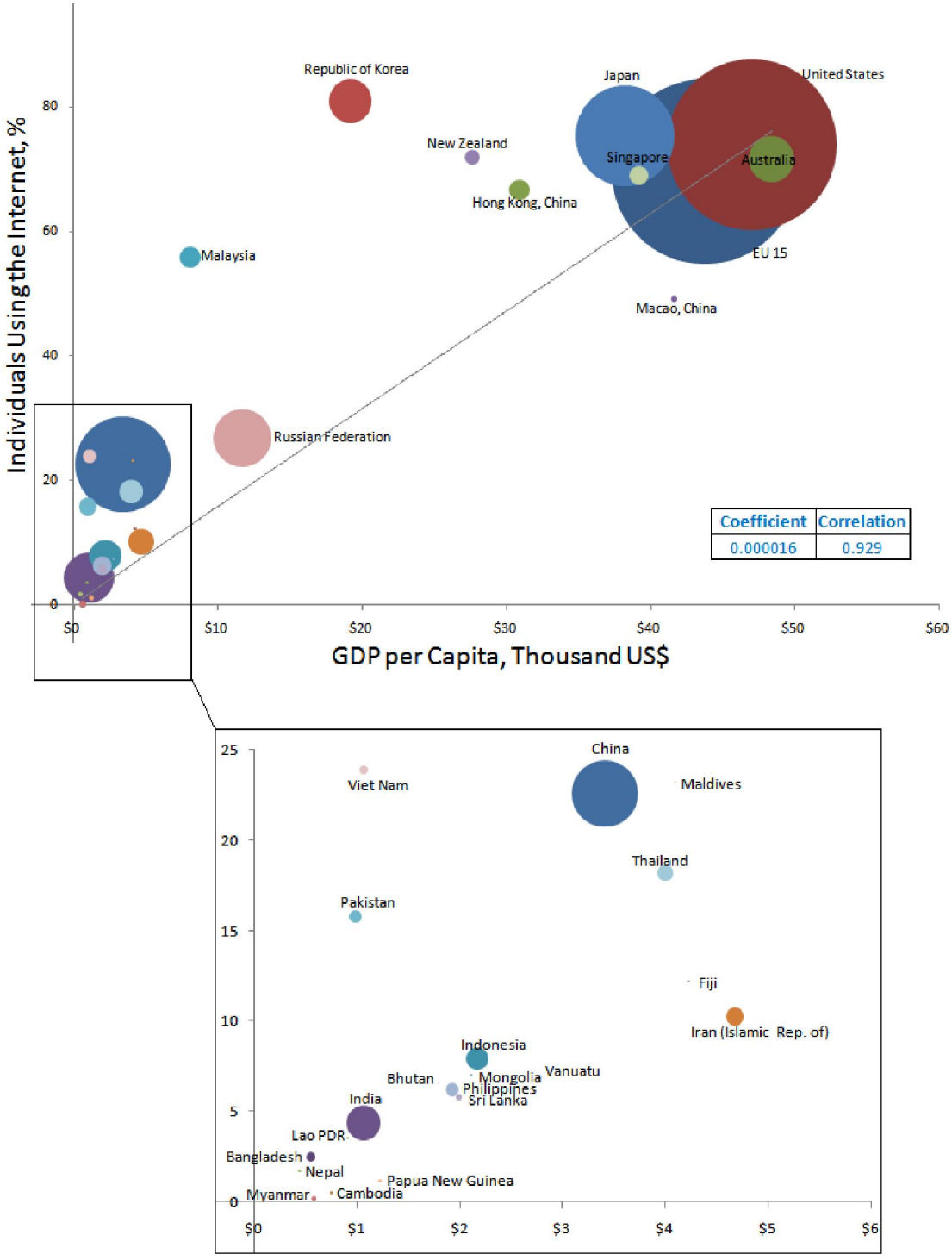
An analysis of standard error explains the wide variation in correlation coefficient values quoted for the first two relationships above. To do this, we take the standard deviation of the three variables (IDI, GNI, IPB) and calculate the standard error of the mean. If we compare the resulting values for both with and without outliers, IPB has the greatest reduction of standard error, proportionally to the ranges of values: from 0.035 to 0.007. For the other two variables the situation is different because the standard errors increase. IDI remains almost the same (0.574 with outliers and 0.659 without outliers) and GNI passes from 3395.97 with outliers to 4376.82 without. As a result, when we investigate IDI and GNI together, removing the outliers doesn't bring any improvement in the r^2, but actually worsens the result, because we loose valuable data owing to the sample being smaller.

Outliers: The graphs show that countries like Cambodia, Papua New Guinea, Lao PDR, Nepal and Bangladesh are not on the path of the line of best fit. This is due to the fact that they have attained a certain level of ICT development, but at user prices that are much higher.

2. Internet

Figure 2 below shows the relationship between Gross Domestic Product (GDP) per capita and the percentage of the national population using the Internet in a given country. Malaysia and the Republic of Korea have managed to achieve high levels of internet usage compared to countries with much higher GDP per capita. The graph also shows the line of best fit between these indicators, with the European Union 15 (EU) and the United States (US) also shown for comparative purposes. Both, Malaysia and the Republic of Korea have values far from the line of best fit which affects the result substantially, given that the number of countries shown is small. If the outliers were excluded from the calculation of the line of best fit, the cross correlation coefficient would be very high (0.93), indicating a strong association between these two variables. The gradient of the line of best fit is 0.0000158, meaning that for an increase of US$ 100 in GDP per capita, the percentage of the national population using the Internet would increase by 0.16 per cent.

Fig. 2 Relationship between the percentage of the national population using the Internet (2010) and GDP per capita (2008) for selected economies



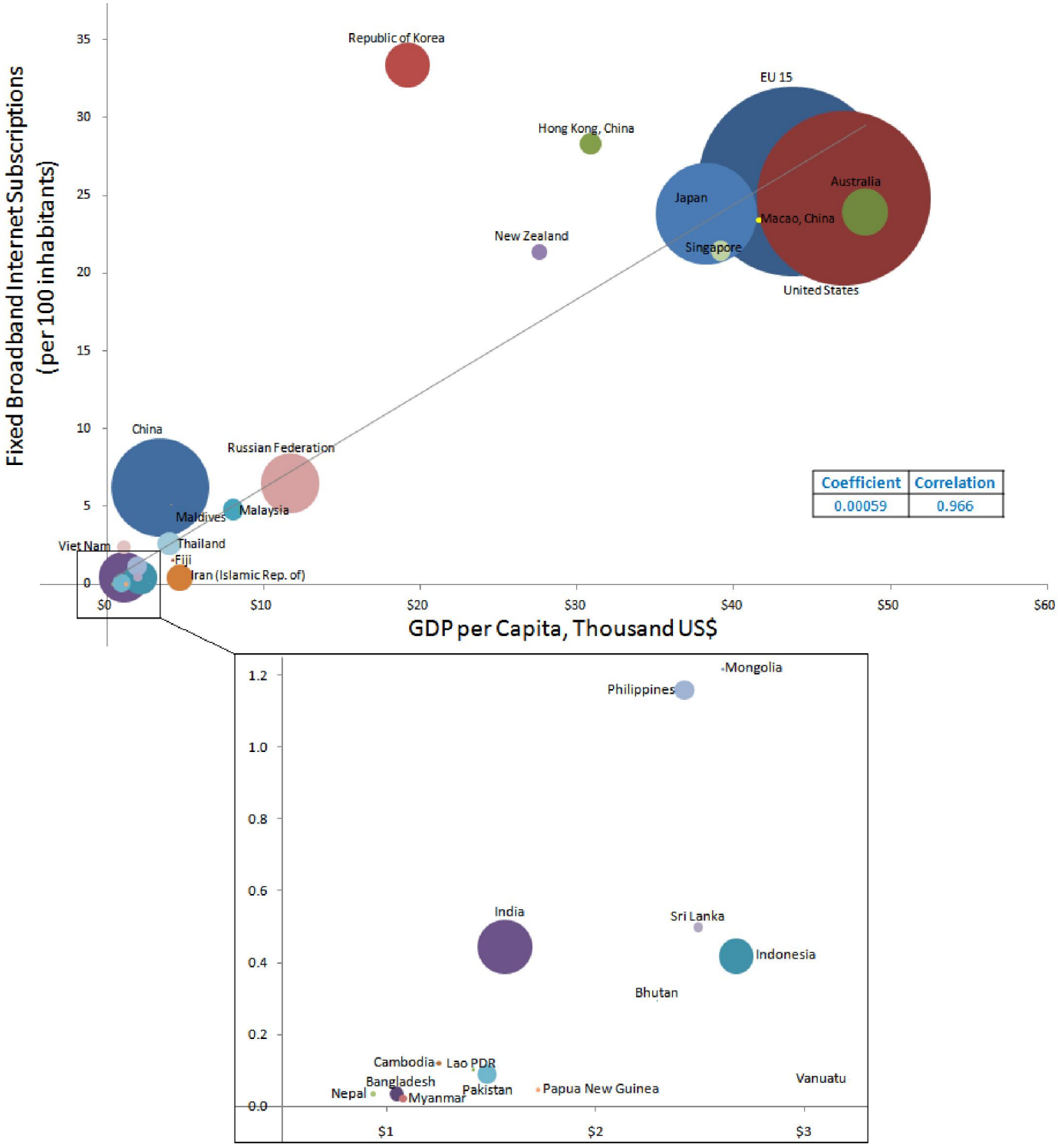
The size of the bubble refers to nominal GDP per capita 2008, current US$. Source: ESCAP. Data on GDP per capita from World Bank National Accounts data files, and OECD National Accounts data files, accessed at data.worldbank.org; data on Internet usage from the International Telecommunications Union, World Telecommunication/ICT Indicators Database 2011;

3. Broadband

Low levels of access to ICT across the Asia-Pacific region can widen inequality. This is particularly the case with high-speed broadband internet which is instrumental in the exchange of content-rich materials. On average, less than 20 per cent of people in Asia-Pacific have access to the Internet and a mere 3 - 4 per cent have access to high-speed broadband. This level of connectivity is not only much lower than in North America (78 per cent), Europe (62 per cent) and even Latin America and the Caribbean (33 per cent) but it also concerns precisely those technologies that are most closely associated with the reshaping of the information economy and the transition to a knowledge-based society.

Figure 3 shows the number of internet subscriptions per 100 inhabitants using fixed (wired) broadband internet by country against GDP per capita by country. The results show two groups of countries: one where broadband technology is very developed and the other where it is not. The gap between the two groups is much wider than in Figure 2, because broadband internet is a more recent technology. The main outlier is the Republic of Korea which has a GDP per capita which falls between the two main cluster groups and at the same time the highest ratio of broadband usage per 100 inhabitants - a reflection of the importance accorded to the development of the ICT sector in the Republic of Korea's national development strategy. In Figure 3, for the line of best fit, the cross correlation coefficient is equal to 0.96 (excluding the outlier of the Republic of Korea), while the gradient of the line of best fit is 0.000604, meaning that for an increase of 100 units in the GDP per capita the subscription to broadband internet will increase by 6%. Note: the European Union 15 (EU) and the United States (US) were added to the graph for comparison purposes and are not included in the calculations just described.

Fig. 3 Fixed (wired) broadband Internet subscriptions (2010) and GDP per capita (2008), selected economies



The size of the bubble refers to nominal GDP per capita 2008, current US$. Source: ESCAP. Data on GDP per capita from World Bank National Accounts data files, and OECD National Accounts data files, accessed at data.worldbank.org; data on Broadband from the International Telecommunications Union, World Telecommunication/ICT Indicators Database 2011;

4. Mobile telephony

In five years, the number of mobile telephone subscriptions in the Asia-Pacific region more than tripled, rising from 0.83 billion in 2005 to 2.67 billion in 2010. In East Asia, for example, 83 per cent of people living in rural areas have a mobile phone. This technology is providing an affordable and inclusive means of communication to large segments of the population.

Figure 4 shows the relationship between GDP per capita and the number of mobile phone subscriptions per 100 inhabitants in selected economies in the region. Up to a certain level of GDP per capita (around $10,000) there is a strong and positive correlation between the variables. After this point the pattern splits into two parts: first, an "outlier" part including the Russian Federation, Hong Kong (China) and Macao (China) showing very high penetration percentages of around 120-150 per cent; and a second part, for countries with high per capita incomes, where usage penetrations flatten at around 100 per cent and remain stable.

This indicates that high GDP per capita is not necessarily a prerequisite of high levels of mobile phone ownership. The graph also shows the line of best fit between these indicators. In this case, the outliers - the Russian Federation, Hong Kong (China) and Macao (China) - are excluded and the cross correlation coefficient is 0.60. The correlation between the two variables is quite low as would be expected from the above discussion. The gradient of the line of best fit is 0.00165, meaning that for an increase of US$ 100 in GDP per capita the percentage of subscription to mobile phones will increase by 16.5 per cent.