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ABSTRACT

Very small island states face challenges that are unique and may benefit from coordinated electronic governance strategies. They have populations of less than 1.5 million, are susceptible to natural disasters, have higher volatility in their economies, greater reliance on larger economies for trade, remittances from nationals living abroad and limited capacity in their domestic industries and public sector services. In particular, very small island states have populations of which a large portion comprise of tourists, limited resource base and tend to rely on service industries such as tourism and offshore finance to sustain their vulnerable economies. This means that these states need assistance in building their capacity to sustain economic development. In particular, there is a correlation between Information and Communication Technology (ICT) usage and per capita Gross Domestic Product (GDP) which may enable greater capacity building efforts to be successful in small island states. This paper draws upon the most recent data on the very small island states to arrive at an analysis of the link between ICT usage and per capita GDP growth. Following a regression analysis of two hypotheses, further analysis is conducted to identify a multiplier effect between ICT usage and per capita GDP growth. This paper illustrates how the ICT multiplier effect takes place to bring about increases in per capita GDP. An understanding of the relationship between these two indicators can enable capacity building strategies to be developed that can contribute to sustainable development in the small island states.

Keywords: Information and Communication Technology (ICT) Usage, Per Capita Gross Domestic Product (GDP), Multiplier effect, Very Small Island States.

INTRODUCTION

The characteristics of the very small island states are unique in that they have undergone some changes in their demographics that affect the human resources available to them. This in turn is affected by changes in the economic conditions that in effect lead to cyclical changes bringing about greater volatility. In particular, the recent volatility in some of the small island states has been highlighted and explained through studies depicting the vulnerabilities of the small island states (Adam and Urquhart 2007, Briguglio et al. 2008, Prasad 2003, Pelling and Uitto, 2001, Douglas 2006). As there is limited public information available on the development of small islands states as it relates to their use of ICTs, the analysis of this paper will rely on publically available data to arrive at an understanding of the link between per capita incomes and ICT usage. In doing so, this analysis will enable a better understanding of how public administration in very small states may support their growth and development through investments to build ICT capacity.

The impact of the role of ICT in public administration has been limited (Meijer, 2007). According to Meijer (2007), one of the reasons for this limited impact is a reluctance of public administrations to discuss the deterministic or causal characteristics of the ICTs within the context of institutional transformation. Given the challenges faced by small island states, governance mechanisms to assist them are needed. Electronic governance has long been touted as a means of increasing transparency in government operations, enabling better interaction with citizens, greater civic engagement in the political process and better response to disaster and recovery from it (Baliamoune-Lutz, 2003, Alshawi and Alalwany 2009, Kottemann, and Boyer-Wright 2009). While there have been successes from electronic governance, there are still many areas in which small island states stand to benefit. In particular, there appears to be a role for Information and Communications Technologies (ICTs) in enabling the small island states to be able to achieve greater economic development.

A key ingredient it seems in enabling small island states to be able to achieve greater economic development through ICTs, is by building ICT Capacity. The concept of ICT capacity building is has been used in the literature to illustrate how ICTs can be used to enhance local human and organizational abilities to achieve organizational objectives through investments in

ICTs which have been correlated with a rise in human development (Adam and Urquhart 2007, Andoh-Baidoo et al. 2013, Kottemann, and Boyer-Wright 2009, Bollou, and Ngwenyama 2007). Studies have also shown that there is a role for governments in increasing the ICT capacity of their people through the provision of eGovernment services to facilitate ICT usage and ICT infrastructure (Baliamoune-Lutz, 2003, Alshawi and Alalwany 2009, Kottemann, and Boyer-Wright 2009, Andoh-Baidoo et al 2013).

In this paper, the notion of ICT capacity is based on the fact that the usage of certain types of ICTs, such as mobile phones, lead to an increase in incomes (Abraham 2006, Economist 2009, Aker and Mbiti 2010, Chavula 2013). The proportion of this increase is studied in this paper as the multiplier effect that investments in ICTs to build capacity can bring about increases in incomes, measured as GDP growth. This paper investigates the role of mobile communication technologies, internet and broadband networks in supporting the growth of small island states. It investigates the question: How does growth in ICT usage bring about growth in per capita GDP in very small island states? The analysis of the effects of ICT usage on GDP growth is based on the most recent data available from the World Bank and ICT data from the International Telecommunications Union. Very small island states are used in this analysis because they have unique characteristics that enable them to either take advantage of ICT directly where there is the capacity to do so, particularly in terms of human capital.

The following sections provide an overview of the key demographic characteristics of small island states that make them stand to benefit from electronic governance. Following a regression analysis of the variables identified in the model, further analysis is conducted to identify a multiplier effect between ICT usage and per capita GDP growth. This is then used to develop a model of capacity building in small island states.

DEVELOPMENT IN VERY SMALL ISLAND STATES

Very small island states have some very unique characteristics that make them particularly prone to environmental disasters, climate change, and are prone to depletion of their resources (Pelling and Uitto, 2001). They tend to rely on tourism for their main sources of income as their agricultural and fishing industries are becoming depleted. Small Island states that have benefitted from tourism and off shore finances, such as Antigua and Barbuda, Barbados, Dominica, and Mauritius have also demonstrated higher levels of economic development than

those that rely exclusively on agriculture and manufacturing services. Small Island states are defined as those with populations of less than 1.5 million, are bodies of land surrounded by water and have statehood in terms of political sovereignty (Prasad 2003). The characteristics of the very small island states make them unique in their need for governance mechanisms in that they need support for their economies. These characteristics include but are not limited to (Briguglio et al. 2008, Prasad 2003, Pelling and Uitto, 2001, Douglas 2006, Easterly and Aart 2000):

1) The small size of small island states makes the use of their limited land resources an important consideration for their governments. These resources can be spread across agriculture, manufacturing, tourism, services or financial services.

2) Their natural resources are limited and often dwindling thereby increasing dependency on other countries. Food security is a challenge for very small island states whose agricultural resources are limited and fishing industry dwindling.

3) Volatile economies are very susceptible to fluctuations in global markets. Very small island states depend upon other nations, particularly the larger ones for their trade in resources, goods and services.

4) Dependence on neighboring nations makes them particularly vulnerable to economic and political changes.

5) Insular and remote from other states means that these small island nations are surrounded by sea and have large costal zones. Transportation is needed within and in between the small island states to enable trade.

6) Vulnerability to climate change and natural disasters makes the small island states dependent on assistance from outside sources.

7) Limited human resource base due to small population makes it difficult for these states to develop labour intensive industries like manufacturing or agriculture.

Their natural resources tend to be scarce and some small island states such as Malta, suffer from water shortages. In addition, those states, such as Barbados, that benefitted from off shore financing have been subject to increased regulations (Prasad 2003).

There is evidence to suggest that small states have on average higher income and productivity levels than large states, and grow no more slowly than large states. While Per capita

GDP growth rates are more volatile in small states, any growth disadvantages of this greater volatility are more than outweighed by the growth benefits of trade openness reaped by small states Easterly and Aart, (2000). Prasad (2003) found that economic trade zones have been successful in bringing about economic development in small island states. Electronic government strategies that support the creation of ICT based industries and electronic commerce can enable the small island states to become more resilient to the vulnerabilities identified by Briguglio (2010), Briguglio et al. (2008) and Douglas (2006).

The limited human resource bases of the small island states can be best illustrated through the changes in their populations and their per capita incomes using the most recent data available. The reason these indicators are used, is because the data for them was most current and complete. In addition, they represent the most reliable measure of the human resources available for the small island state to draw upon. The populations of the very small island states have varied considerably for the very small state of Nauru whose population declined by about 33% from 14,019 in 2009 to 9,267 in 2010 (Government of Nauru 2013). It appears that when the Australian government decided to move its immigration processing center from the island of Nauru to its mainland, a large number of Nauru's population lost their livelihoods and some even left the island for search of better jobs. Dominica and Seychelles have also seen declining populations of their residents since 2009. While the total population data also includes tourists, it is difficult to use that as a metric for the human resource base of the islands. In order to get a sense of the human resource base, we use population growth where fluctuations in tourism can be considered a constant. The following section, considers the Information and Communication Technology (ICT) capacity of the small island states and their ability to achieve Development through their ICTs.

INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) CAPACITY

Even though ICT capacity is an important component of development, it is rarely discussed in the literature. Adam and Urquhart (2007) define ICT capacity building as "..the process of creating or enhancing local human and organizational abilities to use ICT to perform specific tasks in organizations in order to attain organizational objectives, and it is based on the idea of human capital" (p.317). The importance of human and social capital to enable ICT investments to succeed has been stressed by a number of authors (Hosman, Fife and Armey 2008, Bollou,

and Ngwenyama 2007, Adam and Urquhart 2007, Kottemann, and Boyer-Wright 2009). Where there appears to be a positive relationship between countries in which ICT investments are connected to a rising human development index and education (Bollou, and Ngwenyama 2007, Diaz Andrade and Urquhart 2008, Kottemann and Boyer-Wright 2009). It appears therefore that the social capital in a country affects its ability to develop using its ICT investments (Díaz Andrade and Urquhart 2009, Hosman, Fife and Armey 2008).

It appears that these interdependencies might be fueled by the innovative uses of ICTs and the possibilities opened up by these offer wealth to those who have access to the ICT infrastructure and capacity of a country to use ICTs. The role of public administration is important in supporting the development of ICT capacity. Adam and Urquhart (2007) suggest that three major conditions are necessary for capacity building to take place: (a) an enabling environment with appropriate methods, tools, policies, and legal framework; (b) an institutional development that supports community participative development efforts; and (c) human resources development through training and education. Studies have shown that there is a connection between GDP growth and ICT uptake (Bollou, and Ngwenyama 2007, Diaz Andrade and Urquhart 2008, Kottemann and Boyer-Wright 2009, Qureshi 2010, Qureshi et al 2009). In this section, the relationship between per capita income growth and ICT growth will be analysed to arrive at an understanding of areas in which capacity building efforts can lead to growth in the small island states. The human resource base as indicated by populations and per capita incomes provide an indicator of the ability of people in a small island state to be able to contribute to its development. ICT capacity of the small island states is assessed in terms of the usage of ICT as it relates to per capita GDP growth. The following sections identify and define the key indicators used in our analysis:

Income Growth

In recent years, the very small island states with low per capita incomes have seen significant growth in their people's ability to spend. Solomon Islands per capita incomes grew by 20.33%, Kiribati's by almost 16%, Vanuatu BY 9.21%, Tuvalu's by 12.31%, Mauritius's grew by 15.55% and Tonga's per capita incomes rose by 17.14%. The growth in these incomes is largely due to growth in tourism in these states. Although Barbados also saw a rise in its tourist population from 519,000 in 2009 to 532,000 in 2010, its decline in per capita incomes may be

due to increased regulation of the financial markets and global security and crime prevention initiatives that make it more difficult for investors to put their money in off shore accounts. This data is illustrated table 1 in appendix 1. While per capita incomes are a good indicator of disposable incomes, they do not take into account the total amount spent or available for spending by governments. In order to get a more accurate picture of available funds, the Gross Domestic Product (GDP) of a country is used in this research.

Per capita Gross Domestic Product (GDP) is an important indicator of very small island states' resource base. It is the total income of a country divided by its population. It illustrates the income available per person that can be used to purchase goods and services. Increasing levels of per capita incomes provide an indicator of the level of income a government can expect through taxation when trying to develop policies for the benefit of their citizens. Low or declining levels of per capita income indicate opportunities for public administrations to develop their human resource bases through training and the creation of high demand industries, such as in ICT services. Per capita incomes are also reliable indicator of the effect of remittances from nationals living abroad who send money to relatives in the small island states. This also has the effect of increasing disposable incomes and thus enabling people to purchase goods and services they would otherwise be unable to.

ICT Usage

There are three indicators of ICT usage: the number of mobile cellular telephone subscriptions (MCT) per 100 inhabitants; individuals using the Internet and Fixed (wired) Internet subscriptions per 100 inhabitants (INTU); and Broadband Internet subscriptions per 100 inhabitants (BIS). This data is collected from the International Telecommunications Union's ICT at a glance database and other public sources for small states whose data is not available through the ITU.

The first indicator, Mobile cellphone telephone subscriptions (MCT) is an important indicator of the use of mobile phones in their daily lives. The economist (2009) reported a study that found that for every 100 cellphones in use in a typical developing country, its GDP rose by 0.8%. Other studies have shown that mobile phone usage leads to an increase in incomes by increasing market efficiencies, access to capital, gains in productivity and a reduction in price fluctuations (Abraham, 2006, Aker and Mbiti 2010).Qureshi (2012) reported that the growth of

an economy based on the penetration of ICTs is significant in that the difference between use ICTs in countries that adopt ICTs amounts to a 750% growth in businesses that adopt ICTs compared to those that do not. The same study showed an increase in profitability by 113% and labour productivity of 56%. The use of mobile phones in these same countries can have a cyclical effect on their growth. Qureshi (2013) reported that a cyclical relationship between mobile phone use and growth would mean that an increase in individual income would lead to purchase of mobile phones which would lead to the emergence of new businesses supported by the mobile phones that address the demand of certain products of services.

The majority of very small island states have over 100% cellphone penetration suggesting that there are multiple cellphone per citizen. States that have over 100% and growing mobile cellphone penetration are Antigua Barbuda, Maldives, Dominica, Saint Kitts and Nevis, Seychelles, Grenada, Saint Lucia and Malta. High and declining growth in mobile phones are being experienced by Trinidad and Tobago, Barbados, Bahamas and Vanuatu. It is the very small island states of Kiribati, Tuvalu, Solomon Islands, Belize, Mauritius, Malta and Samoa that are experiencing rapid growth in their mobile cellphone subscriptions. The ICT usage data combined over four years is illustrated in Table 2, in appendix 1.

The second indicator of ICT usage is through the number of individuals using the Internet and Fixed (wired) Internet subscriptions per 100 inhabitants (INTU). This is an important indicator in that some small island states have over half their populations using the internet and growing, while others are barely making a dent in their internet usage and are at single digits. While internet users are growing in small island states such as Antigua and Barbuda which has an average 80% internet penetration, Barbados (71%), St Kitts and Nevis (75.48%), Malta (65.28%) and the Bahamas (53%) , there are a large number who are being left behind. These states include Guinea-Bissau in which only 2.6% of the population have internet access, Comoros (5%), Solomon Islands (5.5%) and Timor-Leste (0.55%) (see Table 2 in Appendix 1). Many in these small island states are unable to read or use a computer to search the web, those who are unable to understand the language that is used to communicate on the internet and those who have been marginalized by the lack of access to ICTs (Qureshi, 2013).

The third indicator of ICT usage is measured through Broadband Internet subscriptions per 100 inhabitants (BIS). The data in our sample suggest there are a few countries with low

levels of broadband Internet subscriptions that are experiencing growth in this area. For example, in Tonga BIS penetration is at 1.18% and growing at a rate of 15.32%, in Guyana on average 2.2% of the population have BIS which is growing at a rate of 45% and in Seychelles the average is about 9% and growth is at 13.13%. There is also declining growth in this area in many of the small island states in our sample. For example, the small island states of the Bahamas, Antigua and Barbuda, Brunei Darussalam, and Saint Kitts and Nevis have over 50% percent internet penetration but declining growth in broadband internet subscriptions. While the small island states of the Bahamas, Trinidad and Tobago, Brunei Darussalam, Barbados, Saint Kitts and Nevis and Antigua and Barbuda have over 50% of their people using the Internet, some states such as Malta are actually seeing a rise in their broadband subscriptions. It appears that while this is an important indicator of ICT usage, it is mostly connected to the availability and access to the use of the other two indicators. Given these conditions, we hypothesize that:

H1: An increase in ICT Usage (Measured through the MCT, INTU and BIS variables) will lead to an increase in per capita GDP growth.

Population Growth

The majority of the very small Island states have seen steady increases in their populations. Notable examples of increases in populations have taken place in Belize, Solomon Islands, and Vanuatu, Antigua and Barbuda, the Bahamas, Barbados, Grenada, Maldives and Malta are estimated to have more than double the number of tourists than their populations (Waters. 1998). However, in recent years, 2009 onwards, these states have seen declining numbers of tourists. For example, Antigua and Barbuda has seen a decline in its tourist population from 234,000 to 230,000 in 2009 to 2010 and Trinidad and Tobago have also seen a decline from 433,000 to 413,000. (World Bank DataBank, 2013). Antigua and Barbuda's and Trinidad and Tobago registered populations are a fraction of their tourist populations, remain steady. While tourism is an important source of income for very small states, tourism is also a source of volatility on their economies due to global recessions, climate changes and/or natural disasters can decrease any gains made from that industry. Given these fluctuations in populations, we use population as a mediating variable to see if changes in population growth affect changes in the relationship between growth in ICT usage and per capita GDP. We therefore hypothesize that:

H2: An increase in ICT usage will lead to greater increases in per capita GDP growth when there is an increase in population Growth.

METHODOLOGY AND ANALYSIS

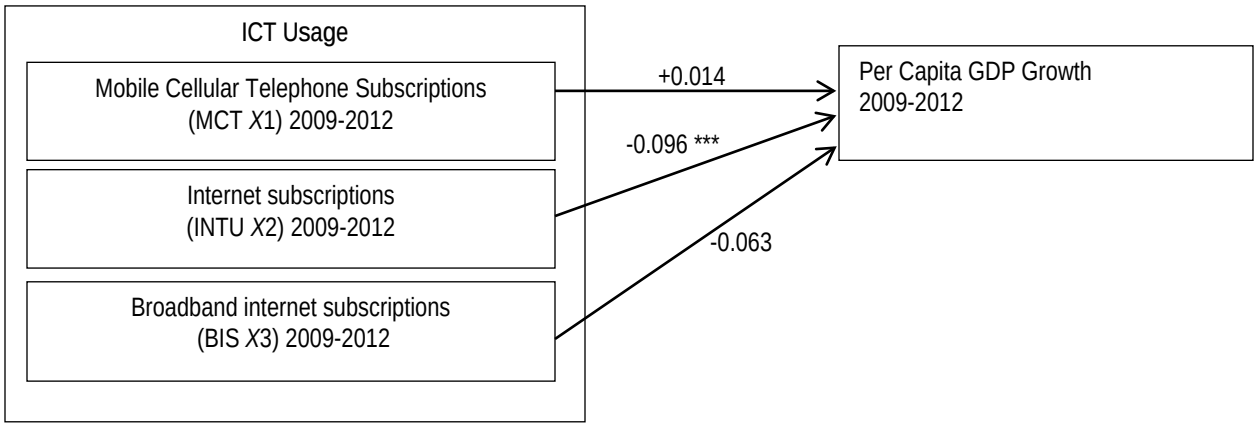
The key characteristics that are deemed to influence the development of very small island states are described using data from the World Bank, Information Telecommunications Union and other sources such as census bureaus of countries not listed in the public databases. Wherever possible, case studies are used to highlight the key causes of the volatility shown. First the growth for the separate indicators, BIS, MCT and INTU was calculated for the years 2010-2012. Then these were combined in an average to produce an index of ICT growth for each of the small states over that same period. As GDP growth represents the growth of a country as a whole, per capita Income growth was calculated over the years 2010 and 2012 for all the 32 very small island states in our sample.

A linear regression model in which the independent variables: BIS, MCT and INTU are tested against the dependent variable, per capita GDP Growth. Population growth is seen to be a mediator and using hierarchical regression, we are able to determine its influence on the relationship between the ICT variables. In order to understand the relationship between Mobile Cellular Telephone Subscriptions (MCT), Internet subscriptions (INTU), Broadband internet subscriptions (BIS) and per capita GDP Growth from 2009 to 2012, a linear regression was carried out. The first hypothesis we tested was: H1: An increase in ICT Usage (Measured through the MCT, INTU and BIS variables) will lead to an increase in per capita GDP growth.

The results of our initial linear regression to test Hypothesis 1 show that it partially holds. Increases in Mobile Cellular Telephone Subscriptions in the very small island states in our sample lead to an increase in per capita GDP growth. However, Internet Subscriptions and Broadband internet subscriptions are inversely correlated to per capita GDP growth. The results suggest that for all the 32 countries over a period of four years (2009, 2010, 2011, 2012) there is a link between the growth in incomes and the ability of people to pay for ICTs. For every increase in the use of Mobile Communications Technology (MCT) in our sample there is a 0.014 percentage growth in per capita GDP.

Our data illustrates that the majority of countries in our sample tend to increase their use of MCTs by a greater proportion than their growth in per capita incomes. Even countries with falling per capita incomes tend to continue to demonstrate sustained MCT growth. However, an increase in the usage of Internet subscriptions (INTU) and Broadband internet subscriptions (BIS) over the same period for the 32 countries leads to a decrease in per capita GDP growth of -0.096 percent for INTU and -0.063 percent for BIS. The results of this analysis are illustrated in the figure 1 below:

Figure 1: ICT Usage to Per Capita GDP Growth

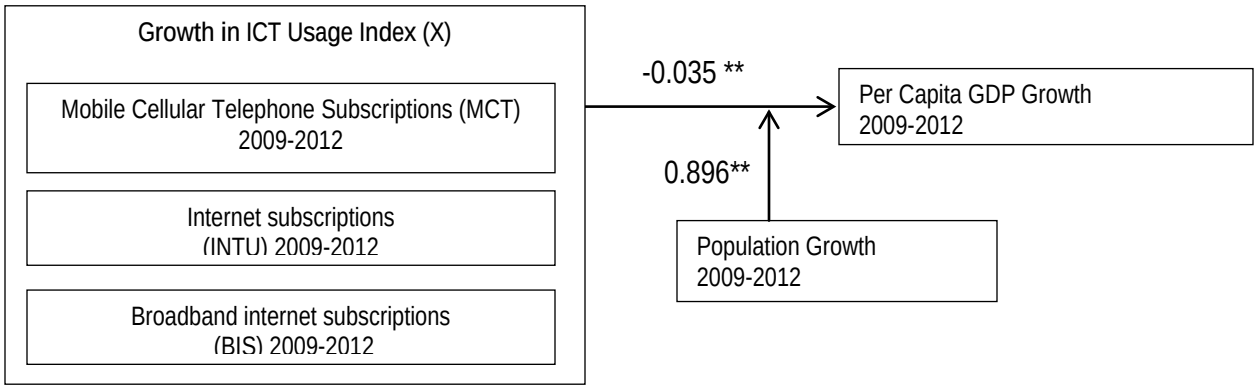


Note: *** significant at 0.001

Further analysis illustrates that there appears to be some multicolinearity between the ICT usage variables, in particular among the INTU and BIS variables. We conducted a principal component analysis (Factor analysis) to find that all three ICT variables correlated into one component matrix. In order to account for this the three ICT variables: MCT, INTU and BIS were integrated into an ICT Usage Index (construct). This variable was then used in a hierarchical linear regression model to ascertain the effects of ICT usage on GDP growth.

In this model, Population growth (POPg) was used as a mediator in order to find out if the relationship between ICT Usage is affected by the growth in a very small island state's population. In this analysis we tested the second hypothesis H2*: An increase in ICT usage will lead to greater increases in per capita GDP growth when there is an increase in population Growth.* The results of this analysis are illustrated in figure 2 below:

Figure 2: The effects of ICT Usage on Per Capita GDP Growth



Note: ** : significant at 0.05

Combining the ICT usage variables into a single Index variable for all the countries over the four year period provides us with a generalizable view of the relationship between the aggregate variables and per capita GDP growth. As illustrated in figure 2, the results suggest that there is an inverse relationship between ICT usage and per capita GDP growth: for every percentage point increase in aggregate ICT Usage for the 35 countries over four years, there is a decrease in per capita GDP of -0.035 percent. The results of the linear hierarchical regression suggest that for every percentage increase in population, there is a 0.896 percent increase in per capita GDP growth. For the entire sample, Hypothesis 2 does not hold.

However, our data shows that on average for the four years, in Barbados per capita GDP are declining by 5% in 2009 but ICT usage continues to grow at a rate of over 70%, Antigua and Barbuda's GDP are declining by -12% but ICT usage grows by over 90%, the Maldives saw their per capita incomes shrink by 2.5% but a staggering growth in their ICT usage of 13%, and the Bahamas saw their per capita GDP fall by 4.2% in and a growth in ICT usage of 58.4% in 2009 (see appendix for data).

In order to find out why some countries are experiencing large growth rates connected to their ICT usage, we conducted an analysis of our data for the four years. To see the changes in GDP growth over the period of 2009-2012 based on a yearly basis, an indicator variable was

introduced to represent years and three dummy variables (X1-X3) were created as the independent variables. These variables are illustrated as follows:

Table 1: Variables representing years

X1=1 if year 2010	X2=1 if year 2011	X3=1 if year 2012
X1=0 o.w	X2=0 o.w	X3=0 o.w

We then conducted multiple regression using these variables. Now the multiple regression includes five independent variables and the ANOVA shows that all the variables are significant as before as well as the indicator variable, which is, time. The new model with a time indicator was improved from the base model when the time indicator was not introduced to the Regression model. Adjusted R-sq increased which is indication of a better and a robust model. The results of the regression are illustrated as follows:

Table 1: Regression results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	**(Constant)**	-.048	.998		-.048	**.962**
	ICTg	-.042	.014	-.258	-2.979	**.004**
	x1	2.616	.896	.288	2.919	**.004**
	x2	3.776	.897	.416	4.207	**.000**
	x3	3.358	.932	.352	3.602	**.000**
	POPg	.895	.364	.212	2.462	**.015**

a. Dependent Variable: GDPg

Our results suggest that while there is an inverse relationship between the aggregate ICT usage variable and per capita GDP growth in 2009, there is a positive direct relationship between ICT usage and per capita GDP growth in 2010, 2011 and 2012. Table 2 illustrates the results of the regression in which a multiplier value was identified to account for growth in each year. While hypothesis 1 and 2 do not hold for 2009, they do appear to hold for the rest of the years. As there was a major global recession in 2009 and small island states are most vulnerable to external economic pressures, it is not surprising that these states experienced declining GDP growth rates.

In order to account for this, based on the results of the regression for each year, we created the following model:

GDPg=-.048 -.042 ICT + .895 POPg + 2.616 X1 + 3.776 X2 + 3.358 X3

For the Year 2009, GDPg=-.048 -.042 ICTg + .895 POPg

For the Year 2010, GDPg=-.048 -.042 ICTg + .895 POPg + 2.616

For the Year 2011, GDPg=-.048 -.042 ICTg + .895 POPg + 3.776

For the Year 2012, GDPg=-.048 -.042 ICTg + .895 POPg + 3.358

Based on this model we are able to see that in each of the years staring from 2009, the multiplier value for growth each year is different. These values are described as follows:

GDP growth (GDPg) between 2010 and 2009, given that ICTg and POPg stays constant, grows at a rate of 2.616

GDP growth (GDPg) between 2011 and 2009 given that ICTg and POPg stays constant grows at a rate of 3.776

GDP growth (GDPg) between 2012 and 2009 given that ICTg and POPg stay constant grows at a rate of 3.358

GDP growth (GDPg) increases from 2009-2011, but slightly decreases in year 2012.

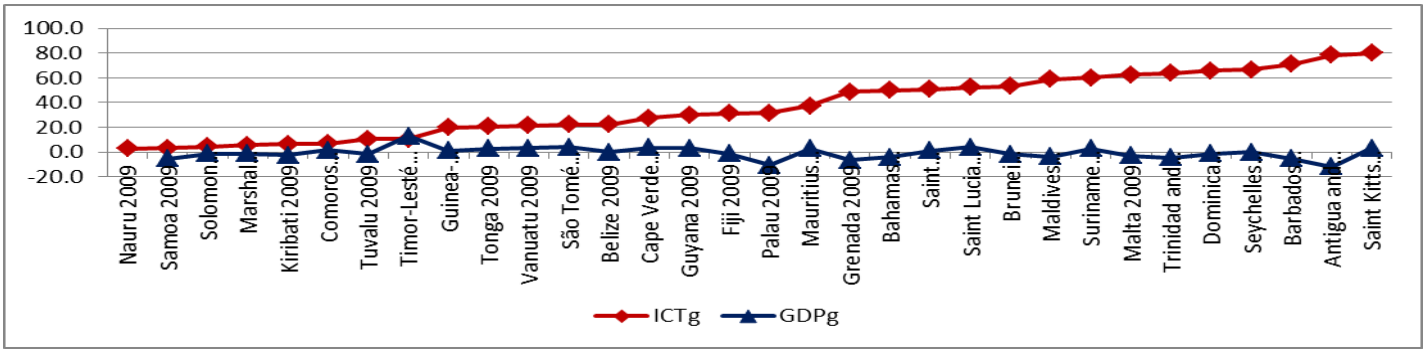
THE MULTIPLIER EFFECT

There appears to be a multiplier effect that causes these very small island states to see rises in their incomes from ICT usage. The economist (2009) estimated that extra 10 phones per 100 people in a typical developing country boosts GDP growth by 0.8 percentage points. More than 4 billion handsets are now in use worldwide, three-quarters of them in the developing world. In Africa, four in ten people now have a mobile phone. (Economist Sept 2009). This means that the multiplier effect of investments in mobile phones has an almost direct effect on incomes by about 10 points. In their study of the economic development effects of mobile phones, Aker and Mbiti (2010) found that in a typical African country, increased communication through mobile phones improve firms' productive efficiency by allowing them to better manage their supply chains, create new jobs to address demand for mobile-related services, thereby providing

income-generating opportunities in rural and urban areas, and mobile phones can facilitate communication among people enabling households to better respond to risks (p.214). In particular, many authours have suggested that mobile phones have a direct effect on economic development by improving living standards and market efficiencies through the reduction of search costs (Chavula 2013, Aker and Mbiti 2010, Kalba 2008, Abraham 2006). In particular Chavula (2013) found that mobile phones have the largest impact on growth in low income countries. Many very small island states are low income countries.

Growth in ICT usage in small island states tends to generate a multiplier effect. This means that when people use their disposable incomes to purchase ICTs, they will use their mobile cellphones to communicate with relatives, customers and suppliers from abroad thereby creating opportunities for increased income generation. They will use their disposable incomes to make use of internet to search for market prices, information on products and services and find new market opportunities for their goods and services. This multiplier effect can be seen, as the gap between growth in per capita incomes and growth in ICT usage. When sorted by ICT growth, from the lowest to the highest in 2009, the following chart in Figure 3, illustrates this gap:

Figure 3: Gap between ICT growth and per capita GDP growth in 2009



The gap between ICT growth and per capita GDP growth in 2009 is particularly apparent in the small island states of Belize whose per capita GDP growth is a mere 0.04% but has a staggering ICT growth rate of 22.5%, Saint Kitts and Nevis has a per capita GDP growth rate of 3.37% and growth in ICT use of 80%, Antigua and Barbuda has an ICT growth rate of 78.38% and a per capita GDP growth rate of -12%, Grenada has a per capita GDP growth rate of -6.7% and an ICT growth of 48.6% and Malta whose per capita GDP is at -2.7 has ICT usage growing by 62.3%. It

appears that growth in ICT usage continues to grow with greater units of per capita GDP spent on it. This is also the case for the very small island states of Kiribati, Tonga, and the Solomon Islands whose ICT usage contuse to grow despite low or negative levels of per capita GDP growth.

In 2010 the small island states started seeing moderate increases in their per capita GDP growth. This lead to an even greater increase in ICT usage growth, thereby increasing the gap between ICT usage growth. The multiplier as described in the above regression analysis states that GDP growth (GDPg) between 2010 and 2009, given that ICTg and POPg stay constant, is at a rate of 2.616 as described in the above model. This means that the growth of ICT usage also leads to a growth in per capita GDP, thereby bringing about enough money to enable people to purchase more ICT goods and services thus increasing their ICT usage. The growth in ICT usage and per capita GDP is a cyclical process. It is fueled by moderate to little increases in per capita GDP which in turn leads to further growth in per capita GDP at a rate of 2.6. The ensuing gap is illustrated in the following figure 4 in which the countries are displayed from the lowest to the highest growth in ICT usage:

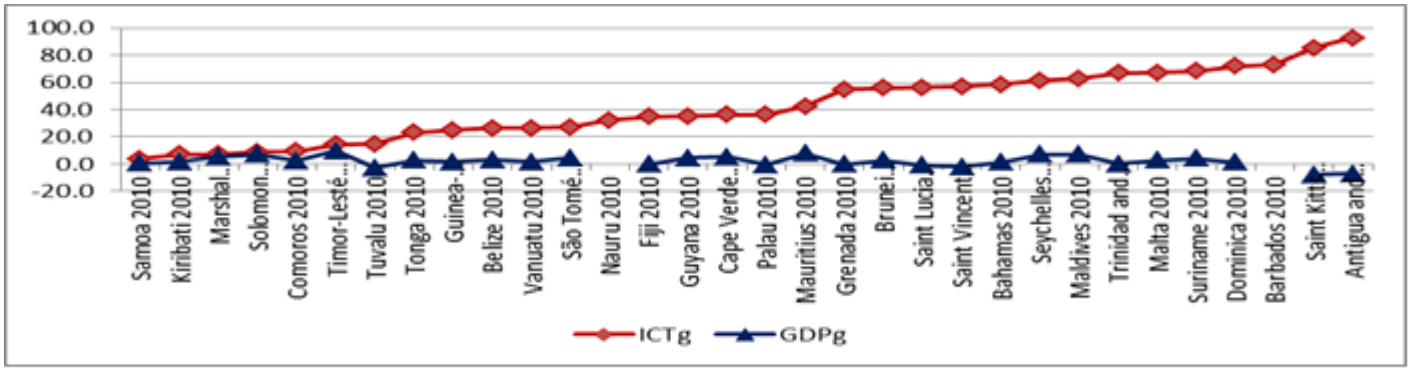
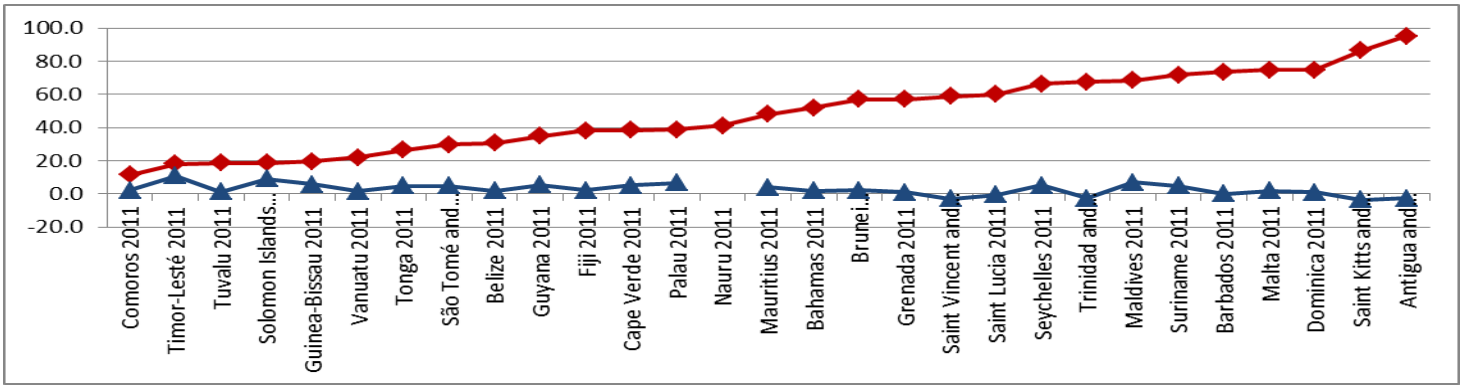


Figure 4: Gap between ICT growth and per capita GDP growth in 2010

The GDP growth multiplier was the highest of all four years in 2011. As stated above, GDP growth (GDPg) between 2011 and 2009 given that ICTg and POPg stays constant grew at a rate of 3.776%. The gap between ICT growth and GDP growth illustrated in order to lowest to highest

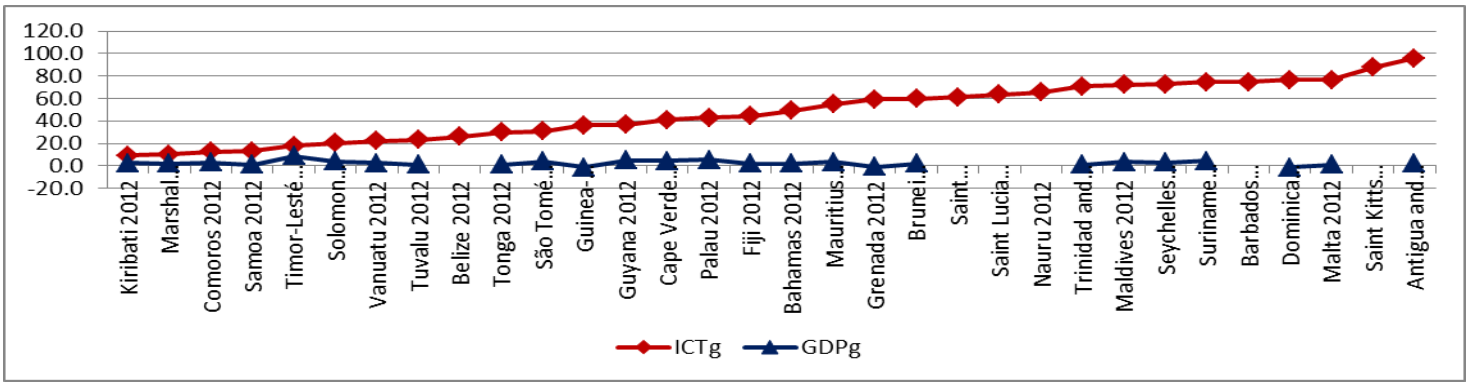
in Figure 5, illustrates this effect. The growth in GDP per unit of ICT usage in some states was more than double the amount spent on the ICT itself. This is illustrated in figure 5 below:

Figure 5: Gap between ICT growth and per capita GDP growth in 2011



In 2012 the GDP growth (GDPg) between 2012 and 2009 given that ICTg and POPg stay constant grew at a rate of 3.358. This is a slight decrease from the previous year, but did not seem to affect the multiplier between ICT usage and GDP growth. This is illustrated in figure 6 below:

Figure 6: Gap between ICT growth and per capita GDP growth in 2012



The volatility in the growth of ICT usage can be seen in the discrepancy between the growth in mobile cell phone usage (MCT) and internet usage (INTU) between 2011 and 2012. The small

island states that exhibit this discrepancy are the Bahamas with a decline in its mobile cellphone subscriptions of -31% and rise in its internet usage of 51%, Vanuatu's cellphone subscriptions declined by -21% and internet usage rose by 12.5%, Trinidad and Tobago's mobile cellphone subscriptions declined by -4% and internet usage rose by 14%, Tonga saw a slight growth in its mobile cellphone use of 0.85% and a rapid rise in its internet use of 56% and Mauritius saw a rise in cellphone use of 9% and a staggering growth in its internet use of 23.4%. It is interesting to note that the small island states that are experiencing double digit growth rates in their per capita income, are also showing very high ICT usage and volatility between mobile cellphone and internet usage. For example, Kiribati with per capita income growth of 16% has 28% growth in its mobile cellphone use and 10% growth in its internet use, whereas, Nauru has a per capita income growth of 14%, a 7.5% growth in mobile cellphone subscriptions and a 17% growth in internet usage.

There are cases in which some small island states have not been able to take advantage of the multiplier effect brought about through growth in per capita incomes used to purchase ICT goods and services A notable example is the small island state of Vanuatu whose per capita income rose by 9% but saw a decline in ICT usage of -4.4%. It appears that Vanuatu may need support to develop its capability to access and use ICTs. In addition, some states appear to have achieved saturation in their ICT usage and there for exhibit a lower growth rates in their ICT usage than their per capita incomes. These are Antigua and Barbuda whose per capita GDP is growing at a rate of 3.5% and ICT usage at a rate of -4.2%, the Bahamas whose per capita GDP is growing by 1.9 but ICT usage growth is at -14.6% and Brunei Darussalam whose per capita GDP is growing at a rate of 2.2% but have an ICT usage growth of -1.3%. These small island states have around or over 100% mobile cellphone subscriptions. There is an opportunity to find out what it is that is causing this level of saturation and what are the effects on GDP growth multiplier.

The analysis so far suggests that as the per capita GDP of small island states increase and they take advantage of ICTs, there is a multiplier effect that takes place bringing about further increases in incomes and ICT usage. However, the opposite effect may take place in small island states that are unable to take advantage of the ICTs. This means that public administrations of the small island states can take advantage of electronic governance strategies to assist their citizens in their use of ICTs in their daily lives and in supporting the provision of goods and

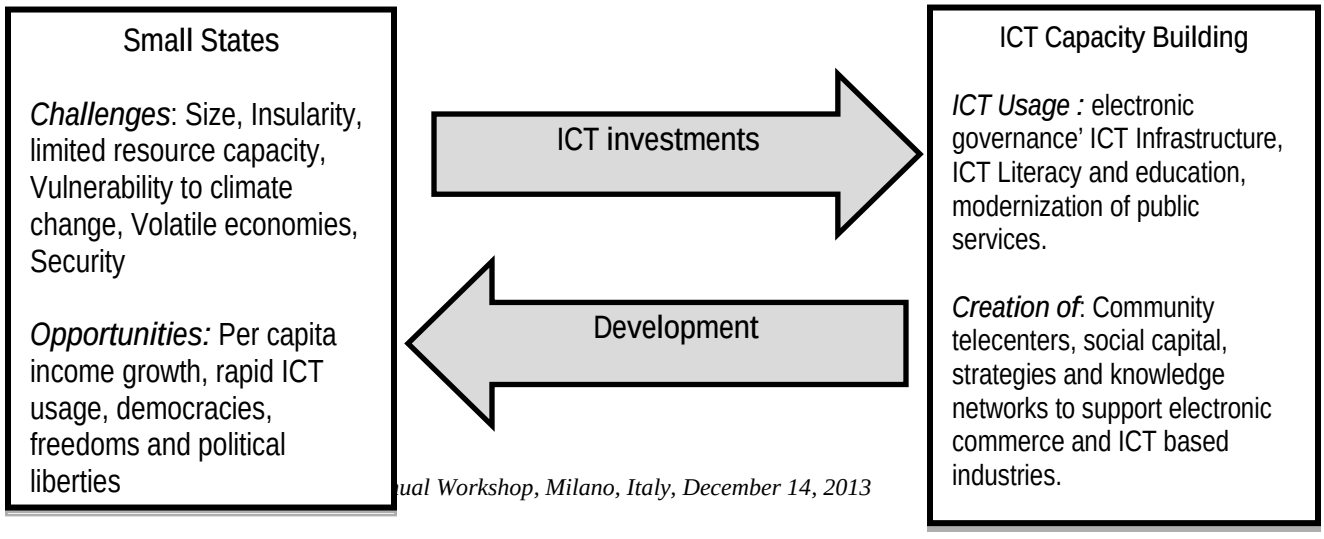
services for their citizens. The following section draws upon this analysis and additional research to arrive at a process model for electronic governance in very small island states.

A MODEL FOR ICT CAPACITY BUILDING IN SMALL ISLAND STATES

The role of public administration in very small island states is just as unique as the states themselves. The above analysis identified the links between per capita incomes and ICT growth as being a defining characteristic of the small island states analyzed in this study. In addition to these indicators, small island states have unique democracies in that they have a post-colonial heritage that guides their view of themselves. In a study of why small island states are democracies?, Anckar (2002) found that small island states that were post-colonial democracies also had higher levels of modernization, literacy and education. The Commonwealth small island states reported as being high on the democracy ranking in order of highest first were: Barbados, Dominica, Saint Vincent and the Grenadines, Tuvalu, Kiribati, Belize, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago, Antigua-Barbuda, Grenada, Mauritius, Nauru and the Solomon Islands (Hadenius, 1992 in Acker 2002). In this study, these same small island states also exhibited sustained growth in their ICT usage.

This presents opportunities for ICT capacity building in small island states. In particular, the support of civic engagement and democracies of the small island states through ICT infrastructures for literacy and education, and community participation in the public sector. It appears that public policy has the potential to spur a country into a positive multiplier effect. The concepts that can enable capacity building in small island states are brought together in a model depicted in figure 7 below:

Figure 7: A Model for Capacity Building in Small Island States



The above process model depicts the effects of the ICT multiplier on the growth of small island states. Electronic governance strategies targeted at promoting ICT usage can drive increased economic development through targeted investments in ICT infrastructure and education and the creation of community programs that promote social capital and knowledge networking. ICTs provide citizens of small island states with the capability to connect with each other to share information and knowledge needed to carry out certain business ventures. Qureshi et al. (2009) have shown that knowledge networking can help reduce the effects of the digital divide. In order to promote knowledge networking electronic governance infrastructures will have to include education and literacy programs.

The levels of education in a country can affect the level of utilization of ICT capacity while at the same time may also marginalize groups of people from the opportunities made possible by ICT. Education alone does not affect the levels of utilization of ICT. Baliamoune-Lutz examines the diffusion of ICTs in developing countries through careful analysis of economic indicators. The indicators of ICT she analyzes are Internet hosts, Internet users, personal computers and mobile phones she found the similar correlations between Internet use and civil liberties, financial liberalization and mobile phone and personal computers, and no correlation between foreign direct investment and ICT diffusion. Contrary to expectations, ICT diffusion was found not to be associated with education but was effected by mobile phones and Internet hosts, civil liberties and political rights (Baliamoune-Lutz, 2003).

The concept of information literacy has been used to denote people who are able to interact using ICTs (Queau 2002). This suggests that a new culture is emerging of ‘information literacy’ through online interactions comprised of visual representations and mental images that can potentially increase the disparities between people who are part of this culture in industrialized countries and those who are not, as well as within societies themselves (Queau 2002, Norris 2001). That is why an electronic governance strategy should include information literacy as part of its offering to its citizens. Distance education programs may be a means to carry out this strategy in an efficient and effective manner.

SUMMARY AND CONCLUSIONS

This paper investigates the connection between growth in per capita GDP and ICT usage in very small island states. Using data available through the World Bank and the International Telecommunications Union, Internet World Statistics and country profiles on their government websites, an analysis is conducted to identify the link between the two indicators with population used as a mediator. The analysis identifies a multiplier effect that brings about greater levels of growth in ICT usage for every percentage increase in per capita GDP in countries in our sample from 2010-2012. The cycle is however, negative for the year 2009. There is a cyclical effect from the increase usage of ICT for access to information, knowledge and skills and new market opportunities that lead to future growth in per capita incomes. Public administrations can tap into this multiplier effect by implementing electronic governance strategies to build upon the ICT capacity of their countries. If these strategies are targeted to increasing ICT usage through investments in ICT infrastructures, education and literacy programs and create social capita and knowledge networking to support ICT based, electronic commerce businesses, then growth in the small island states can be sustained and even driven by bringing a positive multiplier effect into motion.

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Appendix I:

Table 1: Per Capita Income in US Dollars (Lowest to highest in average per capita income)

Country	Per capita Income 2009	Per capita Income 2010	Per capita Income 2011	Average Per Capita Income	Per capita Income Growth (2010-2011)
Solomon Islands	1147.244	1261.039	1517.422	1308.568	20.33%
Kiribati	1227.139	1422.618	1648.88	1432.879	15.90%
Vanuatu	2525.552	2833.327	3094.385	2817.755	9.21%
Tuvalu	2753.539	3237.664	3636.069	3209.091	12.31%
Samoa	2892.638	3388.065	3485.414	3255.372	2.87%
Tonga	3076.599	3544.012	4151.597	3590.736	17.14%
Belize	4048.619	4057.151	4059.17	4054.98	0.05%
Saint Vincent and the Grenadines	6153.094	6171.623	6290.804	6205.173	1.93%
Nauru	5312.8	6300	7200	6270.933	14.29%
Maldives	6229.67	6570.429	6405.053	6401.718	-2.52%
Saint Lucia	6810.525	6947.434	7153.854	6970.604	2.97%
Dominica	7085.448	6963.872	7153.855	7067.725	2.73%
Grenada	7449.854	7499.518	7780.097	7576.49	3.74%
Mauritius	6928.962	7577.106	8755.373	7753.814	15.55%
Seychelles	9637.473	11129.81	11711.47	10826.25	5.23%
Saint Kitts and Nevis	13307	12846.87	13143.55	13099.14	2.31%
Antigua and Barbuda	13829.83	13006.3	12479.55	13105.23	-4.05%
Barbados	13181.34	15034.88	13452.59	13889.6	-10.52%
Trinidad and Tobago	14771.91	15613.73	16699.31	15694.98	6.95%
Malta	19564.2	19624.85	21209	20132.68	8.07%
Bahamas	22807.43	22664.86	22431.03	22634.44	-1.03%
Brunei Darussalam	27390.05	31007.99	40301.22	32899.75	29.97%

Sources: World bank Databank, ITU Data, Nauru census bureau

Table 2: Mobile Communications Technology Subscriptions per 100 population (MCT), BroadBand Internet Subscriptions (BIS) and Internet and Fixed (wired) Internet subscriptions per 100 inhabitants (INTU)

Country	**MCT Average (2009-2012)**	**MCT growth (2011-2012)**	**BIS Average (2009-2012)**	**BIS Growth (2011-2012)**	**INTU Average (2009-2012)**	**INTU Growth (2011-2012)**	**Ave ICT Growth (2009-2012)**	**Per Capita GDP Growth (2011-2012)**
Antigua and Barbuda	184.51	1.12	6.91	-15.97	80.00	2.20	-4.2	3.5
Bahamas	97.34	-15.98	5.94	-38.12	53.40	10.31	-14.6	1.9
Barbados	126.27	-0.48	21.88	7.59	71.00	2.09	3.1	0.4
Belize	58.97	-27.64	2.93	0.98	17.35	33.69	2.3	0.0
Brunei Darussalam	109.34	4.21	5.27	-15.76	54.58	7.68	-1.3	2.2
Cape Verde	74.36	6.28	3.27	-5.97	29.43	8.44	2.9	-1.0
Comoros	25.16	12.61	0.02	50.00	5.03	9.09	23.9	-4.7
Dominica	155.83	0.36	11.96	2.36	49.00	7.60	3.4	0.3
Fiji	84.49	17.13	2.11	-42.54	24.68	20.36	-1.7	0.9
Grenada	116.84	2.00	13.29	-0.36	34.45	10.50	4.0	0.8
Guinea-Bissau	52.64	23.62	0.00	0.00	2.60	7.41	10.3	-9.6
Guyana	70.32	3.24	2.22	45.28	30.03	7.19	18.6	10.0
Kiribati	12.49	14.27	0.88	6.59	9.70	7.00	9.3	3.8
Maldives	160.48	4.30	5.17	1.10	31.05	14.41	6.6	1.2
Malta	116.14	3.06	29.32	5.78	65.28	1.16	3.3	-5.1
Marshal Islands		0.00	10.00	0.00	7.68	23.46	7.8	7.5
Mauritius	96.99	14.18	8.21	8.19	31.80	18.29	13.6	-7.1
Nauru	63.68	0.89	3.73	0.00	54.00	0.00	0.3	14.3
Palau	72.77	10.25	1.83	17.53		0.00	9.3	6.5
Saint Kitts and Nevis	152.39	1.21	26.92	-1.20	75.48	2.19	0.7	-1.1
Saint Lucia	118.61	3.80	12.12	14.03	43.23	8.00	8.6	-2.9
Saint Vincent and the Grenadines	118.95	2.79	11.83	-3.41	40.00	10.47	3.3	3.1
Samoa			0.11	0.00	9.23	17.27	8.6	5.9
São Tomé and Principe	62.77	3.98	0.39	23.81	19.25	6.93	11.6	3.5
Seychelles	142.20	8.86	8.48	13.13	43.77	9.03	10.3	-3.0
Solomon Islands	33.53	7.16	0.42	-13.64	5.50	16.67	3.4	13.9
Suriname	169.59	2.25	3.74	25.82	32.43	8.44	12.2	9.1
Timor-Lesté	44.88	-1.73	0.05	0.00	0.55	0.00	-0.6	15.1
Tonga	52.35	1.45	1.18	15.32	21.48	39.60	18.8	9.6
Trinidad and Tobago	138.61	2.79	11.33	18.25	51.88	7.79	9.6	1.7
Tuvalu	19.12	31.19	3.40	21.88	27.50	16.67	23.2	2.8
Vanuatu	59.36	-2.37	0.67	0.98	8.83	15.22	4.6	-2.3

Sources: World bank Databank (2013), International telecommunications Union, Internet World Statistics (2013), Nauru census bureau

Table 3: Growth in ICT, Population and per capita GDP.

	2009			*2010*			*2011*			*2012*		
Country	***ICTg***	***POPg***	***GDPg***	***ICTg***	***POPg***	***GDPg***	***ICTg***	***POPg***	***GDPg***	***ICTg***	***POPg***	***GDPg***
Antigua and Barbuda	*78.38*	*1.1*	*-12*	92.5	1.1	-7.1	95.0	1	-2.8	96.0	1	2.3
Bahamas	*49.8*	*1.8*	*-4.2*	58.4	1.7	1	51.8	1.6	1.7	48.9	1.5	1.8
Barbados	*71.1*	*0.5*	*-5.3*	72.9	0.5		73.7	0.5		74.5	0.5	
Belize	*22.5*	*2.5*	*0*	26.4	2.5	2.9	30.6	2.5	1.9	26.2	2.4	
Brunei Darussalam	*53.2*	*1.6*	*-1.8*	55.8	1.6	2.6	57.0	1.5	2.2	59.6	1.4	2.2
Cape Verde	*27.4*	*0.2*	*3.7*	36.0	0.4	5.2	38.4	0.6	5	40.9	0.8	4.3
Comoros	*6.9*	*2.6*	*1.8*	9.2	2.5	2.1	11.4	2.5	2.2	12.8	2.4	3
Dominica	*65.9*	*0.2*	*-1.1*	71.9	0.2	1.2	74.8	0.3	1	76.4	0.4	-1.5
Fiji	*31.2*	*1*	*-1.3*	34.6	0.9	-0.2	38.1	0.9	2	44.4	0.8	2.2
Grenada	*48.6*	*0.3*	*-6.7*	54.7	0.4	-0.4	57.0	0.4	1	59.1	0.4	-0.8
Guinea-Bissau	*20.0*	*2.2*	*1.1*	24.8	2.3	1.7	19.6	2.3	5.7	36.2	2.4	-1.5
Guyana	*29.9*	*0.7*	*3.3*	35.2	0.6	4.4	34.9	0.6	5.4	36.8	0.6	4.8
Kiribati	*6.6*	*1.5*	*-2.3*	6.9	1.5	1.4	8.2	1.5	1.8	9.1	1.5	2.5
Maldives	*58.9*	*1.8*	*-3.6*	62.6	1.9	7.1	68.4	1.9	7	72.4	1.9	3.4
Malta	*62.3*	*0.5*	*-2.7*	67.2	0.5	2.7	74.7	0.2	1.8	76.8	0.4	1
Marshal Islands	*5.6*	*0.2*	*-1.3*	7.0	0.2	5.2	8.1	0.1	5	10.0	0.1	1.9
Mauritius	*37.3*	*0.5*	*3*	42.4	0.5	7.7	47.9	0.4	3.8	55.0	0.4	3.2
Nauru	*3.0*	*1.75*		32.2	0.59		41.0	0.61		65.6	0.61	
Palau	*31.7*	*0.6*	*-10.6*	36.0	0.6	-0.8	38.7	0.7	6.5	42.8	0.7	5.3
Saint Kitts and Nevis	*80.0*	*1.2*	*3.37*	85.5	1.2	-8.07	86.6	1.2	-3.62	87.6	1.2	
Saint Lucia	*52.3*	*1.4*	*4.09*	56.3	1.2	-1.05	60.0	1.1	-0.54	63.4	0.9	
Saint Vincent and the Grenadines	*50.8*	*0.1*	*1.28*	56.8	0.1	-2.26	58.8	0	-2.84	61.3	0	
Samoa	*3.1*	*0.7*	*-5.1*	3.6	0.7	0.4	11.0	0.7	2	12.9	0.8	1.2
São Tomé and Principe	*22.1*	*2.9*	*4*	27.1	2.8	4.5	29.6	2.7	4.9	31.0	2.7	4
Seychelles	*66.6*	*0.4*	*-0.2*	61.4	2.8	7.1	66.4	-2.6	5	72.5	0.4	2.9
Solomon Islands	*4.6*	*2.2*	*-1.2*	9.0	2.2	7	18.7	2.2	9	20.2	2.1	3.9
Suriname	*60.0*	*0.9*	*3*	68.1	0.9	4.1	71.8	0.9	4.7	74.4	0.9	4.5
Timor-Lesté	*10.7*	*2.9*	*12.8*	14.1	2.9	9.5	18.1	2.9	10.8	17.8	2.9	8.6

Tonga	*20.7*	*0.6*	*2.9*	23.1	0.5	2.7	26.3	0.4	4.9	29.9	0.4	0.8
Trinidad and Tobago	*64.0*	*0.5*	*-4.4*	66.8	0.4	0.2	67.5	0.4	-2.6	70.8	0.3	1.2
Tuvalu	*10.4*	*0.2*	*-1.7*	14.6	0.2	-3	18.7	0.2	1.2	23.0	0.2	1.2
Vanuatu	*21.3*	*2.4*	*3.3*	26.4	2.3	1.6	22.0	2.3	1.4	22.0	2.2	2.3

Sources: World bank Databank (2013), International telecommunications Union, Internet World Statistics (2013), Nauru census bureau

Appendix II: Linear Regression

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	394.959	3	131.653	11.060	.000[a]
	Residual	1154.639	97	11.903		
	Total	1549.597	100			
2	Regression	408.722	4	102.181	8.598	.000[b]
	Residual	1140.875	96	11.884		
	Total	1549.597	100			

a. Predictors: (Constant), INTU, BIS, MCT
b. Predictors: (Constant), INTU, BIS, MCT, POPg
c. Dependent Variable: GDPg

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.069	.747		5.446	.000
	MCT	.014	.010	.183	1.395	.166
	BIS	-.063	.066	-.120	-.953	.343
	INTU	-.096	.028	-.534	-3.401	.001
2	(Constant)	3.239	1.074		3.016	.003
	MCT	.015	.010	.184	1.406	.163
	BIS	-.050	.067	-.095	-.747	.457
	INTU	-.090	.029	-.501	-3.131	.002
	POPg	.445	.413	.109	1.076	.285

a. Dependent Variable: GDPg

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.289[a]	.083	.075	3.8279488
2	.352[b]	.124	.108	3.7588088

a. Predictors: (Constant), ICT Ave
b. Predictors: (Constant), ICT Ave, POPg

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	153.093	1	153.093	10.448	.002[a]
	Residual	1685.117	115	14.653		

	Total	1838.210	116			
2	Regression	227.545	2	113.773	8.053	.001[b]
	Residual	1610.665	114	14.129		
	Total	1838.210	116			

a. Predictors: (Constant), ICT Ave
b. Predictors: (Constant), ICT Ave, POPg
c. Dependent Variable: GDPg

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.578	.696		5.137	.000
	ICT Ave	-.047	.014	-.289	-3.232	.002
2	(Constant)	2.084	.944		2.207	.029
	ICT Ave	-.035	.015	-.220	-2.374	.019
	POPg	.896	.390	.213	2.296	.024

a. Dependent Variable: GDPg