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Relation and Growth of Internet Penetration Rate with Human Development Level from 2000 to 2010

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Abstract

This study examines the relation of Internet penetration rate with human development level over the last decade. The main purpose is to investigate the possible existence of a digital divide between developed and developing countries during the last 10 years. Furthermore, it also explores how the growth of the Internet penetration rate in developed countries is compared to that of developing countries. UNDP Human Development Index is used to measure human development level, while Internet penetration rate is represented by the number of Internet user per 100 inhabitants of a country. The result of this study supports the argument that a digital divide exists because of this disparity in Internet penetration rates.

Keywords: Developed Country, Developing Country, Human Development, Internet Penetration.

Introduction

In the past few years, information technology (IT) has advanced rapidly throughout the world. In particular, Internet usage has grown so quickly that the number of Internet users doubled from late 1999 to the end of 2000 (Bradshaw 2001). IT and Internet were suggested as part of a new indicator of technological capabilities for all countries (Archibugi and Coco, 2004). This situation has made the Internet a definitely important and essential part of everyone's life as well as the development status of any country.

However, research published in 2004 has suggested the existence of a gap phenomenon between developed and developing countries regarding access to IT and Internet (Dewan et al. 2004). The existence of this phenomenon—called the digital divide—should be verified; if it does exist, it should be determined if it has become stronger in previous years.

This study will examine the relation between human development and the Internet penetration rate by looking to the appropriate data to represent both parameters. It will also investigate the change that took place in the past few years and see whether the Internet penetration rate grew faster in the developed countries compared with the developing countries. In addition, this study will determine whether the change in the human development level is related to the growing speed of the Internet penetration rate for both developed and developing countries.

Background

The United Nations Development Programme (UNDP) periodically issues a Human Development Report to distinguish

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between both developed and developing countries. The report classifies all countries of the world as developed or developing according to the Human Development Index (HDI). The HDI value itself is calculated according to four variables in three different factors: income (GDP per capita adjusted by purchasing power parity), education (adult literacy rate and gross combined school enrolment number) and health (life expectancy rate at birth) (UNDP Human Development Report 2010). These three factors have always been used as the only indicators for human development. However, this has changed in this technological era where access to digital technologies has become much more important and thus may be significant enough to be included as another indicator of human development.

The Internet can be considered the symbol of the technological era. It was introduced in the US first before it spread all over the world. It has proven very popular because it provides an effective way of communicating without the constraints of time and distance (Leiner et al. 2009). However, the Internet relies on a computer network infrastructure. Thus, developed countries can adapt it earlier and receive more benefits from the Internet because they can build the infrastructure easier than developing countries can.

The fact that the Internet has been growing so rapidly is undeniable (Archibugi and Coco 2004, Leiner et al. 2009, Odlyzko 2001). It has transformed into a famous alternative media that people use to interact to communicate, share and gain information. People may also use it as multipurpose medium to better themselves or others socially or economically through education, entertainment, health and even politics.

The Internet penetration rate, which can be inferred from the percentage of Internet users in the entire population of a country, is one method of measuring the technologies that can be used to indicate human development. Research suggested the inclusion of Internet penetration as part of a new indicator of technological capabilities to distinguish between developed and developing countries (Archibugi and Coco, 2004).

The term 'digital divide' was introduced in the early 21st century (Dewan et al., 2004; Norris, 2001; Sidorenko and Findlay, 2001). It receives a lot of attention from many researchers, including those from study cases in India (Mohanty, 2008) and South Africa (Brown and Brown, 2008), who consider it an indication of the important role that IT and Internet play in a country's development (Dewan et al., 2004).

These facts are the underlying issues of this research, which will study countries growth of human development and Internet penetration rate and the relation between the two areas. The result of this study will give a clear picture on whether the digital divide actually exists. Also, this study can be used as base information to perform further research and as a supportive argument of the inclusion of technological access as an indicator in measuring human development level.

Methods

This study used the HDI to measure human development and configured the Internet penetration rate as the number of Internet users per 100 inhabitants.

Data Collection

The HDI is available for download on the UNDP website (Human Development Report Statistic of UNDP, 2010) alongside some indicators of human development and the periodical Human Development Report. The percentage of Internet users in a population is represented by the number of Internet users per 100 inhabitants, as seen on the World Bank website (The World Bank Data Indicators, 2010). In this case, 'Internet user' refers to any person who has access to the Internet no matter what the type of access (private/shared), connection (wired/wireless) or location (household/school/office/café).

The latest data available for both variables were for 2010, whereas the most complete

data of the past few years were for 2000. Therefore, the data from these two years were used in this study to check whether there was any change in the relation of human development and Internet penetration rate as well as to measure their growth.

Seventy-five countries were excluded from this study because of the absence of any of the four required variables. As a result, only 135 of 210 total countries were included. The data sample is presented in the Appendix.

Statistical Analysis

For the statistical analysis of this research, both the t-test and chi-square test were used. The t-test was used to check the existence of significant differences between the two parameters, and the chi-square test was used to check the existence of significant differences of Internet user penetration in both developed and developing countries. The term 'developed country' refers to any country with an HDI at 0.788 or above; countries with lower scores are categorised as developing countries. The UNDP uses this definition in their Human Development Report (UNDP, 2010). A high Internet penetration rate is defined as more than 50 Internet users per 100 inhabitants; countries with fewer users have a low Internet penetration rate.

The null hypothesis for this study was that there is no significant difference in Internet penetration rate between developed and developing countries. The data of 2010 were used because they were the latest available usable data. Furthermore, simple regression analysis was used with scatter graphs to plot and check the relation between the two parameters as well as their growth during the past few years.

Result

The t-test analysis for both variables in 2010 gave a p-value of 0.000 with a significance level of 0.01. Furthermore, the chi-square test, with a contingency table shown in Table 1, gave the same result (p-value 0.000) at the same significance level (0.01).

Table 1. Contingency Table of HDI and Internet Users in 2010

Country Status	High Rate	Low Rate
Developed	35	2
Developing	5	92

There was only small increase in the HDI during 2000-2010 (Figure 1), where the average of 0.603 in 2000 raised to 0.650 in 2010. Meanwhile, the growth of the number of Internet users during the same period seems to be very high (Figure 2), where the average of 8.7 users per 100 inhabitants in 2000 raised to 35.91 per 100 inhabitants in 2010.

In general, the increasing HDI means that the human development level of the world population improved regarding income, education and health. The high increase of Internet users was predictable; the same trend was shown during previous years (Bradshaw 2001), and Internet use still had a very low average value in 2000 (8.7%). Starting in 2004, the rapid growth of Web 2.0, which attracts more users, has been changing how people communicate with each other and has produced myriad popular web applications such as Wikipedia, YouTube and Facebook (Anderson, 2007; Cooke and Buckley, 2008). This has contributed to the significant increase of Internet use during 2000-2010.

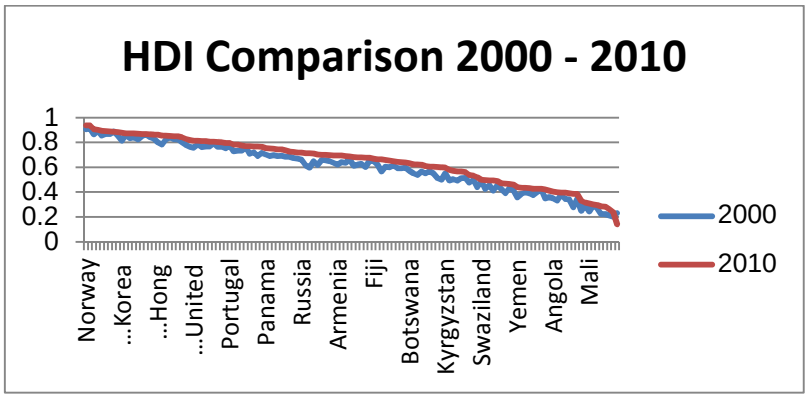

Fig. 1. Human Development Index (HDI) in 2000 and 2010. Countries are Sorted from the Highest HDI in 2010 to the Lowest One

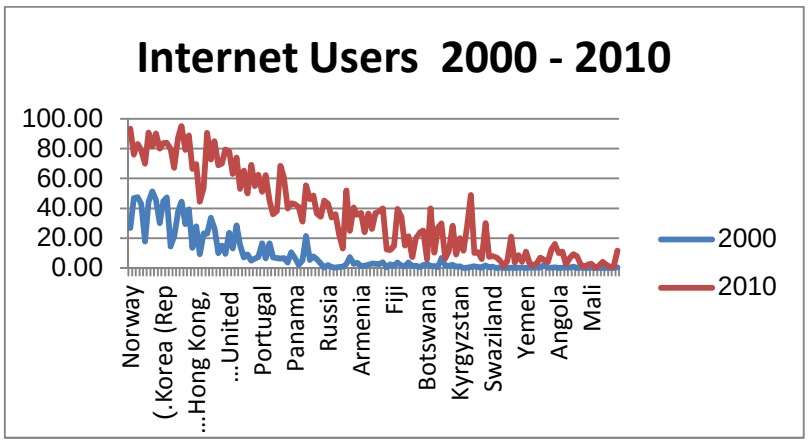

Fig. 2. Internet Users per 100 Inhabitants in 2000 and 2010. Countries are Sorted from the Highest HDI in 2010 to the Lowest One

The correlation and simple regression analyses (Figures 3-6) resulted in a moderate positive correlation coefficient (R = 0.71) and in a coefficient of determination (R2 = 0.51) between HDI and number of Internet users in 2000; this correlation became stronger in 2010 (R = 0.87 and R2 = 0.76). This analysis also resulted in a high positive correlation between the growth of HDI and the increased number of Internet users during 2000-2010 (R = 0.82 and R2 = 0.67) and a weak negative correlation between HDI change and the increased number of Internet users during the same period (R = 0.12 and R2 = 0.01).

Moderate to high positive correlations in Figures 3-5 mean that developed countries have a higher Internet penetration rate that grows faster than in developing countries. This fact clearly shows the existence of a digital divide between the developed and developing countries.

However, according to Figure 6, a country's increase in the human development level does not necessarily parallel an increase in the Internet penetration rate. In fact, the result indicates that the Internet penetration rate of countries with improved HDI values compared with previous years tends to grow a little bit slower than in other countries. This interesting fact needs to be investigated further using appropriate additional variables and methods to give a clearer picture of the relation between these two indicators and how one affects the other.

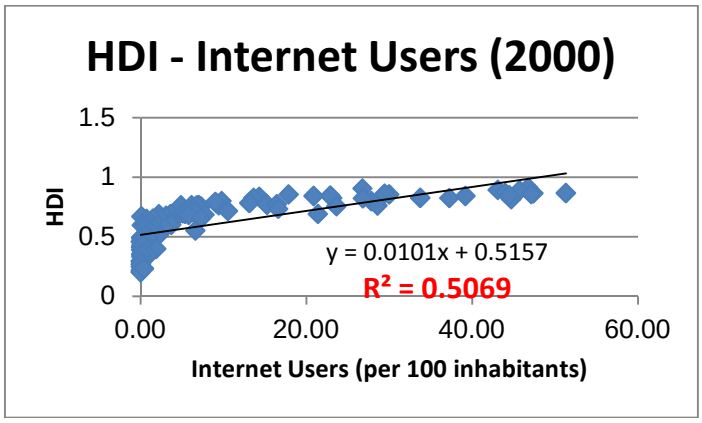

Fig. 3. Scatter Graph and Simple Regression Result of HDI and Internet Users per 100 Inhabitants in 2000

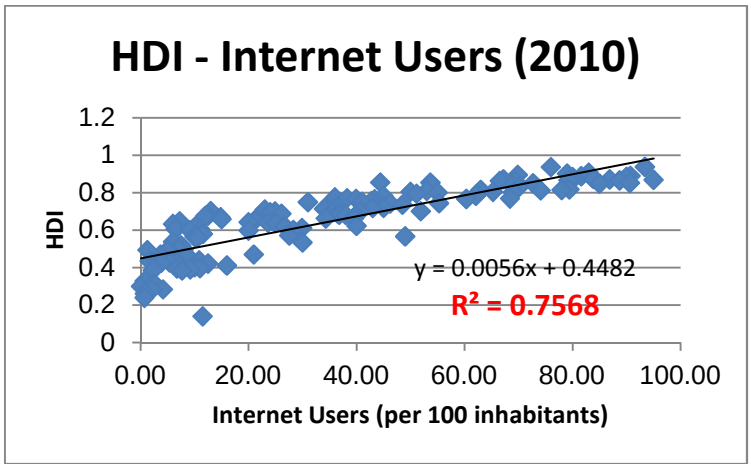

Fig. 4. Scatter Graph and Simple Regression Result of HDI and Internet Users per 100 Inhabitants in 2010

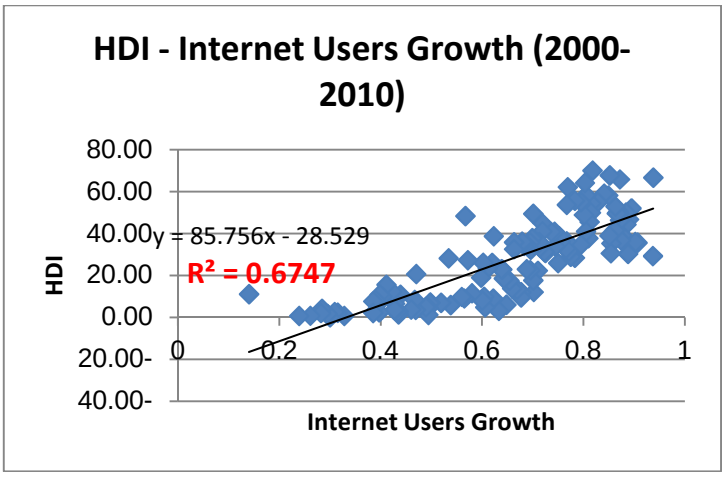

Fig. 5. Scatter Graph and Simple Regression Result of HDI and Internet Users Growth per 100 Inhabitants during 2000-2010

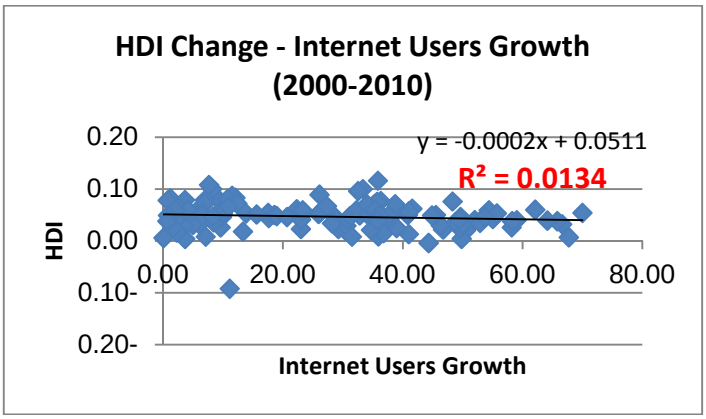

Fig. 6. Scatter Graph and Simple Regression Result of HDI Change and Internet Users Growth per 100 Inhabitants during 2000-2010

Conclusion

The main findings of this study are that there is a positive correlation between human development level and Internet penetration rate and that the correlation has become stronger over the past few years. This means that the developed countries have a significantly higher Internet penetration rate compared with the developing countries. This study also concludes that the Internet penetration rate in the developed countries grows faster than in the developing countries. However, there is also an interesting result that a change in human development level has a weak negative correlation to the growth of the Internet penetration rate. In other words, the Internet penetration rate of countries with a higher change in human development level tends to grow a little bit slower than in countries where such a change is lower. The fact of disparity in Internet penetration rates between Developed and Developing countries shows that a digital divide actually exists. This information is useful in giving a clear picture of the actual condition of technology adoption in the world, which in return can be also useful in term of business information management.

This result, however, may not describe exactly what happened during 2000-2010 because it compares only those two years instead of monitoring the changes for every year during that period. Moreover, some countries (75 of 210) were excluded because of the absence of one or more variables needed in the analysis. However, the information gained from this study can be used to support the existence of a digital divide between developed and developing countries and even suggests that this phenomenon tended to be stronger during the past few years.

In the future, research on this topic should use the very latest and more complete data to give a better description on how the relation of human development level and Internet penetration rate is changing. Furthermore, to determine the causality between human development level and Internet penetration rate, future studies should use more data, including both quantitative and qualitative data, time series possibility and more detail and complex analysis, such as in the study by Cronin et al. (1991).

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Appendix

Table 1. Internet Users per 100 Inhabitants and HDI in 2000 and 2010 of Top 5 Countries. Sorted by HDI in 2010

Country Name	Internet Users		HDI	
	2000	2010	2000	2010
Norway	26.76	93.39	0.906	0.938
Australia	46.76	76.00	0.914	0.937
New Zealand	47.38	83.00	0.865	0.907
United States	43.08	79.00	0.893	0.902
Ireland	17.85	69.85	0.855	0.895

Table 2. Internet Users per 100 Inhabitants and HDI in 2000 and 2010 of bottom 5 Countries. Sorted by HDI in 2010

Country Name	Internet Users		HDI	
	2000	2010	2000	2010
Mozambique	0.11	4.17	0.224	0.284
Burundi	0.08	2.10	0.223	0.282
Niger	0.04	0.83	0.212	0.261
Congo (Dem. Rep.)	0.01	0.720	0.201	0.239
Zimbabwe	0.40	11.50	0.232	0.140