Global Diffusion of Virtual Social Networks: A Pyramid Model

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Abstract

Virtual social network (VSN) has become an international phenomenon, but its diffusion is far from even across different countries. Such a digital divide prevents people in certain parts of the world from enjoying the benefits of VSN. The objective of this study is to find out what lead to the variation in the global diffusion of this new innovation. It identifies relevant cultural, developmental and regulatory factors and conceptualizes them as hierarchical foundations of VSN diffusion in a pyramid model. The model was empirically validated with secondary data. The results suggest that the regulatory foundation has relatively strong but volatile impact on the diffusion of virtual social networks, whereas the cultural foundation yields relatively weak yet stable influence, and somewhere in between is the developmental foundation. The findings have important practical implications, especially for policy makers, on how to facilitate the diffusion of virtual social networks in different countries.

Keywords: virtual social network, global diffusion, digital divide, user culture, country development, telecom regulation

1. INTRODUCTION

Nowadays, more and more people are using virtual social network (VSN) applications such as Facebook and Twitter. Such applications are websites that let users create and maintain relationships with each other (Boyd & Ellison, 2008). Compared with traditional computer-mediated communication applications (e.g. instant messaging), they allow users to easily create profiles, add friends, join groups, update activities and share personal experiences (e.g. stories and pictures) with acquaintances (Quan-Hasse & Young, 2010; Waisanen, 2010). Virtual social networks have become a global phenomenon within a decade as over a billion Internet users spend a significant proportion of time on them (Meattle, 2007). For instance, Facebook alone tops 900 million monthly users in 2012 and the number is still quickly increasing, making it the world's leading virtual social network (Cohen, 2012).

The benefits of VSN applications can be captured with the concept of social capital, which generally refers to the collective value of all the relationships among people (Coleman, 1988). Through the mediation of VSN applications, users can establish, maintain and materialize social capital for psychological wellbeing and practical benefits (Ellison, Steinfield & Lampe, 2007). Also, the tremendous social capital accumulated through the use of such applications has great commercial potential in areas such as marketing and e-commerce (Yazdanifard et al., 2011). For

instance, social gaming as a special type of virtual social network is a billion-dollar market. The transactions of virtual goods from mobile social media services alone reached $3 billion in 2011 (Stratmann, 2011). Some VSN applications are not only used for personal purposes, but also for business purposes. For example, Facebook launched its services tailored for cooperate networks after the initial school networks (Cassidy, 2006). Based on the connections established, business partners can build closer relationships through information sharing (Saraf, Langdon, & Gosain, 2007).

Though VSN applications can bring huge benefits to human society at different levels, the distribution of users of VSN applications around the globe is very uneven. For instance, a recent global survey of 10 countries (Australia, Brazil, France, Germany, Italy, Japan, Spain, Switzerland, US and UK) found that the percentage of online population who actively use VSN applications range between 59% to 86%, and the usage time ranged between 157 minutes to 387 minutes per month (Heras, 2010; Van Grove, 2010). Most of the countries in the survey were developed countries, and the gap between the most developed countries and the least developed countries in the usage of VSN applications is much wider.

The uneven diffusion of VSN usage in the world contributes to the widening global digital divide, the gap between information haves and have-nots across different countries (Roberts, 2008). At the individual level, it means that people in different parts of the world do not have the equal access to information services (Dekimpe et al., 2000; Quibria et al., 2003). At the national level, the disparity hampers the efforts of developing countries to catch up with developed countries in knowledge-based social and business activities (Oxley & Yeung, 2001). Countries where information and communication technologies (ICT) are less accessible are not as competitive in the global economy, and their people and societies cannot fully benefit from such technologies (Antonelli, 2003).

Thus an important question is: what are the factors that lead to the uneven diffusion of VSN among different countries? Several existing studies have investigated the adoption of VSN applications at the individual level. For example, a survey study found that individual factors such as gender, race and ethnicity, educational background, computer experience and autonomy of use influence whether people use VSN applications or not (Hargittai, 2008). So far, few researchers have addressed the question at the national level. This study will identify the country-specific factors that make differences in the diffusion of VSN, and empirically examine the effect of each with secondary data collected from multiple sources.

The rest of the article will be organized as follows. First, it will identify the cultural, developmental and regulatory factors related to VSN diffusion based on a review of relevant studies and theories. Then it will propose a research model and describe the methodology for an empirical study. After the presentation of results, it will discuss theoretical and practical implications, followed by the conclusion.

2. THEORETICAL BACKGROUND

To identify factors that are relevant to the diffusion of VSN technology, it is necessary to examine the phenomenon with an appropriate theoretical framework. VSN is an innovation based on the Internet technology, and its diffusion has been a worldwide phenomenon. To study how such an information technology is adopted by the people in different countries, Diffusion of Innovations Theory is well suited (Baskerville & Pries-Heje, 2003). Developed by Everett Rogers (1962), the theory describes the adoption process, provides an explanation of the means of diffusion, and predicts the success or failure of new inventions. Rogers specified the major components of innovation diffusion: a social system in which interrelated units are engaged in joint problem solving to accomplish a common goal, human decision process on the acceptance or rejection of an innovation, and various communication channels for marketing the innovation (Rogers, 1983, pp. 11-24).

The social system in this study is a nation in which a certain percentage of people adopt VSN. The diffusion pertains to both individual users and the organizations that offer and regulate VSN. For this Internet-based innovation, the telecommunication industry of each country provides the necessary infrastructure. Meanwhile, the lack of broadband Internet infrastructure is considered as the supply side of global digital divide, in comparison to the demand side related to people who need information (Prieger, 2003). Accordingly, there are two aspects of issues related to uneven VSN diffusion in the world: demand-side issues

related to users and supply-side issues related to the telecommunication industry.

In the study of innovation diffusion at the national level, researchers have found that countries at different development stages have different degrees of openness and receptiveness to innovations (Gomulka, 1971). Country development affects the readiness of both users (e.g. service affordability and computer literacy) and telecommunication industry (e.g. broadband infrastructure) to adopt VSN. Thus, it is related to both the demand side and supply side of VSN diffusion, as shown in Figure 1.

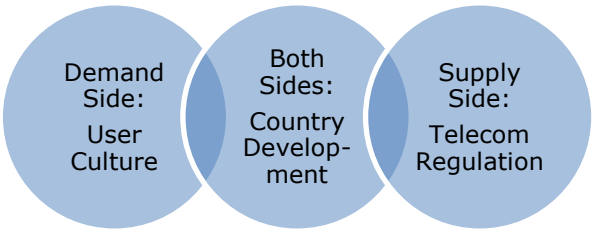

Figure 1. VSN Diffusion Factors

On the demand side, users communicate with each other through the mediation of VSN applications. It has been found culture is an important factor at the national level that regulates people's communication behavior (Singelis & Brown, 1995). Thus, user culture is the factor specific to the demand side. On the supply side, industrial regulation has a direct impact on the development and implementation of new technologies (Whitford & Tucker, 2009). Thus, telecommunication regulation is the factor specific to the supply side.

3. RESEARCH MODEL

User culture, country development and telecommunication regulation does not affect VSN diffusion in the same way as they have different natures. As a supply-side force, telecommunication regulation pushes or constrains VSN diffusion as it may facilitate or discourage (or even prohibit) the innovation. As the demand-side force, user culture pulls or repulses VSN diffusion as it somewhat influences how individuals in a nation are likely to accept or reject the innovation. Country development, on the other hand, prepares both the people and industry for the adoption of VSN technology. Therefore, the influence of telecommunication regulation is relatively direct and strong, the influence of user culture is relatively indirect and weak, and the influence of country development is somewhere in the middle.

These factors vary not only in the mechanisms of influence, but also in their durability. Telecommunication regulation needs to adapt to the change in technological, commercial and political environment (Blackman & Srivastava, 2011). Thus, its influence is relatively volatile in terms of years or even months. On the other hand, culture is rather stable once it is formed (Hofstede, 1991; Smith, 1992). Thus, its influence is long-lasting in terms of centuries. Country development takes the efforts of generations. Thus, the durability of its influence is intermediate in terms of decades.

To reflect the different natures of telecommunication regulation, country development and user culture in their influences on VSN diffusion, a pyramid model is developed as shown in Figure 2. Telecommunication regulation has a relatively direct but volatile impact, and thus it is the foundation immediately underneath the VSN innovation. User culture has rather indirect but long-lasting influence, and thus it is the foundation at the bottom. Taking some effort and time to change, country development supports both the user base and telecommunication industry, and it is the foundation in the middle.

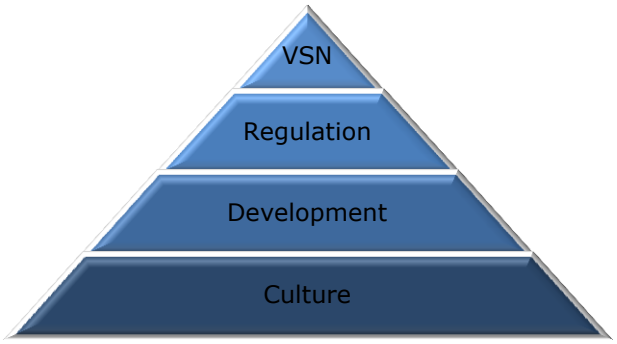

Figure 2. A Pyramid Model of VSN Diffusion

The understanding of how different types of factors affect VSN diffusion provides the general framework for design of an empirical study to verify the pyramid model. Based on literature review, the following section will identify specific variables of cultural foundation, developmental foundation and regulatory foundation, and propose the testable hypotheses on the relationships between them and VSN diffusion. In addition, the examination of previous studies will

provide clues on how to operationalize each variable in data collection.

Due to the hierarchical relationships among the regulatory foundation, developmental foundation and cultural foundation, it is necessary to discuss them in an order. Culture is pertinent to the fundamental values of people in a country and may make differences in country development (Mbakogu, 2004). Together, the culture and development level of a country may also influence how the country makes policies for telecommunication regulation (Blackman & Srivastava, 2011). Though the influence in the reverse direction may exist, it is not as strong. The discussion follows the same culture-development-regulation sequence.

Cultural Foundation

There have been many definitions and measures of culture, but it is commonly agreed that culture is related to the fundamental values and beliefs shared among a population of people (Tarasa, Rowneyb & Steelc, 2009; Hofstede, 1991; Smith, 1992). The most influential framework to assess the influence of culture was developed by Geert Hofstede (1980). He initially proposed four dimensions of culture: 1) Power Distance: the extent to which the less powerful members of a society accept and expect an unequal distribution of power; 2) Uncertainty Avoidance: the extent to which members of a society feel threatened by uncertain and unknown situations; 3) Individualism versus Collectivism: the extent to which members of a society are integrated into strong cohesive groups; and 4) Masculinity versus Femininity: the extent to which a society attributes qualities such as assertiveness and material success to men, and modesty and quality of life to women.

Hofstede (1980) also developed a numerical score system for these dimensions. It greatly facilitates empirical studies of cultures in different settings and at different levels (e.g. Allik & McCrae, 2004; Benet-Martinez, & Karakitapoglu-Aygun, 2003; Earley, 1993; Gannon, 2004). Not many researchers, however, have taken culture into account in the investigation of information technology diffusion. VSN applications are somewhat special in that they facilitate computer-mediated communication (Boyd & Ellison, 2008). Because Hofstede's cultural dimensions have been found to regulate human communication behavior (Singelis & Brown, 1995), they are closely related to people's use of such technology.

As for power distance, people are more likely to accept and expect differential social statuses in cultures high in this dimension than those in the counterparts. VSN applications, however, encourage equality in user rights and obligations to enhance social capital (Ellison, Steinfield & Lampe, 2007). Thus power distance is in contradiction to the spirit of VSN.

As for individualism vs. collectivism, individualists are less concerned with the thoughts and actions of others and tend to communicate directly (Singelis & Brown, 1995). To use a VSN application (e.g. Facebook), an individual first establishes a personal account and then let others (e.g. friends) connect to it. Compared with other types of virtual community such as Internet forum, VSN provides people a user-centric (rather than topic-centric) platform to display their own personalities (Bachrach et al., 2012). In this sense, individualists are likely to adopt this innovation earlier than collectivists.

As for masculinity versus femininity, gender makes a difference in the communication behavior mediated through VSN: researchers found that females are more inclined and effective to use this computer-mediated media than males (Thelwall, 2008; Thelwall, Wilkinson & Uppal, 2010). Thus masculinity may be negatively correlated with VSN usage.

As for uncertainty avoidance, cultures high in this dimension generally encourage compliance with norms and rules, but those low in this dimension encourage creativity and innovation (Triandis, 1989). As VSN itself is an innovation, people of high uncertainty avoidance may be hesitant to use it. The discussions lead to the following set of hypotheses:

H1: Cultural foundation affects VSN diffusion.
- H1a: Power distance has a negative effect on VSN usage.
- H1b: Individualism has a positive effect on VSN usage.
- H1c: Masculinity has a negative effect on VSN usage.
- H1d: Uncertainty avoidance has a negative effect on VSN usage.

Developmental Foundation

Because VSN is still an emerging phenomenon, few researchers have discussed the relationship between country development and VSN diffusion. However, VSN is an ICT innovation, and there have been many studies on how country development affects ICT diffusion. Most of these studies address the issue of digital divide in terms of why people have different rates of access to ICT across and within countries (Chen & Wellman, 2004; Roberts, 2008; Hersberger, 2002-2003; Talukdar & Gauri, 2011). Digital divide is a complex issue as it involves countries at different development stages and people of different socio-economic statuses (Van Dijk & Hacker, 2003).

The development level of a country can be measured from multiple aspects. The most common aspect is the economic development. The diffusion of ICT in the world is closely related to economic growth (Bassanini & Scarpetta, 2002; Eagle, Macy & Claxton, 2010). Because VSN is an ICT innovation, economic development is likely to affect VSN diffusion. Economic development is also the foundation of other aspects of development, such as human development and technological development (Parente & Prescott, 1994). Such aspects of development may also influence the VSN diffusion.

As aforementioned, the development level of a country is related to both the individual users on the demand side and the telecommunication industry on the supply side of the VSN diffusion. Among different aspects of country development, the one that is closely related to telecommunication industry is technological development, and the one that is closely related to users on the demand side is human development. On the supply side, the importance of Internet infrastructure for the reduction of global digital divide has been well recognized by researchers (Warf, 2001). In particular, the broadband Internet infrastructure is often used to measure how developed the telecommunication industry in a country is as for the concern of digital divide (Prieger, 2003). Because it demands heavy capital investment, or ICT expenditure, to establish such an infrastructure in each country (Mohan, 2007), this study adopts ICT expenditure as the independent variable to capture the technological development.

A puzzling phenomenon is that the same amount of ICT investment may lead to different results, such as digital divide and digital dividend, in different countries (Wong, 2002). It may be related to human development, the demand-side force determining how prepared people are to use technological innovation, such as VSN applications. Education is the key for people to develop necessary knowledge and skills to use ICT applications (Bruce, 1997), and this important aspect of human development leads to the human capital essential for technology adoption at the national level (Benhabib & Spiegel, 2005). The term human development describes the development of a country in this regard, which is about "creating an environment in which people can develop their full potential and lead productive, creative lives in accord with their needs and interests", according to the United Nations Development Programme (http://hdr.undp.org/en/humandev/). As a recent technological innovation, VSN applications require a certain level of human development to penetrate the population.

The three aspects of country development – economic development, educational development and technology development – are complementary to each other as they affect the global competitiveness of a country (Lall, 2001). All of them contribute positively to VSN diffusion. Because cultural foundation has a more fundamental effect on VSN diffusion, the effect of developmental foundation needs to be examined after the former is filtered out. Thus, the relationship between country development and VSN diffusion can be hypothesized as follows:

H2: Controlled for the influence of cultural foundation, developmental foundation affects VSN diffusion.
- H2a: Economic development has a positive effect on VSN usage.
- H2b: Technological development has a positive effect on VSN usage.
- H2c: Human development has a positive effect on VSN usage.

Regulatory Foundation

For a similar reason, there have been few studies on regulatory factors associated with VSN diffusion. However, this innovation is based on Internet technology, and there have been plenty of studies on Internet-related regulation. There are generally two types of regulatory forces related to the diffusion of Internet technology:

government regulation and industry regulation (Gibbs, Kraemer & Dedrick, 2003; Whitford & Tucker, 2009). It is generally agreed that Internet censorship is the main government regulation that is directly related to people's Internet usage (Dutton, Dopatka, Law & Nash, 2011). On the other hand, the competitiveness in the telecommunication industry is the main industry regulatory force that influences Internet penetration (Wallsten, 2002; Lie, 2002).

Almost all VSN traffics are transmitted over the Internet, both Internet censorship and telecommunication competitiveness have direct impact on the diffusion of this innovation. For instance, during the protest in Egypt in 2011, the Egyptian government blocked Facebook and Twitter (Kessler, 2011). Though this is an extreme case, it shows how telecommunication regulation can quickly change and greatly affects the use of VSN applications. In this sense, telecommunication industry competitiveness and Internet censorship constitute the regulatory foundation of VSN diffusion.

The tougher the Internet censorship is, the more restrictions and fears that people will have to share information (e.g. political opinions) with each other through VSN applications. Thus Internet censorship is likely to have a negative effect on VSN diffusion. On the other hand, if a government encourages competition among telecommunication providers, the price of Internet usage should be lower than in the case of monopoly. A more affordable Internet service means a larger user base for VSN applications. Therefore, telecommunication competitiveness is likely to have positive effect on VSN diffusion. For more accurate estimation of their effects, the more fundamental effects of cultural and development foundations need to be filtered out. The discussions lead to the following hypotheses:

H3: Controlled for the influence of cultural foundation and developmental foundation, regulatory foundation affects VSN diffusion.
- H3a: Telecommunication competition has a positive effect on VSN usage.
- H3b: Internet censorship has a negative effect on VSN usage.

4. METHODOLOGY

In this study, all the variables need to be measured at the national level as the unit of analysis is "country". As for cultural foundation, Hofstede (2001) gave complete scores of the four cultural dimensions – power distance, uncertainty avoidance, individualism versus collectivism and masculinity versus femininity – for 78 countries. All the countries were included in the dataset compiled for this study. Thus, the sample size of this study is 78, and it includes countries on all the continents except for Antarctica.

As for development foundation, the most important aspect is the economic development as it is the basis for technological and human development. A common measure of economic development of a country is gross national income (GNI). It is necessary to take the population of each country into account to make GNI comparable across different countries. Thus, GNI per capita is used in this study. GNI data were collected from the World Bank's latest World Development Report (http://econ.worldbank.org/), and national population data were collected the Central Intelligence Agency's World Fact Book (https://www.cia.gov/library/publications/the-world-factbook/).

To assess human development, the United Nation Development Programme (UNDP) has developed the Human Development Index (HDI) (http://hdr.undp.org/en/humandev/). Because human development is related to economic development in terms of people's incomes, UNDP also gives non-income HDI by adjusting HDI values with average income. As economic development is already included as part of developmental foundation, this study uses non-income HDI to avoid high correlation between two aspects of development that may lead to a collinearity issue.

To measure technological development, this study uses the investment in information and communication technology (ICT). Like economic development, ICT investment per capita was calculated by dividing the national amount with the population of each country to make it comparable across different countries. ICT investment data were collected from the World Telecommunication Database compiled by the International Telecommunication Union (http://www.itu.int/ITU-D/ict/statistics/).

As for regulatory foundation, it includes two factors: telecommunication competitiveness and Internet censorship. The measure of telecommunication competitiveness was obtained from the Global IT Report (Dutta & Mia, 2011).

Internet Censorship was obtained mainly from the report by United Nations Educational, Scientific and Cultural Organization (UNESCO) (Dutton et al., 2011).

Finally, the dependent variable VSN diffusion is measured with the VSN usage index given in the Global IT report (Dutta & Mia, 2011). It was computed based on the percentage of VSN users in the total population and the time that they spend on VSN on average.

Based on the research model, there are three groups of independent variables in terms of cultural, developmental and regulatory foundations, and they have hierarchical effects on VSN diffusion as the dependent variable. Thus, this study will employ hierarchical regression method to control for the effects of lower-level factors for more accurate estimation of the effects of higher-level factors. This method also allows for the testing of the overall effect of each block of variables entered based on the difference in *R*-square and *F* statistic.

5. RESULTS

Table 1 gives the descriptive statistics of the observations. The value of virtual social network usage has a range of 3.37, and is left-skewed as the mean is closer to the maximum than the minimum. The distribution shows that more countries are closer to the front than the end in the adoption of VSN innovation. The coefficient of variation (i.e. the ratio between standard deviation and mean) is close to 10%. It shows that the diffusion of VSN is very fast in most parts of the world, but some countries still lag far behind, leading to a new form of digital divide.

Table 1. Descriptive Statistics

Variable	Range	Mean
Dependent		
VSN Usage	3.11-6.48	5.32(0.73)
Cultural		
Power	11-104	61.54(21.25)
Individualism	6-91	42.1(22.81)
Masculinity	5-110	50.21(17.53)
Uncertainty	8-112	65.58(22.39)
Developmental		
GNI per capita	737-59993	18837(14806)
ICT Investment	27-7669	1188(1363)
Non-income HDI	0.37-0.98	0.78(0.15)
Regulatory		
Competitiveness	0-6	4.94(1.52)
Censorship	1-5	2(1.28)

Note: Standard deviations given in the parentheses beside the means. GNI – gross national income; HDI – human development index.

As for the cultural foundation, the average range of the four dimensions is about 100, with the means in approximately the middle. The coefficients of variation are about 30%. As for developmental foundation, countries vary widely in economic development, technological development and human development. Except for human development, economic development and technological development are seriously right-skewed, indicating that the majority of countries in the world are under development in these two aspects. In comparison, human development is more balanced, as the coefficient of variation is about 25%, in comparison to about 100% for economic development and technological development. As for regulatory foundation, telecommunication competitiveness is more right-skewed and Internet censorship is more left-skewed. This indicates that most countries recognize the harm of monopoly and encourage competition. On the other hand, Internet censorship is a common practice for a lot of regimes in the world.

Table 2. Standardized Regression Estimates

Predictor	Model1	Model2	Model3
H1: Cultural			
-a: Power	$-.15^{NF}$	$-.05^{NF}$	$.01^{NF}$
-b: Individualism	$.34^{**}$	$-.01^{NF}$	$-.05^{NF}$
-c: Masculinity	-.18	-.16	$-.18^{*}$
-d: Uncertainty	-.15	$-.19^{*}$	-.13
H2: Developmental			
-a: GNI per capita		$.39^{**}$	$.68^{***}$
-b: ICT Investment		$-.07^{NF}$	-.16
-c: Non-income HDI		$.35^{**}$	$.04^{NF}$
H3: Regulatory			
-a: Competitiveness			$.26^{***}$
-b: Censorship			$-.30^{***}$
Model Comparison			
$-R^2$	.28	.52	.64
-*F* change	5.55^{***}	8.95^{***}	8.51^{***}

Note: ^{NF} – Not significant at 0.2 level; * – significant at 0.1 level; ** – significant at 0.05 level; *** – significant at 0.01 level.

Table 2 reports the results of hierarchical regression analysis. The change of F statistic in model comparison shows that each of the three foundations significantly contributes to the

explanation of VSN usage when the effects of lower-level foundations are controlled for the estimation of the effects of higher-level foundations. As the model R-square indicates, cultural foundation explains 28% of the variation of VSN diffusion, developmental foundation explains an additional 24% of it on top of cultural foundation, and regulatory foundation explains an additional 12% of it on top of both cultural and economic foundations.

All three models include cultural dimensions as the predictors of national VSN usage. In model 1 where only cultural foundation is considered, Individualism is significant at the 0.05 level. In model 2 where both cultural and developmental foundations are considered, Individualism becomes insignificant, but Uncertainty Avoidance becomes significant at the 0.1 level. When cultural, developmental and regulatory foundations are all taken into account, masculinity becomes the only one that is significant at the 0.1 level. The directions of the significant relationships between these dimensions and the dependent variable are consistent with what are hypothesized: Individualism has a positive effect, and Masculinity and Uncertainty Avoidance have negative effects on national VSN usage. Power Distance is not significant in any of the models.

Both Models 2 and 3 include Economic Development, Human Development and Technological Development as the predictors of national VSN usage. In model 2 where cultural foundation and developmental foundation are considered, Economic Development and Human Development are significant, but Technological Development is not significant. In model 3 where the regulatory foundation is added, Economic Development becomes more significant but Human Development becomes insignificant. The directions of the significant relationships between different aspects of development and the dependent variable are all positive, consistent with the overall hypothesis that country development enhances VSN usage.

Finally, only Model 3 includes Telecommunication Competitiveness and Internet Censorship as the predictors of national VSN usage, and both variables are highly significant. As hypothesized, Telecommunication Competitiveness has a positive effect and Internet Censorship has a negative effect on VSN usage.

All the variance inflation factors (VIFs) are below 5 (the highest is 3.53 for Non-income HDI in Model 3), indicating that collinearity is moderate and does not confound the results. The moderate correlations among the independent variables explain the changes in the significance levels of some variables when more significant variables are entered. In specific, the variation in the significance of specific cultural dimensions in different models is mainly due to the fact that its effect sizes is relatively small compared to developmental and regulatory foundations as the R-square and F change statistics show. When more significant variables are added, the effects of original variables may change. For instance, Individualism is somewhat related to Human Development that encourages creativity and independent thinking. Also, it has been found that individualism is positively related to economic development of a country (Ball, 2001). Thus, when the developmental foundation is taken into account, Individualism becomes insignificant but Uncertain Avoidance becomes more significant.

The shift of salience from Uncertainty Avoidance in Model 2 to Masculinity in Model 3 may also be due to the fact that regulatory foundation implies assertive forces and uncertainty reduction. Also, Human Development became insignificant after the regulatory foundation is taken into account. This may be due to the fact that Telecommunication Competitiveness and Internet Censorship is somewhat correlated with Human Development. A country with higher Human Development is likely to have higher level of Telecommunication Competitiveness but lower Internet Censorship.

6. CONCLUSION AND IMPLICATIONS

Virtual social network (VSN) has become a worldwide phenomenon and this study examines the national factors that influence its global diffusion. Through a thorough literature review, it identifies that there are three types of factors: user culture on the demand side, industry regulation on the supply side, and country development related to both. To capture how they influence VSN diffusion, a pyramid model is proposed based on their different natures in terms of effect and durability. As the model indicates, regulatory foundation has the direct impact on VSN diffusion but it is quick to change, cultural foundation has an indirect impact but it is quite stable, and developmental foundation is somewhere in between from both aspects. The

relationships between specific variables and VSN usage are hypothesized and tested, and results of hierarchical regression analysis support the pyramid model.

There are several limitations of this study. First, the sample was not randomly collected from all the countries in the world. The 78 countries included in the sample are the ones to which Hofstede has given the values of the four cultural dimensions. In this sense, this can be considered as a convenience sample. Because of the potential sampling bias, the findings may not be generalizable to other countries. In addition, the effective sample size is 62 due to missing values. The excluded cases represent 20.51% of the sample size. Three countries do not have virtual social network usage values, and 16 countries (including the previous three) do not have ICT investment values. As the countries with the missing values may be somewhat different from others, the exclusion of them could have further increased the bias.

Despite the limitations, this study answers some important theoretical, empirical and practical questions. The pyramid model proposed in this study describes the hierarchical relationships between VSN usage and its cultural, developmental and regulatory foundations. Compared with traditional information technologies, VSN is unique in that it has been a social and global phenomenon since it birth. The model not only identifies the important foundations at the national level but also distinguish their natures and effects related to VSN usage. In specific, cultural foundation is stable and hard to control, and it has indirect and weak effects on the diffusion of such a technology. On the other hand, regulatory foundation is volatile and possible to manipulate, and it has direct and strong effects on VSN diffusion. Developmental foundation takes time and effort to change and its effects are intermediate. Thus, this study contributes to the current innovation diffusion literature in that it tries to understand the phenomenon from different aspects of country characteristics.

The hierarchical regression technique employed in this study provides the means to test the relationships between VSN usage and cultural, developmental and regulatory foundations. Controlling for the effects of lower-level foundations when the effects of higher-level foundations are examined, the model comparison statistics (i.e. change in *R*-square and *F* statistic) confirmed that they have hierarchical effects on the dependent variable as the pyramid model suggests. In addition, the analysis revealed that there were moderate correlations among the independent variables (variance inflation factors between 1 and 3.5), and the entering of higher-level variables changed the significance of some lower-level variables. This further supports the pyramid model in that cultural, developmental and regulatory foundations are not independent from but rather connect with each other. The results indicate that developmental foundation is related to both cultural and regulatory foundations as its model entrance lead to the change of significance in several cultural variables, and the effects of its own variables varied when regulatory variables were added. This confirms that the developmental foundation is associated with the cultural foundation on the demand side and regulatory foundation on the supply side of VSN diffusion.

The findings of this study have important practical implications, especially for policy makers. As for industrial regulations, this study suggests that they have great impact on VSN usage in a country. Enhancing the competition in the telecommunication industry facilitates VSN diffusion, but tightening Internet censorship constrains or even blocks it. Because the effects were strong, governmental officials and industrial stakeholders need to be cautious in making such manipulations. Compared with regulatory foundation, developmental foundation is beneficial in all aspects but it takes time and effort for a country to strengthen it. Among the three aspects, the findings suggest that it is more important to advance economic development and human development than technological development as the latter depends on the previous two. Thus, economic development and human development are the keys for national diffusion of VSN, especially developing countries. Finally, cultural foundation is hard to change, but that does not mean that researchers and practitioners can do little in this regard. Rather, they can adapt VSN usage to a particular cultural environment by guiding user behavior. In a society that emphasizes collectivism, for instance, VSN service providers encourage users to establish interest circles (e.g. hobby, shopping, social events) and make joint efforts.

7. REFERENCES

Antonelli,C. (2003). The digital divide: understanding the economics of new information and communication technology in the global economy. *Information Economics and Policy, 15* (2), 173-199.

Bachrach, Y., Kosinski, M., Graepel, T., Kohli, P., & Stillwell, D. (2012). Personality and patterns of Facebook usage. In the *Proceedings of Web Science'12* (June 22–24, 2012, Evanston, IL, USA).

Ball, R. (2001). Individualism, Collectivism, and Economic Development. *Annals of the American Academy of Political and Social Science,573*, 57-84.

Bassanini, A., & Scarpetta, S. (2002). Growth, technological change, and ICT diffusion: Recent evidence from OECD countries. *Oxford Review of Economic Policy, 18* (3), 324-344.

Baskerville, R., & Pries-Heje, J. (2003). Diversity in Modeling Diffusion of Information Technology. Journal of Technology Transfer, 28, 251-264.

Blackman, C. & Srivastava, L. (2011) Telecommunications Regulation Handbook. Washington, DC: The World Bank.

Boyd, D. M. & Ellison, N. B. (2008). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication, 13*, 210–230.

Cassidy, J. (2006, May 15). Me media: How hanging out on the Internet became big business. *The New Yorker, 82*(13), 50.

Chen, W. & Wellman, B. (2004). The global digital divide – Within and between countries. *IT&Society, 1* (7), 39-45.

Chinn, M. D. & Fairlie, R. W. (2007). The determinants of the global digital divide: A cross-country analysis of computer and internet penetration. *Oxford Economic Papers, 59* (1), 16-44.

Cohen, N. (2012, April 24) The breakfast meeting: Grilling for James Murdoch, and Facebook tops 900 million users. New York Times.

Coleman, J. S. (1988). Social capital in the creation of human capital. American Journal of Sociology, 94(Supplement), S95–S120.

Dekimpe, M. G., Parker, P. M. & Sarvary, M. (2000). Global diffusion of technological innovations: A coupled-hazard approach. Journal of Marketing Research, 37(2), 47–59.

Dewan,S., Ganley,D. & Kraemer, K. L. (2010). Complementarities in the Diffusion of Personal Computers and the Internet: Implications for the Global Digital Divide. Information Systems Research, 21 (4), 925–940.

Dutta, S. & Mia, I. (2011). *The Global Information Technology Report 2010–2011*. Geneva, Switzerland: World Economic Forum.

Dutton, W. H., Dopatka, A., Law, G., Nash, V. (2011). *Freedom of Connection, Freedom of Expression: The Changing Legal and Regulatory Ecology Shaping the Internet*. United Nations Educational, Scientific and Cultural Organization (UNESCO): Division for Freedom of Expression, Democracy and Peace.

Eagle, N., Macy, M. and Claxton, R. (2010). *Network diversity and economic development*. Science 328: 1029.

Ellison, N. B., Steinfield, C. & Lampe, C. (2007). The benefits of Facebook "friends": Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication, 12*, 1143–1168.

Gibbs, J., Kraemer, K. L. and Dedrick, J. (2003). Environment and policy factors shaping global e-commerce diffusion: A cross-country comparison. *Information Society, 19* (1), 5-18.

Gomulka, S. (1971). Inventive Activity, Diffusion, and the Stages of Economic Growth. Aarhus, Denmark: Institute of Economics and Aarhus University Press.

Guillen, M. F. & Suarez, S. L. (2005). Explaining the Global Digital Divide: Economic, Political and Sociological Drivers of Cross-National Internet Use. Social Forces, 84 (2), 681-708.

Kessler, S. (2011, January 26). Facebook & Twitter both blocked in Egypt. Retrieved on November 26, 2011 from: http://mashable.com/2011/01/26/facebook-blocked-in-egypt/

Lie, E. (2002). Competition policy in telecommunications: Background paper. ITU New Initiatives Workshop on Competition Policy in Telecommunications (20-22 November 2002, in Geneva).

Hargittai,E. (2008). Whose Space? Differences among users and non-users of social network sites. *Journal of Computer-Mediated Communication, 13*, 276–297.

Heras, K. (2010). Social media usage worldwide: Australia / Brazil lead the way. Retrieved on November 29, 2011 from: http://thenextweb.com/au/2010/06/22/social-media-usage-worldwide-australia-brazil-lead-the-way/

Hersberger, J. (2002-2003). Are the economically poor information poor? Does the digital divide affect the homeless and access to information? *Canadian Journal of Information and Library Science, 27* (3), pp. 45-63.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Newbury Park, CA: Sage.

Hofstede, G. (1991). *Cultures and Organizations: Software of the Mind*. Maidenhead, UK: McGraw-Hill.

Kagami,M., Tsuji, M. and Giovannetti, E. (eds.) (2004). Information technology policy and the digital divide: lessons for developing countries. Northampton, Massachusetts: Eduward Elgar Publishing.

Mbakogu, I. A. (2004). Is There Really a Relationship Between Culture and Development? Anthropologist, 6(1), 37-43.

Meattle, J. (2007). Top-20 Websites: Where do we spend our time online? Retrieved on November 15, 2011 from: http://blog.compete.com/2007/01/25/top-20-websites-ranked-by-time-spent/

Mohan, R. (2007). Determinants of ICT Expenditure Using Logit Transformation for Proportion Data Analysis. *Journal of Information Technology Impact, 7* (2), 145-158.

Norris, P. (2001). *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide*. Cambridge, UK: Cambridge University Press.

Oxley, J. E. & Yeung, B. (2001). E-Commerce readiness: Institutional environment and international competitiveness. *Journal of International Business Studies, 32*(4), 705–723.

Rogers, E. M. (1962). *Diffusion of Innovations*. New York: The Free Press.

Rogers, E. M. (1983). *Diffusion of innovations (3rd ed.)*. New York: Free Press.

Parente, S. L. & Prescott, E. C. (1994). Barriers to technology adoption and deveolopment. *Journal of Political Economy, 102* (2), 298-321.

Prieger, J. E. (2003). The Supply Side of the Digital Divide: Is There Equal Availability in the Broadband Internet Access Market? *Economic Inquiry, 41* (2), 346-363.

Quan-Hasse, A., & Young, A. L. (2010). Uses and gratifications of social media: A comparison of Facebook and instant messaging. *Bulletin of Science Technology & Society, 30*, 350-361

Quibria, M. G., Ahmed, S. N., Tschang, T. & Reyes-Macasaquit, M. (2003). Digital divide: Determinants and policies with special reference to Asia. *Journal of Asian Economics, 13*, 811–825.

Roberts, S. (2008). *The global information society: A statistical view*. Santiago, Chile: United Nations Publication.

Saraf,N., Langdon, C.S. & Gosain, S. (2007). IS application capabilities and relational value in interfirm partnerships. *Information Systems Research, 18,* 320-339.

Singelis, T. , & Brown, W. (1995). Culture, self, and collectivist communication: Linking

culture to individual behavior. *Human Communication Research*, *21*, 354-389.

Smith, P. B. (1992). Organizational behaviour and national cultures. *British Journal of Management, 3*(1), 39.

Stratmann, J. (2011). Mobile virtual goods revenue to reach $3bn in 2011 and $4.6bn by 2016. Retrieved on February 15, 2012 from: http://www.freshnetworks.com/blog/2011/10/mobile-social-virtual-goods-revenues-to-reach-3bn-in-2011-and-4-6bn-by-2016/

Talukdar, D. and Gauri, D. K. (2011). Home Internet Access and Usage in the USA: Trends in the Socio-Economic Digital Divide. *Communications of the Association for Information Systems, 28*, 85-98.

Thelwall, M. (2008). Social networks, gender and friending: An analysis of MySpace member profiles. *Journal of the American Society for Information Science and Technology, 59* (8), 1321–1330.

Thelwall, M., Wilkinson, D., Uppal, S. (2010). Data mining emotion in social network communication: Gender differences in MySpace*. Journal of the American Society for Information Science and Technology, 61* (1), 190–199.

Triandis, H.C. (1989). The self and social behavior in differing cultural contexts. *Psychological Review, 96* (3), 506-520.

Van Dijk, J. and Hacker, K. (2003). The digital divide as a complex and dynamic phenomenon. *Information Society, 19* (4), pp. 315-326.

Van Grove, J. (2010) Social Networking Usage Surges Globally. Retrieved on October 30, 2011 from: http://mashable.com/2010/03/19/global-social-media-usage/.

Waisanen, D. (2010). Facebook, diasporic-virtual publics, and networked argumentation. In the *Proceedings of National Communication Association/American Forensic Association (Alta Conference on Argumentation)*, 550-557.

Wallsten, S. (2002). Regulation and Internet use in developing countries. World Bank Policy Research Working Paper No. 2979. doi:10.2139/ssrn.366100.

Warf, B. (2001).Segueways into cyberspace: multiple geographies of the digital divide. *Environment and Planning B: Planning and Design, 28*, 3 - 19.

Whitford, A. B. and Tucker, J. A. (2009). Technology and the evolution of the regulatory state. *Comparative Political Studies , 42* (12), 1567-1590.

Wong, P.-K. (2002).ICT production and diffusion in Asia Digital dividends or digital divide? *Information Economics and Policy, 14* (2), 167-187.

Yates, D. J., Gulati, G. J., and Tawileh, A. (2010). Explaining the Global Digital Divide: The Impact of Public Policy Initiatives on Digital Opportunity and ICT Development. *Proceedings of the 43th Hawaii International Conference on System Sciences*, January 2010. Kauai: University of Hawaii at Manoa.

Yazdanifard,R., Obeidy, W. K., Yusoff, W. F. W. and Babaei, H. R. (2011). Social Networks and Microblogging;The Emerging Marketing Trends&Tools of the Twenty-first Century. In the *Proceedings of 2011 International Conference on Computer Communication and Management, Vol. 5*, 577-581.