

# JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

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# Global Diffusion of Virtual Social Networks: A Pyramid Model of Cultural, Developmental and Regulatory Foundations

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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 new form of global digital divide prevents many people all over 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 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 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, telecommunication regulation

## 1. INTRODUCTION

Nowadays, more and more people are using virtual social network (VSN) applications such as Facebook and LinkedIn. They are websites on which users create and maintain relationships with each other (Boyd & Ellison, 2008). Compared with traditional computer-mediated communication applications (e.g. instant messaging), VSN allows users to easily create profiles, add friends, join groups, update activities and share personal experiences with each other (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 collective use has great commercial potential in areas such as marketing and e-commerce (Yazdanifard et al., 2011). For instance, social gaming, a special type of VSN, is a billion-dollar market. The transactions of virtual goods through 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 can bring huge benefits to human society at different levels, its global diffusion is far from even. For instance, a recent global survey of 10 countries (Australia, Brazil, France, Germany, Italy, Japan, Spain, Switzerland, USA and UK) found that the percentage of online population who actively use VSN applications ranged 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 and the least developed countries in VSN usage is much wider.

The uneven penetration of VSN 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 terms of 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 literature review. Then it will propose a research model and describe the methodology to validate the model. After the presentation of analyses and findings, 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. For the study of 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 leading to 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 and use VSN. The diffusion pertains to both individual users and the organizations that provide and regulate VSN services. In particular, the telecommunication industry of each country establishes the necessary Internet infrastructure. The lack of broadband access constitutes the supply side of global digital divide, in contrast to the demand side related to people's need of 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 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 VSN readiness of users (e.g. service affordability and computer literacy) as well as telecommunication industry (e.g. broadband infrastructure and policy). Thus, it is related to both the demand and supply sides of VSN diffusion, as shown in Figure 1.

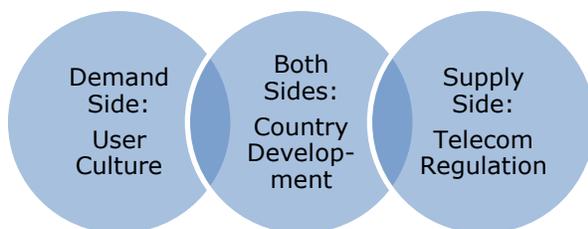


Figure 1. VSN Diffusion Factors

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 due to their different natures. As a supply-side force, telecommunication regulation pushes or constrains VSN diffusion as it may facilitate or discourage (sometimes even prohibit) people's use of 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 VSN penetration. 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 between.

These factors also vary in the durability of their influences. Telecommunication regulation needs to quickly adapt to the change in technological, commercial and political environment (Blackman & Srivastava, 2011). Thus, its impact on VSN diffusion is short and volatile in terms of years or even months. On the other hand, culture is rather stable, and its effect is long-lasting in terms of centuries (Hofstede, 1991; Smith, 1992). Country development takes the efforts of generations, and the durability of its influence is intermediate in terms of decades.

The pyramid model in Figure 2 reflects the different natures of telecommunication regulation, country development and user culture in terms of their influences on VSN diffusion. 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 is related to both user base and telecommunication industry, and it is the foundation in the middle.

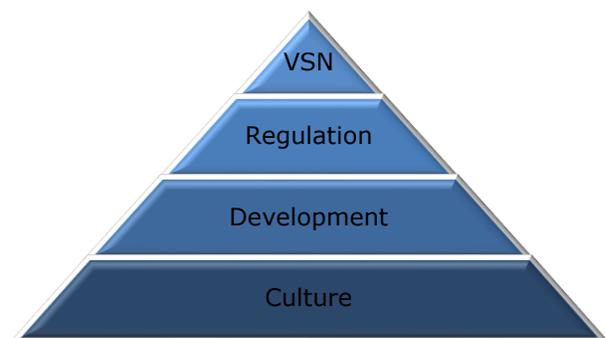


Figure 2. A Pyramid Model of VSN Diffusion

The understanding of how different types of factors affect VSN diffusion provides a guideline for designing an empirical study. Due to the hierarchical relationships among the regulatory foundation, developmental foundation and cultural foundation, it is necessary to examine each type of factors 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. Therefore, the rest of this section will identify the specific variables of cultural, developmental and regulatory foundations respectively, and hypothesize their effects on VSN diffusion.

### **Cultural Foundation**

There are many definitions 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. Unlike individual applications, VSN facilitates computer-mediated communication (Boyd & Ellison, 2008). Hofstede's cultural dimensions are related to people's use of such an innovation as they explain human communication behavior to some extent (Singelis & Brown, 1995).

As for power distance, people tend to accept and expect differential social statuses in the cultures that are high in this dimension. However, VSN encourages equality in user rights and obligations to enhance social capital (Ellison, Steinfield & Lampe, 2007). Thus people in the cultures of lower power distance are more likely to adopt VSN.

As for individualism versus collectivism, individualists are less concerned with the

thoughts and actions of others and tend to communicate with them more directly than collectivists (Singelis & Brown, 1995). To use a VSN application (e.g. Facebook), an individual establishes a personal space and invites others (e.g. friends) to join it. Compared with other virtual community applications such as Internet forum, VSN provides people a user-centric (rather than topic-centric) platform that allows them to display personalities (Bachrach et al., 2012). In this sense, individualists are more likely to adopt this innovation than collectivists.

As for masculinity versus femininity, this dimension is related to gender difference. Researchers found that females are more inclined and effective to use VSN than males (Thelwall, 2008; Thelwall, Wilkinson & Uppal, 2010). Thus, such a cultural dimension makes a difference in the new form of computer-mediated communication behavior. That is, masculinity may be negatively but femininity may be positively 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 is a relatively new innovation, people of high uncertainty avoidance may be hesitant to use it, or vice versa.

The above 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 levels of information access across and within countries (Chen & Wellman, 2004; Roberts, 2008; Hersberger, 2002-2003; Talukdar & Gauri,

2011). Thus 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 more closely related to telecommunication industry is technological development, and the one that is more 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). As for determining where a country is in the divide, its broadband Internet infrastructure is often used as an index to measure the development level of its telecommunication industry (Prieger, 2003). Each country needs to make a significant capital investment in form of ICT expenditure to establish and maintain such an infrastructure (Mohan, 2007). Therefore, 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 ICT innovations. Education is the key for people to develop necessary knowledge and skills to use technologies (Bruce, 1997). 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 ICT innovation, VSN requires 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 the cultural foundation has a more fundamental influence on VSN diffusion, the effect of the developmental foundation cannot be examined separately unless the former is controlled for its influence. 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**

VSN is an innovation based on the Internet. Though not many researchers have examined how regulatory factors affect VSN diffusion, there have been plenty of studies on the regulation of the Internet. 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 directly impacts 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 affects 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). It shows how quickly telecommunication regulation can change people's VSN usage. In this sense, telecommunication industry competitiveness and Internet censorship constitute the regulatory foundation of VSN diffusion.

Internet censorship imposes restrictions and even fears on people 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, it will lower the cost of Internet access compared with the case of monopoly. A more affordable Internet service means a larger user base for VSN. Thus telecommunication competitiveness is likely to have a positive effect on VSN diffusion. The accurate estimation of their effects requires the consideration of cultural and development foundations that have more fundamental influence. 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. This study includes all of them in the dataset and the sample size is 78. The countries are from 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 multicollinearity issue.

To measure the technological development of a country, this study uses the investment in information and communication technology (ICT). Like GNI per capita, 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 employs 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 differences 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 innovators than the laggards in the diffusion 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, forming a new digital divide.

Table 1. Descriptive Statistics

Variable	Range	Mean
<u>Dependent</u>		
VSN Usage	3.11-6.48	5.32(0.73)
<u>Cultural</u>		
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)
<u>Developmental</u>		
GNI per capita	737-59993	18837(14806)
ICT Investment	27-7669	1188(1363)
Non-income HDI	0.37-0.98	0.78(0.15)
<u>Regulatory</u>		
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 still underdeveloped 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 many regimes in the world.

Table 2. Standardized Regression Estimates

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

Note: <sup>NF</sup> – 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 multicollinearity is not serious enough to confound the results. The moderate correlations among the independent variables also 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 their effect sizes are relatively small compared to the variables of developmental and regulatory foundations as the *R*-square and *F* change statistics show. When more significant variables are entered, 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. In addition, Human Development became insignificant after the regulatory foundation is taken into account. This may reflect that Telecommunication Competitiveness and Internet Censorship are somewhat correlated with Human Development: a country with higher Human Development is likely to have higher level of Telecommunication Competitiveness but lower level of 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 literature review, it identifies 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 influence and durability. As the model suggests, regulatory foundation has the direct impact on VSN diffusion but it is quick to change, cultural foundation has an indirect effect but it is quite stable, and developmental foundation is somewhere in between. The relationships between specific variables and VSN usage are hypothesized and empirically tested, and results of hierarchical regression analyses support the validity of pyramid model.

There are several limitations of this study. First, the observations are not randomly selected from all the countries in the world. The 78 countries included in the sample are the ones to which Hofstede gave the values of the four cultural dimensions. In this sense, this can be considered as a convenience sample. Because of the potential selection 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 may further increase the selection 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 its birth. The model not only identifies the important foundations at the national level but also distinguish their natures related to VSN usage. In specific, cultural foundation is stable and hard to control, and it has an indirect and relatively weak influence on the diffusion of such a technology. On the other hand, regulatory foundation is volatile and possible to manipulate, and it has a direct and relatively strong impact on VSN diffusion. Developmental foundation takes time and effort to change and its effect is intermediate. Thus, this study contributes to the current innovation diffusion literature in that it enhances the understanding of the phenomenon from different aspects of country characteristics.

The hierarchical regression technique employed in this study provides the means to empirically 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) confirm that they have hierarchical effects on the dependent variable as the pyramid model suggests. In addition, the analyses reveal that there are moderate correlations among the independent variables (variance inflation factors between 1 and 3.5), and the entering of higher-level variables changes 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 connected with each other. The results indicate that developmental foundation is related to both cultural and regulatory foundations as its model entrance leads to the change in the observed significance levels of several cultural variables, and the effects of its

own variables shift when regulatory variables are 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 potentially 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 impact is direct and strong, governmental officials and industrial stakeholders need to be careful in making relevant policies. Compared with regulatory foundation, developmental foundation is beneficial in all aspects but it takes time and effort to materialize. 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 may encourage users to establish interest circles (e.g. hobby, shopping, social events) and make joint efforts.

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