Bad Neighbors and The Internet: A Geospatial Analysis of Internet Adoption

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Literature Review

Technology Acceptance Theories

Researchers have attempted to outline theoretical frameworks and apply them to the society's adoption of new technologies that has proliferated in the past two decades, such as the Wireless Internet, Internet banking, instant messaging, social networking sites. (Leng et al. 2011, Martins, Oliveira, and Popovič (2014), Y. Lu, Zhou, and Wang (2009), J. Lu et al. (2003)) The literature is concentrated on three theories: the Innovation Diffusion Theory, Technology Adoption Model, and the Theory of Planned Behavior.

Innovation Diffusion theory explains the process and the speed of the spread of technologies with a 5 stage process. (Miller 2015) A successful innovation diffusion curve follows an S-shaped curve and the diffusion process is due to different types of technology adoptees. The technology adoptees are categorised into laggards, early or late majority, early adopters, and innovators. A key feature of the Innovation Diffusion theory is how innovation decisions of individuals are heavily dependent on others. The Innovation Diffusion theory originated from agrarian research, but has been continually validated with newer innovations. Another criticism of the theory is the static nature of categorisation as society has evolved since the initial modelling of the theory, the categorisation may be less relevant in today's context. (Wani 2015)

Other researchers have contested against the static nature of the Innovation Diffusion theory and outlined the Technology Acceptance Model (TAM) as an alternative theoretical framework for technology adoption (Davis 1989, Mathieson (1991), Taylor and Todd (1995), J. Lu et al. (2003)). The composition of society may have evolved to be more diverse than the outlined five categories of technology adoptees. The Technology Acceptance Model focuses on the effects of perception on technology adoption behaviour. (Davis 1989, Mathieson (1991)) Firstly, researchers focus on characteristics of an individual to explain inclinations in adopting new technology. Parasuraman outlined traits that inhibits and drives an individual's likeliness to

accept new technologies. (Parasuraman 2000) Secondly, TAM focuses on technology attributes that affect perceptions and adoption of new technologies. (Davis 1989) The TAM suggests that perceived ease of use and usefulness are beliefs that influence an individual's attitude toward the technology and ultimate adoption of the new technology.

The Theory of Planned Behavior links behavior to beliefs and has been widely and successfully applied to predict behavioral intention in technology acceptance (Ajzen 1991). An individual's behavioral intention is conditional on three antecedents: the attitude towards behavior, the perceived behavioral control and the existing subjective norm. The attitude towards behavior reflects a personal evaluation (positive or negative) of the behavior. The perceived behavioral control reflects one's perception of their capability to perform the given behavior. Subjective norm reflects whether an individual's behavior will be accepted by his or her reference group of people who are important to an individual. (Ajzen and Fishbein 1975).

Internet Diffusion

Building on the theoretical frameworks of technology acceptance, the existing literature on Internet diffusion considers both supply-side and demand-side factors to attain widespread internet diffusion. Previous literature has established three main channels - economic, demographic and institutional - for internet proliferation in a country. Economic variables, such as telecommunication infrastructure and GDP per capita, were identified as key determinants of Internet diffusion in various studies. Economic variables, such as telecommunication infrastructure and GDP per capita, were identified as key determinants of Internet diffusion in various studies (Beilock and Dimitrova 2003, Hargittai (1999), Crenshaw and Robison (2006), Wunnava and Leiter (2008), Warf (2009), Andrés et al. (2010)). Hargittai (1999) is one of the first econometric studies analyzing the spread of the Internet across countries. Using a sample of OECD countries from 1994 to 1997, Hargittai finds that differences in GDP per capita affect diffusion rates, even for OECD countries with comparable social and economic development. Her findings also identify other important determinants such as telecommunications policy and telephone density. Kiiski and Pohjola also found income per capita, telephone access costs, and years of schooling to be significant determinants in their examination of internet penetration in 60 OECD and developing countries. (Kiiski and Pohjola 2002) Beilock and Dimitrova (2003) conducted their empirical study on a sample of 105 countries with a greater variation of socioeconomic levels. Their results affirm previous findings that income per capita is the paramount determinant of aggregate Internet usage in countries. Other important factors from their findings include telephone infrastructure, political freedom and economic openness of a country. Additionally, Chinn and Farlie examined a sample of 161 countries from 1999 to 2001 and attempted to decompose the relative importance of determinants of internet adoption. Their findings asserted that the most influential factor in Internet diffusion is GDP per

capita, followed by telephone lines per capita. (Chinn and Fairlie 2006) In their next study, they focused on disparity in internet adoption in developed and developing countries and found that income per capita, telephone density, human capital and legal quality account for poor internet adoption in developing countries.

Other economic variables that have been considered in different comparative studies include openess to trade, regulatory policies of the telecommunication industry and educational attainment. Mixed conclusions have been found for these three variables, depending on the measurements of the data and empirical specification. Low levels of education are expected to impede the accessibility and diffusion of technologies. In Kiiski and Pohjola's (2002) analysis of Internet diffusion in both OECD and developed countries, average years of schooling positively affects Internet diffusion, but competition in the telecom market was found to be insignificant. More recent work also found evidence of school education positively affecting ICT adoption (Cruz-Jesus et al. 2016, Tengtrakul and Peha (2013)). Caselli and Coleman's study found that imports per worker and the attainment of secondary education strongly increases computer diffusion (Caselli and Coleman II 2001). However, Hargittai (1999) and Chinn and Farlie (2007) did not find a significant relationship between education and Internet diffusion, but their results highlighted the significance of telecommunication regulatory policy.

Besides economic factors, previous literature had also taken an interest in investigating the importance of institutions, policies crafted and enforced for ICTs advancement (Wallsten 2005, Andonova and Diaz-Serrano (2009)). In Andonova's analysis of a cross-section of developed and developing countries in 2001, she used different measures of institutional quality, such as civil liberties, political constraints, and political rights, and their resultant impacts on investment climate to posit an explanation of the differences between Internet and mobile phone usage; and found a positive relationship between infrastructural development, institutional environment and Internet usage. (Andonova 2006) Henisz and Zelner also concluded that the risk of the state taking over an investment is a paramount institutional parameter in telecommunications development. (Henisz, Zelner, and others 2001) Additionally, countries with greater political freedom and better property rights are more likely to have higher Internet adoption rates (Crenshaw and Robison 2006).

Many studies of Internet diffusion also considered demographic controls as particular demographic characteristics are expected to advance Internet diffusion. For instance, countries with a younger population and greater urbanization are expected to accept the Internet more readily. Previous studies by Goldfarb and Prince (Goldfarb and Prince 2008) and Chinn and Farlie (2007) hint at a positive relationship between youth and Internet adoption, which aligns with findings from other microdata (National Telecommunications and Information Administration 2002). On the other hand, findings regarding levels of urbanization in countries are less clear-cut. Andonova (2006) and Crenshaw and Robison (2006) find a significantly positive impact of

urbanization, whereas Chinn and Farlie (2007) find opposite results.

Bibliography

Ajzen, Icek. 1991. "The Theory of Planned Behavior." *Organizational Behavior and Human Decision Processes* 50 (2). Elsevier: 179–211.

Ajzen, Icek, and Martin Fishbein. 1975. "Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research." Reading, MA: Addison-Wesley.

Andonova, Veneta. 2006. "Mobile Phones, the Internet and the Institutional Environment." *Telecommunications Policy* 30 (1). Elsevier: 29–45.

Andonova, Veneta, and Luis Diaz-Serrano. 2009. "Political Institutions and Telecommunications." *Journal of Development Economics* 89 (1). Elsevier: 77–83.

Andrés, Luis, David Cuberes, Mame Diouf, and Tomás Serebrisky. 2010. "The Diffusion of the Internet: A Cross-Country Analysis." *Telecommunications Policy* 34 (5). Elsevier: 323–40.

Beilock, Richard, and Daniela V Dimitrova. 2003. "An Exploratory Model of Inter-Country Internet Diffusion." *Telecommunications Policy* 27 (3). Elsevier: 237–52.

Caselli, Francesco, and Wilbur John Coleman II. 2001. "The Us Structural Transformation and Regional Convergence: A Reinterpretation." *Journal of Political Economy* 109 (3). The University of Chicago Press: 584–616.

Chinn, Menzie D, and Robert W Fairlie. 2006. "The Determinants of the Global Digital Divide: A Cross-Country Analysis of Computer and Internet Penetration." *Oxford Economic Papers*. Oxford Univ Press.

Crenshaw, Edward M, and Kristopher K Robison. 2006. "Globalization and the Digital Divide: The Roles of Structural Conduciveness and Global Connection in Internet Diffusion." *Social Science Quarterly* 87 (1). Wiley Online Library: 190–207.

Cruz-Jesus, Frederico, María Rosalía Vicente, Fernando Bacao, and Tiago Oliveira. 2016. "The Education-Related Digital Divide: An Analysis for the Eu-28." *Computers in Human Behavior* 56. Elsevier: 72–82.

Davis, Fred D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information

Technology." *MIS Quarterly*. JSTOR, 319–40.

Goldfarb, Avi, and Jeff Prince. 2008. "Internet Adoption and Usage Patterns Are Different: Implications for the Digital Divide." *Information Economics and Policy* 20 (1). Elsevier: 2–15.

Hargittai, Eszter. 1999. "Weaving the Western Web: Explaining Differences in Internet Connectivity Among Oecd Countries." *Telecommunications Policy* 23 (10). Elsevier: 701–18.

Henisz, Witold J, Bennet A Zelner, and others. 2001. "The Institutional Environment for Telecommunications Investment." *Journal of Economics & Management Strategy* 10 (1). Citeseer: 123–47.

Kiiski, Sampsa, and Matti Pohjola. 2002. "Cross-Country Diffusion of the Internet." *Information Economics and Policy* 14 (2). Elsevier: 297–310.

Leng, Goh Say, Suddin Lada, Mohd Zulkifli Muhammad, Ag Asri Hj Ag Ibrahim, and Tamrin Amboala. 2011. "An Exploration of Social Networking Sites (Sns) Adoption in Malaysia Using Technology Acceptance Model (Tam), Theory of Planned Behavior (Tpb) and Intrinsic Motivation." *Journal of Internet Banking and Commerce* 16 (2). ARRAY Development: 1.

Lu, June, Chun-Sheng Yu, Chang Liu, and James E Yao. 2003. "Technology Acceptance Model for Wireless Internet." *Internet Research* 13 (3). MCB UP Ltd: 206–22.

Lu, Yaobin, Tao Zhou, and Bin Wang. 2009. "Exploring Chinese Users Acceptance of Instant Messaging Using the Theory of Planned Behavior, the Technology Acceptance Model, and the Flow Theory." *Computers in Human Behavior* 25 (1). Elsevier: 29–39.

Martins, Carolina, Tiago Oliveira, and Aleš Popovič. 2014. "Understanding the Internet Banking Adoption: A Unified Theory of Acceptance and Use of Technology and Perceived Risk Application." *International Journal of Information Management* 34 (1). Elsevier: 1–13.

Mathieson, Kieran. 1991. "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior." *Information Systems Research* 2 (3). INFORMS: 173–91.

Miller, Rebecca L. 2015. "Rogers' Innovation Diffusion Theory (1962, 1995)." *Information Seeking Behavior and Technology Adoption: Theories and Trends: Theories and Trends*. IGI Global, 261.

National Telecommunications and Information Administration. 2002. "A NATION ONLINE : How Americans Are Expanding Their Use of the Internet." *Population (English Edition)*, no. February: 92.

Parasuraman, Ananthanarayanan. 2000. "Technology Readiness Index (Tri) a Multiple-Item Scale to Measure Readiness to Embrace New Technologies." *Journal of Service Research* 2 (4). Sage Publications

Sage CA: Thousand Oaks, CA: 307–20.

Taylor, Shirley, and Peter A Todd. 1995. "Understanding Information Technology Usage: A Test of Competing Models." *Information Systems Research* 6 (2). INFORMS: 144–76.

Tengtrakul, Pitikorn, and Jon M Peha. 2013. "Does Ict in Schools Affect Residential Adoption and Adult Utilization Outside Schools?" *Telecommunications Policy* 37 (6). Elsevier: 540–62.

Wallsten, Scott. 2005. "Regulation and Internet Use in Developing Countries." *Economic Development and Cultural Change* 53 (2). The University of Chicago Press: 501–23.

Wani, Tahir Ahmad. 2015. "Innovation Diffusion Theory."

Warf, Barney. 2009. "The Rapidly Evolving Geographies of the Eurasian Internet." *Eurasian Geography and Economics* 50 (5). Taylor & Francis Group: 564–80.

Wunnava, P, and DB Leiter. 2008. "Determinants of Inter-Country." *Zentrum Für Europäische Wirtschaftsforshung Gmbh (ZEW), Discussion Paper*, no. 3666.