Journal of Data Science **9**(2011), 83-92

Association between Use of Internet Services and Quality of Life in Taiwan

Te-Hsin Liang
Fu Jen Catholic University

Abstract: The study explored the association between the use of Internet services and quality of life in Taiwan. The use of broadband, wireless, and mobile Internet is found to be positively correlated with the people's overall quality of life. The more the Internet services of e-Government are used, the higher the satisfaction with social-economic status and social competence. People using more Internet services in their daily activities also have higher self-esteem and less psychological pressures. However, people who deeply rely on Internet services for e-Business such as online shopping or ticket booking have lower satisfaction with community support.

Key words: Canonical correlation, internet service, quality of life.

1. Introduction

The Internet has a significant influence on the quality of life, including social, leisure, economic, and community well-being (Israel, 2000; Chairncross, 1997; DiMaggio et al.; Sirgy et al.) The computer and the Internet also influence the people's psychological make-up. The Internet is often used to while away time, taking people's minds off their loneliness and improving their self-confidence. E-mail is also found to facilitate social contact (Fokkenma and Knipscheer, 2007). Online chats/discussions have a positive impact in some cohorts (Ebeling-Witte et al., 2002). The Internet also offers shy individuals a medium through which to communicate with the world around them (Peng and Zhu, 2008).

There are significant differences between Internet users and nonusers among different demographic groups. Perceived Internet influence was found to increase with age (Ebeling-Witte et al., 2007). Older adults who use the Internet are less lonely, less depressed, and have more positive attitude toward computers, and are more confident than non-Internet users (White et al.,2002). The Internet and e-mail are excellent sources of support and enjoyment, resulting in improved quality of life for older homebound adults (Nahm and Resnick, 2001). On the other hand, family alienation and pathological Internet use are positively correlated among

adolescents (Lei and Wu, 2007). Although many researches have proposed various influences of Internet among different groups, studies focusing on the association between the use of Internet services and quality of life are rare.

The penetration rates of the Internet and computers in Taiwan are both very high. In 2006, 90.4% of residents own computers at home and 80.59% of residents have access to the Internet (TIER, 2006). Such high penetration implies that Internet service would highly influence the daily lives of residents. Owing to scarce findings in the literature on the association between the use of Internet services and quality of life, we put forth three research questions for the current study: (a) What is the current quality of life of residents in Taiwan? (b) What is the degree of Internet services usage in Taiwan? (c) What is the relationship between quality of life and use of Internet services?

2. 1. Methods and Materials

2.1 Survey and sample structure

The stratified simple random sampling according to 23 the cities/counties in Taiwan was used. Through telephone interviews, 3,024 respondents who are Taiwanese nationals aged 15 and above were interviewed. The survey was conducted from September 9th to October 16th in 2007.

In the questionnaire, there were three demographic items including gender, age group, and living area. Of the 3,024 respondents, 50.34% are male and 49.66% are female; 17.69% are aged between 15 and 24, 20.50% are aged between 25 and 34, 9.91% are aged between 35 and 44, 18.81% are aged between 45 and 54, 10.88% are aged between 55 and 64, and 12.22% are aged above 65. The northern part of Taiwan is the most populated area, thus it was represented by 32.19% of the respondents; 24.76% were from the central area and 21.73% were from the southern area of Taiwan, respectively. Over 17% of respondents live in the two main cities of Taiwan, that is, Kaohsiung (6.68%) and Taipei (11.69%). The sparsely populated east area and off-shore islands are represented by less than 3% of respondents. The sample structures are consistent with the population structures in these three demographics (with P-value of chi-square test close to 1).

2.2 The measurement of quality of life

Twenty-four items related to quality of life (see Table 1) were included in the questionnaire, which followed the refined framework of the quality of life indicators of the e-Program implemented by the Taiwanese government (Liang, 2008a; Liang, 2008b). The Likert five-point scale ranging from 1 to 5 representing

'strongly disagree', 'disagree', 'neither agree nor disagree', 'agree', and 'strongly agree' was used.

The internal consistency reliability of the overall scale is good with Cronbach's alpha 0.869 and the 24 items of quality of life representing it are highly correlated. This research follows the refined framework of the quality of life indicators of the e-Program in Taiwan to create the scores of each dimension and overall quality of life by averaging the weights of these items and dimensions (see Table 1).

Table 1: The refined framework of the quality of life indicators of the e-Program in Taiwan

Dimensions	Original Question Items	w_{ij}	w_i
Social-Economic Status	Q1. You are satisfied with the property that you have at present.	0.27	0.20
	Q2. You are satisfied with the stability of the property that you hold at present.	0.26	
	Q3. You are satisfied with your present economic conditions.	0.26	
	Q4. You are satisfied with your present social status.	0.21	
Self-Esteem	Q5. You are satisfied with your ability to concentrate.	0.28	0.16
	Q6. You are satisfied with your own contributions to the society.	0.26	
	Q7. You are very confident with yourself.	0.26	
	Q8. You are competent in your present work and feel happy doing it.	0.20	
Social Competence	Q9. You are satisfied with your relationship with your relatives.	0.36	0.14
	Q10. You are satisfied with your present family relationship.	0.36	
	Q11. You are satisfied with your relationship with colleagues / classmates / spouse / friends.	0.28	
Life Freedom	Q12. You have enough time to do something you want to do.	0.35	0.14
	Q13. You can freely arrange your time.	0.33	
	Q14. You have enough recreation in your life.	0.32	
Community Support	Q15. You are satisfied with the living conditions of your present neighbors.	0.28	0.13
	Q16. You are satisfied with your ability to get along with your neighbors.	0.25	
	Q17. You feel satisfied while using the medical treatment and social care services.	0.24	
	Q18. When you feel the pressure, you can get sufficient social support.	0.23	
Psychological Pressure	Q19. You often feel blue, depressed, or anxious.	0.34	0.12
	Q20. You think that the pressure has already affected your behavior in daily life.	0.34	
	Q21. You often have a lonely feeling.	0.32	
Physical Health	Q22. You need to take medicines in the long-term rely on the medical treatment at present.	0.36	0.11
	Q23. You are satisfied with your present health status.	0.34	
	Q24. You feel you are physically active.	0.30	

The average score of overall quality of life is 3.48 (SD=0.485). From the results of multiple comparisons of means, there are significant differences on satisfaction among the dimensions of quality of life (All P-values are less than 0.000). Taiwan residents have the highest satisfaction with Social Competence, with mean

value of 3.95 (SD=0.662). The second and third satisfied dimensions are Physical Health and Psychological Pressure, with mean values of 3.73 (SD=0.755) and 3.61 (SD=0.803), respectively. Life Freedom and Self-Esteem, with mean values of 3.50 (SD=0.827) and 3.43 (SD=0.645), respectively, are in the fourth and fifth positions. Community Support and Social-Economic Status with mean values of 3.31 (SD=0.627) and 3.07 (SD=0.813) are the two lowest dimensions of satisfaction.

2.3 The measurement of Internet services usage

Twenty-six questions (Table 2) such as "Have you ever used some Internet services?" were used to measure the degree of Internet services. These 26 items covered the five major dimensions, namely, e-Daily Life, e-Business, e-Government, Broadband in the Home, which were proposed in the Taiwanese e-Program (Liang, 2008a; Liang, 2008b; III, 2004; TIER, 2006).

Table 2: The framework of internet services and their penetration

Dimensions/ Sub-dimensions	26 items	Penetration(%)
e-Daily Life		
e-Learning	1. Online learning	25.06
	2. e-Bag	4.31
Digital Amusement	3. Online Video-on-Demand system	25.76
	4. Online game 1	9.42
	5. Online music /broadcast	17.82
Cultural Resource Reservation	6. Library /museum database query	46.89
Real Estate Information Center	7. Online querying the real estate information	17.33
Network Health Service	8. Electronic case history	14.50
	9. Register online	13.86
	10. Online medical information query	12.23
e-Traffic	11. Online (static) traffic information query	39.75
	12. Real-time (dynamic) traffic information query	25.40
	13. Order train tickets or air tickets online	22.14
Network Communication	14. E-mail	79.35
	15. Real-time communication	66.43
	16. Network telephone	44.63
e-Business	17. Shopping online	54.60
	18. Online querying for personal consumption	36.77
	Information	
	19. Booking tickets / making reservations online	26.76
e-Government	20. Online querying for information	25.02
	21. Online applying for related services	17.17
	22. E-filing tax	14.75
	23. Citizen Digital Certificate	10.51
Broadband in the Home	24.Wired broadband	33.83
	25.Wireless broadband	18.10
	26.Mobile Internet	54.60

Each Internet service will get a score of 1, if people have ever used it; otherwise, it will get 0. There are 26 Internet services, thus the total score for Internet services usage ranges from 0 to 26. When a respondent gains a score of 0, it means he has never used any one of 26 Internet services; a score 26 means he has used all of the 26 Internet services. The score ranges from 0 to 16 for e-Daily life, from 0 to 3 for e-Business, from 0 to 4 for e-Government, and from 0 to 4 for Broadband in the home.

The results showed that 20.08% of respondents have never used any of the 26 Internet services (score 0); 24.41% have used less than four Internet services (score ranging from 1 to 4); 27.21% have used five to nine Internet services (score ranging from 6 to 9); 19.98% have used 10 to15 Internet services (score ranging from 10 to 15), and only 8.32% have used more than 16 Internet services (score ranging from 16 to 26). On average, each resident has used 6.43 Internet services (SD=5.70). Each resident has used 3.88 Internet services (SD=3.68) for e-Daily life, 0.96 Internet services (SD=1.22) for e-Business, 0.55 Internet services (SD=1.24) for e-Government, and 1.04 Internet services (SD=0.90) for Broadband in the Home.

Table 3: Pearson correlation between quality of life and use of internet services

	Quality of life							
Internet service usage	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Total	0.098[1] (0.000)[2] ***[3]	0.077 (0.000) ***	0.125 (0.000) ***	0.071 (0.000) ***	-0.036 (0.049) *	-0.030 (0.104	0.063) (0.001) **	0.195 (0.000) ***
e-Daily life	0.088 (0.000) ***	0.064 (0.000) ***	0.112 (0.000) ***	0.060 (0.001) **	-0.035 (0.055)	-0.018 (0.324)	0.056 (0.002) **	0.183 (0.000) ***
e-Business	0.059 (0.001) ***	0.039 (0.031) *	0.076 (0.000) ***	0.046 (0.012) *	-0.033 (0.069)	-0.045 (0.014) *	0.052 (0.004) **	0.152 (0.000) ***
e- Government	0.067 (0.000) ***	0.071 (0.000) ***	0.105 (0.000) ***	0.054 (0.003) **	-0.023 (0.211)	-0.013 (0.484)	0.037 (0.040) *	0.064 (0.000) ***
Broadband in the Home	0.092 (0.000) ***	0.078 (0.000) ***	0.087 (0.000) ***	0.068 (0.000) ***	-0.008 (0.658)	-0.036 (0.050)	0.046 (0.012) *	0.191 (0.000) ***

Note:
(a) = Overall, (b) = Social-Economic Status, (c) = Self-Esteem, (d) = Social Competence, (e) = Life Freedom, (f) = Community Support, (g) = Psychological Pressure, (h) = Physical Health.
[1]Pearson correlation between quality of life and Internet services usage. [2] p-value of t test for Pearson correlation, [3]*** : p-value < 0.001, ** : p-value < 0.01, * : p-value < 0.05.

3. Results

Pearson correlations and their t test show that use of Internet services are generally significantly correlated with people's quality of life. The total Internet services usage is slightly correlated with the overall quality of life. While total Internet services usage is positively correlated with quality of life in terms of Social-Economic status, Self-Esteem, Social Competence, Psychological Pressure, and Physical Health, there is a negative correlation with quality of life on Life Freedom. There is no association between total Internet services usage and Community Support. The Internet service usage in e-Daily life, e-Business, e-Government, and Broadband in the Home are all positively correlated with quality of life in terms of Social-Economic status, Self-Esteem, Social Competence, Psychological Pressure, and Physical Health. However, the Internet service usage for e-Business has a slightly negative correlation with Community Support (see Table 3).

Eight stepwise regression analyses were also conducted for the overall and seven dimensions of quality of life with Internet service usage in e-Daily Life, e-Business, e-Government, and Broadband in the Home as independent variables. Only the regression model for Life Freedom is not significant. Broadband in the Home and e-Government exert positively significant influence on overall quality of life ($\hat{\beta}_{broadband} = 0.043$, p-value < 0.000; $\hat{\beta}_{Government} = 0.019$, P-value < 0.011). Broadband in the Home and e-Government also exert positively significant influence on Social-Economic Status ($\hat{\beta}_{broadband} = 0.058$, P-value < 0.001; $\hat{\beta}_{Government} = 0.036$, P-value < 0.003) and Social Competence ($\hat{\beta}_{broadband} = 0.043$, p-value < 0.002; $\hat{\beta}_{Government} = 0.021$, P-value < 0.036). e-Daily Life and e-Government exert positively significant influence on Self-Esteem ($\hat{\beta}_{e-Life} = 0.015$, p-value < 0.000; $\hat{\beta}_{e-Government} = 0.038$, P-value < 0.000). e-Business exerts negatively significant influence on Community Support ($\hat{\beta}_{e-Businss} = -0.023$, P-value < 0.014). e-Daily Life exerts positively significant influence on Psychological Pressure ($\hat{\beta}_{e-Life} = 0.012$, P-value < 0.002). Broadband in the Home, e-Daily Life, and e-Business exert positively significant influence on Physical Health ($\hat{\beta}_{broadband} = 0.08$, P-value < 0.000; $\hat{\beta}_{e-Life} = 0.005$, P-value < 0.000; $\hat{\beta}_{e-Business} = 0.014$, P-value < 0.039).

Canonical Correlation Analysis was used to explore the association between Internet services usage and quality of life. There are two significant eigenvalues in the Canonical Correlation Analysis between Internet services usage and quality of life (all p-values of Wilks' lambda, Phllai's trace, Hotelling-Lawley trace, and Roy's greatest root, and F test for two canonical correlations are less than 0.001). The proportions of the first and second eigenvalues are 0.848 and 0.108, respectively, thus, 95.6% of information between the use of Internet services and

the quality of life can be explained by the Canonical Correlation structure.

$V1$ and $V2$ are two eigenvectors for the use of internet services. Because each dimension of Internet service has high positive coefficient (greater than 0.5) with $V1$, we named $V1$ as 'Overall Internet service'. Eigenvector $V2$ is highly correlated with the Internet service of e-Government (with correlation 0.810), thus we named it as 'Public Internet service'. $W1$ and $W2$ are two eigenvectors for the quality of life. Eigenvector $W1$ has high or medium correlation with Social-Economic status, Self-Esteem, Social Competence, Psychological Pressure, and Physical Health (with correlation ranging from 0.291 to 0.798). These dimensions of quality of life represent one's social position, psychological or physical interaction capability, thus eigenvector W1 is named as 'Overall Social Interaction Capability'. Eigenvector W2 has high correlation with Self-Esteem ($r_{Self-Esteem} = 0.729$), and medium positive correlation with Social-Economic status and Community Support ($r_{social-Economic} = 0.298$ and $r_{CommpuitySupport} = 0.301$), but medium negative correlation with Physical Health ($r_{PhysicalHealth} = -0.359$); thus, $W2$ will have a high score when someone's attainment or self-expectancy and relationship with others are great but his physical condition is not so good, thus we named eigenvector W2 as 'Self-Attainment, Expectancy and Need' (see Table 4) .

Table 4: Canonical correlations between quality of life and use of Internet services

Dimension of Internet Service	Canonical Correlation coefficient								Dimension of Quality of life
	$V1^a$	$V2^a$	$W1^b$	$W2^b$	$V1$	$V2$	$W1$	$W2$	
e-Daily Life	0.844	0.113	0.210	0.010	0.092	0.027	0.368	0.298	(1)
					0.123	0.067	0.496	0.729	(2)
e-Business	0.709	-0.135	0.176	-0.012	0.094	0.012	0.379	0.133	(3)
					-0.021	-0.004	-0.083	-0.048	(4)
e-Government	0.508	0.810	0.126	0.074	-0.023	0.028	-0.095	0.301	(5)
					0.072	0.008	0.291	0.085	(6)
Broadband in the Home	0.860	-0.272	0.214	-0.025	0.198	-0.033	0.798	-0.359	(7)

Note:
(1) = Social-Economic Status, (2) = Self-Esteem, (3) = Social Competence, (4) = Life Freedom, (5) = Community Support, (6) = Psychological Pressure, (7) = Physical Health.
^{a}the canonical vectors for Internet services, ^{b}the canonical vectors for quality of life.

The first Canonical Correlation coefficient is equal to 0.248, that is, 'Overall Internet Service' and 'Overall Social Interaction Capability' are positively correlated. The second Canonical Correlation coefficient is equal to 0.091, which means that 'Public Internet Service' and 'Self-Attainment, Expectancy and Need' have little correlation (see Figure 1)

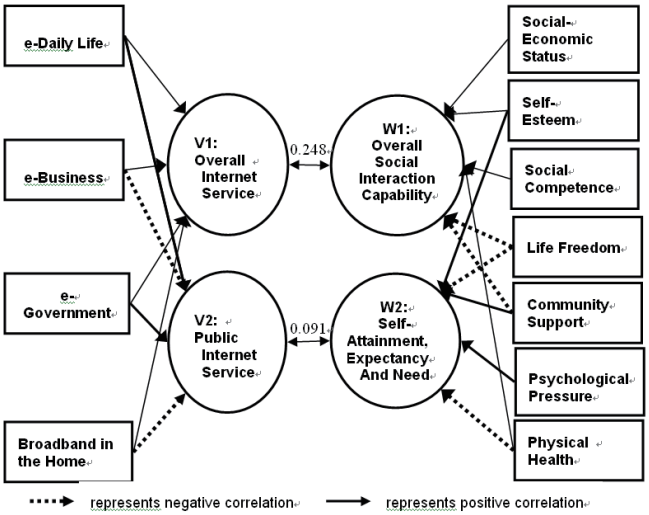

Figure 1: The canonical correlation structure between quality of life and use of Internet services

4. Discussion

Generally speaking, people's quality of life tends to be positive in Taiwan. People have the highest satisfaction with Social Competence and the lowest satisfaction with Social-Economic Status. Internet services usage has already become part of daily activities for most of the residents, with each resident having used 6.43 Internet services on average. More than 8% of residents are heavy users of Internet services in Taiwan; they have used more than 60% of Internet services. Nearly 20% of residents are medium users of Internet services (using 5–15 Internet services) half of the residents are light users (using 1–4 Internet services) and one-fifth of residents are nonusers.

The Internet indeed greatly helps people and makes their lives convenient. People using more Internet services have better quality of life in terms of Social-Economic Status and Self-Esteem; that is, people with high positions in society or high self-perception will use more Internet services to enhance their lives. Internet services usage could raise people's satisfaction on the relationship with others such as families, colleagues, friends, and so on. For people who are shy, disabled, or depressed, the Internet is a good medium for communication; they can get information, do shopping or enjoy recreation by using Internet services. However, people with Internet addiction or people who are too busy would entirely rely on Internet services for most of their activities, and it might cause lower satisfaction with Life Freedom.

Broadband in the Home and e-Government have significant influence on people's quality of life. When people can easily and quickly query information or report their tax statements through the Internet, they may feel that they have better quality of life because they save time by not being caught in traffic jams. Thus, the popularity of wired/wireless broadband and mobile Internet and government e-services indeed bring convenience to people and raise people's quality of life. Using the Internet in one's daily activities such as learning, information search, booking tickets, registering for medical check-up or e-mail makes people feel more confident and more satisfied about their abilities and releases them of pressure. However, relying entirely on Internet services for e-Business may isolate people from the community and decrease their interaction with the real world. On the other hand, someone who is not satisfied with the support of the community may tend to satisfy his needs by using more Internet services for e-Business.

In summary, except for a slightly negative correlation between the Internet services usage for e-Business and Community Support, Internet services usage has positive influence on people's quality of life. The more Internet services one uses, the more satisfactory social interaction he has. In a country or area with high Internet penetration rate, the digital divide is no longer a serious problem. Internet services usage could lead to improving people's quality of life, thus, government should focus on promoting the use of Internet services and narrow down the gap of internet services usage among different demographic groups.

Acknowledgment

The funding of this research was provided by the Institute for Information Industry in Taiwan.

References

Israel, B. (2000). Understanding the Web, Social, political, and economic dimensions of the Internet. *Journalism and Mass Communication Quarterly* **77**, 931-933.

Cairncross, F. (1997). *The Death of Distance, How the Communications Revolution Will Change Our Lives.* Orion London.

DiMaggio, P. E., Hargittai, W. R. N. and Robinson J. P. (2001). Social implications of the Internet. *Review of Sociology* **27**, 307-336.

Sirgy, M. J., Lee, D. J. and Bae, J. (2006). Developing a measure of internet well-being, nomological (predictive) validation. *Social Indicators Research* **78**, 205-249.

Fokkema, T. and Knipscheer K. (2007). Escape loneliness by going digital, A quantitative and qualitative evaluation of a Dutch experiment in using ECT to overcome loneliness among older adults. *Aging and Mental Health* **11**, 496-504

Ebeling-Witte, S., Frank, M. L. and Lester, D. (2007). Shyness, internet use, and personality. *Cyberpsychology and Behavior* **10**, 713-716.

Peng, T. Q. and Zhu, J. J. H. (2008). Cohort trends in perceived internet influence on political efficacy in Hong Kong. *Cyberpsychology and Behavior* **11**, 75-79.

White, H., Mcconnell, E., Clipp, E., Branch, L. G., Sloane, R., Pieper, C. and Box, T. L. (2002). A randomized controlled trial of the psychosocial impact of providing internet training and access to older adults. *Aging and Mental Health* **6**, 213-221

Nahm, E. S. and Resnick, B. (2001). Homebound older adults' experiences with the internet and e-mail. *Computers in Nursing* **19**, 257-263.

Lei, L. and Wu, Y. Adolescents' paternal attachment and internet use. (2007). *Cyberpsychology and Behavior* **10**, 633-639.

Taiwan Institute of Economic Research (TIER) (2006). The survey of quality of e-life indicators and measurement system-concise report. Taipei, Taiwan.

Liang, T. H., Peng, J. L. and Yu, Cy. (2008). How is the quality of life in taiwan? And will the internet have a positive impact on it? — using the simpler structure of quality of life indicator (SEQOL). *08'International Conference On Digital Divide, National Yunlin University of Science and Technology.* June 4-5 2008.

Liang, T. H. and Yang, Y. H. (2008). Does internet have a positive impact on the quality of life in Taiwan? In *Proceedings of International Symposium on Information Technology 2008*, Faculty of Information Science and Technology (IEEE), Kuala Lumpur Convention centre, Maaysia, August 26-29 2008.

Institute for Information Industry (III). (2004). *2004 Yearbook of Information National Powers.* Science and Technology Advisory Group of Executive Yuan, Taipei, Taiwan.

Taiwan Institute of Economic Research (TIER) (2006). The survey of quality of e-life indicators and measurement system-concise report on researches entrusted by institute for information industry. Taipei, Taiwan.

Received April 8, 2009; accepted May 6, 2009.

Te-Hsin Liang
Department of Statistics and Information
Fu Jen Catholic University
Xin Zhuang, Taipei, Taiwan
stat1013mails.fju.edu.tw