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# System Quality, User Satisfaction, and Perceived Net Benefits of Mobile Broadband Services

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## ABSTRACT

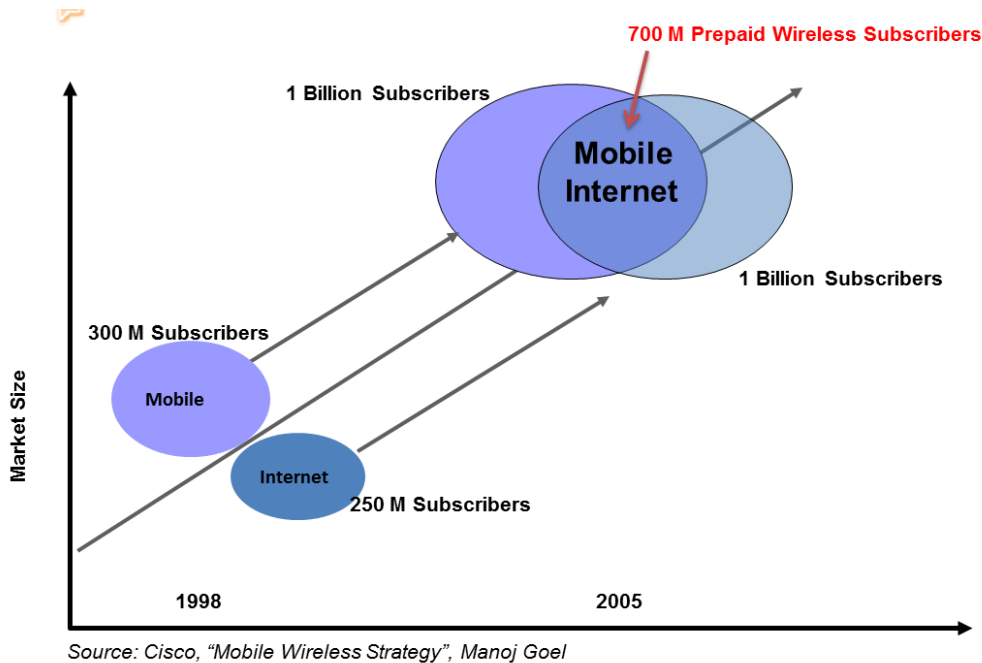
The continued decline of voice revenues is pushing mobile operators in Taiwan turn into data and content services for exploring new revenue opportunities and raising ARPU. This study aims to discuss the critical determinants of the internet user's adoption of 3.5G mobile broadband services in Taiwan. The theoretical framework employed in the study is *Information System Success Model* (DeLone & McLean, 2003; Chae et al.,2002), which is operationally defined with mobile web-services measurement scales. The study attempts to identify how the system quality of 3.5G mobile broadband services affects the customer satisfaction and their perceived net benefit.

With the affordable mobile broadband connectivity, 3.5 G access or HSDPA in Taiwan has played a major role in the burgeoning mobile Internet market. HSDPA (High Speed Downlink Packet Access) could be viewed as an advanced version of WCDMA wireless network. HSDPA ideally provides mobile data services up to 14.4 Mbps for the downlinks and up to 5.8 Mbps for the uplinks. According to TWNIC, the number of cell phone subscribers in Taiwan has grown up to 23 million by March 2009 with a 100% penetration rate Yet, among cell phone subscribers there were only 1.6 million users adopting mobile broadband services.

**Keywords:** Mobile Broadband Services, IS Success Model, Customer Satisfaction, Net Benefits

# 1. Introduction

In recent years, wireless high speed packet data has attracted enormous attention in wireless industry under the context of 3G standardization. This trend is believed to be driven by the wireless internet. Recent 3G standardization and related technology development reflect the need of the high-speed packet data of wireless Internet.



With the affordable mobile broadband connectivity, 3.5 G access or HSDPA in Taiwan has played a major role in the burgeoning mobile Internet market. HSDPA (High Speed Downlink Packet Access) could be viewed as an advanced version of WCDMA wireless network. HSDPA ideally provides mobile data services up to 14.4 Mbps for the downlinks and up to 5.8 Mbps for the uplinks, and it has been more market-ready than WiMAX.

According to NCC(National Communications Commission), the number of cell phone subscribers in Taiwan has grown up to 27,839,852 by Dec 2010, and the number of 3G subscribers is 18,734,177. However, there were only 3,587,368 users adopting mobile broadband services, and there were 2,696,743 user by phone and 890,625 users by data card. We can see, although the penetration rate of 3G is 67.29%, that only 19.15% of 3G users adopting mobile broadband services. This paper aims to investigate users' behavioral intentions when they adopt 3.5G mobile data services.

## 2. Theoretical background

### 2.1 The DeLone and McLean Model of Information Systems Success

In 1992, DeLone and McLean presented an Information Systems (IS) Success Model (hereafter referred to as the "D&M IS Success Model") as a framework and model for measuring the complex-dependent variable in IS research. (DeLone & McLean, 1992)

From 1992 to 2003, nearly 300 articles in refereed journals have referred to, and made use of the IS Success Model. DeLone & McLean reviewed these articles and then proposed "The Updated D&M IS Success Model" in 2003.

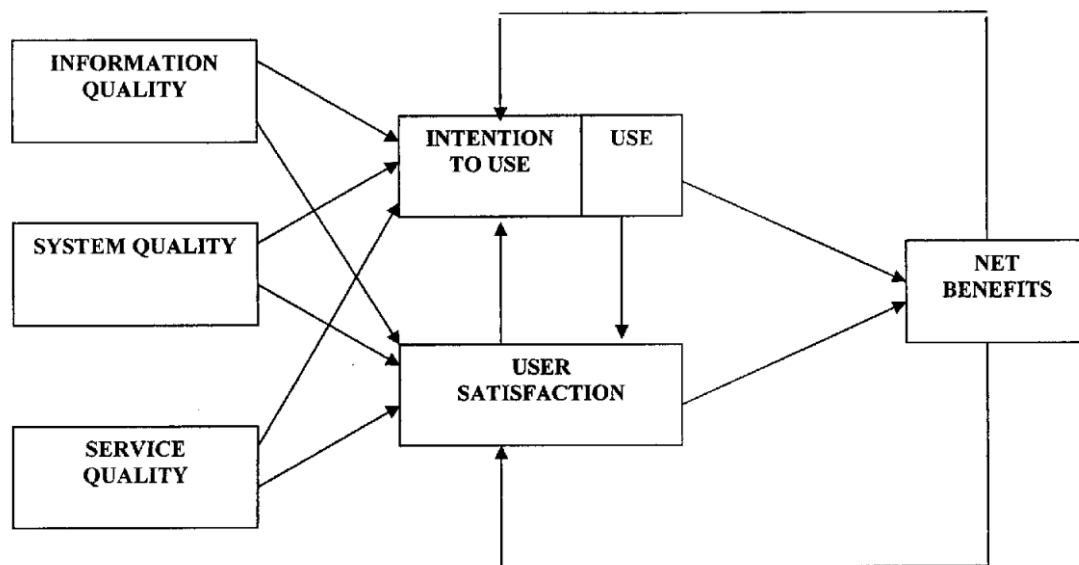


Fig. 1. The Updated D&M IS Success Model (DeLone & McLean, 2003)

The most important updates of the model are stated in the following:

1. In the original formulation of the D&M Model, the term "impact" was used. However, the original term "impacts" may be positive or negative, thus leading to a possible confusion as to whether the results are good or bad. So, Seddon(1997) used "consequences" and "net benefits" in his characterization of the outcomes. DeLone & McLean agree with Seddon's viewpoint and think "net benefits" is probably the most accurate descriptor of the final success variable. Also, the inclusion of "net" in "net benefits" is important because no outcome is wholly positive, without any negative consequences. (DeLone & McLean, 2003)
2. Pitt et al.(1995) maintained that IS researchers will not measure correctly IS

effectiveness if they do not include in their assessment package a measure of IS service quality. DeLone & McLean adopted the suggestion and added "service quality" as the third dimension of quality.

3. Because of the difficulties in interpreting the multidimensional aspects of "use", DeLone & McLean suggest "intention to use" will be a worthwhile alternative measure in some contexts. "Intention to use" is an attitude, whereas "use" is a behavior.

## **2.2 HSDPA in Taiwan**

3.5G is the advanced evolvement of 3G wireless network. To improve the system performance, 3.5G makes a number of changes to the radio interface that mainly affect the physical and transport layers. 3.5G provides extraordinary speed and mobility, such as IP-based network which is optimized for packet data; the upgrade of existing voice networks; enabling wireless web lifestyle and meeting the next generation performance.

In Taiwan, the great era of fixed line telecom may be changed gradually in the future, 3.5G service that mobile operators introduced has already struck fixed line and Internet service continuously. Many mobile operators have already launched their HSDPA networks.

Chunghwa Telecom (CHT), one of the top four operators of 3G mobile communication services in Taiwan, was the first to launch the 3.5G mobile data services with the aim of increasing non-voice revenue, the growth of voice revenue being slow. FarEasTone (FET) was the second mobile operator offering these services in Taiwan. TaiwanMobile and Vibo Telecom were put into 3.5G business later successively. Their business models are:

- ▶ small business user market: 3.5G subscription bundling with smart phones (e.g. iPhone and Android Phone)
- ▶ potential critical mass market: 3.5G subscription bundling with (free) NetPCs or iPad plus affordable flat monthly fee (27 USD)

Now, more and more laptops, smartphones and tablet computers are sold bundling with the HSDPA module and 3.5G service. The number of 3.5G subscribers increase every month and it still has a large space for the development in Taiwan.

### 3. Research Method

#### 3.1 Research structure

In this study, we want to discuss the critical determinants of the Internet user's adoption of 3.5G mobile broadband services in Taiwan. According to the Updated D&M IS Success Model, the study picked up six dimension: ""

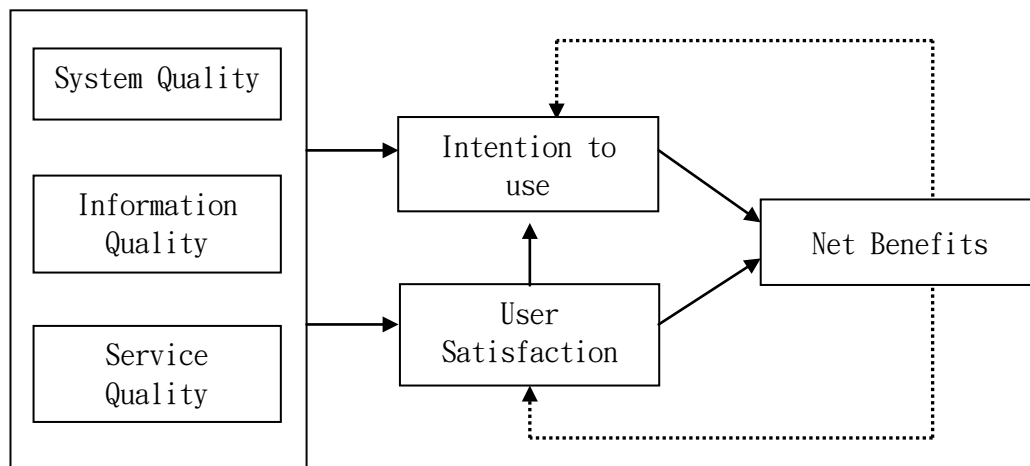


Fig. 2. The Research Framework

#### 3.2 Research Hypothesis

H1: The *system quality* of 3.5G mobile broadband services tends to be a positive predictor to *customer satisfaction*.

H2: The *system quality* of 3.5G mobile broadband services tends to be a positive predictor to customer's *intention to use*.

H3: The *information quality* of 3.5G mobile broadband services tends to be a positive predictor to *customers satisfaction*.

H4: The *information quality* of 3.5G mobile broadband services tends to be a positive predictor to *customer's intention to use*.

H5: The *service quality* of 3.5G mobile broadband services tends to be a positive predictor to *customer satisfaction*.

H6: The *service quality* of 3.5G mobile broadband services tends to be a

positive customer's *intention to use*.

H7: The *customer satisfaction* of 3.5G mobile broadband services contributes a significant influence to customer's intention to use.

H8: The customer satisfaction of 3.5G mobile broadband services seems to have significant impacts on customer's net benefits.

H9: The customer's intention to use of 3.5G mobile broadband services seems to have significant impacts on customer's net benefits.

#### 4. Analysis and Result

A web-based survey was conducted for the users who have subscribed 3.5G mobile broadband services. There were 426 valid questionnaires administered by a purposive sampling, and 58% of the respondents were male, and 42% were female.

The age of the majority of the respondents was between 26 to 30 years old (49.1%). The education background of the respondents was mostly above university (67.6%). Most of the respondents (81.7%) have used the Internet service for more than five years. Moreover, 38.0% of the respondents use the 3.5G mobile broadband services for less than five hours per week.

As of questionnaire reliability analysis, the Cronbach's  $\alpha$  was shown with .947 as the whole questionnaire and ranged from .809 to .912 for individual domains.

##### 4.1 Pearson Correlation Analysis

Table 1. The correlation matrix for the variables

Pearson's r	system quality	information quality	service quality	intention to use	Customer satisfaction	Customer net benefits
system quality	1.000					
information quality	.584**	1.000				
service quality	.598**	.360**	1.000			
customers' intention to use	.376**	.366**	.294**	1.000		
customers' satisfaction	.645**	.591**	.535**	.684**	1.000	
customers' net benefits	.604**	.490**	.424**	.520**	.739**	1.000

\* $P \leq 0.05$ ; \*\* $P \leq 0.01$

## 4.2 Multiple Regression Analysis on Quality to Customer Satisfaction

Table 2. Summary of the Multiple Regression Analysis on quality to customer satisfaction

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	R <sup>2</sup> Change	F Change	Sig. F Change	Standardized Coefficients $\beta$
system quality	.645 <sup>a</sup>	.416	.415	.416	302.320	.000***	.322
information quality	.697 <sup>b</sup>	.486	.484	.070	57.500	.000***	.320
service quality	.721 <sup>c</sup>	.519	.516	.033	29.127	.000***	.227

Durbin-Watson Value: 1.868

a. Predictor : system quality \*P ≤ 0.01; \*\*P ≤ 0.05; \*\*\*P ≤ 0.001

b. Predictors : system quality, information quality

c. Predictors : system quality, information quality, service quality

d. Dependent Variable : customers' satisfaction

## 4.3 Multiple Regression Analysis on Quality to Intention to use

Table 3. The Multiple Regression Analysis on intention to use

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	R <sup>2</sup> Change	Sig. F Change	Standardized Coefficients $\beta$
customers' satisfaction	.684 <sup>a</sup>	.467	.466	.467	.000***	.587
system quality	.704 <sup>b</sup>	.496	.492	.029	.000***	.244
information quality	.716 <sup>c</sup>	.513	.511	.017	.000***	.156
service quality	.724 <sup>d</sup>	.524	.521	.011	.041**	.113

Durbin-Watson Value: 2.109

\*P ≤ 0.01; \*\*P ≤ 0.05; \*\*\*P ≤ 0.001

a. Predictors : customers' satisfaction, system quality



- b. Predictors : customers' satisfaction, system quality, information quality
- c. Predictors : customers' satisfaction, system quality, information quality, service quality
- d. Dependent Variable : customers' intention to use

#### 4.4 Multiple Regression Analysis on Customer's Net Benefits

Table 4. The Multiple Regression Analysis on customer's net benefits

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	R <sup>2</sup> Change	Sig. F Change	Standardized Coefficients β
customer satisfaction	.739 <sup>a</sup>	.546	.542	.546	.000***	.645
Customer's intention to use	.783 <sup>b</sup>	.613	.410	.067	.026**	.119

Durbin-Watson Value: 2.109

\*P ≤ 0.01; \*\*P ≤ 0.05; \*\*\*P ≤ 0.001

- a. Predictors : customers' satisfaction
- b. Predictors : customers' satisfaction, customers' intention to use
- c. Dependent Variable : customers' net benefits

#### 4.5 Path Analysis of the research framework

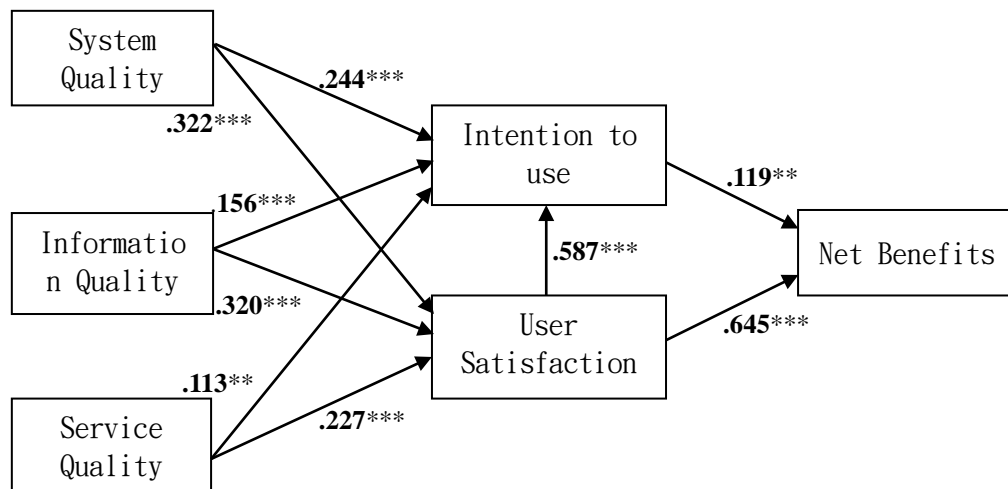


Fig. 3. The result of Path Analysis

## 5. Discussion and Conclusion

The results demonstrate that the *system quality*, *information quality* and *service quality* of 3.5G mobile broadband services are significantly influential to *customer satisfaction* and *usage*. The *system quality* was shown as the most critical factor among those determinants affecting *customer satisfaction*. The *customer satisfaction* demonstrates the most influential effect on *net customer benefits*.

The study findings are summed up as follows:

1) ***System quality*** was shown in the results as a decisive factor predicting *satisfaction* and *intention of usage*.

3.5G mobile broadband services in Taiwan are still at an initial stage. We suggest that how to enhance the mobile *systems quality* will be crucial and challenging for operators in increasing subscribers' *usages*.

2) ***Customer satisfaction***, viewed as the most crucial indicator ( $\beta = .645^{***}$ ) in the research framework, significantly leverages users' perceived *net benefits*.

We strongly suggest that mobile operators should make efforts on offering advanced *systems quality* and improving *customer satisfaction*. This definitely leads to leverage users' perceived *net benefits* such as their increased productivity and an enhanced job performance, etc. The more important finding is that those users who perceive positive *net benefits* likely tend to continue subscribing the mobile broadband services offered by the operators.

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