FACTORS AFFECTING THE USE OF 4G SERVICES: THE CASE OF VIETNAM

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4G services open the door for conversation and data communications by means of high-speed mobile connection. However, the actual use of the 4G speeds is still below expectations. Therefore, it is important to understand the interaction of factors involved in the adoption of this technology. Previous studies have shown that such variables as convenience, efficient service quality and variety of services, perceived value and price are important factors in the course of 4G technology adoption. In this study, the authors examine the impact of these factors on own sample of the 4G service users. Our research results demonstrate that: 1) price, convenience and varied services are important predictors of value perception; 2) there is a relationship between diversity of services and the sense of value mediated by convenience and 3) perceived value has a strong relationship with the intention to buy.

Keywords: 4G technology; convenience; diversity of services; perceived value; Vietnam.

Introduction

4G services as the fourth-generation cellular technology opens the door to high-speed communications for both people and data. Improved capabilities of 4G networks and devices in their combination with greater customer satisfaction together have made the usage of media much more attractive, thus quickly increasing the attractiveness of 4G services for

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potential clients globalwide. 4G services offer a full-range access to music, videos and data services. This feature is seen as the key prospect for all service providers in most countries (Forrester Research, 2002; 4G UK, 2004; Garfield, 2004).

Review of literature

Most empirical studies on this topic have used innovation-oriented measures; acceptance is frequently specified as acquisition of innovation (Eichmann and Kemmerer, 1999) or as a commitment to apply it. The most widely adopted models in this context include: TAM (Technology Acceptance Model) derived from the theory of reasoned action (TRA), in particular, its version of computer usage behavior became quite popular (Davis et al., 1989). TAM is specifically planned for the users that adopt modeling information systems. It focuses on the attitude of ignoring subjective rules due to theoretical and psychological uncertainty (Davis et al., 1989). This model combines two beliefs of the acceptance of potential customers -- the perception of usefulness and the sense of technology used -- as the main determinants of attitudes towards a new technology. These two beliefs create a favorable or intentional orientation towards the role of information technology (IT), thus affecting indirectly its use (Davis et al., 1989).

TAM is an adaptation of the Theory of Reasoned Action (TRA) to the fields in which information systems (IS) are used most actively. TAM acknowledges that it is helpful and easy to identify individual intent to use a system with the aim of having it as an intermediary in a certain real-life arrangement. The perceived useful also be studied to immediately touch the feel of use. Researchers have previously simplified TAM by means of removing the constructive attitude found in TRA from the current specification (Venkatesh et al., 2003). Attempts to extend TAM are usually taken in one of the possible three ways: introducing elements from the relevant models; introducing additional or alternative beliefs; or examining premises and operating perceptions (useful and easy) in the course of using (Wixom and Todd, 2005).

Observed variables

Under the TAM model, the observed variables affect the acceptance of a technology. Trends (1979) stated that the facilitating variables, including the level and the type of support, are affecting both adoption and use of technologies by individuals. Venkatesh et al. (2003) stated in this regard the following: "Facilitating as such is the extent to which an individual believes that organizational and technical infrastructure exists to back up the function of the system". Several previous studies have suggested a number of variables to observe in the course of technology adoption (see the suggestions provided in (Legris Ingham and Collette, 2003) for example).

After examining the previous researches on the use of 4G services (Han, 2002; Pedersen and Ling, 2002; Pagani, 2004) we also would like to identify a group of observational variables that drive the acceptance of 4G services. Stemming from suitability of 4G technology, the following variables have been chosen: service quality, convenience, efficiency, and variety of services. Factors not included here directly but which are still part of general satisfaction are by default considered as part of convenience (Yale and Venkatesh, 1986).

Convenience

The 4G service today is taking technology to the next level of service provision which includes trouble-solving anytime and at anyplace. Convenience includes, inter alia, changeability which is understood here as access to information during the time of direct communication (Pagani, 2004). Convenience alone may be a necessary element in using 4G services, however, it is not enough, Ng-kruelle and her colleagues (2002) came to such a conclusion while analyzing the cost of convenience. In their discussion, privacy is often the price as today what is convenient in use often brings along the loss of freedom and privacy. For example, a 4G phone user may be uncomfortable using video phone features, when he or she is not properly dressed.

Yale and Venkatesh (1986) classified convenience into six measures: the time in use, location, fit, mobility, access and avoiding discomfort. However, Gehrt and Yale (1993) later argued that these types are not complete or enough. Building on their research and conclusions, Berry, Seiders and Grewal (2002) formulated their own five features of convenient services: convenient decision, convenient access, convenient transaction, convenient process of servicing and convenient after-sales service. These types reflect all the stages of consumer activity in the course of buying something or using some services. Consumers tend to have certain separate perceptions related to time, costs and efforts pertaining to each type of service and also each stage of being serviced. Together they define the overall convenience for consumers. In this study, we will be looking at 4G services as a service and technology at the same time, as opposed to a pure product.

Quality of service

Quality of service has been studied in many fields, including marketing, economics, consumer research, information systems and more. Service quality perception is defined as the customer's overall perception of service quality (Zeithaml, 1988). Consumer decision results, to some extent, mean comparing consumers' expectations and their perceptions of the actual service being performed (Lewis, 1989). Parasuraman et al. (1988) argued that the overall quality of customer service depends on how wide is the gap between these two.

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Since the 1980s, SERVQUAL model (Parasuraman et al., 1988) has been widely used for consumer service evaluation. SERVQUAL, based on the unstable model, helps to analyze this gap between the performing quality of a servicing organization on the one hand and the service needs of the customers being serviced on the other. Despite the obvious usefulness of this model, it has been also widely criticized (see, for example, Brown et al., 1993; Buttle, 1996). In particular, SERVPERF has been offered as an alternative to measure the performance based solely on service quality as opposed to what is expected (purely cognitive element) (Cronin Jr. and Taylor, 1994).

In the context of 4G services, service quality includes availability of network, its reliability and accessibility. A user can also consider the level of functionality of both hardware and software, the size of devices, battery life, Internet speed, speed to downloads and installations, display screen and other functionality features provided (Pagani, 2004).

Value

Value has been defined in a variety of different ways. For example, according to (Zeithaml, 1988), meaningful value can be defined as follows: 1) Value is low when overall quality is low; 2) Value is what you want to get from a product you've purchased or service you are using; 3) value is the quality received according to the price paid and 4) value is what consumers are getting, what has been given to them. In much simpler terms, value is the difference between what is received and what has been given. Some studies have adopted the vision that value is a balance between benefits and sacrifices. The benefit components of value include prominent intrinsic attributes, external attributes, feeling the quality, and other high levels of abstraction can be also involved. The sacrificial components include price and non-monetary price. In this study, the authors use the definition from (Zeithaml, 1988). Perceived benefits can take the form of the products that are related to benefits (i.e., product quality) or transactional benefits (i.e., quality of service, time, and effort).

In the context of 4G services, transaction processes are as important as product quality. Clients accumulate information about a particular telecom company through the experience of dealing with this company. From the viewpoint of maximizing value (Kahneman and Tversky, 1979; Thaler, 1985; Zeithaml, 1988), customers are able to perform transactions that maximize benefits and minimize sacrifices. Perceived value has been proposed as a multidimensional structure. Kahneman and Tversky (1984) used to classify values as two different types: value experience and decision value. Sheth et al. (1991) proposed five value scales: functional, social, emotional, knowledge and conditional. Convenience includes six dimensions - time of use, location, fit, dynamic feature, access and avoiding discomfort (Yale and Venkatesh, 1986).

A variety of services will empower users perform more tasks. Many utilities will be implemented with only one integrated device, thus reducing the time and the effort required to make changes in functions. Thus, the greater is the variety of services offered by the

technology, the more convenient it will be for all current and potential customers. Ng-Kruelle et al. (2002) also show that higher level of technology allows better problem-solving with 4G services, thus increasing their convenience, among other things. Thus, we formulate our hypothesis H as follows:

H1: Diversity (S1) offered by 4G has its positive influence on the convenience of using 4G.

Functional value is the perceived utility acquired as a result from the ability to reach the goal through various functions (Sheth et al., 1991). Integrating more services into a single device, users get more benefits by using one and the same technology. Thus, the hypothesis H2 has been formulated as follows:

H2: Diversity (S2) offered by 4G has its positive influence on the perceived value of using 4G.

Ng-Kruelle et al. (2002, p. 277) have provided quite exact definition for convenience: this is "how some operations are made easier." When a user feels that 4G service is providing convenience by reducing time and effort, it will impact the user's perception of the benefits provided by this service, thus also influencing the perception of price and value. Thus, the hypothesis H3 has been formulated as follows:

H3: Convenience (S3) has a positive impact on the value of using 4G.

Value experiences refer to the level of satisfaction, joy or sadness or frustration experienced through the course of being serviced (Kahneman and Tversky, 1984). Convenience of 4G will increase user satisfaction, thereby positively impacting the value experience. Similarly, service quality can be enhanced through valuable experience as well. Thus, the hypothesis H4 has been formulated as follows:

H4: Quality of service (S4) has a positive impact on the value of using 4G.

Value perception is derived from the comparison between objective price and the reference price (Thaler, 1985). Due to this negative impact of price perception, which serves as a sacrificial component, we recognize the negative relationship between price perception and perceived value. This negative relationship has been supported by several studies, including (Dodds et al., 1991; Teas and Agarwal, 2000; Chen and Dubinsky, 2003). Thus, high prices will lead to reducing value of the 4G services in the eyes of consumers. Thus, the hypothesis H5 has been formulated as follows:

H5: High prices (S5) negatively affect the value perceived from using 4G.

High value perception also implies high perception of benefits and sacrifices. From the perspective of maximizing value (Kahneman and Tversky, 1979; Thaler, 1985; Zeithaml, 1988) customers are able to perform transactions so that to maximize benefits and minimize

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sacrifice. Numerous studies show that perceived value is an important predictor of behavior (Bolton and Drew, 1991; Cronin et al., 2000). Thus, the hypothesis H6 is formulated as follows:

H6: *Value perception (S6) influences positively the behavior of users through the process of using 4G.*

Research Methods

The most commonly used method to consider customer satisfaction is the "Expectation Confirmation" theoretical framework. According to Oliver (1980), this theoretical connection is based on two small processes that have independent impact on customer satisfaction: anticipation of service prior to purchase and perception of service after it has been actually experienced. Applying this theory to the 4G services, it would be possible to understand customer satisfaction as a process as follows: firstly, the customer develops his/her thinking expectations about the components that make up the quality of a service that the supplier can deliver before the customer decides to buy. Then goes buying the service and using the service, both contributing (or not, in the most unfortunate cases) to customer trust in the true performance of the 4G service that they can feel is good or bad. Thus, survey would be probably the most appropriate way to deliver the research questions about consumer beliefs and/or behaviors (Neuman, 2003).

In the case of our questionnaires specifically, the information has been collected from the customers who are professionals and managers aged 20-40, all using 4G services with postpaid subscriber registration. Our respondents were clients of the three main service providers at Vietnam's telecommunication market: Vinaphone, Mobifone, and Viettel. The reason for choosing these clients as the interviewees was because all three of these service providers are currently using the same 4G technology, also because their customer-oriented products are quite similar in many ways. And finally, these are the three major 4G service providers that cover the majority of the local market. Selection of the postpaid customers as subjects for our study was predetermined by the fact that post-paid subscribers are those who usually have thoroughly explored the service, thus, they have certain expectations about the quality of service before deciding to register with a provider. The sample consists of the majority of professionals, managers working in the central district of HCM City.

Table 1 - Survey sample structure divided by service providers

(Source: made by the authors)

	VINA	VIETTEL	MOBI	Other Businesses	Total
Frequency	124	139	51	12	326
Ratio in %	38.04	42.64	15.64	3.68	100

Table 2 - Full sociological details on the research sample

(Source: made by the authors)

No	Features (n = 326)	Number of people	Ratio in %	No	Features (n = 326)	Number of people	Ratio in %
Gender				Family status			
1	Male	158	48.47	1	Single	102	33.01
2	Female	168	51.53	2	Newly married	39	12.62
	Total	326	100.00	3	Family and children	144	46.60
Ages				4	Multiple generations family	24	7.77
1	Under 30	141	43.25		Total	309	100.00
2	From 30 to 40	121	37.12	Education			
3	From 40 to 50	38	11.66	1	Level 3 or Intermediate	34	10,0
4	From 50 to 60	9	2.76	2	College	53	5,2
5	Over 60	17	5.21	3	University	195	78,0
	Total	326	100.00	4	After university	19	5,6
Religion				5	Other	25	1,2
1	Buddhism	79	24.23		Total	326	
2	Catholic	44	13.50	Income			
3	Protestantism	24	7.36	1	<5 mln VND	63	19.33
4	Islamic	2	0.61	2	5 to 10 mln VND	135	41.41
5	Other religion	15	4.60	3	10 to 15 mln VND	78	23.93
6	None of the above	162	49.69	4	Over 15 mln VND	50	15.34
	Total	326	100.00		Total	326	100.00

Scale of measurement and measurement model

Table 3 shows that the Cronbach's Alpha coefficients for all the scales are greater than 0.6, and the coefficients of variance sum are greater than 0.4. Therefore, we can state that all the scales can be used in the exploratory factor analysis (EFA). The main method used for data analysis was the comparative statistical method and descriptive statistics via SPSS 23.0 software and using analytical techniques such as scale reliability testing, exploratory analysis (EFA), confirmatory factor analysis (CFA) and linear structural analysis (SEM) (Nunnally & Burnstein, 1994).

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Table 3 - Test results on Cranbach's Alpha scales
(Source: made by the authors)

N ^o	SCALES	Scale Variances	Cronbach's Alpha	Cronbach's Alpha if Item Deleted
1	Diversity (S1)	5	0.844	0.659
2	Convenience S2)	5	0.706	0.613
3	Quality of service (S3)	3	0.866	0.751
4	Price (S4)	4	0.664	0.445
5	Value perception (S5)	3	0.808	0.470
6	Intention to buy (S6)	3	0.740	0.526

Table 4 - EFA results for customer perceived value scales
(Source: made by the authors)

Pattern Matrix ^a						
Observed Variables	S Component					
	S1	S2	S4	S5	S3	S6
S14	.982					
S11	.976					
S12	.973					
S13	.969					
S15	.968					
S22		.784				
S21		.726				
S25		.723				
S23		.719				
S24		.668				
S43			.786			
S44			.764			
S41			.758			
S42			.732			
S51				.943		
S52				.942		
S53				.741		
S31					.844	
S32					.779	
S33					.694	
S61						.844
S62						.780
S63						.544
Eigenvalue	6.288	3.149	1.991	1.664	1.622	1.437
Variance (%)	27.339	41.032	49.688	56.925	63.976	70.223
Cronbach's Alpha	0.844	0.706	0.664	0.808	0.866	0.740

The results of the exploratory factor analysis (Table 4) show that 13 observed variables in the 4 components affect the value of 4G services. The coefficient $KMO = 0.840$, so EFA is consistent with the Chi-square data and statistics of the Bartlett test with the value of 7480.778, significance level of 0.000. Thus, the observed variables are generally correlated. The variance of 70.223% indicates that the four factors explain 70.223% of the variance in data while the eigenvalue is 1.437. The extracted factors are credibility and value.

Multiple regression analysis

There are 3 regression models that need to be implemented: the first model (single regression) is supposed to determine the effective level of diversity on convenience; the second one (multivariate regression) is expected to determine the important role of each factor of the perceived value. The third model (regressive regression) is to determine the impact of value perception on the purchase intention of the customers. Linear regression results show the R-coefficients of the models are as follows:

- Model 1: R^2 is 0.118 and R^2 is adjusted to 0.110, which means that the model explained 11.0% of the variation in the variable depending on the convenience for customers.

Table 5 - Parameters of each variable in the first regression equation

(Source: made by the authors)

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations	
		B	Std. Error	Beta			Tolerance	Tolerance
1	(Constant)	2.035	.247		6.272	.000		
	S1	.469	.087	.453	3.217	.000	0.860	1.009
a. Dependent Variable: S2								

- Model 2: R^2 is 0.604 and R^2 is adjusted to 0.589, which means that the model explained 58.9% of the variation in the variable depending on the perceived value for the customer.

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Table 6 - Parameters of each variable in the second regression equation
(Source: made by the authors)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.463	.342		-1.124	.165		
	S1	.252	.063	.268	4.283	.000	.877	1.020
	S2	.256	.065	.272	3.492	.000	.875	1.243
	S3	.169	.047	.199	3.225	.003	.954	1.242
	S4	.504	.053	.532	8.734	.000	.947	1.126
a. Dependent Variable: S5								

- Model 3: R^2 is 0.415 and R^2 is adjusted to 0.410, which means that the model explained 41.0% of the variation in the variable depending on the purchase intention of customers.

Table 7 - Parameters of each variable in the third regression equation
(Source: made by the authors)

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta				B
1	(Constant)	.663	.329		2.013	.047		
	S5	.779	.089	.624	8.795	.000	.850	1.012
a. Dependent Variable: S6								

The results of testing the theoretical model

From the above analysis, it can be concluded that the theoretical model is fully suitable for our research data and all our initial hypotheses -- H1, H2, H3, H4, H5, and H6 -- are confirmed.

H1 (the variance explaining 11% of the data), H5 and H6 (41.0% explaining the intent to purchase) are strongly supported. H2, H3, and H4 are also supported. Diversity, convenience, quality of service and price together shape a larger part (58.9%) of the perceived value.

In the differential analysis, gender variables, age, monthly spending on telephone bills, phone usage and subscription to 4G services are now included in the model. However, their effect on buying intent is negligible. The effect of IT on efficiency for both purchase intent

and value added was found to be negligible and efficacy could be random, thus resulting in the overall negligible effects.

Structural Equation Model Results

The table below shows the results for fit of both structures, including customer behavior and purchase intentions of clients, and the texture models for the two sets of data. Chi-square (X^2) is used in this study to examine the existence of the relationships among variables in the model (Hair et al., 2006). The AMOS output is presented in Table 7 which shows that the models are equipped with good data, therefore, the proposed model is appropriate in explaining relationship between the variables.

Table 8 - Results of the AMOS analysis

(Source: made by the authors)

Model	X2	Df	p	Goodness of fit Measures		NFI	RFI	IFI	TLI	CFI
				X2/df (CMIN/DF)	RMSEA					
Sample	413.893	214	0.000	1.934	.052	.936	.946	.973	.968	.973
Criteria	P>.05	≥0	-	2 to 3	<.08	>.90	>.90	>.90	>.90	>.90
(non-significant)										

Note: X^2 = Chi-square test, df = Degrees of freedom, RMSEA = Root mean square error of approximation, NFI = Normed Fit Index, RFI = Relative Fit Index, IFI = Incremental Fit Index, TLI = Tucker-Lewis Index, CFI = Comparative Fit Index.

The results show that this model valuable chi-squared statistics are 413.893 with 214 degrees of freedom ($p = 0.000$). Chi-squared relative degrees of freedom accordingly CMIN/DF was 1.934 (<2). Other indicators are GLI = 0.910 (>0.9), TLI = 0.968 (>0.9), CFI = 0.973 (>0.9) and RMSEA = 0.052 (<0.08). Therefore, this model achieved compatibility with the data already collected.

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Figure 1- SEM results
(Source: made by the authors)

Testing the reliability of estimates by means of bootstrap

The bootstrap method is usually used to test the model estimates, with the pattern repeat being $N = 1000$. The estimation results for 1000 samples averaged together with the deviations are presented in Table 8. CR has very small absolute value, thus, it can be stated that the deviation is very small; while not statistically significant at the 95% confidence level. Thus, we can conclude that the model estimates can be trusted.

Table 9 - Results estimated by bootstrap, $N = 1000$.

(Source: made by the authors)

Estimate standard values			Estimate Bootstrap with $N=1000$						
Parameter	Estimate	SE	SE-SE	Mean	Bias	SE-Bias	CR		
S6 <--- S1	0.023	0.057	0.001	-0.022	0.001	0.002	2		
S6 <--- S2	0.106	0.105	0.002	0.096	-0.01	0.003	-0.3		
S6 <--- S5	0.034	0.092	0.002	-0.038	-0.004	0.003	-0.75		
S6 <--- S3	0.115	0.099	0.002	-0.117	-0.002	0.003	-1.5		
S6 <--- S4	0.032	0.055	0.001	-0.025	0.007	0.002	0.29		

Discussion and implications

The focus of this study has been on identifying the key variables that significantly influence the business success of 4G services' provision. The expected variety of service, convenience, and quality of service -- all contribute to the benefit components of value perception, and they also contribute to the cost components of value perception. Finally, the expected perceived value has a positive influence on the intention to buy.

The answers demonstrate that the monetary value is the most important element of value perception, followed by convenience and quality of support. Price is found to have a significant negative impact on cognitive value. The highest average score (3.9 out of 5) indicates that most customers feel that 4G services are too expensive for them. Price can thus be considered as one of the most important factors in the widespread adoption of 4G services.

Saving of time and effort (aka Convenience) provided by 4G service is also found to have a significant impact on value. The impact of service quality is lower because many respondents may not really evaluate various aspects of service provision if not actually subscribed to 4G services. Another important finding is that the effect of many types of services on value perception is negligible. This implies that merely providing a large variety of services does not attract many new users. In fact, users may find themselves overwhelmed by the amount of services provided, especially when they do not really need so many of them. Nevertheless, diversity of services has its potential influence on convenience, hence sustaining a positive effect on value. This means that while many types of inspection and repairs may not instantly contribute to perceived value, convenience, mainly due to time savings and service delivery effort, contribute to increased value perception.

Conclusions, limitations and recommendations

This study has several implications. First, this empirical research contributes real-life data on the acceptance of 4G service according to the Zeithaml value model (1988). Factors such as convenience and quality of service add to the beneficial aspects of value perception, while prices add to its cost aspect. Secondly, value perception is found to be a significant predictor of buying intention. This means that a consumer who has determined a solid value in a product/service is likely to buy/accept it more easily. Finally, diversity of services has been found to not that directly affect the perceived value, as it is mostly mediated by convenience.

One of our key conclusions is that rather than simply offering a large number of services, it is much more important to link the top convenience services with the key goal to save time and efforts. Finally, prices in many cases have been reduced to make 4G services more attractive, thus boosting their development further.

However, due to limited time and costs of this research, there are certain other limitations as well. The sample size of the pilot data was quite small (28 valid samples out of

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30 collected) and the final sample was also quite small (326 participants). Secondly, this research study has been limited to professionals working in the central business district of the HCM City. Thus, the sample could also be expanded in number and also in terms of representation. Also, other countries where 4G services are already available at the market can be also considered for the sake of further comparison of the results obtained.

Generally speaking, this research suggests that price, convenience, quality of service, diversity in the service offer are needed to sense the value from a service. The relationship between service diversity and value perception are mediated by convenience. In other words, our research suggests that value perception has a solid direct relation with the intention to purchase.

Future research studies in the same direction can be expanded onto different samples in other districts in Ho Chi Minh City. Similar studies can be also carried out in rural areas as long as 4G services are already introduced there.

The study can be also interestingly expanded to include other factors of influence, such as demand for 4G services, their availability locally, enjoyment from using and so on. All of these factors, together or alone, may affect the intention to buy. Same logic can be also applied to study the application of the technologies other than 4G.

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