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Freemium business model: construct development and measurement validation

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Abstract

Purpose – In recent years, the freemium model is popular with online users in internet markets. Regarding operation, the characteristics of the freemium business model are the focus of all websites and software managers. However, research lacks the literature on the development of the dimensions of the freemium business model and validation of measurement. Hence, the purpose of this paper is to probe into the development of the dimensions of the freemium business model and validate the measurement.

Design/methodology/approach – First, by related literature and practical observations, this study reorganizes the characteristics of the freemium business model and develops dimensions and items of the freemium business model to design the items of scale. The development of scale is based on the procedures of standardized testing, including draft, expert consultation, and pretest and test analysis, in order to test the reliability and validity of the scale. This study treated online users as the questionnaire subjects and analyzed 1,016 valid questionnaires.

Findings – Regarding empirical analysis, confirmatory factor analysis is conducted to test the internal quality of the model, including composite reliability, convergent validity, and discriminant validity. According to the empirical result, the freemium business model can be divided into basic free tier, two-sided markets, revenue sharing, service convenience, and network effect, which are the key factors of users' selection of freemium products or services. This study developed 25 items of scale for the freemium business model.

Originality/value – Finally, this study plans to develop a scale of the freemium business model, which can serve as an appropriate measurement tool to measure the freemium business model, as well as help websites and software developers to plan or execute the introduction of freemium products and services. Hence, it can develop and design products and services meeting the needs of online consumers. Website and software managers can adjust their products and services to satisfy online users' needs.

Keywords Service convenience, Network effect, Freemium business model, Two-sided markets

Paper type Research paper

1. Introduction

In an era of changeable techniques and extremely uncertain business environments, many enterprises try to survive in service industries and establish their competitive advantages. Some studies have suggested that the key factor of organizational performance is a business model instead of techniques (Johnson *et al.*, 2008). After all, the competition among modern enterprises is the competition of business models,

not products. As argued by some studies, innovation of a business model can lead to competitive advantages (Chesbrough, 2010; Huang *et al.*, 2012, 2014).

However, in a severely competitive network industry, what kinds of innovative strategies of business models are more suitable for enterprises in the network service industry? In recent years, many software service companies on the internet provide free service. By word-of-mouth, they effectively acquire numerous customers, have systematic marketing, offer value added services to users, or upgrade service versions, such as Google, Layers, Prezzi, Twitter, Skype, Flickr, Trillian, Newsgator, and Webroot (Garcia-Penalvo *et al.*, 2012). The model is called "The freemium business model (free + premium = freemium)." Freemium is the innovation of the business model commonly adopted in network industry in recent years. In an era of networks, business models with payment applications are the product of old times. With the progress of time, applications upon payment are no longer attractive. Many network companies turn to operations by the freemium business model, and introduce many freemium products or services to satisfy online users' needs. Therefore, business circles and academia pay greater attention and research to the freemium business model. The freemium business model has become an important issue widely discussed by business circles and academia in recent years (Anderson, 2009; Lyons *et al.*, 2012).

Innovation can expand customer value or provide better services for customers and markets (Lu, 2014; Weis, 2010). In operations of network industries, innovation is the only measure of survival. Successful network enterprises (or website companies) should be continuously updated, flexibly and rapidly respond to customers, and maintain innovation of products and services in order not to be eliminated. Thus, the purposes and contributions of this study are, as follows. First, with the increased attention and research of business circles and academia on the freemium business model, this study attempts to determine what the freemium business model is. How does the concept the freemium business model construct and develop the dimensions of research? Construction and development of dimensions is an appropriate start to study the freemium business model, which is an issue of concern by many researchers, including this study. Hence, based on the theory of business model innovation and practical observations, this study constructs and develops the characteristics of the freemium business model. Second, according to the characteristics, this study measures the dimensions of the freemium business model by second-order factor analysis. This aspect is neglected by past studies. The freemium business model is a new concept or term in practice, and is often discussed in recent years. However, in research, measurement on the freemium business model is rare. This study supplements the literature on the freemium business model. Third, items of dimensions constructed by this study can serve as test and validation of empirical study results for future researchers. Finally, the characteristics of the freemium business model, as explored in this study, can be reference for network managers to apply the findings of this study to practice. It is the main contribution and purpose of this study.

2. Theory
2.1 Business model innovation
A business model is the measure and method for a business to create revenue and profit. Timmers (1998) suggested that a business model is system structure constructed by product flow, service flow, and information flow. The system structure indicates the participants and the roles, the income sources of the system structure, and participants' potential benefits. Hence, a business model serves to specifically indicate value, confirm

market segmentation, define the organizational value chain structure, estimate the cost structure and potential profits, and describe the organizational positioning in the value network (including confirmation of potential partners and competitors) in order to form competitive strategy (Chesbrough, 2010). Business model innovation introduces new business models in the production system, creates value for customers and organizations, and obtains profits by new and effective methods. Business model innovation is a kind of new innovation which is as important as technical innovation and traditional innovation.

Business model innovation and the traditional innovation model are not totally the same. Tapscott *et al.* (2000) suggested that a business model means to create new value in order to change competitive rules and use manpower and resources in order to result in unprecedented performance. From the perspective of customer value, Tucker (2001) defined business model innovation and suggested that it is based on customers' perspectives and improves the organizations by imagination. Magretta (2002) defined business model innovation as organizational adjustment of the current value chain. Mitchell and Coles (2003) indicated that when organizations create unprecedented products and services by new operational models, the reformed business model is business model innovation. The transformation to carry out the new business model is called innovation. According to the research findings, organizations with prominent performance are those which continuously review and update business models to adapt to environmental change. Moore (2004) indicated that business model innovation means to re-define customer value propositions or organizational roles in the value chain. Johnson *et al.* (2008) suggested that a business model consists of four related factors that are combined to create value. The four factors include customer value proposition, profit formula, key resources (or assets), and key processes. They are the bases of enterprises. Customer value proposition and profit formula defines customer and organizational value. Key resources and key processes mean to create value for customers and organizations. Therefore, according to past literature (Magretta, 2002; Mitchell and Coles, 2003; Moore, 2004; Johnson *et al.*, 2008; Tapscott *et al.*, 2000; Tucker, 2001), business model innovation aims to create added value for customers. Business model innovation is systematic and essential, and it is not the change of any single factor. It can be related to changes of several factors in the business model. Therefore, the freemium business model is a kind of business model innovation.

2.2 Freemium business model

The term "freemium" was first proposed by Fred Wilson of Union Square Ventures in 2006. The freemium business model means a business model provides free products with basic functions, and attracts users with free services. After acquiring numerous users, it provides advanced functions or value added services with a fee for profits (Anderson, 2009; Lyons *et al.*, 2012). Initially, freemium appeared in the traditional software industry, instead of on the internet. Software companies offered some free trial versions; after use, users could purchase an advanced version. Currently, many well-known software enterprises still adopt the measure. For instance, Kaspersky, the enterprises of network security software, provides a free trial version, which cannot be upgraded. The characteristics of the freemium business model are shown, as follows.

Basic free tier. One of the characteristics of the freemium product is to provide basic free tiers in services or products for customers (Anderson, 2009; Lyons *et al.*, 2012), as 90-95 percent of the content of the freemium model is free, and only 5-10 percent of the content is fee based. For instance, the well-known online album, Flickr, is a free service.

However, Flickr Pro, the value added version with more capacities and functions is fee based. The model can easily acquire or attract new or potential users. At the early stage, network enterprises have high investment cost. However, the marketing cost of service is minimal. The profits acquired by paid services can immediately supplement free services (Anderson, 2009; Lyons *et al.*, 2012). According to Anderson (2009), many online websites use free value added models according to the "5% principle," meaning that providing one out of 20 people pay for value added service, it can cover the cost of free use of the remaining 19 people.

Witell and Löfgren (2013) suggested that free service is critical for innovation in a business model. In practice, the basic free tier is extremely attractive to consumers. As suggested by Visnjic Kastalli and van Looy (2013), free service significantly influences sales of products. In an internet market, free trial version or products with many free services can attract online users more willing to try the products.

Two-sided markets. Based on the network effect, the freemium model also adopts the principle of "two-sided/n-sided market," as raised in the era of Web 2.0 (Adebanjo and Michaelides, 2010). Two-sided markets are also called two-sided networks. It means that on the platform, there is interaction between two types of participants (Economides and Tag, 2012). Many internet intermediaries operate two-sided networks. In other words, they provide a platform and collect two types of participants, such as buyers and sellers (Bakos and Katsamakas, 2008). In order to attract online users to visit the websites, many attractive services are introduced, such as search engines (e.g. Google), online auctions (e.g. eBay), online stores (e.g. Amazon), social activities (e.g. Facebook), online video (e.g. YouTube), online job bank, online games, etc. The freemium business model acquires a great amount of users (one-sided market) by these free services, which attract advertisers, firms, stores, and buyers (another sided market) that are willing to pay. It is the characteristics of a two-sided market or two-sided networks (Casey and Toyli, 2012; Economides and Tag, 2012; Faliagka *et al.*, 2012; Tucker and Zhang, 2010).

The freemium model has two-sided markets or multi-sided markets, where value creation is based on direct interaction between two types of participants, such as advertisers and users in search engines, firms and job seekers in online job banks, game companies and players of online game websites, men and women on personal websites, and bankers and gamblers of gambling websites.

Revenue sharing. Network advertising was launched in the USA in 1994, when well-known magazine *Wired* introduced an online version of Hotwired (www.hotwired.com). On the main page were the advertising banners of 14 customers, such as AT&T. Hence, network media managers changed operation to multi-development, which purpose was to attract more visitors and advertising clients. Currently, advertising circles treat the internet as the fifth medium after the traditional top four media (TV, radio, newspaper, and magazine). Thus, many international advertising companies establish "network media departments" in order to expand into the enormous market of online advertising. For instance, famous advertising enterprise, Western International Media, which is the agent of super clients such as Walt Disney, has treated interactive web advertising as the main business. Most internet firms make profits by advertising and offer charged services. However, for small-scale internet companies that are not influential, it is difficult to obtain profits by advertising, as most advertisers select platforms that are more influential. Thus, websites and advertisers are the important force to continuously enhance changes of internet models, and new service content and products of websites are introduced.

Generally speaking, there are many types of payment for online advertising. For instance, websites charge advertisers by pay-per-click, pay-per-impression, and pay-per-sale (Taylor, 2011). In order to introduce new services, and attract users and advertisers, websites develop a profit sharing mechanism of advertising. Among the network companies that first adopted business models of profit sharing, Google, the network company with the largest global market capital, is the most significant representative. The enterprise provides Google AdSense, which can be downloaded by professional websites and blogs. By Google, appropriate online advertising is selected to be transmitted to the websites. Once online users click on the advertising, blogs, and websites can share the profits. In 2007, YouTube introduced the YouTube Partner Program (YPP), which provides various resources and opportunities, and helps video creators to enhance skills, construct loyal audiences, and obtain more profits. In other words, YPP is the mechanism that allows YouTube to share advertising profits with popular and successful video creators.

Through revenue sharing, users can obtain benefits from the freemium business model and their intention of participation will increase. For instance, the characteristic of the App Store is that all users can be program developers. They pay a fixed amount every year and do not have to pay extra. Therefore, through a platform of design sharing, Apple not only increases iPhone sales but also sells content. Hence, the key to transform users into app developers is benefit. Without revenue sharing, website or program developers will undertake enormous costs and will need to hire manpower to provide services or develop products. Through the construction of revenue sharing, website or program developers can attract more people and creative ideas. Thus, they will introduce more attractive services or products.

Service convenience. In an era of the internet, the high acceptance rate of online information products is based on the convenience and efficiency of transaction or use. Through wifi, online users can transmit information and access the internet by smart phone or tablet computer, and without a cable. Internet services can be anywhere. Convenience is one of the main factors of online shopping (Beauchamp and Ponder, 2010; Jiang *et al.*, 2013). With such convenience, online users have the intention to repurchase on the websites. For instance, Brown (1989) suggested that when product or service providers offer convenience, they are more likely to enhance consumers' consideration of products and services, thus, increasing purchase and use intentions. Moreover, convenience should include time, place, acquisition, use, and execution. According to Jiang *et al.* (2013), convenience of online consumption includes access, search, evaluation, transaction, and possession/post-purchase convenience. In research on value added service, Clarke (2001) indicated that "convenience" is the key factor of expansion of value added service. Previous studies concerning mobile business, e-commerce, and online goods have demonstrated that convenience is an important characteristic of consumers' intention of use and acceptance (Lariviere *et al.*, 2013; Shin *et al.*, 2013).

Network effect. The freemium model significantly uses the positive effect of a network. The network effect is also called "network externalities" or "demand-side economies of scale." It means that when there are more consumers of certain product, individual consumers' effectiveness of product use will be more significant. The phone is the best example of network effect. Due to the network effect, enterprises' incremental cost (such as cost to increase users or service) can be neglected. With increased users, beyond a set limit, the users willing to pay for high-quality service will increase (Lin and Lu, 2011).

Online information products should be based on the internet, as the purpose of users is to collect and exchange information. Need satisfaction is closely associated with scale of network (Shapiro and Varian, 1998; Tseng and Teng, 2014), as a network only with one user is worthless. When there are only a few users on network, they must undertake high operational costs, but can only exchange information and use experience with limited partners. With an increased number of users, the disadvantage of scale economy will be improved. The cost undertaken by each user will continually reduce, and the scope of information and experience exchange will be expanded. All users can acquire more value by expansion of network scale (Katz and Shapiro, 1994). Hence, network value increases in geometric progression. In other words, the value of one product to certain user depends on the number of other users that use the said product. In an economy, network externality or network effect is also called Metcalfe's law, which means "direct ratio between network effectiveness (U) and square of number of users (N), $U = N^2$" (Hanson, 2000). Previous research demonstrated that network effect is the key factor of users' use of technology (Lin and Lu, 2011; Yang and Mai, 2010).

3. Methods

According to the theory of business model innovation, theories related to online economy, and practical observations, this study suggests that the characteristics of the freemium business model include a basic free tier, two-sided markets, revenue sharing, service convenience, and network effect. The dimensions are based on the development of a questionnaire and are related measurement validation (Chen *et al.*, 2013; Churchill, 1979; Lucia-Palacios *et al.*, 2014; Sethi and King, 1994; Yu, 2011). In addition to theoretical literature, there is also precise validation.

3.1 Measures

Measurement of items is based on a Likert five-point scale, ranging from 5 (strongly agree) to 1 (strongly disagree).

Basic free tier: the basic free tier means 90 percent of the functions of the freemium products are free (Anderson, 2009). This study defines the basic free tier, as follows: users freely download the product, basic service, and upgrading version of online goods or services. Referring to Anderson (2009), Lyons *et al.* (2012), and Wang and Li (2012), this study modifies the freemium business model to develop the items.

Two-sided markets: two-sided markets are also called two-sided networks, which mean that there is interaction between two types of participants on the platform (Economides and Tag, 2012). This study defines two-sided markets, as follows: when users use online goods and services, there are users of other different roles on the network (e.g. advertisers, firms, bankers, and sellers), and they can directly interact with others. Referring to Casey and Toyli (2012), Economides and Tag (2012), and Tucker and Zhang (2010), this study develops items by appropriately modifying the freemium business model.

Revenue sharing: this study defines revenue sharing, as follows. In order to introduce new goods and attract more users and advertisers, websites will share advertising profits with users. Referring to Taylor (2011), this study designs the items by appropriately modifying the freemium business model.

Service convenience: means consumers' perception of saved time and effort (Berry *et al.*, 2002). This study defines this variable, as follows: the perceived convenience of

time, place, acquisition, use, and execution, to use online goods or services. According to the scales of Burke (1997), Hsiao *et al.* (2012), Jiang *et al.* (2013), Li *et al.* (2012), and Mathwick *et al.* (2001), this study develops items by appropriately modifying the freemium business model.

Network effect: means the value of one product increases to users when users who adopt the same product expand, there is network externality. Product value continually increases with the increased number of consumers of a product, and the interoperability of products. Consumers' perceived value of the product is also enhanced (Gretz and Basuroy, 2013; Katz and Shapiro, 1994; Shankar and Bayus, 2003; Shy, 2001). This study defines network effect, as follows. For users, the value of online goods or service depends on the number of users of the product or service. Referring to Katz and Shapiro (1992, 1994), this study develops items by appropriately modifying the freemium business model.

3.2 Scale development process

Churchill's (1979) scale of development includes eight steps: Step 1: specify the domain of the construct, Step 2: generate a sample of items, Step 3: collect data, Step 4: purify measures (eliminate inappropriate items), Step 5: collect new data, Step 6: assess reliability, Step 7: assess validity, and Step 8: develop norms. Based on Churchill's (1979) scale of development and other scholars' views (Fuller *et al.*, 2013; Magdalena Jimenez-Barrionuevo *et al.*, 2011; Sethi and King, 1994; Yang *et al.*, 2014), this study develops a scale.

The researcher first designed the pretest questionnaire. In order to construct content validity, this study conducted in-depth interviews with ten high-rank supervisors of network companies in order to find how the network service industry introduces freemium products and services, as well as user acceptance and consumer usage behavior. After the interviews, this study designed a draft of questionnaire. A total of ten experts, scholars, and workers in business circles were then invited to examine the questionnaire's validity. After proper modification and adjustment, this study conducted the questionnaire pretest on the users.

This study provided 30 pretest items and invited experts, scholars and business workers to screen or review the questionnaire content, dimensions, and terms. The experts and scholars were asked to evaluate each item as being appropriate, appropriate after revision, or inappropriate, and then provide their opinions for revision. Items with cumulative percentages for "appropriate" and "appropriate after revision" of 80 or 90 percent were kept. According to the examination result, five items were eliminated and 25 remained.

Based on the experts' and scholars' examination and revision, this study conducted the questionnaire pretest. The subjects were representative. The ratio of number of items and number of pretest subjects was 1:5. The number of pretest subjects was at least 100. This study selected 125 online users for the pretest. Based on the pretest result, Cronbach's α of the dimensions were more than 0.8. All items were proper for the following study and analysis.

3.3 Item analysis

Based on items analysis, this study selects the items to construct an effective questionnaire or high-quality items. Item quality can be enhanced by item analysis, which means to analyze the usefulness of scale or test items. According to the average

total scores of all respondents in the scale, this study divides the first 27 percent of
scores in the high-score group, and the last 27 percent of scores as the low-score group.
t-test of independent samples is conducted to obtain the discrimination of the items and
select items for questionnaires according to composite reliability (CR) (*t*-value).
Cronbach's α of the scales after eliminating the items were similar to that of the total
scale. There were no added items. Hence, all 25 items remained.

3.4 Data collection and the sample
For the formal questionnaire survey, this study selected the samples using convenience
sampling. The questionnaires were collected by two methods. One was an internet-
mediated questionnaire, and the link to the questionnaire was e-mailed to the subjects.
The other was a delivery and collection questionnaire for students in senior high
schools, universities, and graduate schools, as well as on-the-job programs of graduate
schools. The respondents had to be online users. This study adopted telephone surveys
as a support tool to enhance the response rate. Among 1,200 questionnaire distributed,
1,020 were retrieved, including 1,016 valid responses.

The subjects' sample structure is shown below (see Table I). As to gender, males
were 54.13 percent and females were 45.87 percent of the total; as to educational level,
senior high school or below was 36.02 percent and university or above was
63.98 percent. As to age, below 20-year old was 26.08 percent of the total, 21-30-year old
was 29.04 percent, 31-40-year old was 19.39 percent, 41-50-year old was 15.75 percent,
and older than 51 was 9.74 percent. Most of the samples were male users below 30-year
old. The distribution of the retrieved samples indicated they were representative of
online users.

3.5 Non-response bias test
In order to confirm the representativeness of the samples, this study assessed the
effects of non-responses using the wave analysis method. Thus, after comparing the
first-round retrieved data (participants with early responses) with the second-round

	Number	%
Gender		
Male	550	54.13
Female	466	45.87
Educational level		
Senior high school or below	366	36.02
University or above	650	63.98
Age		
< 20-year old	265	26.08
21-30-year old	295	29.04
31-40-year old	197	19.39
41-50-year old	160	15.75
> 51-year old	99	9.74
User type		
Free user	951	93.60
Premium user	65	6.40
Total	1,016	100

Table I.
Characteristics of
the sample

data (participants with late responses), the researcher evaluated the effects of non-responses (Armstrong and Overton, 1977). Armstrong and Overton (1977) used the *t*-test to compare key data characteristics of early and late responses, such as the participants' age. Based on a significance level of 5 percent, the ages of early and late participants were not found to be significantly different. Thus, non-response bias in this study was insignificant.

3.6 Common method variance (CMV) test

CMV is a potential problem in behavioral research (Podsakoff *et al.*, 2003). When a participant fills in all variables or measurements, there can be single source bias and CMV might exist in the research (Avolio *et al.*, 1991; Podsakoff and Organ, 1986). In order to prevent such a problem, this study adopted confidential interview data, hidden meanings of items and reverse item design. In addition, this study conducted a post hoc test of CMV using Harman's single factor analysis (Podsakoff and Organ, 1986). After non-rotated factor analysis on all items, this study obtained five factors (76.033 percent cumulative explained variance). Factor 1 had 35.438 percent variance, which was not more than 50 percent. Since no single factor showed significant variance, CMV in this study was not serious (Mossholder *et al.*, 1998).

4. Results

4.1 Descriptive statistics and correlation analysis

This study first explained the results of the descriptive statistics and Pearson correlation analysis and then conducted confirmatory factor analysis (CFA). Table II shows the descriptive statistics and Pearson correlation coefficient analysis of the variables.

4.2 Exploratory factor analysis

In order to ensure that the data are suitable for exploratory factor analysis, prior to formal analysis, this study must calculate Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. According to the perspective of Kaiser and Rice (1974), when KMO is at least 0.6 and the *p*-value of the Bartlett test of sphericity is close to 0, factor analysis can be conducted. KMO of this scale is 0.951 and *p*-value is close to 0, which means the research data are appropriate for factor analysis.

Through factor analysis, this study extracts representative factors. First, it conducts the principal component method of factor analysis, and then practices rotation of common factors by the varimax solution of orthogonal rotations (DeVellis, 2003). The purpose is to determine the greatest difference in factor loadings of each common

	(1)	(2)	(3)	(4)	(5)
1. Basic free tier	1				
2. Two-sided markets	0.777**	1			
3. Revenue sharing	0.358**	0.477**	1		
4. Service convenience	0.348**	0.434**	0.737**	1	
5. Network effect	0.641**	0.538**	0.156**	0.229**	1
Mean	4.6465	4.1892	3.5596	3.1854	4.2811
SD	0.60628	0.82531	1.03449	1.03679	0.79488

Notes: $n = 1{,}016$. Figures in parentheses are Cronbach's α's. ** $p < 0.01$

Table II.
Descriptive statistics and correlation analysis

factor after rotation in order to identify common factors. This study selects factors with eigenvalue > 1, cross-loadings > 0.3, and communality > 0.5 (Ford *et al.*, 1986; Hinkin, 1998). Based on factor analysis results, this study extracts five factors, including 25 items. The explained variance of the five factors are 16.504, 15.839, 15.079, 14.609, and 14.359 percent, and the cumulative explained variation is 76.390 percent. In extracted factors, this study selects and names variables with the absolute value of factor loading > 0.5. When the absolute value of factor loading is above 0.5, it means communality is high and the measurable common characteristics of items in the questionnaire are more significant, which is more suitable for factor analysis (Hair *et al.*, 2005). The results of factor analysis are as shown in Table III, where the five factors are named; basic free tier, two-sided markets, revenue sharing, service convenience, and network effect.

4.3 CR and convergent validity
Using CFA, this study tested the internal quality of the model (Jöreskog and Sörbom, 1993). As to evaluation on the measurement model, Bagozzi and Yi (1988) suggested assessing the measurement model according to individual item reliability, significance level of the estimate parameters, CR, and average variance extracted (AVE) in order to evaluate the internal quality of the model. Table IV shows that the *t*-test values of factor loading were higher than a significance level of 1.96. The factor loadings (λ) of all observable variables on individual potential variables were 0.65-0.88, which matched

Construct	Items	Factor loading (λ)	Eigenvalue	Variance (%)	Cumulative explained variation (%)
Factor 1: basic free tier	BFT1	0.712	4.126	16.504	16.504
	BFT2	0.746			
	BFT3	0.705			
	BFT4	0.777			
	BFT5	0.775			
Factor 2: two-sided markets	TWS1	0.757	3.960	15.839	32.343
	TWS2	0.741			
	TWS3	0.728			
	TWS4	0.769			
	TWS5	0.778			
Factor 3: revenue sharing	RS1	0.789	3.770	15.079	47.422
	RS2	0.808			
	RS3	0.711			
	RS4	0.703			
	RS5	0.726			
Factor 4: service convenience	SC1	0.691	3.652	14.609	62.031
	SC2	0.756			
	SC3	0.612			
	SC4	0.726			
	SC5	0.726			
Factor 5: network effect	NE1	0.536	3.590	14.359	76.390
	NE2	0.776			
	NE3	0.738			
	NE4	0.724			
	NE5	0.744			

Table III.
Results of
exploratory factor
analysis

Construct	Items	Factor loading (λ)	Individual item reliability (λ^2)	t-value
Factor 1: basic free tier	BFT1: it is attractive that I can freely and randomly download a product or service from the internet	0.67	0.4489	23.40
	BFT2: it is attractive that most of the functions are free when using the product or service	0.79	0.6241	29.34
	BFT3: it is attractive that I can freely upgrade the product or service when a new version is introduced	0.80	0.6400	30.31
	BFT4: I can accept that I should pay for advanced versions of functions of the product or service	0.86	0.7396	33.61
	BFT5: when the product or service is updated, it increases new functions, which should be paid; however, most of the functions are free and I accept it	0.85	0.7225	22.98
Factor 2: two-sided markets	TWS1: in the product or service, there are users of different types or roles at the same time	0.65	0.4225	22.52
	TWS2: in the product or service, there are users with roles as mine	0.68	0.4624	23.93
	TWS3: in the product or service, there are users with roles different from mine	0.78	0.6084	29.03
	TWS4: when using the product or service, I can directly interact with users with roles the same as mine	0.84	0.7056	32.53
	TWS5: when using the product or service, I can directly interact with users with roles different from mine	0.88	0.7744	34.95
Factor 3: revenue sharing	RS1: if I can obtain profits by using the product or service, I will have higher intention of use	0.80	0.6400	30.03
	RS2: profits obtained from the product or service can be paid by the internet Service Provider (ISP)	0.86	0.7396	33.38
	RS3: profits obtained from the product or service can be paid by the advertiser	0.80	0.6400	30.15
	RS4: profits obtained from the product or service can be paid by the internet company	0.83	0.6889	31.53
	RS5: profits obtained from the product or service can be paid by other users	0.72	0.5184	25.70
Factor 4: service convenience	SC1: using the product or service at any time is the key factor of my use of the product	0.86	0.7396	33.24
	SC2: using the product or service in any place is the key factor of my use of the product	0.87	0.7569	34.04
	SC3: only a simple device (smart phone or tablet computer) is required to use the product or service, and it can be easily downloaded. It is the key factor of my use of the product	0.77	0.5929	28.57

Table IV.
Individual item
reliability

Construct	Items	Factor loading (λ)	Individual item reliability (λ^2)	t-value	Freemium business model
	SC4: using the product or service by friendly interface or simple operation is the key factor of my use of the product	0.76	0.5776	27.68	
	SC5: convenience of payment for transactions is the key factor of my use of the product	0.78	0.6084	28.89	**615**
Factor 5: network effect	NE1: when there are many members of the product or service, my intention of use will be enhanced	0.75	0.5625	27.05	
	NE2: when many online users use the product or service at the same time, my intention of use will be enhanced	0.80	0.6400	29.56	
	NE3: when my friends have the experience of using the product or service, my intention of use will be enhanced	0.83	0.6889	31.48	
	NE4: when my friends discuss the experience of using the product or service, my intention of use will be enhanced	0.79	0.6241	29.53	
	NE5: if I can have a common language with related people by using the product or service, my intention of use will be enhanced	0.83	0.6889	31.58	**Table IV.**

the threshold value of 0.45 proposed by Bentler and Wu (1993). Hence, all observable variables could reflect the dimensions, and the scale of this study had a certain degree of convergent validity. The reliability (λ^2) of the observable variables ranged from 0.4225-0.7744, which matched the threshold value of 0.20 proposed by Bentler and Wu (1993). The result matched the reliability of single variables, and all observable variables therefore had reliability.

When Cronbach's α is more than 0.7, it means the reliability is acceptable. According to Table V, Cronbach's α of the dimensions were more than 0.9, indicating that the dimensions had high reliability. The CR of the five dimensions ranged from 0.8786 to 0.9044, which matched the standard of 0.6. Therefore, the dimensions had reliability. When the CR of the latent variables is higher, it means their observable variables can predict the latent variables, and that the internal consistency of the latent variables is higher. The AVE of the five dimensions was more than 0.5, and mostly between 0.5947 and 0.6551. According to Bentler and Wu (1993) and Fornell

Construct	No. of items	Cronbach's α	Composite reliability (CR)	Average variance extracted (AVE)	
1. Basic free tier	5	0.929	0.8962	0.6350	
2. Two-sided markets	5	0.913	0.8786	0.5947	
3. Revenue sharing	5	0.933	0.9007	0.6454	
4. Service convenience	5	0.937	0.9044	0.6551	**Table V.**
5. Network effect	5	0.933	0.8991	0.6409	Composite reliability and average variance extracted

and Larcker (1981), when the AVE of the dimensions is higher, it means there is higher convergent validity. According to the analysis, the scale of this study had a certain degree of convergent validity.
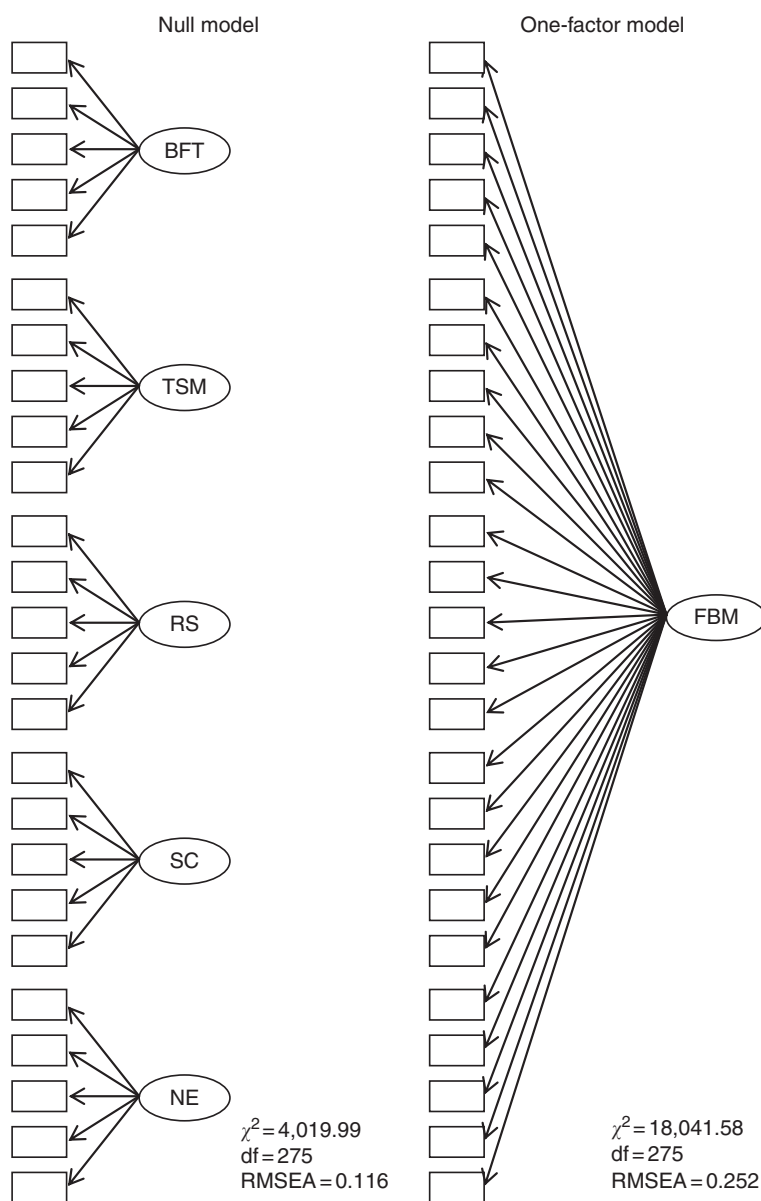
4.4 Second-order factor analysis
To find empirical support for the second-order model, three conditions needed to be fulfilled: the target coefficient (T coefficient) should be close to 1.00; the goodness-of-fit indices of the second-order factor structure should indicate a fit approximately similar to that of the first-order factor structure; and the second-order factor loadings should all be statistically significant (Venkatraman, 1990). First, the researcher conducted CFA on all items of the scale of the freemium business model. The freemium business model was divided into the null model, the one-factor model, the five-factor model and the second-order model, as shown in Figures 1 and 2. Fit measures of the models and differences of the χ^2 values among the models were compared. As shown in Table VI, the null model set the path coefficient of the variables as 0, and the one-factor model allocated all items of the freemium business model in the same dimension. The five-factor model was the standard model of this study. The model was based on the perspectives of Anderson (2009) and Lyons *et al.* (2012). In order to fulfill the first condition, this study calculated the target coefficient (T coefficient). The target coefficient is the ratio of the χ^2 of the first-order model (target model) to the χ^2 of the more restrictive model (the higher-order model) (Marsh and Hocevar, 1988). It reflects the extent to which the higher-order factor model accounts for covariation among the first-order factors and can be interpreted as the percent of variation in the first-order factors that can be explained by the second-order construct. As suggested in Table VI, the target coefficient of the χ^2 of the first-order model ($\chi^2 = 1{,}667.29$) to the χ^2 of the second-order model ($\chi^2 = 2{,}128.07$) was 0.783. Although the fit measures of the second-order model were similar to the first-order model and the factor loadings of the second-order model were significant (see Figure 2), according to Table VI, in comparison to the other models, the assumed model (five-factor model) in this study had better fit ($\chi^2/\text{df} = 6.292$; RMSEA $= 0.072$) and ECVI was the least. In addition, GFI, AGFI, CFI, NFI, NNFI, PNFI, IFI, RFI, PGFI, RMR, SRMR, and RMSEA of the assumed model in this study were superior to other models. According to the result, the freemium business model could be classified as a five-factor model. The measures mostly matched the standard. The freemium business model scale designed by this study could be the base for follow up research.

4.5 Discriminant validity
Using the test proposed by Fornell and Larcker (1981), Anderson and Gerbing (1988), and Jap and Ganesan (2000), this study examined the discriminant validity. The method was to set the correlation coefficient (ψ_{ij}) of the pair dimensions as 1, and then test the χ^2 difference by the constrained model and the original measurement model (free estimation). Based on a freedom difference of 1, when the gap was more than 3.84 the two dimensions were distinguishable and had discriminant validity. In other words, when the fit χ^2 of the original measurement model (unconstrained model) was low, the correlation of the dimensions was low.

As to the original measurement model (unconstrained model) of the theoretical model proposed by this study, $\chi^2 = 1{,}667.29$ and df $= 265$. When the correlation coefficient between the basic free tier and two-sided markets was set as 1, the constrained model $\chi^2 = 2{,}260.97$; df $= 266$. The researcher conducted a χ^2 difference test of the constrained model and unconstrained model. Δdf was 1 and $\Delta\chi^2$ was 593.68. There was a significant

Notes: FBM, freemium business model; BFT, basic free tier; TSM, two-sided
markets; RS, revenue sharing; SC, service convenience; NE, network effect

Figure 1.
Second-order
confirmatory factor
analysis: null model
and one-factor model

difference. When the gap was larger, the correlation between the basic free tier and two-
sided markets was low, and there was discriminant validity. According to Table VII, the
discriminant validity of the dimensions in this study was significantly different. Hence,
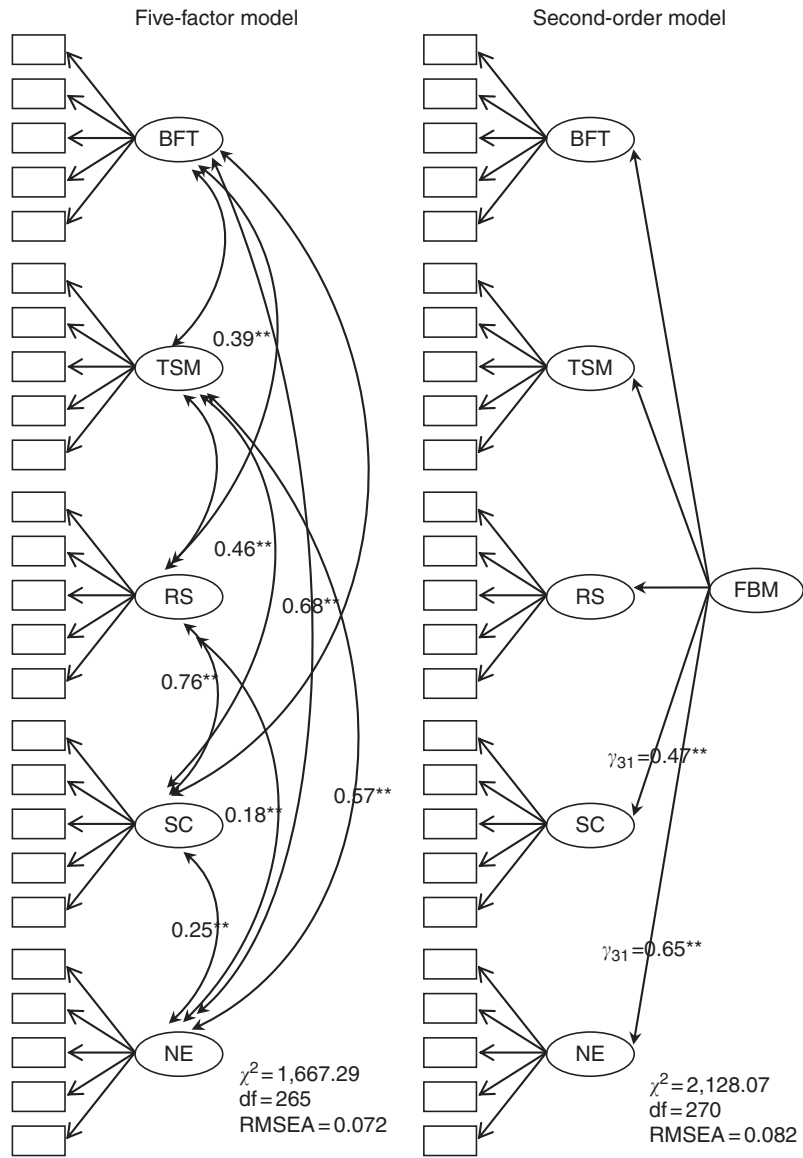there was discriminant validity among the dimensions.

Figure 2.
Second-order
confirmatory factor
analysis: five-factor
model and second-
order model

Notes: FBM, freemium business model; BFT, basic free tier; TSM, two-sided markets; RS, revenue sharing; SC, service convenience; NE, network effect. **p < 0.01

5. Conclusions
5.1 Contributions
In order to achieve competitive advantages and prominent performance, organizations should have continuous innovation and progress. This relies on innovative business models and consumer value created by organizations, in order to be winners in an era

of network economy competition. The research conclusion and contribution are shown as follows. As to measurement of the freemium business model, past research tended to probe into the cases (Anderson, 2009; Lyons *et al.*, 2012), but few measured the freemium business model according to multiple dimensions. Hence, using LISREL second-order factor analysis, this study measured the freemium business model, which is rare in comparison to past research. This study classified the freemium business model into basic free tier, two-sided markets, revenue sharing, service convenience and network effect, and developed 25 items. The measurement helped in the process of understanding and studying the freemium business model. The freemium business model is new type of business model innovation. According to past literatures, business model innovation enhances the construction of competitive advantages (Chesbrough, 2010; Huang *et al.*, 2012, 2014). Therefore, this study further categorized the freemium business model in order to realize how online users identify with it.

5.2 Managerial and practical implications

Once online service companies understand the characteristics and operation of the freemium business model (see Figure 3), they can introduce freemium products and services. In Figure 3, when network firms introduce online products on websites, they must first divide the products into free services and paid services. The products introduced can be used freely through the internet. The free version and its

Models	χ^2	df	χ^2/df	$\Delta\chi^2$	GFI	AGFI	CFI	NFI	NNFI
1. Null model	4,019.99	275	14.618	–	0.759	0.716	0.930	0.925	0.924
2. One-factor model	18,041.58	275	65.606	14,021.59**	0.413	0.306	0.836	0.832	0.821
3. Five-factor model	1,667.29	265	6.292	2,352.7**	0.884	0.858	0.975	0.970	0.972
4. Second-order model	2,128.07	270	7.882	1,891.92**	0.856	0.827	0.964	0.959	0.960

Models	PNFI	CN	ECVI	IFI	RFI	PGFI	RMR	SRMR	RMSEA
1. Null model	0.948	88.62	4.059	0.930	0.918	0.643	0.339	0.307	0.116
2. One-factor model	0.762	40.015	17.873	0.836	0.816	0.349	0.223	0.163	0.252
3. Five-factor model	0.857	213.408	1.761	0.975	0.966	0.721	0.058	0.049	0.072
4. Second-order model	0.863	158.502	2.205	0.964	0.954	0.711	0.167	0.116	0.082

**Note:** **$\Delta\chi^2 > 6.33$

Table VI.
Results of confirmatory factor analysis for freemium business model

Each pair of constructs (constructs constrained)	Constrained model ($\psi_{ij} = 1$) χ^2	df	Unconstrained model (ψ_{ij} = free) χ^2	df	$\Delta\chi^2$	Δdf
Basic free tier − two-sided markets	2,260.97	266	1,667.29	265	593.68**	1
Basic free tier − revenue sharing	5,406.69	266	1,667.29	265	3,739.4**	1
Basic free tier − service convenience	5,485.05	266	1,667.29	265	3,817.76**	1
Basic free tier − network effect	3,793.03	266	1,667.29	265	2,125.74**	1
Two-sided markets − revenue sharing	4,539.95	266	1,667.29	265	2,872.66**	1
Two-sided markets − service convenience	4,689.21	266	1,667.29	265	3,021.92**	1
Two-sided markets − network effect	4,248.25	266	1,667.29	265	2,580.96**	1
Revenue sharing − service convenience	2,753.32	266	1,667.29	265	1,086.03**	1
Revenue sharing − network effect	5,684.80	266	1,667.29	265	4,017.51**	1
Service convenience − network effect	5,650.86	266	1,667.29	265	3,983.57**	1

Note: **$\Delta\chi^2 > 6.33$

Table VII.
Discriminant validity of first-order constructs

Figure 3.
Freemium business
model adoption
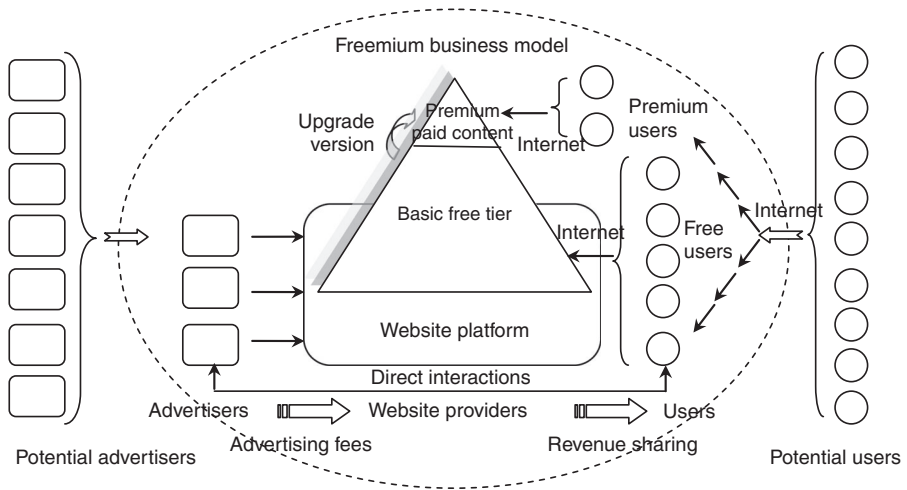
convenience can attract a great number of users. By creating value added content, some free users can become paid users. In addition, to attract more users, online service companies can share the profits from ad revenue with users who contribute to the website. In addition, the participation of more users will create network externality and attract more advertisers and users. In other words, once the free model attracts more customers, there will be a market for paid services. Network service firms can therefore create more profits.

The introduction of the freemium business model increases the value of network applications and demonstrates Metcalfe's law. The freemium business model overthrows the law of diminishing returns of the traditional economy and creates online business opportunities according to the law of increasing returns of the digital economy. New online users can obtain information exchange through others' network connections. Networks have extremely strong externality and positive feedback. In other words, when there are more online users, network value will be higher, and internet demand will increase. As to consumption, there is increasing effectiveness. In other words, demand creates new demand. In the process to create customer value, by creating value added services, network service firms can turn some free users into paid users and thereby create business opportunities and profits. Many companies are introducing the freemium business model for business model innovation. For instance, in the USA an international interactive entertainment software manufacturing and publishing firm (Electronic Arts) has suggested that the freemium business model is the base for future profit. The network service industry should consider how to use internet marketing to attract more potential users and construct competitive advantages using the freemium business model. If they can adopt the model constructed by this study, the freemium business model will considerably benefit the online industry.

5.3 Limitations and future research directions
This study had some limitations which should be addressed in future research. First, CMV is a potential problem in behavioral research (Podsakoff *et al.*, 2003). In order to avoid the effect of CMV, in the design of the questionnaire, this study constructed the

dependent variable at the beginning of the questionnaire and adopted other methods. Although this study tried to avoid the problem caused by CMV, it was impossible to totally escape from the bias. Second, as to validation of the model, future research can validate the validity and explained power using other data. Regarding the validation of the freemium model innovation, the empirical model of this study was based on validation of the primary model. Future researchers can focus on different types of service industries or combine the model with other variables in extended research. Third, as to the research on the freemium business model, although some past scholars probed into the freemium business model, generally speaking, studies on technology management are few. Since the freemium business model is a new concept and there are fewer related studies, there is no common consensus on the concept. Most studies concerning the freemium business model should be conducted. Finally, this study suggested that future studies can further probe into related issues to complete the research.

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