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Estimating the Value Obtained from Using a Software Service Platform

Netsanet Haile, Jörn Altmann

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151-742 서울시 관악구 관악로 599

Technology Management, Economics, and Policy Program
College of Engineering, Seoul National University
599 Gwanak-Ro, Gwanak-Gu, Seoul 151-742, South-Korea
Phone: ++82-2-880-9140, Fax: ++82-2-880-8389

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Jörn Altmann, Editor

Office: 37-305
Technology Management, Economics, and Policy Program
College of Engineering
Seoul National University
599 Gwanak-Ro, Gwanak-Gu
Seoul 151-742
South-Korea

Phone: +82-70-7678-6676
Fax: +1-501-641-5384
E-mail: jorn.altmann@acm.org

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Netsanet Haile, Jörn Altmann

Technology Management, Economics, and Policy Program (TEMEP)
College of Engineering
Seoul National University
netsanet@temep.snu.ac.kr, jorn.altmann@acm.org

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Abstract. Service markets allow users to discover, purchase, and utilize services offered on a specific platform. As service platforms grow in number of users and variety of offerings, it raises the question of whether this phenomenon continues to benefit users. Based on a literature review, the paper identifies usability, service variety, and the number of personal connections accessible over the service platform as major determinants that contribute to the value to users. Based on survey data on the behavior of mobile service users, the relationship between user value and the determinants is analyzed and estimated. The results show positive correlations between all three determinants and the value. Using regressions, we estimate how much these determinates contribute to the user value. Mobile service users are satisfied with the usability of services of their chosen platforms, although the impact on the user value is the lowest. Users benefit the most from an increase in the number of their personal connections and the number of services they use.

Keywords: Network Effect Theory, UTAUT, Value Creation, Service Platforms, Survey, Multiple Regression.

JEL Classification Numbers: C13, C42, C51, C88, D46, L86, M15, M21, O32.

1. Introduction

Service platforms can be considered one of today's highly valued technologies. In recent years, there has been a rapid growth in the number of services being developed and offered over various platforms. By January 2013, Apple's App Store contained 750,000 registered services. Google's Android operating system runs on many devices and competes with the iPhone. It comes with more than 700,000 services as of April 2013, that are offered through its software service market Play Store.

The introduction of mobile service platforms made the development and offering of services simple and helped their integration into users' daily lives [32]. From a business perspective, value creation is the main focus of service platform operators, both in the context of creating better value for customers purchasing their services as well as for their shareholders, who want to see their stake increase in value. Due to the novelty of technologies, delivery modes, and business models in service platforms, the definition of their value system is at its early stage. Therefore, the question whether the existing models from theories of network analysis and information systems explain the specific characteristics of the value creation process in service platform markets needs to be addressed.

Prior to the web services era, demand-side interdependencies in communication markets have been investigated in earlier literature [1]. Following these approaches, economic theories regarding information goods stated that usage of products in these markets is driven by the need for compatible (interoperable) products to exchange information and the need for complimentary products and services [2], [3]. The concepts of complementarities and network effects are adopted into theoretical models for platform leadership and value creation in e-businesses in recent studies [4], [5]. These studies introduced direct and indirect network effects which come from the installed base and the availability of complimentary services as value drivers for both providers and consumers. However, they provide a general overview of network effect markets, investigating reactions to an aggregated number of users without considering variations of user choices. In addition to this, a complete value function needs to account for the benefits from actual use of functions. For this purpose, we adopt the measures of usability introduced through the Technology Acceptance Model (TAM) and later extended into the Unified Theory of Acceptance and Use of Technology (UTAUT) [6] [7]. This paper applies measures (i.e., perceived usefulness and perceived ease of use) used in the UTAUT to capture the user value from the usability of a service platform. The paper addresses a research gap regarding the identification of determinants of a service platform user's value and the introduction of a measurement method. In detail, it responds to the question of what aspects of a service platform determine a user's value. It also addresses a question on how to estimate the value function of a service platform user.

Our main hypothesis is that the value creation process in mobile service markets is significantly influenced by personal experiences of the users' in relation to the usability of functions provided, size of personal networks built with other users, and the number of services a user chooses to utilize. In order to evaluate the relationships between service users' value and a set of variables measuring their usage experience, the study applied multiple regressions on survey data.

The contribution of our paper is that it builds an aggregated model based on a previously established research framework of IT usage and network effects [4], [5], [6], [7], [8], [9], [10], [11], [12]. Using this model, it presents an estimation of a value function of service platform users. The value function is computed empirically from the analysis of survey-based consumption data of service platform users. As the business model of service platforms is dominated by advertisement-based, charge-free offerings, the paper suggests a value measure that takes into account this fact. The results of the analysis are used to discuss the extent of impact on service users' value due to the ever increasing provision of new service offerings, improvements in usability, and the ability to connect to a larger number of other users via the service platform.

In the following section, we will give a short overview of service marketplaces, approaches using network effect theory, the Unified Theory of Acceptance and Use of Technology (UTAUT), and related literature on value creation. Section 3 presents the model proposed. After describing the data collection in section 4, section 5 presents the results and discussion of the estimated data. Section 6 concludes the paper.

2. Related work

2.1. Software Service Markets

The term software services (services) is used to refer to software-as-a-service offerings that run on computing devices such as smartphones, tablet personal computer, and notepads. They are made available through service platforms or service marketplaces such as Apple App Store, Google Play Store, Windows Phone Store, BlackBerry App World, and Amazon App Store. The software services are downloaded from the platform to the users' devices, which run operating systems such as iOS, Android, Windows, and BlackBerry OS. The operating systems are free of charge or are obtained through a perpetual license. The software services are usually produced by third-party developers and are offered via the platform for a share of the sales price (e.g., for about 20-30%). Today, multiple OS-native and third-party software service providers operate in the service market. iOS and Android hold the largest shares in the market as they are adopted by more than 500 million users each [13]. In detail, App Store of Apple contained 775,000 services as of January 2013 [14], Google Play Store of Google has 700,000 services as of April 2013 [15], Window Phone Store of Microsoft 130,000 services as of February 2013 [16], and BlackBerry World of RIM offered 100,000 services as of March 2013 [17].

2.2. Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) focuses on identifying measures (factors, constructs) for a technology to be successfully adopted and used by the target market [7]. It is an integrated and updated presentation of the earlier Technology Acceptance Model (TAM) and the subsequent developments that have been made based on TAM [6].

2.3. Network Effects Theory

In empirical studies based on network effect theory, authors mainly put effort into proving the existence of network effects and estimating its value using regression analysis [18], [19], [20], [21]. Some of the studies use equilibrium analysis to explain problems such as market failure, competition, and path dependency of markets [2], [8], [9], [10], [11], [12], [22], [23]. Looking into these earlier studies of network effects, they provided a general theoretical framework showing responses of a potential market to an aggregated size of an installed base and complimentary products. Theories of network effects have also been adopted as value factors in web service markets in recent studies [4], [5].

2.4. Value Creation

Value creation describes the performance of businesses or the consumption decisions that increase the value of goods, services, or a business [24]. Creating value for a customer entails providing products and services that customers find consistently useful. In today's economy, such value creation is typically based on products and process innovation. Creating value for investors means delivering consistently high returns on their capital. This generally requires both strong revenue growth and attractive profit margins. These, in turn, can be achieved only if a company delivers sustained value for customers [24].

There have been a number of studies performed on the value creation process and value factors in platform-based markets in general [4], [25], [26]. A few studies also exist on IT service markets [5], [27], [28], [31]. These studies focus on value creation in e-business [4], adoption of mobile Internet [25], mobile service ecosystem [26], IT service platforms [5], [27], and on the evaluation of service platform business models [28], [31].

The theories of network effect and UTAUT are used in this paper as sources of determinants, explaining the value creation process. In constructing a service platform user’s value model, the paper employs two value drivers (namely installed base and complementary services), which have been introduced by the theory of network effects. In addition to this, the paper also adopts perceived usefulness and perceived ease of use from the UTAUT measures of usability.

3. Model Specification

3.1. Determinants of Value of Service Platform Users

Identifying the major value determinants is important for modeling the value creation in service platforms. For this, we examined studies on the Technology Acceptance Model (TAM), its extended versions, the Unified Theory of Acceptance and Use of Technology (UTAUT), network effect theories for information goods markets, and the adoption of network effects concepts. We found that value creation in service platforms could be explained using three determinants: usability, service variety, and installed base.

3.1.1. Usability.

Adopting the concepts of UTAUT [7], usability of a service can be described as the level of effort the user needs to access, understand, utilize the service platform and its offerings. It also entails the level, at which the service platform includes offerings that fulfill the user's functionality requirements. Usability of a service platform is enhanced by its functional and non-functional performance. Whether a user's experience meets the expectations determines the value of the user (Table 1). In this model, the value for perceived usability as a latent variable was obtained from the interaction of two proxy measures (Table 2). Those measures are the users' indication of their perceived level of usefulness (PER_USEFUL) and perceived level of ease of use (PER_EASE_USE) of their service platform [6], [7]. The reciprocal of the product (equation 1) is taken to represent the perceived usability of user i in the value model:

$$USAB_i = \frac{1}{PER\_USEFUL_i + PER\_EASE\_USE_i} \quad (1)$$

Table 1. Value determinants summary

Determinant	Definition	Source
Usability	Degree of performance of a system to accomplish the required functions as well as degree of difficulty to understand and use a system.	[6],[7]
Installed base	Quantity of existing users of a system.	[2],[4],[5],[9],[10], [11],[12]
Service variety	Quantities of services interoperable (compatible) with the system used.	[2],[3],[4],[5],[8],[29], [30],[9],[10],[11],[12]

3.1.2. Service variety.

Services, which run over the same service platform, are developed using a common standard. If a user adopts a service platform, the user is offered basic functionalities, enabling him to run further and complementing services. The existence of complementarities makes a product or service a more attractive offering to users [2], [4], [5], [9], [10], [11], [12], [29], [30]. The use of additional services could cost more for the user though. Therefore, the variety of services available determines the quantity of services and service categories a user has access to over this platform (Table 1). In this model, service variety accessed by the user is measured by the total number of services the user subscribed to or stored in their smart device (S_TOTAL) and the average number of services used per day (S_DAILY_USE)(Table 2). The number of services a user chooses to install and to use daily are assumed to indicate their valuation of the variety of services their service platform offers. We normalized the value using the maximum number of services expected to be installed and used daily. The resulting

level of use of service variety is in the range [0,1]. Therefore, service variety for user i is represented in the model as shown in equation 2:

$$S_i = \frac{\text{S\_TOTAL}_\text{i} * \text{S\_DAILY\_USE}_\text{i}}{Max(\text{S\_TOTAL}_\text{i} * \text{S\_DAILY\_USE}_\text{i})} \quad (2)$$

3.1.3. Installed base.

The installed base is the total number of a particular product or system in the entire market or product segment. However, when calculating the installed base of a market, it is important to exclude products that have been replaced by technology upgrades or are no longer in use. Therefore, the installed base corresponds to the size of the actual end-user base, indicating its popularity (Table 1). The installed base measure is particularly important if the adoption of a new product depends on a product (e.g., device, software) that is already installed in the market [11].

Table 2. Summary of variables and measures used in the value model

Variable	Measure	Description
Usability	Perceived Ease of use (PER_EASE_USE)	Level of ease, at which a user can discover, purchase, and utilize services on the service platform.
	Perceived usefulness (PER_USEFUL)	The ability of services offered on the platform in relation to the user's functional requirement.
Service variety	Number of services currently installed (S_TOTAL)	Total number of services the user currently has installed on his device.
	Number of services used per day (S_DAILY_USE)	The number of services the user uses frequently.
Installed base	Number of connections to other users (N_TOTAL)	Total number of contacts a user has stored in their communication and social media services.
	Number of active connections to other users (N_RECENT_INTER)	Number of other users the service user communicates with frequently.

In the context of service platform markets, one unit of an operating system activated corresponds to one user. The total number of devices with a certain operating system run by a single platform service user makes the installed base of the service platform. Current software service platforms are dominated by use scenarios which involve communication, collaboration, and exchange of information among users [5], [28],

[30]. Thus, the number of other users that a user can connect with on a platform is an important determinant.

Similarly, the installed base is represented by the number of total connections stored by the user (Table 2). The number of connections (N_TOTAL), which the user chose to make over their social media, communication, and entertainment services, is taken as the indicator of their valuation of the installed base. In addition, the frequency of interactions (N_RECENT_INTER) with a part of those connections is also considered. The installed base value is also normalized to generate a value in the range [0,1]. Therefore, we define the installed base for user i as shown in equation 3:

$$N_i = \frac{\text{N\_TOTAL}_\text{i} * \text{N\_RECENT\_INTER}_\text{i}}{Max(\text{N\_TOTAL}_\text{i} * \text{N\_RECENT\_INTER}_\text{i})} \quad (3)$$

3.2. Proposed Value Model

We construct a value model consisting of the determinants identified in the previous section. The model assumes that service platform users get value from their experience of usability of the service platform, the variety of services (functionalities) that they can utilize, and the number of communications (connections) that they can make with other users. When deciding on the adoption of a service platform, a user i is assumed to expect the value $V_i(USAB_i, S_i, N_i)$ of using the service platform to be greater or equal than the value of not using it. The value V_i is a function of $USAB_i$ (equation 1), S_i (equation 2), and N_i (equation 3).

To indirectly measure the value V, we introduce two more measures (Table 3), namely the time spent on using services (C_TIME) and the monetary cost of using services (C_USAGE). In detail, C_USAGE is the amount of money the user spent on purchasing services, fees paid for upgrading and access to content such as movies, music and games per day. C_TIME is the cost of time the user spends on using the service platform daily. The total cost, which is a function of C_TIME and C_USAGE, represents a lower bound to the value V that a user gets. A user would never use a service platform, if the value V were lower than the cost spent.

Table 3. Summary of the variable and measures used to estimate the user value in the model

Variable	Measure	Description
Total cost	Time spent on using services (C_TIME)	Amount of time a user spends on using services on average per day.
	Cost of using services (C_USAGE)	Amount of money a user spends on using services on average per month.

Based on these two measures of cost, the value of a user i can be estimated as shown in the following equation:

$$V_i(USAB_i, S_i, N_i) > \text{TOTAL\_COST}_i(C\_USAGE_i, C\_TIME_i) \quad (4)$$

where V_i, $USAB_i$, S_i, and N_i are defined as described above. $TOTAL\_COST_i$ is a function of C_USAGE_i and C_TIME_i. It calculates the sum of $\ln(C\_USAGE_i)$ and $\ln(C\_TIME_i)$.

Service platforms are dominated by advertisement-based service offerings. In such an environment using willingness-to-pay for service usage as the only indicator of value would undermine the results. Therefore, we add the cost of time the user spends daily utilizing services as well. Based on the user's annual income, we estimate their approximate hourly income and use it as the cost of one hour of time spent.

Based on this value model, multiple separate relationships between the platform users' value (estimated through the total cost) and the explanatory variables can be measured. The value model (equation 5) is based on an additive logarithmic function.

$$TOTAL\_COST = \beta_0 + \beta_1 ln(USAB) + \beta_2 ln(S) + \beta_3 ln(N) \qquad (5)$$

The coefficients β_0, β_1, β_2, and β_3 indicate the intercept and the amount of change in the total cost (i.e., the proxy for the value of service users) as a result of the change in one unit of usability (USAB), service variety used (S), and number of connections (N), respectively. It describes their individual relationship with the resulting value (TOTAL_COST), assuming the other variables constant.

4. Method

4.1.Data Collection

A user survey has been conducted from May 1st to May 31st 2013 to collect the data for the analysis. The survey was distributed to global smartphone users and administered online, through social media and email. Anyone, who owned a smartphone, was eligible to respond to the survey. The survey questionnaire included 26 questions:

In total, 183 responses have been received. The characteristics of our respondents are: 78 students (43%), 51 (28%) employees of private companies, 43 (23%) government employees, and 11 (6%) self-employed. It is clearly a small sample to represent the whole population of mobile service users. However, it includes a good distribution of possible behaviors of new and experienced mobile service users: 140 (77%) of which have been smartphone users for more than a year. The respondents of the survey were users of different service platforms: 46 (25%) Apple iOS users, 98 (54%) Google Android users, 7 (4%) Microsoft Windows Mobile users, 27 (15%) RIM BlackBerry users, and 5 (3%) users of other platforms. Among the responses received, 177 valid records are used in the analysis. Observations with 0 service usage per day were omitted. Table 4 shows the measurement types of the main variables collected by using the questionnaire.

Table 4. Types of data collected for each variable considered in the study

Variables	Measures	Measurement types used
USAB	PER_EASE_USE	Likert scale (1-5)
	PER_USEFL	Likert scale (1-5)
S	S_TOTAL	20 Intervals, Range (1-200)
	S_DAILY_USE	8 Intervals, Range (0-21)
N	N_TOTAL	15 Intervals, Range (1-1500)
	N_RECENT_INTER	10 Intervals, Range (1-100)
V (Value)	C_TIME	17 Intervals, Range (0-8)
	C_USAGE	6 Intervals, Range (0-25)

5. Data Analysis Results

5.1. Time Spent on Using Services

The peak frequency on time spent on services is the range 0.5 hours to 1.0 hour. 35 subjects (20%) indicated this range. The second highest frequency with 32 subjects (18%) is the range 1 hour to 1.5 hours. The distribution of the frequency on time spent has a lognormal shape (Figure 1).

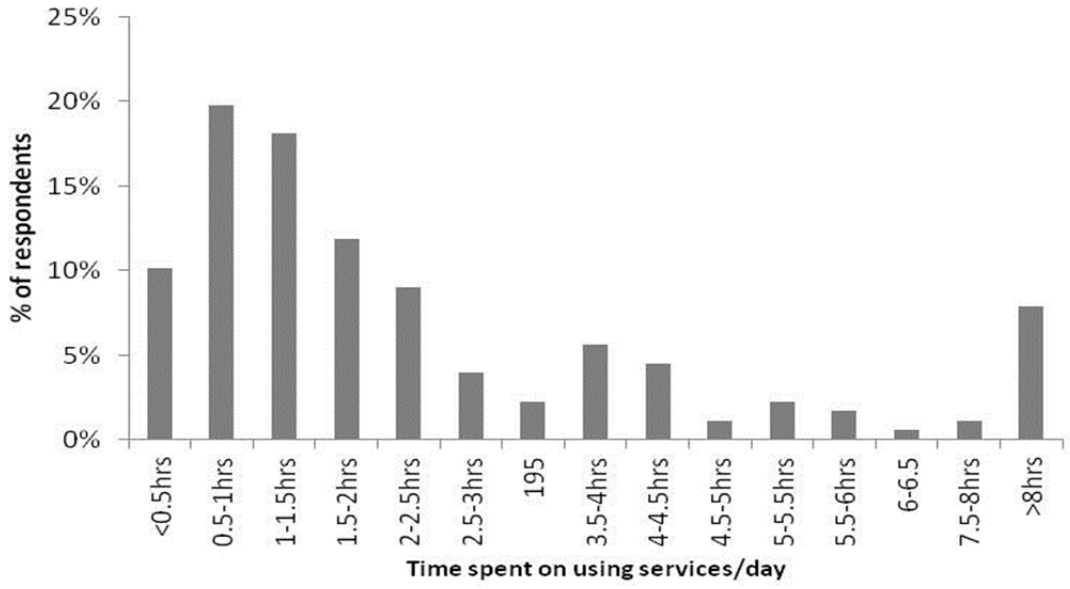

Fig. 1. Average time spent on using services per day

Only 71 of our respondents (31%) spent more than 2.5 hours a day on using any of the services on their smartphones.

5.2. Correlation

All explanatory variables (Usability (USAB), service variety (S), and installed base (N)), which have been identified in section 3, show positive correlations with each other as well as a significant correlation with the response variable (TOTAL_COST), representing the value to users (Table 5).

Table 5. Correlation between determinants and total cost

	USAB	S	N	TOTAL_COST
USAB	1			
S	0.66749	1		
N	0.49424	0.68236	1	
TOTAL_COST	0.47194	0.62693	0.60457	1

The strongest positive correlation (0.682) is shown between the number of services installed on users' smartphones (S) and the number of personal connections they have made over their communication and social media services (N). This correlation is in line with the fact that communication is the preferred functionality of services of many mobile platform users. The second highest positive correlation (0.667) is between usability of the platform (USAB) and service variety (S). In addition to this, TOTAL_COST (i.e., willingness-to-pay) and service variety show also a strong correlation (0.626). In general, these results confirm that users are willing to pay (through money and time spent) for communication with personal contacts and for service variety.

5.3. Estimation of Coefficients

Based on the data collected, we can estimate the coefficients of the model that is shown in equation 5 as follows:

$$TOTAL\_COST = 1.04 + 0.85\, ln(USAB) + 6.22\, ln(S) + 4.66\, ln(N) \quad (6)$$

As shown in Table 6, the explanatory power of the model is satisfactory with an adjusted R^2 of 0.44. The t-test detected statistically significant dependence of V on all 3 independent variables (USAB, S, and N). Both the F-test and P-value are sufficiently low to indicate good reliability of the model.

All of the estimated parameters have a positive sign. The estimated rate of change of V with respect to USAB, if S and N are fixed, is between -0.877 and 2.587, with respect to S, if USAB and N are fixed, is between 3.118 and 9.327, and with respect to N, if USAB and S are fixed, is between 2.484 and 6.837. The detail results of the regression are shown in Table 6 below. Service variety is estimated to be the strongest positive determinant of platform users' willingness to spend time and money on usage, if other factors are fixed.

Table 6. Model estimation results

Regression Statistics	
Multiple R	0.674
R Square	0.455
Adjusted R Square	0.445
Standard Error	1.758
Observations	177

	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	1.045	0.164	6.367	0.00	0.721	1.369
USAB	0.855	0.877	0.974	0.33	-0.877	2.587
S	6.222	1.573	3.956	0.00	3.118	9.327
N	4.661	1.103	4.226	0.00	2.484	6.837

While having a positive impact, a change on the level of usability does not cause a significant increase in the willingness-to-pay for service usage, assuming other factors fixed. Personal connections and service variety have been identified as the two important determinants for service platform users. The rate of change of the total cost in response to one level increase in the number of personal connections to other users is significant (4.661), assuming other parameters fixed. The same goes for service variety. In this case, the rate of change is even 6.222.

6. Conclusion

Motivated by the globally increasing attractiveness of software service platform use and the paralleled increasing interest of developers to offer more services over these platforms, this paper aimed at proposing a model explaining the value of software service platform users. We explained the relevance of the theoretical framework in service platform markets and analyzed their implications. We chose three explanatory variables: usability, service variety, and installed base. Each of those variables can reasonably contribute to the service users' value. The dependent variable, user value, is proxied (substituted) through the cost of time that users spend on using the service platform and the spending on purchasing and using services. This is reasonable to assume as the user value needs to be higher than the cost that is incurred to a user. Otherwise, i.e., if the return in user value were lower, the user would not use the platform at all. Therefore, the estimate gives a lower bound on the value.

Based on a survey conducted among smartphone users, we estimated the coefficients of the value model. Most of its explanatory power of the model resides in the variable service variety and the variable installed base. It is remarkable that their explanatory power is stronger than the explanatory power of the variable usability.

Though efforts were made to include subjects revealing all possible behaviors in relation to the variables of interest, this study has limitations due to a small sample size. Further studies could be conducted involving a more representative sample size.

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