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Evaluation of Value Creation in IT Service Platforms:

Analysis based on Simulation and Structural Equation Modelling

IT 서비스 플랫폼의 가치창출 평가:

시뮬레이션과 구조방정식 모형에 기반하여

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Netsanet Haile

Technology Management, Economics and Policy Program

College of Engineering

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Abstract

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IT service platforms allow users to build, discover, purchase and utilize services offered. As these platforms grow in their number of users and variety of services, it raises the question of whether this phenomenon continues to benefit all participants in this service ecosystem. Aside from striving to gain more customers, IT service platform providers need to maintain their existing users and services as active sources of value. This is because it is vital that all stakeholders can generate sufficient value to sustain their participation in the market.

For this research, we consider platform providers, service developers and users as the main stakeholders in the ecosystem of IT service platforms. The question to be addressed in this study is the nature and dynamics of value generated by these stakeholders. For this purpose, an interacting value creation model is constructed. The basis for the description of the values and their interrelationship is the identification of parameters. Based on these parameters, a model has been developed to help in inferring the relative impact of these parameters on the evolution of the IT service platform stakeholder values. Then, the model is evaluated using system dynamics simulation software. The results confirm the existence of a two-sided network effect. However in a maturing market, a larger participation of developers mainly benefits the service platform provider. Therefore, we can state that a large fraction of the value from two-sided network effects goes to the platform provider, although all stakeholders of a service platform benefit from a growing installed base of application users. This implies that users are the common source of value for all three stakeholders. Therefore, we investigate further the value model for IT service platform users.

Based on a literature review, the investigation of the user's value model identifies system usability, service variety and connectivity over the service platform to be the major determinants that contribute to the value offered to users. A structural equation model (SEM) is constructed from

six observed constructs reflecting the three determinants and value of the user. Relationships among constructs in the model are hypothesized based on the technology acceptance model, network externalities and utility theory. Co-variance based structural equation analysis using AMOS has been conducted based on survey data of 210 mobile service platform users. The results show positive correlations between all constructs confirming the hypothesized model and 49% of the variance in the value obtained by users has been explained collectively. Relatively, the individual determinants' contributions to explaining the value obtained is indicated as: services used (52%), connectivity (23%) and system usability (16%).

The evaluations of both the simulation and structural equation models show that users benefit the most from an increase in the number of services that they can use and the increase in connectivity to other users enabled by the service platform. Overall, this study contributed to research in the area of value creation and IT services. It also infers implications that can support service platform managers.

Keywords: IT service platform, value creation, system dynamics, two-sided network effect, IT business, SaaS, cloud computing, survey, SEM.

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Chapter 1 Introduction

1.1 Overall Introduction

As part of the phenomenon of interconnected industries (Gawer and Cusumano, 2002), an increasing number of industries today are organized around platforms through which multiple parties conduct transactions (Iansiti and Levien, 2004; Eisenmann, Parker and Alstyne, 2006; Boudreau, 2010). These platform-based markets are often viewed as two-sided because platform providers must get both consumers and providers (e.g., developers of complementary applications) on board to succeed. An example of such a market is a software market. Computer operating systems such as Linux, Mac and Microsoft Windows are among the earliest software platforms; later versions include web browsers such as Internet Explorer and Firefox. Examples of major IT platform providers in the market today include Microsoft, Apple, Google, Yahoo, Salesforce, Amazon, Facebook, eBay and YouTube. These service platforms provided the underlying technology and value system on which the entire service market ecosystem was built and transformed the way consumers and businesses find, buy and use services. Thus, the common feature of these

providers is that they serve as a common marketplace for application developers, content creators, advertisers, retailers and consumers.

Among the earlier successful providers of applications built by independent developers were companies such as Salesforce (Barros and Dumas, 2006). Following that experience, Amazon launched its software application services marketplace (AWS) in April 2012, an online marketplace that made it easy for customers to find, compare and immediately start using the software and technical services they need to build products and run their businesses (Amazon.com). The AWS marketplace, which offered providers of software built for the AWS platform, provided easy deployment, customer awareness, customer accounts management, and processing of payments. Google and Apple applied similar business models through Android and iOS mobile platforms, currently holding the two largest market shares in the software service market. The ecosystems of these marketplaces are composed of various interconnected businesses and consumers. Value creation is the core purpose and central process of the economic exchange (Vargo, Maglio and Akaka, 2008) among the participants of these ecosystems.

Value creation is any action that increases the worth of goods. Vargo and Lusch (2008) described value creation through services as "tied to value-in-use" in addition to value created at production.

1.2 Problem Description

The changes in the mode of production, delivery and ways of use introduce new challenges to determining their business value in IT service systems (Bieberstein et al., 2005; Demirkan et al., 2008). The major phenomenon in these IT service systems is the emergence of service platforms as common grounds integrating all activities of service creation, offering and use, becoming the foundation for both the technology and the marketplace. As a result, the need for evolution of value creation in IT services towards ways emphasizing the interactions in the ecosystem is required (Prahalad and Ramaswamy, 2004; Sarker et al., 2012; Payne et al., 2008). In this context, Spohrer et al. (2008) pointed out the need for creating value with intangible and dynamic resources to raise the quality and effectiveness of services.

IT service platforms often include a marketplace that represents a massive opportunity for service providers. This magnitude of potential raises the question of what kind of value it creates for the participants in the market. Many researchers have addressed the question of value creation conceptually (e.g., Brandenberger and Stuart, 1996; Bowman and Ambrosini, 2000; Amit and Zott, 2001). However, only a few empirical studies have been carried out, particularly on the distribution of value

among stakeholders. Furthermore, a particularity of value creation is that the roles of the providers and users are not clearly distinguished and value is continuously co-created (Vargo et al., 2008) through the interactions and integration in the ecosystems.

Previous literature of different theoretical points of view identified drivers of value in platform based technology markets. Specifically, studies that dealt with network effect theories emphasized the value generated by an increasing number of users (direct network effect) and an increasing number of compatible services (indirect network effect). However, a dynamic model of stakeholder values, which shows the impact of those drivers in the context of a certain marketplace, was not provided. The model provided by this study addressed this gap and in response to the market settings provided, it can show: 1) changes in the value of stakeholders as a result of changes in the determining factors; 2) changes in the value of stakeholders as a result of change in the value of another stakeholder; and 3) the dynamics of value of the stakeholders over time and comparisons of such dynamics.

1.3 Research Objective

This study proposes to fill the gap of a missing value dynamics model for IT service platforms by integrating existing literature on value determinants, theories of network effect and technology use. We aim to better understand the value propositions for the customers and the providers, to identify parameters explaining the service value and make inferences regarding the relative impact of these parameters on the evolution of the IT service platform business in general.

In detail, this study aims at proposing a value dynamics model for IT service platforms by integrating important knowledge from literature. Specifically, this study aspires to achieve a better understanding of: the stakeholders of an IT service platform, the determinants of the value created from offering and consuming services by these stakeholders, the nature of the value distribution among the stakeholders and its implications on the sustainability of the current value exchange methods. Based on a new model that is envisioned, the model aims at supporting business decisions such as selection of business models, service interoperability, as well as other future business strategies from the perspective of developing value.

1.4 Research Questions

Based on the objectives mentioned, a number of research questions are addressed in this study (see Figure 1-1). These research questions can be divided into two groups since the study is conducted on two levels. The first group of research questions addresses the IT service platform value system in general. The second group of research questions addresses the value obtained by software service platform users.

1.4.1 IT Service Platform Value System

In the context of the overall marketplace, the following questions addressed the value obtained by IT service platform stakeholders:

A1) What are the stakeholders and determinates of an IT service platform value system?

This question seeks to identify the stakeholders and determinants of their value. These components are identified through extensive review of academic studies conducted in relevant areas.

A2) What is the relative importance of the value determinants? To address this question, the identified determinants are compared for their relative importance.

A3) What is the nature of interdependence between values of stakeholders? A system dynamics model based on literature analysis addresses this question.

A4) What does the resulting value distribution look like? This question is addressed through a simulation of a system dynamics model composed of the stakeholders and their value determinants.

1.4.2 Software Service Platform User Value System

Focusing on the value obtained by the users, the study addresses the following additional questions:

B1) What are the determining factors of value for a software service platform user? The factors are identified through a literature review of previous studies.

B2) What are the relative direct and indirect impacts of the factors on the value obtained by the users? Coefficients for indicating these relationships are estimated from a structural model.

B3) What is the relationship between the factors? This question is addressed through a structural model of user value, which has been analyzed using a survey data to evaluate the importance of the factors to the users and the providers.

1.5 Methodology

As shown in Figure 1-1, to address the above research questions, a combination of methodologies was employed. The first step was to identify the relevant stakeholders and parameters of value of IT service platforms to be included in the analysis. To generate a well informed system model, documents related to platform service business processes, service developments and service use were reviewed extensively (Research Question A1, Figure 1-1). A model of platform service value system components and their interdependence was developed using system dynamic software. Causal loop diagrams were developed further into a simulation model to analyze the dynamic behaviour of a platform service system involving value creation and growth over time. Due to the lack of prior theories, an experimental approach (Eisenhardt, 1989) was used.

The relationship between platform value parameters is described using algebraic expressions defining one variable in terms of other

variables that are causally connected. The model has been assessed using values representing varying levels of service parameters: to identify the common important determinants (Research Question A2); how changes in stakeholders' values impact each other (Research Question A3); and the share of benefits to each stakeholder under the model's assumptions and analyzed scenarios (Research Question A4) (see Figure 1-1).

Due to the lack of the actual parameter values, intervals of assumed values are used in simulating and analyzing the problem. Analysis of the utility function reveals critical levels of utility that have particular value to the IT service platform provider. This information can be used to target particular markets with new offerings as well as to direct service development.

An empirical study was conducted to evaluate the value of users, as users were found to be the major sources of value creation for IT service platform providers, developers, advertisers and other service providers. The main factors of the user value were obtained through literature review (Research Question B1).

A survey questionnaire was designed and administered online among mobile software service users. Aimed at understanding the value creation for service platform users, a structural equation analysis was conducted using Amos software to estimate the coefficients of importance

for predicting the value to the users (Research Question B2) and among factors (Research Question B3) (see Figure 1-1).

Research questions A1 and B1 deal with identification of the stakeholders of the value system of an IT service platform and the factors that impact the values as the building components of a value model for such platforms. The chosen methodology for conducting this task was the review of previous studies. Research question A2 deals with finding out the relative importance of the determinants identified for their respective stakeholders and the IT service marketplace as a whole. Research question A3 aims to address the interdependence of the values of the stakeholders as components of a value system. To address these two questions, models of values of three stakeholders were constructed using inputs from the literature study conducted. The factors suggested by the research on platform based markets, web services and value creation were combined to construct utility models describing the current value system in the marketplace. Considering the lack of real data to evaluate this model and to generate information useful for decision making, simulation using some instances taken from the market is conducted. Simulation of these models addressed these questions by showing how much change is caused by the introduction of change in any of the factors included in the model. The higher the change that resulted in the value for all stakeholders, the higher was the relative importance of the factor under evaluation. The simulations

also showed the impact of a decision by a stakeholder in relation to the level of the value received on the value of other stakeholders by determining their interdependence. These impacts are shown by simulation of changes in the factors in relation to such decisions, i.e. arrival rates of users and developers and pricing of services. Research question A4 aims to assess how the benefits from such markets are distributed among the stakeholders by comparing the changes in value resulted from the simulation.

Research questions B2 and B3 aim to account for the personal variations in decisions of users regarding the factors identified earlier; the impact of the factors on the value received by users; and the interdependence between the value factors identified under circumstances where individual users make personal decisions. Therefore, a user survey was chosen to be the appropriate method to capture such data. To address research questions B2 and B3, the data collected was compared to existing theoretical relationships of the identified factors with user value as well as among factors (hypothesis testing). As the appropriate method for such evaluation, this was performed using a structural equation modelling technique.

Review of existing literature is the method used for identifying factors that have been well tested and theoretically established. Therefore in this study, previous studies were reviewed to identify determinants of

value and stakeholders as well as their relationships, which have been used as the theoretical basis for this study. The outputs of the literature review were used to build the models that have been evaluated by the simulation. System dynamics simulation is the most appropriate approach for evaluating the outcome of multiple models simultaneously over time and considering the lack of real data. Following up the result of the simulation, which showed users as a main source of value in the IT service platform market, a survey was used to analyze the drivers behind a user's decision to use a certain software service platform. Among the three stakeholders considered in this study, the users were more diversified in relation to the decisions they made and their impact on the value generated by the IT service platform. Therefore, an empirical data reflecting those decisions was found to be important and a user survey was the appropriate method.

In the proposed system dynamics model, increasing the number of services used continuously increased the user's utility as it increases the number of functions to be executed. Similarly, the analysis of the survey results showed that the number of services used by the users strongly predicted their decisions to spend their time and money on using the platform. In line with limited change in utility due to quality of service, system usability showed the weakest association with the users' willingness to pay.

In the concluding chapter of the study, business implications of the findings for service platform providers and developers are presented and the theoretical contribution of the study is stated. The limitations of the study and suggestions for future research are also given.

1.6 Contributions

This work contributes to the existing knowledge of value creation by providing a framework for evaluation of value sources and their roles in promoting improved value creation and distribution. It also adds to a growing body of literature on IT service platforms in particular and platform based markets in general.

The analysis of the stakeholders' value model showed the installed base of users to be the major value determinant and that platform providers appeared to benefit the most from the current value exchange schemes practiced. These findings enhance the understanding of the current value distribution in the market.

The results of the evaluation of the users' value model indicated that the variety of services and connectivity of users were the most important value factors. The model showed the existence and level of incentive for the stakeholders to participate in the ecosystem over time. It also showed

the interaction between the stakeholders. The model can help decision makers to identify the optimal setting of the system and understand the behaviour of the market system.

This research can serve as a basis for future studies by providing a review of the state of the art in the area of service platforms. It offers information on the value creation process in such markets and what has been done so far to address the related problems. It also provides a theoretical model based on the understanding that is available so far.

1.7 Research Outline

The structure of the study is as follows. Chapter 2 is the state of the art chapter that highlights the value creation potential of the market, and that explores the sources of value creation in the related literature of service markets. We review a selected set of relevant articles about the IT service platform market place, the ecosystem and existing practices. The theoretical frameworks of value creation and network externalities used in the study are also included in the chapter. In Chapter 3, the value creation in IT service platforms through two-sided network effects is presented. The proposed value model is developed and evaluated. The components of the model are identified and their relationships are proposed and tested. In

Chapter 4, a structural analysis of the value of users in software service platforms is presented. The succeeding empirical procedure evaluates the value of users. In Chapter 5, a brief discussion and conclusion are given. In this chapter, the study concludes with implications of the results, the limitations of the study and the opportunities for further research.

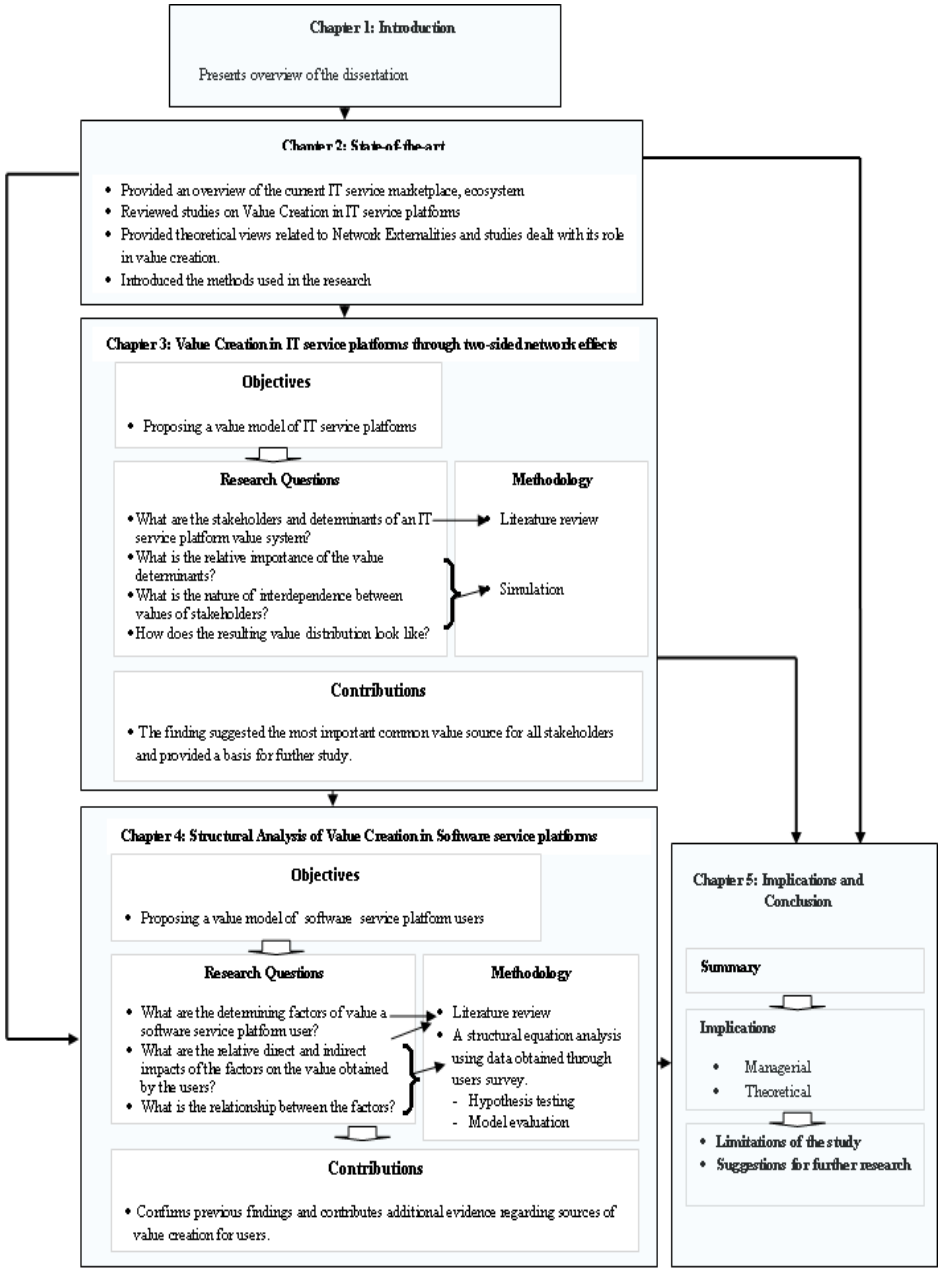

Figure 1-1 Thesis structure

Chapter 2 State-of-the-Art

2.1 IT Service Platforms

IT service platforms are an integration of multiple technologies and business functions to deliver a seamless experience for the customers. They include three defined service roles. Infrastructure as a service (IaaS) provides a virtualization layer of computing resources that are available on demand like Amazon EC2. Platform as a service (PaaS) provides a development platform for building and running applications; examples are Force.com and Google App Engine. SaaS offers applications to be used over the service platform with “pay as you go” pricing, mostly serving as a marketplace for applications; examples are Salesforce and Amazon web services. In most of these cases, these providers play more than one of these roles.

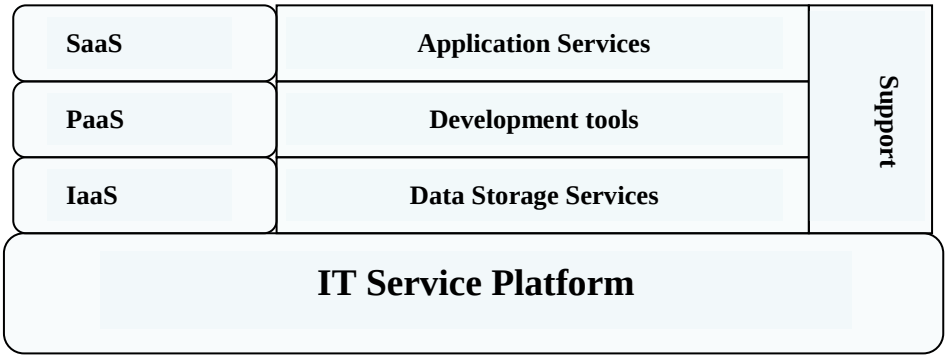

Figure 2-1 IT Service Platforms

2.1.1 IT Service Ecosystems

The service platform ecosystem consists of three major stakeholders. Advertisers are also a part of the ecosystem; however, they are not discussed in this study.

2.1.2 Platform Service Providers

Platform service providers deliver a computing platform and solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. They facilitate deployment of applications by providing and managing the underlying hardware and software layers. Platforms enable developers to create and deploy applications and provide access to other services such as billing and advertisements. The platform service provider

offers the same set of development tools to its customers with no reproduction cost. More customers can be attracted by the number of business processes they can integrate on the platform. In this case, the variety of application services that a platform can provide indirectly drives its adoption among customers.

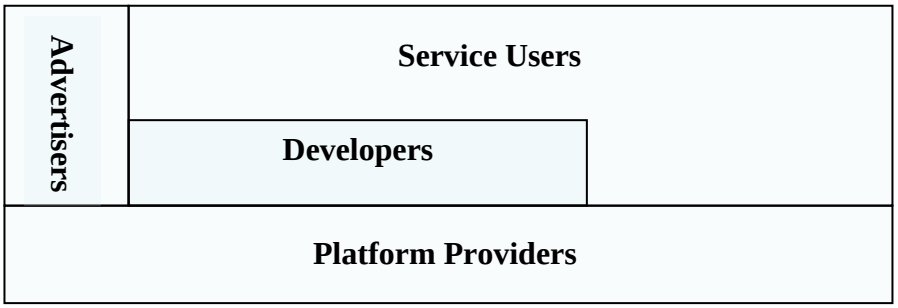

Figure 2-2 Platform Service Ecosystem

2.1.3 Application Service Users

These are the enterprises or individual users of applications provided through a platform. Examples of supported functions are business process management, social networks, search engines, market place, entertainment, etc. Enterprises with various business processes can gain more from using platform services than running multiple in-house applications in parallel, maximizing the value from their existing IT budget.

2.1.4 Application Developers

These are the businesses or individual programmers who use the development kits provided by the platform service providers to create service applications for deployment on the platform or for use in their own organizations. Enterprise customers and application developers can update and customize applications based on changing requirements to run cheaper and faster on platform services.

2.2 Value in IT Service Platforms

2.2.1 Value Creation

2.2.1.1 Characteristics of value creation

Developments in service technologies, specifically in changes in delivery mode and the ways of use, reinforce a new way of thinking about the nature of the value that technologies generate for their stakeholders (Bieberstein et al., 2005). The main distinguishing feature of service platforms from traditional software markets, in addition to delivering end user services, is the provisioning of an environment for service developers

to build functionality and deliver it as services to end-users. For example, IT service platforms can target different user groups by designing specific pricing models with service bundles fitting the usage scenarios preferred by different user groups.

In terms of capabilities for value creation, the characteristics of service markets are also different than those of traditional IT markets. In today's service business environments, service providers can no longer rely on simple comparisons of features, technical functions and prices of their products with those of competitors in determining their competitive advantage in the market. Value created through service integration, user generated content and user networks has a significant impact on the total value generated by all market participants. Therefore, these additional factors need to be considered for the value creation analysis as well.

Summarizing, these unique characteristics result in new ways of value creation. Consequently, evaluation approaches need to consider these circumstances to properly identify the competitive advantages of providers.

2.2.1.2 Theoretical frameworks of value creation

Theoretical value creation frameworks for e-businesses and, in particular, for service platforms have been proposed in recent literature (Amit and

Zott, 2001; Lee et al., 2010; Smedlund, 2012; Iansiti and Levien, 2014; Gawer and Cusumano, 2008; Kim et al., 2010, 2011). A study of value creation in the general context of e-business was conducted by Amit and Zott (Amit and Zott, 2001) that identified dimensions of value creation and provided evaluations of different business models of service platforms. User-created value was discussed by Lee et al. (Lee et al., 2010) and research on value transformation in mobile service ecosystems was done by Smedlund (Smedlund, 2012). However, an evaluation of the effects of the platform value on its stakeholders, which is important for any business decision, has not been achieved with these frameworks. Hence, more sophisticated definitions of value factors and their measurable parameters are required.

There have been a number of studies performed on the value creation process and value factors in platform-based markets in general (Amit and Zott, 2001; Kim et al., 2007; Basole and Karla, 2012). A few studies also exist on IT service markets (Lee et al., 2010; Haile and Altmann, 2012; Smedlund, 2012; Gebregiorgis and Altmann, 2012). These studies focused on value creation in e-business (Amit and Zott, 2001), adoption of mobile Internet (Kim et al., 2007), mobile service ecosystems (Basole and Karla, 2012). IT service platforms (Lee et al., 2010; Haile and Altmann, 2012) and on the evaluation of service platform business models (Smedlund, 2012 ; Gebregiorgis and Altmann, 2012).

Conclusively, we can state that these research works did not fully explain the value system of IT service platforms in terms of all relevant parameters, the stakeholders involved and the value exchange between the stakeholders. This research aims at addressing this gap by introducing a new value creation framework for IT service platforms, which can provide a useful tool to service providers and policy makers. As the framework helps explaining the value of service offerings to application service users, service developers and platform providers, it can also be used as decision support for investments in service offerings and platforms, design of business models, service bundling policies and market structure evolutions.

2.2.1.3 Factors of IT service platform value

Determinants of service value dynamics are the economic variables and the critical factors of revenue and cost functions of a service. They embody the potential for a service provider's competitive advantage. These factors enable enhancing the value created by the participants in a business model, the service provider, its partners and its customers (Brandenburger and Stuart, 1996).

The central purpose of service-oriented technologies like IT service platforms and their management is delivering value added services to the

customer (Cai et al., 2008). In relevant literature, the terms “source of value” and “value driver”, which in many cases are used interchangeably, refer to factors that enhance the total value created by a business, i.e. the sum of all values that can be appropriated by the participants in business transactions (Brandenburger and Stuart, 1996; Amit and Zott, 2001). Based on an empirical study that investigated the potential value sources of virtual markets, Amit and Zott (2001) proposed the value creation potential of e-business to be based on four dimensions: efficiency, complementarities, lock-in, and novelty. In the context of e-business value creation opportunities, value can result from combinations of information, products and services, innovative configurations of transactions, and the reconfiguration and integration of resources, capabilities, roles and relationships among suppliers, partners and customers (Sääksjärvi et al., 2005).

The peculiar characteristics of IT service markets determine how value-creating economic transactions are structured and conducted. Amit and Zott (2001) identified such attributes of e-businesses that also describe IT services. IT service platforms provide an easier and improved opportunity to extend services offerings to a variety of complementary services and access to supporting resources, capabilities and technologies.

They also innovate the ways of integration among service providers and potential customization of products and services.

To gain a better understanding of the value creation process in platform service value provision and use, we will provide a taxonomy of the factors of platform service value. This taxonomy is the result of an extensive literature review on the subject. Researchers strived through time to identify the factors responsible for successful deployment of an innovation or failure originated from the state of the market or customer behaviour.

Quality of service: This determines the users' valuation and adoption decision. Liebowitz and Margolis (1994) argued that service quality is the most important factor that determines the market leader in the platform market by citing the case of Microsoft as an example.

Service variety: Availability of service variety accessible to the users of a platform is also a much discussed factor in this area. Because of the increasing returns of scale in the provision of software, the owner of a personal computer will find a greater variety of applications for similar machines if more computers are sold using the technology. The user also benefits from the ability to exchange programs and files with other users of compatible machines and from superior service that may be available for the computer technology with the larger installed base of machines

(Katz and Shapiro, 1986). In this case, the chain of cause-effect relationships is longer and the positive feedback loops more indirect. Platforms are characterized by the presence of indirect effects: the larger the number of users, the more firms are willing to join, thus increasing the diversity of applications available, which in turn raises users' valuations of the platform. Networking of services considered as the economic value driver (Zhu and Iansiti, 2012, Yoo et al., 2002).

Installed base: The existing number of customers or users of a product or a service, or a compatible product or service, has been one of the most investigated factors in this regard. As Katz and Shapiro (1992) stated, the size of the existing user base of a service has been long considered an object of competition. Studies as early as Katz and Shapiro (1985) focused on identifying and evaluating factors that affect the emergence of a successful platform among competing alternatives. Farrell and Saloner (1986) also studied the adoption pace of new technologies depending on their relative cost and the size of the installed base. The implications of networks for value creation have been discussed by network theorists. Granovetter (1973; 1983) suggested that the size of networks and the variety of their connections has a positive effect on the availability of valuable information to the participants within that network.

Cost: User expenses associated with adopting a certain platform service are mainly in the form of user fee. In the context of platform services, prices are set based on the customer's willingness to pay, which is a factor of the usefulness they expect and the service reliability, mostly indicated by the platform's market share.

Table 2-1 Summary of Factors of Value as Described in Literature

Factor	Source	Findings
Installed base	(Katz and Sahipro, 1985; Shiling,1999; Zhu,(2007)	- There are many products for which the utility the user derives increases with the number of other agents consuming the good. There are direct and indirect sources of these positive externalities. - Path dependent nature of technology trajectories, and the self-reinforcing effects of installed base and complementary goods.
Service Variety	(Farrell and Saloner, 1986; Church and Gandal,1992; Economides,1996; Shiling,1999)	- The provision decision by software firms determines the value and market share of competing technologies. When consumers place high values on software varieties, there is a certain amount of standardization by the market. - The benefits from compatibility create demand side economies of scale. -In a market with network externalities, the market leader has incentive to invite more entrants to adopt its technology free of charge or provide them with subsidy.
Service Quality	(Liebowitz and Margolis,1994;, Evans, 2003; Chang et al., 2009; Rangan and Adner, 2001; Liebowitz, 2002)	- Quality of service determines the value of users.
Cost of use	(Farrell and Saloner, 1986; Church and Gandal ,1992; Bensaid and Lesne,1996)	- High expected sales increase the willingness - In the presence of compatibility benefits a user who switches to a new technology can't obtain full benefit unless other also switch. (switching cost) - Positive network externalities allow the monopoly to commit itself credibly to increasing future prices. -Free licensing suggested as a product strategy for innovators because it generates an installed base.

2.2.2 Value Exchange

The value exchange between the stakeholders can be direct and indirect utility and business values. Platform service providers offer the application service users the services they need such as social networks, communication, search engines, entertainment, market places, computing or storage directly or the environment to use third party applications and services. In return, they collect fees or use their installed base to provide advertisement services, which is the main source of revenue.

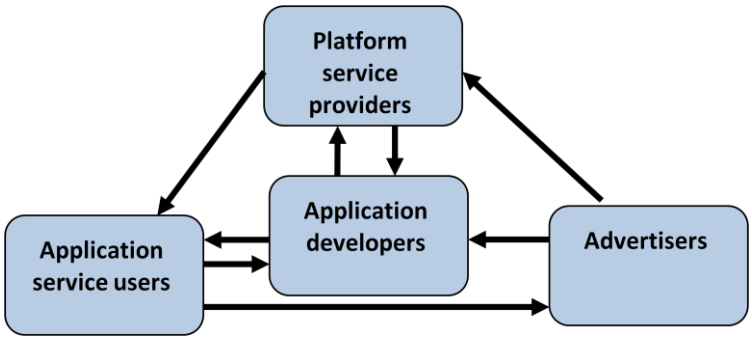

Figure 2-3 Value Exchange in Service Platform Ecosystem

Their value exchange with the application developers is providing a development and deployment environment as well as storage services for exchange fees. Application developers provide their applications to the

end users for a subscription fee or free services where they obtain advertisement revenue from the advertisers.

2.3 Network Externalities in IT Service Platforms

2.3.1 Definition and Types of Network Effect

Network effect was defined by Katz and Shapiro (1985) as the increase in utility that a user derives from consumption of a good with the number of other consumers of the same good. Similarly, Liebowitz and Margolis (1994) defined it as the change in the benefit an agent derives from a good when the number of other agents consuming the same kind of good changes. Relevant literature divides network effect into two ways: as both direct and indirect effects based on the possible source of the effects.

It is considered as a direct effect when generated through a direct physical effect of the number of purchasers on the quality or attractiveness of the product. Conversely, indirect effects are believed to give rise to consumption by motivating the availability of compatible products and services, thereby increasing the utility of the consumers. Clements (2004) did a comparison of direct and indirect effects, claiming their influence on technological standardization to be quite different. Liebowitz and Margolis

(1994) also demonstrated that the two types of effects will typically have different economic implications. Examples of such effects are a direct positive feedback loop in telephone networks and an indirect positive feedback loop in the network of PC users (Bansler and Havn, 2004).

The basic assumption behind direct network effects is that consumers value being part of a large network, i.e., using a technology that many other consumers also use. Models of direct network effects have been used to answer several kinds of questions. Katz and Shapiro (1985) analyzed network effect markets by examining the impact of network effects on competition and the form of the market equilibrium as well as on compatibility decisions among firms.

These studies stated network effects give rise to demand-side economies of scale and consumers must form expectations regarding the size of competing networks. Similar studies were also conducted by Farrell and Saloner (1986b, 1988, 1992) and Economides and Flyer (1997) on the effects of compatibility on competition and incentives for standardization. Farrell and Saloner (1985, 1986a) and Katz and Shapiro (1986) considered the implications of network effects and compatibility for technology adoption and R & D investment.

2.3.2 Two-Sided Network Effects

Two-sided platforms have been extensively studied in interdisciplinary literature of economics and information technology. One of the main issues brought up in such literature is the impact of demand-side economy of scale (network effect) on competition, market equilibrium and compatibility decisions (Katz and Shapiro, 1995; Liebowitz and Margolis, 1994; Farrell and Saloner, 1985; Climents, 2004; Economides, 1997). In determining the economic value of networked services such as IT service platforms, the role of network effects was described as an important value driver by these previous studies. As direct network effects, value generated from the number of existing users of a service, indirect network effects and value built by the availability and interoperability of complimentary products are also well-developed concepts in network economics. The double impact of both effects is explained through two-sided network effects.

Two-sided network effects have been considered a source of value in traditional software markets. Users and providers experience value growth due to such effects. In the traditional software industry, Microsoft Windows is a very good example of the significance of two-sided network effects. Microsoft built a platform business model that utilized indirect network effects. The more Windows applications are available, the more

reasons for a user to choose Windows and the more reasons for developers to build applications for Windows.

However for IT service platforms, interconnecting users and services integration are more important factors than in traditional software markets. Service platforms can reach a large number of users and developers much faster. An example of this is the rise of the social network platform Facebook. A few studies have been performed in this area (Bieberstein, 2005; Amit and Zott, 2001; Lee et al., 2010; Smedlund, 2012). However, a comprehensive system model showing the stakeholders as well as the interdependence of their utilities has not been developed so far.

In earlier studies, researchers examined two-sided network effects in the context of home videocassette recorders (VCRs), DVD players, personal digital assistants and home video games (Gandal et al., 2000; Ohashi, 2003; Shankar and Bayus, 2003; Park, 2004; Venkatraman and Lee, 2004; Clements and Ohashi, 2005; Stremersch et al., 2007). All of these studies, with the exception of Gandal et al. (2000) and Park (2004), relied on static frameworks. Park (2004) modelled network effects assuming that consumer utility is a function of the installed base of consumers in movie markets, but did not consider movie variety in the model. A recent study addressed the presence of direct and indirect utilities in the context of services, in particular the role of mobile app

stores in application delivery environments (Basole and Karla, 2012). Zhu and Iansiti (2012) examined the relative importance of platform quality, indirect network effects and consumer expectations on the success of entrants in platform-based markets. They developed a theoretical model and compared the importance of these factors. Their findings stated that the success of platforms depended on the strength of indirect network effects and the users' expectations regarding future services.

In empirical studies based on network effect theory, authors mainly put effort into proving the existence of network effects and estimating their value using regression analysis (Hartman and Teece 1990; Church and Gandal 1992; Gandal 1994; Economides and Himmelberg 1995). Some of the studies used equilibrium analysis to explain problems such as market failure, competition and path dependency of markets (Katz and Shapiro, 1985, 1986, 1994; Farrell and Saloner, 1985, 1986; Arthur, 1989; Besen and Farrell, 1994; Liebowitz and Margolis, 1995). 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 complementary products. Theories of network effects were also adopted as value factors in web service markets in recent studies (Amit and Zott, 2001; Lee et al., 2010). Our analysis considers dynamics on both sides of the platforms.

2.4 Analysis Methods Applied

This study employs development of models of a platform service value system components and their interdependence. Causal loop diagrams are developed further into a simulation model and are used to analyze the dynamic behaviour of a platform service system involving value creation and growth over time. The parameters of the model were obtained from an extensive review of previous research works. Then structural equation modelling procedures are used to analyze the value of software service users.

2.4.1 System Dynamics

The general approach used in this research to model the dynamics of IT service platform value to stakeholders is system dynamics. This is an aspect of systems theory that is a method for understanding the dynamic behaviour of complex systems. It is a methodology and modelling technique for framing, understanding and discussing complex issues and problems. System dynamics is currently being used for policy analysis and design. The basis of the method is the recognition that in any system,

relationships among its components is often just as important in determining its behaviour as the individual components themselves. For further details of this approach to system dynamics, see Forrester (1961) and Sterman (2000).

System dynamics modelling is useful for understanding the underlying behaviour of complex systems over time, taking into account time delays and feedback loops. Developing the design for an IT service platform value system required extensive modelling, which was carried out using system dynamics software.

2.4.2 Structural Equation Modelling

Structural equation modelling (SEM) is a technique used for testing and estimating causal relations by combining empirical data and qualitative causal assumptions (Pearl, 2000). It is recommended for theory testing and theory development. SEM is used for confirming theories by representing the theoretical assumptions (hypotheses) in path diagrams or causal models. Then the models get tested against the empirical data. One of the capabilities of SEM is that it enables constructing latent variables (Loehlin, 2013), i.e. variables that cannot be measured directly but are estimated in

the model through other measured variables. Factor analysis, path analysis and regression analysis can all be conducted by SEM simultaneously.

2.4.3 Measures of Value

Utility maximization behaviour (expected utility theory) (Tversky, 1979) assumes transactions occur when the consumer's expected utility of consuming a good or a service is larger or equal to not consuming the good or service. Despite the debates regarding feasibility of measurements the willingness to pay (WTP) is a well accepted indicator of individual's valuation of goods and services in market research and in the public sector (Coursey et al., 1987; Mitchell et al., 1989; Shogren et al., 1994). In economics, WTP is the maximum amount a consumer would be willing to pay for consuming any goods, and is assumed to be constrained by an individual's wealth. Several methods have been developed to measure consumer WTP. These methods can be differentiated whether they measure consumers' hypothetical or actual WTP and whether they measure consumer WTP directly or indirectly.

In this study, we measure the actual WTP directly from a consumer survey of mobile service platform users.

Chapter 3 Value Creation in Application Service Platforms Through Two-Sided Network Effects

3.1 Introduction

Service platforms provide an enabling technology for the development and provision of application services in service-oriented environments. Examples of these service platforms are Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS) platforms. Service platforms are where the two sides of these services come together to participate in the market. Service platforms provide the market participants with different values. The values offered to the participants are different but interrelated, creating a complex value system.

IT service platforms are becoming the founding infrastructure of today's digital economy. They enable the achievement of economies of scale and scope quickly, making the speed of adoption, size of customer base, diversity and number of application services offered more important value drivers in such markets. Looking at an example of mobile platform providers such as iOS and Android, more than 700,000 applications

services have been offered to more than half a billion customers. There has been a close and dynamic competition for market leadership. While more and more application services continue to be offered, very little studies have been done to determine what values these offerings actually generate to the stakeholders involved. Therefore, there are inevitable challenges faced by service platform business managers to measure the value of services (Demirkan et al., 2008; Gebregiorgis and Altmann, 2012). An understanding of the structure of value creation and distribution is one major step in approaching such challenges.

Even if there are more and more application services developed and offered to the users, the number of new application users and their capacity to use these services determine the long term incentive for service platform providers and developers to participate in the market. Therefore, sustainable service platform business requires service platform providers to continuously innovate new ways of enabling active value exchange between the stakeholders. Understanding the distribution and dynamics of the value service platforms generated for the multiple market participants can be the basis for such business innovations. To that effect, this research deals with the issue.

In the course of achieving its objective, this study identifies four service value parameters explaining the net value that an application service generates to a stakeholder of a service platform. The study

considers three stakeholders in this context: a service platform provider, service developers and application service users. The four service value parameters, which are quality of service (QoS), service variety, installed base (i.e., number of users) and cost, are integrated into additive utility functions representing the value for the respective stakeholders. The utility functions enable evaluation of the value creation and distribution of a service platform. For the analysis of the relative changes of values for platform stakeholders, a simulation technique (system dynamics) was used. The analysis results imply that the value obtained by service developers is quite low in comparison to the platform provider. In a mature market, where more and more new services are offered, the major beneficiary becomes the platform provider. In the face of limited usage capacity and increasing difficulty to discover app services, the value for the application service users experiences little to no change in their benefits. Under these circumstances, service developers face the most difficulty in generating value. This indicates a risk that developers will withdraw from the platform market, causing a market failure.

The outline of the remainder of this section is as follows: subsection 2 presents the description of the proposed model, followed by the simulation settings and results in subsection 3. Subsection 4 concludes the argument with a brief discussion and summary.

3.2 Proposed Service Value Model

The value creation model we propose in this section involves identification of major stakeholders, the parameters which determine the nature of values generated by the stakeholders and a methodology for measuring the values. Therefore, the model is developed in three steps: stakeholder specification; value parameters and their effect on stakeholders; and the quantification of the values generated.

3.2.1 Identifying Stakeholders

As stakeholder theory (Freeman, 1984; Mitchell et al., 1997) suggests, we identify in this section the group of customers and providers who are affected by and can affect the value system of service platforms.

In the service platform ecosystem, we can identify the roles of service development, consumption and establishing a market place where services are offered to customers. Corresponding to these roles are the main stakeholders who participate in the value creation in service platforms.

Service platform providers establish the market place and enable the value exchange between their two group of customers. A service platform

provider offers an environment in which different types of third-party services (e.g., social network, communication, search engine, entertainment, market place, computing and storage) can be executed. A platform provider also plays the role of an intermediary between a service developer and service consumers; this enables service discovery by prospective customers and potential integration with other services.

In the context of this research, both service developers and platform service providers play the role of service providers since they own their respective services and are responsible for implementing and maintaining them. Nevertheless, they will be treated as two different stakeholders as they are at different positions in the service provision ecosystem.

Service developers are stakeholders who are the consumers of service development and deployment offers by service platforms as well as developers of the application services offered by service platforms. They take on the role of producing and publishing services that are ready to be executed. Service developers, who are software vendors or individual programmers, use development kits provided by the platform service providers to create service applications (e.g., social network services, communication services, search engine services, entertainment services, market place services, computing services, storage services) to be deployed on platform services.

Application users are identified as stakeholders who are the consumers of services developed and offered over service platforms. They are users of services offered by application service developers and platform service providers. Application service users aim at accomplishing a certain task through the use of an application that matches their requirements.

Application users and service developers have been identified in previous literature (Altmann et al., 2007). Even if there are other terms used to identify any of the stakeholders, such as brokers, service integrators and content creators, their roles ultimately fall under one of the above-mentioned three roles of stakeholders, which makes our stakeholder identification more comprehensive.

The value exchange between these stakeholders can be direct (i.e., direct payments for services offered and used) or indirect (i.e., revenue through advertisement), resulting in net utility for users, profit/loss for the IT platform provider, and profit/loss for service developers. The relationships among these stakeholders, which are based on a literature study, are depicted in Figure 3-1.

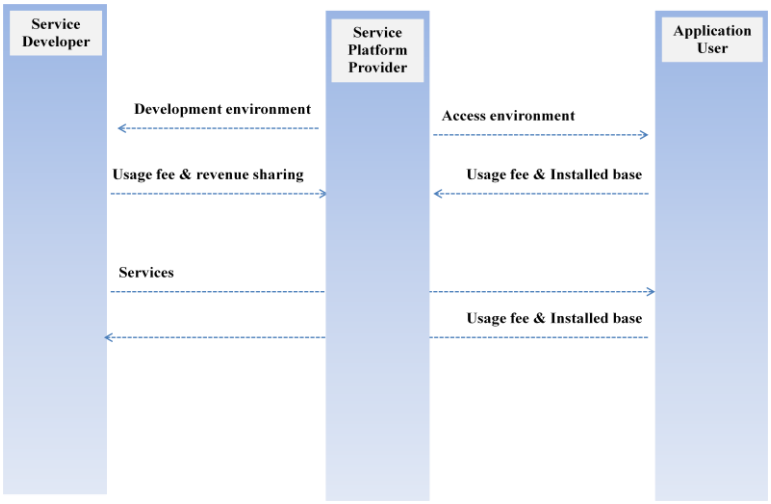

Figure 3-1 Value Exchange of Service Platform Stakeholders

The value exchanged between a platform service provider and service developers comprises the provisioning of deployment and service provisioning environments in exchange for cash fees or a share of the developers' revenue obtained from their respective users. Service developers provide their services to application users for a subscription fee or free of charge but with advertisements. To both platform providers and service developers, the application service users are the major source of revenue. This revenue comes from subscription and usage based charges or from using customer profiles for selling advertisement services.

In summary, the ecosystem of an IT service platform might involve more players such as advertisers, telecom providers (ISPs), shareholders of companies, consultants, policy makers, advertises and integrators.

However, the platform provider, the service developers and users are chosen as the main actors of the value system in service provision and usage as they are directly involved in the value exchange.

3.2.2 Value Parameters and Their Effect on Stakeholders

Service value parameters determine the value obtained by participants. They indicate the source of the values that have been generated from using the service platform. Understanding the impact of these parameters is important to platform providers for formulating their business policies. Existing theoretical frameworks have compared single factor value drivers and identified their interdependence. (Amit and Zott, 2001; Lee et al., 2010)

Based on those theoretical frameworks and concepts, this study presents a consolidated set of measurable parameters. For building the value creation model proposed in this study, we consider quality of service (QoS), service variety, installed base, and cost. They are used for quantifying stakeholder values and to construct the value creation model proposed in this research (see Figure 3-2).

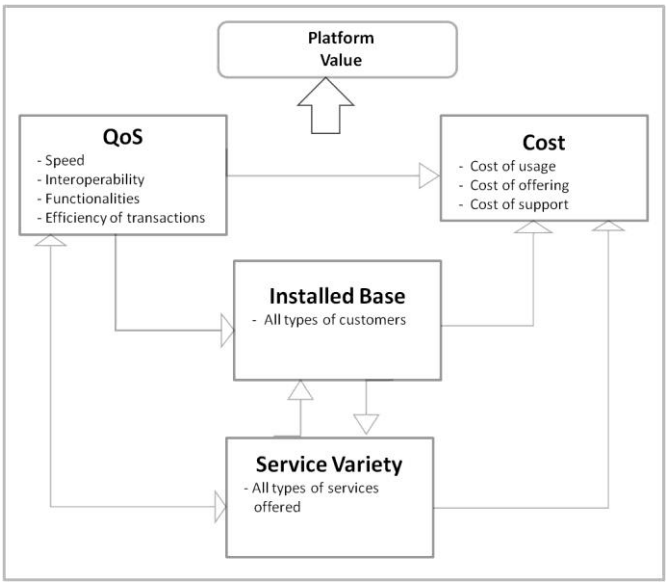

Figure 3-2 Service Value Parameters of Service Platforms

As shown in Figure 3-2, QoS impacts the number of customers and the number of services that a service platform can attract (Liebowitz and Margolis, 1994; Evans, 2003). QoS is also a major factor in the cost of service development and provision for service developers and platform providers. The installed base impacts the number of service varieties to be provided through attracting more developers to join the platform (Zhu and Iansiti, 2012). However, the installed base also causes increases in the cost of supporting customers. The service variety changes the total cost of offering, cost of support, and the QoS experienced by the end users, and ultimately influences the number of customers attracted.

Besides describing the value parameters in detail in the following subsections, we also explain how they impact each of the three stakeholders (Figure 3-3).

3.2.2.1 Quality of service

QoS measures the functional capabilities of services. It indicates whether the functionality, interoperability and performance of a service are up to the requirements of the users and meet the intended service level objectives. With respect to software, it should be noted that QoS also considers the quality of data that is returned by an application (Agarwala et al., 2006). QoS is an important factor in driving the value of products. There are cases where late entrants managed to take the market leadership from incumbents by offering a better QoS (Liebowitz and Margolis, 1994; Evans, 2003). Similarly, the value obtained by IT service platform customers is also determined by the QoS they are offered (Figure 3-3). The QoS offered by a platform provider can be constant or dynamic. For example, changes in the QoS of application services can be caused by the availability of support and updates. If platform providers invest in new functionality to meet user requirements, they improve the quality of the development environment for service developers and the service offering environment for end users.

3.2.2.2 Installed base

The installed base represents the number of active users of a service platform. The installed base affects the value of all stakeholders as a source of revenue and user network (Figure 3-3). The effect of the installed base on the stakeholders' values is explained through network effects. The network effect benefits all stakeholders and attracts even more customers (Katz and Shapiro, 1986, 1992, 1994; Amit and Zott, 2001). Platforms with a larger number of users can leverage their user network to gain competitive advantage. Considering the time and effort a user needs to adapt to services on a new platform (e.g., social networking platforms), many users are less likely to switch platforms (Amit and Zott, 2001).

Specifically, network effect has been identified as an IT platform business strategy (Lee et al., 2010; Eisenmann, Parker and VanAlstyne, 2006). For platform providers, the idea behind network effects is that customers pay more to get access to a bigger network and, as the installed base grows, so will the platform providers' revenue. Therefore, platforms with a critical mass have the advantage to stay in the lead among equally innovative platforms.

The network effects that come into play in a platform environment are the increase in the number of users reinforced by the installed base, as

well as the increase in service variety due to the increase in the number of users, which in turn makes more users join the platform.

3.2.2.3 Service variety

Service variety represents the availability of complementary services that users of the platform can access. Service variety is one of the value sources in platforms. If platform providers offer services that are complementary to services offered by the same platform, they generate a network effect, increasing the value of the platform to their potential customers as the platform's customer base increases. Availability of complementary services makes the offerings of a platform provider more valuable to its customers (Amit and Zott, 2001; Zhu and Iansiti, 2012). Therefore to create more value, cooperation between complementary service providers is a likely successful strategy in the service industry (Nalebuff and Brandenburger, 1997).

In summary, the idea of increasing the variety of services in the context of platform services as a value driver is well supported. Therefore, we consider service variety as a value parameter in our model. Service variety impacts the platform provider's revenue and the application users benefit positively (Figure 3-3).

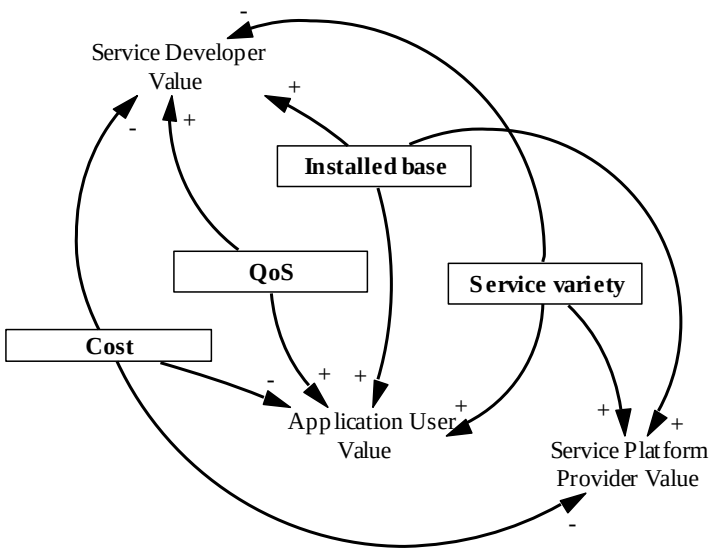

Figure 3-3 Effect of Service Value Parameters on Value Obtained by Stakeholders

3.2.2.4 Cost

Cost is used in this model to represent all types of costs incurred by all stakeholders. Cost incurred by stakeholders negatively affects the services' value (Figure 3-3).

The usage cost of application users in the context of platform services includes the subscription and periodical fees paid by users to both of the providers. The platform provider and service developers face costs for offering services (e.g., service maintenance) and supporting their customers in the case of problems with services.

Reducing the cost of offering services (e.g., through improved efficiency) for service providers results in an increase in their net value (Amit and Zott, 2001). However, in the overall platform ecosystem, the increase in the cost of one stakeholder might result in the increase in value for another. For example, if the price of an application is set high, the users' value will be affected negatively, while the service provider's revenue gain increases up to a certain threshold.

3.3 Stakeholder Value Representations

Based on the variables identified and their relationships, we constructed functions quantifying the value that the three stakeholders obtain from an IT service platform.

The decision problem studied here involves one IT service platform and a fixed number of potential users and developers. The application users and service developers continuously have to decide on the adoption of the IT service platform based on the four value-determining parameters mentioned in the previous section. During each time period, new users may join the platform and subscribe to services offered. Similarly, new developers may join the platform, buy development kits, develop services and sell their applications to the installed base of users. The value

functions representing the utility of the application user, the platform provider and the service developer use the value determining parameters as input.

3.3.1 Application User Value

Based on the value creation model, we define an application user's net utility U_{ja}. It is determined by the functional benefits that users obtain from using services offered by the service platform. The net utility is defined as follows:

$$U_{ja}(t) = u1_{ja}\left(Q_j(t)\right) + u2_{ja}\left(S_j(t), D_{ja}(t)\right) + u3_{ja}\left(N_j(t)\right) - C_{ja}(t) \qquad (3-1)$$

$$U_{ja}(t) = 1 - \frac{1}{Q_j(t)} + 1 - \left(\frac{1}{(S_j(t) * D_{ja}(t))}\right) + 1 - \frac{1}{N_j(t)} - C_{ja} \qquad (3-2)$$

where $U_{ja}(t)$ is the total utility that an application user gets from adopting the service platform j at a given time t. It is the sum of all positive benefits minus the respective cost. $u_{1ja}(Q_j(t))$ represents the user's utility from the quality of service Q_j offered at time t, which is the functional benefit of the service. In this model, $D_{ja}(t)$ represents the average number of applications a user uses at the period t and $u2_{ja}\left(S_j(t)\right)$ represents the utility of the user from using a certain number of downloaded application services Dja(t)

among the total services offered on the platform $S_j(t)$ that are available to the users of the service platform at time t. It determines the user's value from adopting a service platform with a certain level of service availability. $u_{3ja}(N_j(t))$ is the utility of the user generated from the installed base of users on the service platform j. It represents the additional benefits obtained from the level of the platform's adoption by other users. $N_j(t)$ represents all the existing users instead of the portion of the installed base that has direct connection with the users. This is because we also consider the benefit from indirect network effects that are generated from the rest of the users not connected to them directly. Each utility is limited to be between the values of [0,1]. The value 1 means that the maximum level of utility has been reached, while a value of 0 represents the lowest level. C_{ja} specifies the application usage cost a user faces for using one service each month. Overall, the net utility that a customer gets from adopting the platform service and using $D_{ja}(t)$ services is obtained by deducting the total cost C_{ja} from the benefits.

3.3.2 Service Developer Value

Considering the overall structure of the value creation model, the value for a service developer U_{js} can be described as follows:

$$U_{js}(t) = Q_j(t) + RS_{js} * C_{ja} * \frac{N_j(t) * D_{ja}(t)}{S_j(t)} - C_{js} \qquad (3-3)$$

where $U_{js}(t)$ is the total value that a service developer gets from adopting the service platform j of quality $Q_j(t)$ at a given time t. A service developer's revenue comes from the average fee C_{ja} that a user pays for a service multiplied by the average number of downloads per service. In this model, the fraction of the number of downloaded applications of the platform is calculated as the total number of downloads of all services by all users of the platform $N_j(t) * D_{ja}(t)$ divided by the number of services $S_j(t)$. This represents the average usage of services. The total revenue obtained is reduced by the revenue share RS_{js} that the platform provider gets. The costs of a service developer C_{js} are either fixed subscription fees or variable usage costs that have to be paid to the platform service provider.

3.3.3 Service Platform Provider Value

The value for the service platform provider U_{jp} is defined as:

$$U_{jp}(t) = C_{js} * S_j(t) + (1 - RS_{js}) * C_{ja} * (N_j(t) * D_{ja}(t)) - C_{jpa} * (S_j(t)) * (N_j(t)) \quad (3-4)$$

where $U_{jp}(t)$ is the value (profit) of a platform provider p from offering service platform j at a given time t. The profit is calculated as the difference between the revenue that the platform generates from all service developers, $C_{js}* S_j(t)$, and all applications downloaded by all users (i.e., the revenue that is shared with the service developer, (equation 3-4) and the cost of supporting users C_{jpa} and maintaining services C_{jps}. Service platforms provide maintenance, data storage and security to the application services they host. It constitutes their cost for services and users, which increases as the number of services ($S_j(t)$ and users ($N_j(t)$ increases.

3.4 Simulation Model

The model assumes the maximum value of each of the parameters measuring the user's benefit from using a service platform to be 1, therefore the value at time t is shown by the fraction of the maximum value expected. In the application user value model, $Q_j(t)$ is used to show the level of the utility of the QoS provided to the user and the developers. It represents, for example, the efficiency of the services consumed by application users. It is also used to represent the efficiency of the development environment used by service developers. The improvement of $Q_j(t)$ from the lower to the highest level is assumed to be caused by the investment by the platform provider as the provider's benefit increases. As a result, the fraction $\{ 1 - \frac{1}{Q_j(t)} \}$ increases overtime. Therefore, $Q_j(t)$ represents the basic value exchange between the platform provider and its consumers.

The second parameter represents the fraction of value received from the variety of services used. The term $S_j(t) * D_{ja}(t)$ combines the user's benefit from indirect network effects of the number of services made available over the platform $S_j(t)$ and the number of services downloaded (installed) by the user $D_j(t)$. $S_j(t)$ is assumed to have the same value for all users of the same platform, and in this model it also indicates the number

of developers who adopted the platform. Therefore, it's a common parameter between the user's value and the platform provider's benefits obtained from the service developers for the development, hosting and management services offered to them. However, $D_{ja}(t)$ is subject to individual decisions of the users and the number of services they download impacts the user's cost. This in turn changes the income service developers obtain from selling services and the share of the platform providers from such income. The parameter $N_j(t)$ represents the fraction of benefits from the use by the installed base of the service platform as a result of direct network effect.

This part of the user utility is assumed to be equal for all users of the service platform. Actual personal connections are not considered here. Even if they can change the real benefit obtained from direct network effect for individual users, it has no impact on the fees collected from the users by the service providers. This parameter is also a part of the value of service developers and the platform provider. It impacts the benefits received by the developers by increasing the sales of services per developer and the revenue share of the platform provider. In addition, it also increases the cost of support and management of users for the platform provider.

The cost of the user $C_j(t)$ is assumed to be driven by the number of services the user installed $D_j(t)$, as it mainly consists of the cost of

purchasing and using services. The user cost is part of the value the developers and platform provide representing the income from paid services. It can also be interpreted to include the cost of time the user spends using free services to generate advertisement revenue for the platform provider and service developers. The structure of the model can hold either case.

In the model for service developers, the parameter RS_{js} is used to represent a constant percentage that divides the fractions of the income from sales of services to the installed base of services. An average number of services downloaded $D_{ja}(t)$ per user $N_j(t)$ is divided to the $S_j(t)$ to obtain the number of services sold per developer (assuming a developer offers a single service). This value multiplied by a constant user cost per service C_{ja} gives the total sales benefit to be shared between the platform and the developer as per the agreed revenue share RS_{js} and 1- RS_{js}.

C_{js} represents the cost of the service developers. It is incurred by service developers and is mainly due to development and hosting fees to service platform providers and varies based on the size of the application, the number of users supported, storage capacity required and the amount of back-end processing required. A constant annual hosting and management fee from service developers is considered as part of the platform providers' income multiplied by the number of developers $S_j(t)$.

In the utility model for the platform provider, the cost of the provider C_{jpa} is driven by both the number of developers and users.

3.4.1 Value Creation Dynamics

We employed system dynamics to better understand the behavior of stakeholders, including how platform providers, service developers and application users might make decisions about offering and adopting a service platform, what strategies platform providers would use to create and add more value to their offerings, and how adjustments to their business policies in response to market conditions could impact value outcomes. The model was built using Vensim system dynamics software provided by Ventana Systems.

The simulation model used here (Figure 3-4) helps in evaluating the dynamics of the value creation. The values, which are created by the service platform for the three stakeholders in a certain time period, are based on equations 3-1, 3-2, and 3-3.

As illustrated in Figure 3-4, the service variety increases by a certain number of new services in every time period. A service developer who subscribes to the service platform requires a development environment to offer an application service. The number of the new services or service

developers is denoted by $S_j(t)$.The installed base increases by a certain number of new adopters in every time period. This number of new adopters is represented by $N_j(t)$. Note that we do not consider an outflow of customers here. Consequently, the installed base $N_j(t)$ and the number of services $S_j(t)$ are cumulative values increasing though new adoptions over time.

Interactions between the stakeholders occur through the value-determining parameters (Figure 3-4). The QoS offered to the service developers and application users is positively affected by the utility of the platform provider. The higher the platform provider's utility, the more the incentive for the platform provider to improve its services to meet the requirements and expectations of its customers. This in turn attracts more customers, increasing the platform's value. The number of service developers is positively affected by the utility of existing service developers, as a high utility motivates more developers to join. The number of application users increases as more services are offered and QoS is improved. This increase in the number of users motivates more users to join the platform and positively affects the value of the platform provider and the service developers.

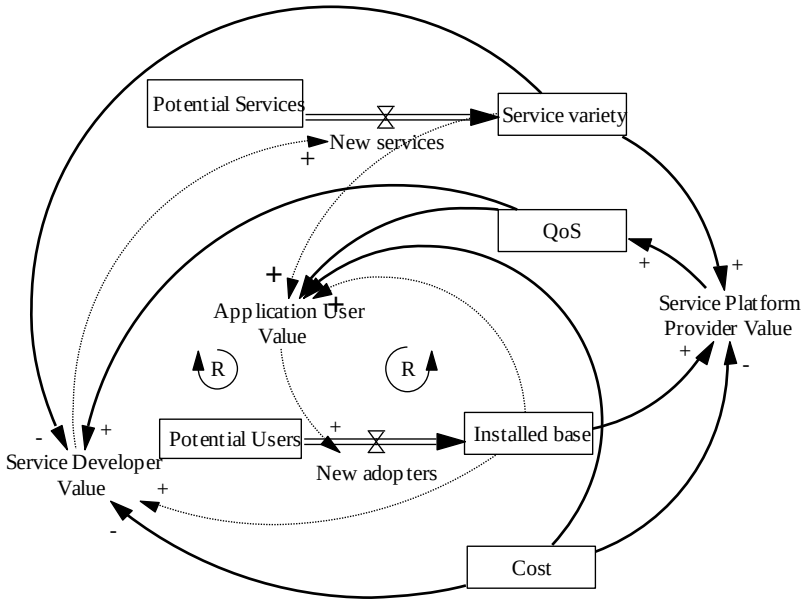

Figure 3-4 A Model of Stakeholder Value Dynamics with Feedback Loops

In an effort to improve the actual value created, platform providers can make business decisions to improve the QoS offered and to reduce the cost incurred through deploying a better infrastructure. Service developers make choices about joining a platform or developing more services to increase the number of services offered. They also make similar decisions as the platform service providers with respect to cost and QoS. Application users simply decide on adopting a platform and using a certain number of services.

3.4.2 Scenario description and settings

To observe the behaviour and output of the value creation model, two user adoption scenarios and two service sales scenarios were used. These scenarios operate on an IT service platform with a limited number of potential users and service developers. The scenarios evaluated were selected based on their significant potential impact on the value of the stakeholders. Then the results of values for each stakeholder were compared.

3.4.2.1 Decreased platform adoption rate

Platform adoption rate represents the number of new users who start using the service platform over time. This rate for new adopters of service platforms can constantly increase until the point of market saturation due to direct and indirect network effects, as shown by the base value in the simulation. However, there have been cases where new adoptions started to decrease due to market factors such as the rise of other competitive service platforms and decreased attractiveness of the platform to potential users. It is important to show the behaviour of a value creation model under such changes in the market.

3.4.2.2 Increased rate of service sales

The rate of service sales represents the number of services (for example, applications) sold over the platform. Platforms can increase their sales of services and the number of services used by each user through various marketing measures. Such ways include improving the quality and attractiveness of services offered, improved service discovery and cheaper usage cost.

3.4.3 Simulation Environment

The service settings evaluated to observe the behaviour of the value of stakeholders represent the two scenarios described. They are based on practices observed in the market ("Apple iTunes", 2012; "Apple Development Kits", 2012; "Amazon Appstore for Android", 2012; "Google Apps Marketplace", 2012). The simulation considers a single service platform provider, multiple service developers and service users. For the implementation of the simulation, we used Vensim system dynamics software. The simulation duration was set to observe the dynamics over a longer period of time (100 months).

Table 3-1 Simulation Parameters

Parameters	Base Values	Higher rate of service sales	Decreased platform adoption rate
Hosting fee/month	$1	$1	$1
Share of revenue	0.7	0.7	0.7
Average downloads	1/user	5/user	1/user
Average service usage fee	$0.001/month	$0.001/month	$0.001/month
Cost of offering	$1	$1	$1
Cost of platform provider			
- cost of handling services	$0.0001/service	$0.0001/service	$0.0001/service
- cost of handling users	$0.00001/user	$0.00001/user	$0.00001/user
Potential services	500	500	500
New services/month	1	1	1
User cost	$0.001 + 0	$0.001 + 0	$0.001 + 0
Quality of service	1→	1→	1→
Potential users	2m	2m	2m
New users/month	1000	1000	at t =50, 500

Regarding the behaviour of stakeholders and the market environment, it was assumed that an application user subscribes to one or more services at a time. Even in cases where the application users and service developers were using free services, they generated a certain value for the providers. Therefore to simplify the model, all customers are considered paying for the services they consume. This means that they either pay a monthly service fee or with advertisement placement on their services.

With respect to the adoption of users, it is assumed that if the value of application users $U_{ja}(t)$ remains greater than 0, a certain number of new

users decide to join the installed base $N_j(t)$ until the point of market saturation. Applying the same principles to service variety $S_j(t)$ and assuming that the value of the service developers $U_{js}(t)$ is positive, new services will also join the platform. In our experiment, the number of new users and the number of new services can also be variable in each time period and they are a portion of potential users and services. In this case, the adoption rate of users per month increases (decreases) as the value of the existing users increases (decreases). In the same way, the actual number of new services can be calculated. As the next section shows, this adoption scheme is simulated for cases of limited potential users.

3.5 Results

In this section we present results showing the dynamics of value creation for all stakeholders. When a service platform provider expects a limited number of potential service users with possible market saturation, the results are shown in Figures 3-5, 3-6 and 3-7.

The two scenarios simulated here are used to show the long term dynamics of the value for the application users $U_{ja}(t)$, value for the service developers $U_{js}(t)$ and the value for the platform provider $U_{jp}(t)$. If the level

of quality of service $Q_j(t)$, cost of usage C_{ja} and cost of offering C_{js} are assumed to be fixed, the differences in the values for service users, service developers, and platform providers are caused by the change in installed base $N_j(t)$, service variety $S_j(t)$ and downloaded services per user $D_{ja}(t)$.

Looking at the application user values of Figure 3-5, application users subscribe to a service that performs a certain task from their service developer at the beginning of period t=0, which outweighs their user cost C_{ja}. This value that the user obtains at the time of joining the platform is indicated by $Q_j(t)$ in Equation 3-2. Consequently, they receive a value $U_{ja}(t) > 0$ at period t=0. Maintaining a positive utility for application users is a condition that has to be fulfilled to successfully launch any application service or a service platform.

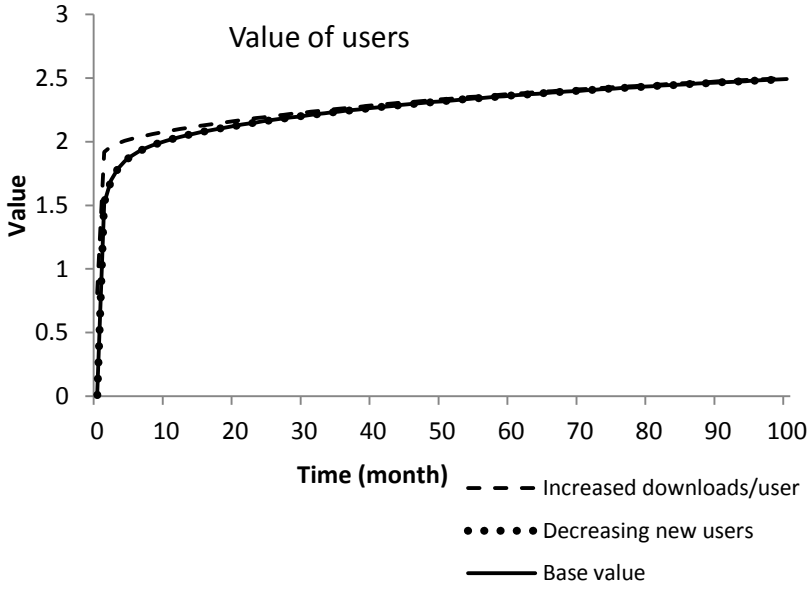

Figure 3-5 Results for Value of Users

The value for users is significantly affected by the change in the downloaded services compared to the impact of the decrease in the growth rate of the installed base.

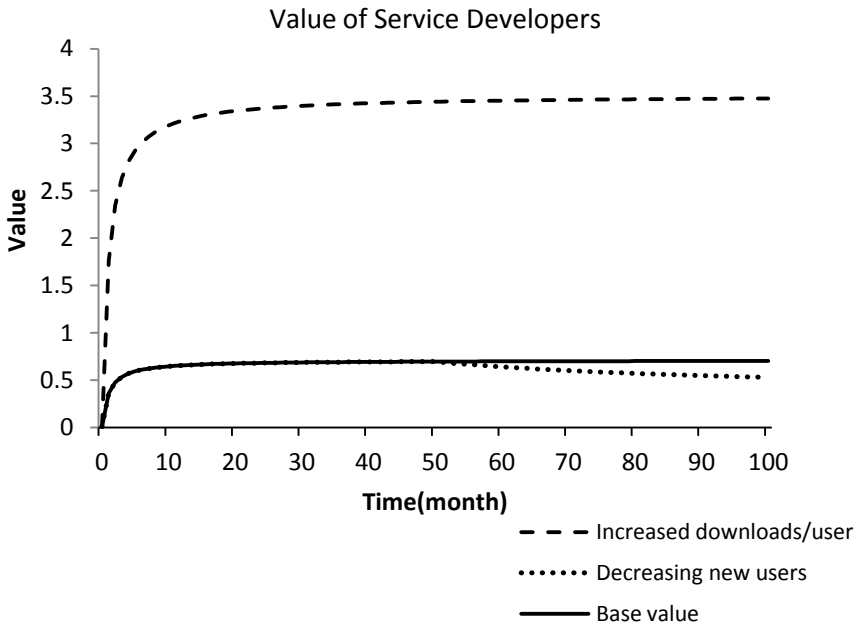

Figure 3-6 Results for Value of Service Developers

Service developers also need to subscribe to a service platform and utilize its offerings to build their services (Equation 3-4). However, the values for service developers show a different behaviour in the beginning (Figure 3-6). This is because their initial cost is higher than the cost faced by application users. They cannot recover their costs of offering C_{js} until they acquire a sufficiently large number of customers and generate revenue. Therefore, they take more time until they receive a value $U_{js}(t) > 0$, as shown in Figure 3-6 at the time period t=3.

In a scenario where services sales increase and the number of downloaded services increase, the value for the service developers shows a significant increase, similar to the value for users in Figure 3-5. However, a decreasing number of new adopters affects the value for service developers more significantly than for users, as the developers offer new services and existing users can only consume limited services.

Figure 3-7 shows that unlike service developers and application service users who share a common behaviour as customers of platform providers, platform providers behave as service providers only. Consequently, their value received $U_{jp}(t)$ at the beginning of the period t=0 remains 0 until they start obtaining customers and generate revenue through development kits and hosting fees from service developers C_{js} and application usage fees from application users C_{ja}. The only cost that has to be covered is the cost of supporting application users C_{jap} and the cost of managing services C_{jsp}.

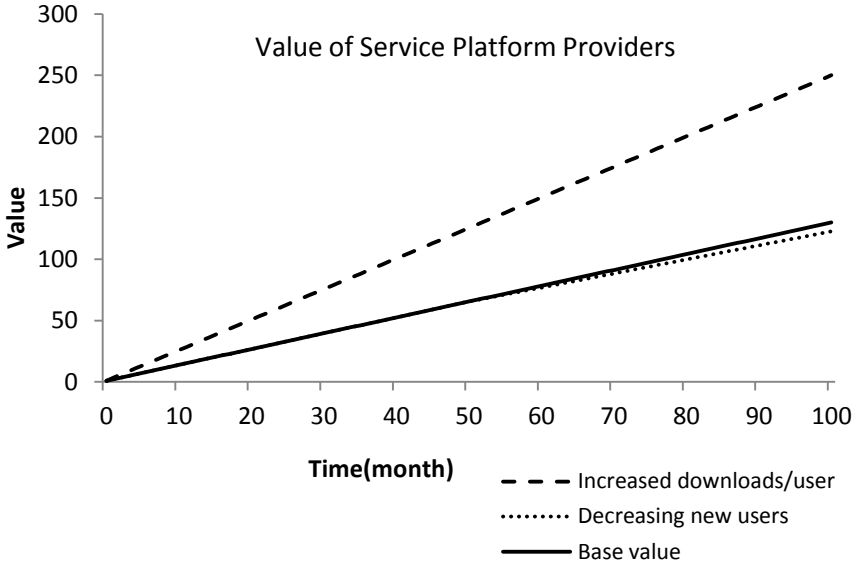

Figure 3-7 Results for Value of Service Platform Providers

The value for service platform providers $U_{jp}(t)$ grows faster than the value for service developers $U_{js}(t)$ and application users $U_{ja}(t)$ as the size of both stakeholder groups grows (Figure 3-5). The platform provider obtains benefits from both sides of the market. In the case of platform providers, the decreasing number of new users can only slow the value growth. Unlike service developers, an immediate decrease in value created does not occur. The case of an increase in service sales shows similar effects on all three stakeholders.

The value for application users shows a slow growth compared to the other two stakeholders since they benefit the least from the growing

number of customers. However, the value for the service developers is only slightly larger than the value for the application service user.

All stakeholder values are interdependent and changes in one of them affect the values for the other stakeholders. An evaluation of the relative impact of all value parameters indicates that the installed base $N_j(t)$ is a common positive determinant of value for all stakeholders. Although the value for the application users is important as the basis for value creation, a sufficiently large value obtained by service developers is necessary to sustain the service platform market. Currently, the value for service developers is quite low because of the risk of developers withdrawing from the service platform.

However, under the assumption of a growing number of new services, a limited number of services used by a user and a decreasing number of new adopters over time, the value distribution among the stakeholders indicates a sustainability problem since incentives for participating in the market are not even (Figure 3-6).

The implications of these results to the service platform market and to the stakeholders considered in this study is that both service developers and service platform providers need to focus on finding a way of sharing the value so that it allows developers to sustain their services over a longer time period. Otherwise, as the number of services increases in the competitive world, the average return on developing an application service

will reduce even further and therefore, increases the risk of developers withdrawing from the market, causing a market failure.

3.6 Conclusions

In this study, we addressed the problem of value distribution in IT service platforms and developed a dynamic value model of the stakeholders. Our findings showed a potential lack of sustainability of values for all stakeholders as a market approaches maturity.

The study identified platform providers, service developers and users as the major stakeholders in IT service platforms, based on their roles in the value system. QoS, service variety and installed base were identified as the major factors in determining the value obtained by the stakeholders. Installed base and service variety were the most important sources of value. The installed base represents the users of services that generate the monetary benefits through usage fees, purchase of services or placement of advertisements. They also enhance the benefits for the users themselves through a network effect. Service variety represents the amount of functionality users will be able to accomplish using the IT service platform and the benefits for the platform provider obtained from

development, hosting and management services offered to service developers. The values of the stakeholders are interconnected as each stakeholder needs to be satisfied with the benefits they receive to stay in the market and continue generating value for the other stakeholders.

The basic value generator in IT service platforms is the sale of services to users, which increases the installed base variable. This has three different effects: 1) change in the value for the users themselves due to the availability of more connections; 2) change in the benefits for the service developers due the income from the sale or usage; and 3) change in the benefits for the service platform providers due to the share of income they receive from it. The second value generator is the decision of service developers to join the platform, which is mainly motivated by the level of usage or the size of the installed base. This will have a reverse effect on the benefits for the users through increased availability of services. As a result, increased sales of services bring more profits to both the platform provider and the developers. The current value system provides most of the benefits to the platform providers, while service developers are the least benefiting stakeholder.

These findings aim to inform IT service platform providers when making policy decisions on pricing and revenue sharing by indicating effects on stakeholder values, and thus affecting the platform provider's business.

This research has presented a value creation model for stakeholders of an IT service platform using additive value functions. The model can be used as a tool for evaluating values created for application users, service developers and platform providers. It allows the integration of value-determining parameters to calculate the value (i.e., utility, profit) for stakeholders. Quality of service, service variety, installed base and user cost are the parameters considered. The value creation model was evaluated using simulation software to examine the value creation dynamics.

The simulation results indicate that the installed base of application users benefits all stakeholders and the service platform provider benefits largely from the two-side network effect. As a strategy for platform providers, it is important to focus on building the network of application users and also to maintain attractive returns for developers. This is important for sustaining the value for all stakeholders and growth of the service platform.

Our future studies may explore additions to the model by incorporating more factors such as pricing policies and market structures. We could investigate how the competition between multiple IT service platform providers affects the values for platform providers and service developers.

Chapter 4 Structural Analysis of Value Creation in Software Service Platforms

4.1 Introduction

Software 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. If we look at mobile platforms only, by January 2013, Apple's App Store contained 750,000 registered services. Google's Android operating system, which runs on many devices and competes with the iPhone system, offered more than 700,000 services as of April 2013 through its software service market Play Store. As the competition to gain more customers gets more intense, value creation remains the main focus of these and other service platform operators, both in the context of creating better value for customers purchasing their services and for their shareholders who expect 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, such as theories from information systems, network industries or

micro economics, adequately 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 were investigated in earlier literature (Rohlfs, 1974). Following these approaches, economic theories regarding information goods stated that the usage of products in these markets was driven by the need for compatible (interoperable) products to exchange information and the need for complementary products and services (Katz and Shapiro,1985; Economides, 1996). The concepts of complementarities and network externalities were adopted into theoretical models for IT platform leadership and value creation in e-businesses in more recent studies (Amit and Zott, 2001; Lee et al., 2010). These studies discussed network effects that cause a change in the benefits of the users due to the usage by other users of the platform and the availability of complementary services as value drivers for both providers and consumers.

A value function needs to account for the benefits from actual use of functions. In addition to network externalities, recent studies also focused on the functional benefits offered by platforms and included related factors in their models of sources of value creation, for example innovative ability and efficiency (Lee et al., 2010) and novelty and efficiency (Amit and Zott, 2001). However these theoretical models did not offer any empirical measurement models for these value drivers. Such a model in the general

context of technology acceptance was introduced by Davis (1989) and extended into a detailed model of acceptance and use of technology (Venkatesh et al., 2003). In addition to network externalities in this empirical study, we adopt the measures introduced by the TAM model i.e., perceived usefulness and perceived ease of use, as measures of system usability.

This study 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 value for a user. It also addresses a question on how to estimate the value function of a software service platform user. Our main hypothesis is that the value creation process in software service markets is significantly influenced by personal experiences of the users' in relation to the system, the level of connectivity with other users, and the number of services a user can access and decides to utilize. To evaluate the relationships between service platform users' value and a set of variables measuring their usage experience, the study applied structural equation modelling and analysis using a user survey data.

The main contribution of our research is that it builds an aggregated structural model based on a previously established research framework of IT usage and network externalities (Davis, 1989; Venkatesh et al., 2003; Katz and Shapiro, 1986, 1994; Farrell and Saloner, 1985, 1986; Arthur,

1989; Amit and Zott, 2001; Lee et al., 2010). The model was analyzed empirically from the analysis of survey-based consumption data of service platform users. The assumption of a utility theory, i.e. users' willingness to pay indicating their valuation of the services they utilize (Neumann and Morgenstern, 1944; Tversky, 1979) was employed to represent value obtained by the level of total spending on usage. As the business model of service platforms is dominated by advertisement-based, charge-free offerings, the study suggests a value measure that takes this into account. 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.

The following two subsections give an overview of software service markets, studies based on network externalities and TAM and related literature on value creation in platform based markets. Subsection 4 presents the proposed model specifications and related hypotheses. After describing the data collection in subsection 5, subsection 6 presents the results and discussion of the path analysis. Subsection 7 presents the conclusions, implications and limitations of the analysis.

4.2 Software Service Markets

The term software services is used to refer to software-as-a-service (SaaS) offerings that run on computing devices such as smartphones, tablet computers and notepads. They are made available through service platforms or service marketplaces such as the Apple App Store (iOS), 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 software service market. iOS and Android hold the largest shares in the market as they are adopted by more than 500 million users each ("Smartphone OS share", 2013). The App Store of Apple contained 775,000 services as of January 2013 ("App Store", 2013); the Google Play Store of Google has 700,000 services as of April 2013 ("Google play", 2013); the Window Phone Store of Microsoft has 130,000 services as of February 2013 ("Windows Phone", 2013); and the BlackBerry World of

RIM offered 100,000 services as of March 2013 (“Blackberry World”, 2013).

4.3 Technology Acceptance Model

The technology acceptance model (TAM) (Davis, 1989), a widely researched theoretical model that attempts to explain the adoption of new information technologies, is based on the theory of reasoned action (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975). TAM is a model of IT adoption that argues that beliefs such as a system’s perceived usefulness and perceived ease-of-use impact attitudes toward use, intentions to use and ultimately the acceptance of IT (most often measured as utilization). The causal linkages in TAM studies typically involve three hypotheses associated with the two fundamental constructs influencing the outcome variables. In studies based on TAM, researchers choose outcomes depending on the questions they are investigating and the research methods they have selected.

First, perceived usefulness is expected to influence outcome variables such as intention to use the system. With self-reported IT system usage, this is the most consistently confirmed hypothesis. The second hypothesis in these studies is the impact of ease of use on the outcome

variables, which did not produce as consistent a confirmation as the first hypothesis throughout TAM based studies. The original TAM study by Davis (1989) explained this outcome stating the impact of ease of use on system use is indirect through an intermediate construct. This theory led to the third hypothesis of the impact of ease of use on perceived usefulness. This was also confirmed by later research. (e.g. Venkatesh and Davis, 1994).

TAM was later developed into the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003), which is an integrated and updated presentation of the earlier TAM and the subsequent developments that have been made based on TAM (Davis, 1989). UTAUT focuses on identifying measures (factors, constructs) for a technology to be successfully adopted and used by the target market (Venkatesh et al., 2003). It incorporates the two constructs of TAM and concepts from similar studies into the constructs of "performance expectancy" and "effort expectancy". Similar to other TAM based models, UTAUT also theorized perception based evaluation of pre and post adoption intentions of technology usage. This study adopts these perception based evaluations and integrates them with other constructs of revealed usage behavior through a standardized measurement unit.

4.4 Model Specifications

4.4.1 Determinants of Value of Software Service Platform Users

This study proposes a model of value obtained for software service platform users, based on TAM and network externality and basic assumptions of utility theory. We found that value creation in service platforms could be explained using three major determinants: system usability, service variety and user connectivity of the platform (Table 4-1).

4.4.1.1 System usability

System usability describes the extent to which a system can be utilized with efficiency and effectiveness (Wang and Senecal, 2007; Calisir et al., 2010). Studies like Brook (1996) stated usability to be a concept that varies in what it entails according to the context of discussion at hand. Even if usability can be summed up to mean a level of "appropriateness to a purpose" of any particular object (Brook, 1996), predefining who the intended users are, the requirements for performance and the environment in which it is used are important to specify fitness to a purpose. This must

be defined by the context of use. In reference to information systems, ISO 9241-11 states measurements of usability to focus on effectiveness, i.e. level of achievement of user objectives, efficiency, or the effort required to achieve those objectives and satisfaction of the users with the experience. Drawing on these descriptions, system usability is a broader concept than merely a functional characteristic (Wang and Senecal, 2007).

As a type of an information system, these concepts can be adopted to describe the usability of a software service platform. Usability can mean the level of effort the user needs to access, understand and utilize the service platform and its offerings, as well as the level at which the service platform includes offerings that fulfil the user's functionality requirements enabled by the quality of service provided (Zeithaml et al., 1990). Therefore, the usability of a software service platform is enhanced by its functional and non-functional performance. Whether a user's experience meets the expectations determines the value for the user. In a theoretical model of value creation in e-business developed by Amit and Zott (2001) and a model of platform leadership in Web 2.0, efficiency has been identified as one of the major factors. Hong et al. (2002) suggested that the attributes of efficiency and effectiveness, which are widely used as measures of usability, match the two user beliefs introduced by the TAM (Davis, 1989) as determinates of users' intentions to use a technology. Perceived usefulness (PU) is the extent to which a person believes using a

certain technology enhances their job performance. Perceived ease of use (PEOU) is the extent to which an individual believes that using a particular technology is effortless. System usability has been found to be a significant factor associated with users' IT/IS usage. Examples exist from many studies (Davis, 1989; Davis et al., 1989; Venkatesh and Davis, 1994; Hong et al., 2002; and Venkatesh et al., 2003).

4.4.1.2 Service variety

Services that run over the same service platform are developed using common standards. If a user adopts a service platform, the user is offered basic functionality that enables running more and complementary services. The existence of complementarities makes a product or service a more attractive offering to users (Katz and Shapiro, 1985, 1994; Amit and Zott, 2001; Lee et al., 2010; Farrell and Saloner, 1985, 1986; Arthur, 1989; Zhu and Iansiti, 2012; Gawer and Cusumano, 2008). However, the use of additional services could cost more for the user. Therefore, the variety of services available determines the quantity of services and service categories a user has access to over the platform (Table 4-1).

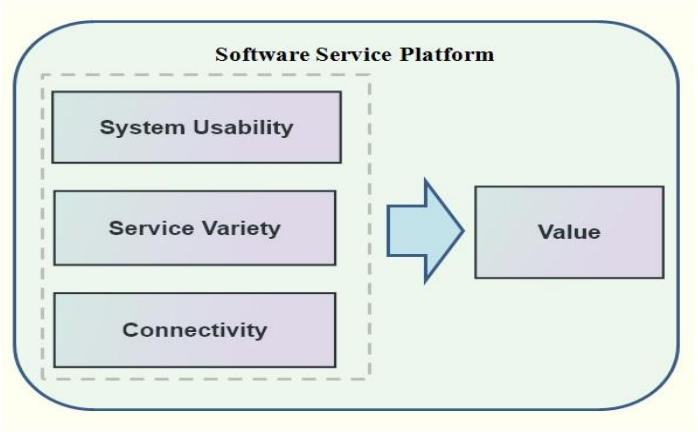

Figure 4-1 Determinants of a Software Service Platform User Value

4.4.1.3 User connectivity

Current software service platforms are dominated by use scenarios that involve communication, collaboration and exchange of information among users (Lee et al., 2010; Gawer and Cusumano, 2008; Smedlund, 2012). Thus, the number of other users that a user can connect with on a platform is an important determinant of value created.

This study proposes that the impact of these system features (connectivity and service variety) on value for the users varies based on individual usage behaviour. Therefore, this study model incorporates stored and active connections, services installed and services used. Table

4-1 presents the summary of the value determinants and the measurements considered in this study.

Table 4-1 Summary of Determinants and Measurements Used

Determinant	Measure	Description	References
System Usability	Perceived Ease of Use (PEOU)	Level of ease, at which a user can discover, purchase, and utilize services on the service platform.	(Davis, 1989; Davis et al., 1992; Thompson et al., 1991; Parthasarathy and Bhattacherjee, 1998; Venkatesh et al., 2003)
	Perceived Usefulness (PU)	The ability of services offered on the platform in relation to the user's functional requirement.	
Service Variety	Services Installed (SI)	Total number of services the user currently has installed on his device.	(Katz and Shapiro, 1985,1994; Amit and Zott, 2001; Lee et al., 2010; Farrell and Saloner, 1985,1986; Arthur, 1989)
	Services Used (SU)	The number of services the user uses frequently.	
Connectivity	Stored Connections (SC)	Total number of contacts a user has stored in their communication and social media services.	(Lee et al., 2010; Gawer and Cusumano, 2008; Smedlund, 2012)
	Active Connections (AC)	Number of other users the service user communicates with frequently.	

4.4.1.4 Value

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 connectivity they can establish with other users of the platform. When deciding on the adoption of a service platform, a user is assumed to expect the value of using the service platform to be greater than the value of not using it.

To measure the value users receive indirectly, the willingness-to-pay (WTP) is used. WTP is captured through two measures (Table 4-2): the time spent on using services and the monetary cost of using services. Cost of usage is observed as the amount of money the user spends on purchasing services, along with fees paid for upgrading and access to content such as movies, music and games per day. The cost of time spent is captured as the amount of time the user spends on using the service platform daily moderated by income level. Therefore, WTP is a function of two cost types and represents a lower bound to the value that a user gets by using a service platform. A user would never use a service platform if the value were lower than the total cost spent (WTP).

Table 4-2 Summary of the Variable and Measures Used to Estimate the User Value in the Model

Determinant	Measure	Description
WTP (Coursey et al., 1987; Mitchell et al., 1989; Shogren et al., 1994)	Cost of Time spent on using services	Amount of time a user spends on using services on average.
	Cost of using services	Amount of money a user spends on using services on average.

Service platforms are dominated by advertisement-based service offerings. In such an environment using WTP for service usage as the only indicator of value would undermine the results. Therefore, we added the cost of time the user spends daily utilizing services as well. Based on the user's annual income, we estimate the 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 WTP) and the explanatory variables can be measured.

4.4.2 Research Model

This section presents the research model and the causal relationships to be tested using empirical analysis.

Based on the assumption that value (utility) a user obtains from using a service is a function of the amount of consumption of the services, we hypothesize the number of services the user chooses to use (SU) and active connections the user maintains over the platform (AC) that positively contribute to WTP.

H1: Services used (SU) positively affects willingness-to-pay (WTP).

H2: Active connections (AC) positively affect willingness-to-pay (WTP).

Perceived usefulness is a concept used to describe the degree to which the user believes using (Davis 1989; Davis et al., 1989) the capabilities of (Thompson et al., 1991) a system enhances job performance. It is found to be a strong predictor of usage intentions of technology systems by various studies (Davis, 1989; Davis et al., 1992; Thomson et al., 1991;Vekantesh et al., 2003) and consistently correlated with users' intentions to use at the initial adoption and post adoption phases. Similar results have been found in the context of continuous usage of online services (Parthasarathy and Bhattacherjee, 1998). Based on these findings, we can assume that the

more users of a software service platform perceive the platform and its services to be useful, the higher the possibility they will choose to consume more of the services it offers. Therefore we hypothesize the positive impact of perceived usefulness on WTP:

H3: Perceived usefulness positively affects willingness-to-pay (WTP).

As services enable connectivity of users, the more services a user uses frequently, it is more likely that they will decide to maintain connections through the platform. Lee et al. (2010) suggested an interaction between complementary services and connectivity in their value model.

H4: Services used (SU) positively affects active connections (AC).

The TAM model (Davis, 1989) theorized the impact of perceived ease of use as a system can be perceived as useful if it is considered easy to use. Difficulty to use and understand makes the system to be perceived as less useful. Based on the same premise, users of a software service platform consider the platform to be useful when they perceive the services offered are easy to use and understand. Therefore we hypothesize that:

H5: Perceived ease of use (PEOU) positively affects perceived usefulness (PU).

Ease of use captures the concept of the effort requirement (Davis, 1989; Davis et al., 1989), difficulty (Thompson et al., 1991; Moore and Benbasat, 1991) and degree of ease (Venkatesh et al., 2003) associated with using a

system. In the TAM and UTAUT (Venkatesh et al., 2003, 2012) models, perceived ease of use is considered an important construct that has a positive impact on users' attitudes towards using an IT system. In some studies (Venkatesh et al., 2003; Thompson et al., 1991; Moore and Benbasat, 1991), the results regarding the impact of ease of use on usage intentions were found to be significant at the early stages of adoption and became insignificant over extended usage. However in the context of software service platforms, various services of diverse functionalities that require different levels of effort are provided over the usage period. Therefore, we hypothesize the positive impact of perceived ease of use on services used.

H6: Perceived ease of use (PEOU) positively affects services used (SU).

Compatibility, the degree of perceiving an innovation to be consistent with existing experience, is considered to predict intentions to use (Moore and Benbasat, 1991) and was adopted into the UTAUT under the construct "facilitating conditions" (Venkatesh et al., 2003). There are studies that confirmed this relationship in the online services (Achjari and Quaddus, 2003; Oh et al., 2003).

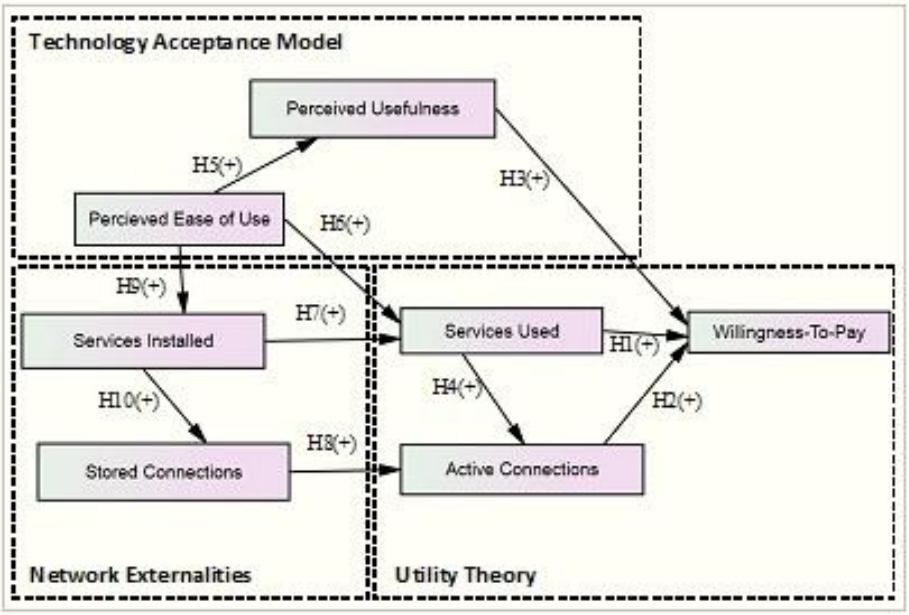

Figure 4-2 Research Model and Hypothesis

In software service platforms, when users find their chosen platform to provide them with more and more quality services, the more they will be able to perform their desired functionalities, and as a result, encourages more usage. These thoughts lead to the hypothesis:

H7: Services installed (SI) positively affects services used (SU).

The theory of network effect suggests an indirect feedback loop between services provided (complementarities) and the users of a system (Katz and Shapiro, 1985, 1994; Amit, 2001; Lee et al., 2010; Farrell and Saloner, 1985, 1986; Arthur, 1989). As a large number of compatible services

attracts more users to adopt the system, large number of adopters attracts more developers to develop services compatible with the platform. Thus, a network of services enables a larger connectivity among the users. Therefore, in the context of service platforms, it is hypothesized that:

H8: Stored connections (SC) positively affects active connections (AC).

H9: Perceived ease of use (PEOU) positively affects services installed (SI)

H10: Services installed (SI) positively affects stored connections (SC).

The study accounts for all causes of user behaviors included in the model, based on the assumptions of a software service platform. This averts the concern for endogeneity, a bias created when random variation of the independent variable doesn't change the dependant variable while other variables are held constant.

4.5 Data Collection

A user survey was conducted from May 1st to May 31, 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, 210 responses were received. The characteristics of the respondents were 90 students (43%), 54 employees of private companies (26%), 51 government employees (25%), and 15 self-employed (6%). It was clearly a small sample to represent the whole population of mobile service users. However, it included a good distribution of possible behaviors of new and experienced mobile service users, 162 (77%) of whom had been smartphone users for more than a year. The respondents of the survey were users of different service platforms: 49 Apple iOS users (23%), 117 Google Android users (56%), 7 Microsoft Windows Mobile users (3%), 27 RIM BlackBerry users (13%), and 10 users of other platforms (5%). All 210 were valid records used in the analysis. Table 4-3 shows the data types and measurement methods used to capture the values for the variables observed through the survey.

Table 4-3 Types of Data Collected for Constructs Considered in the Study

Measures	Measurement method
PEOU	Likert scale (1-5)
PU	Likert scale (1-5)
SI	20 Intervals, Range (1-200)
SU	8 Intervals, Range (0-21)
SC	15 Intervals, Range (1-1500)
AC	10 Intervals, Range (1-100)
WTP1 (Time Spent	17 Intervals, Range (0-8)
WTP2 (Money Spent)	6 Intervals, Range ($0-$25)
WTP3 (Income)	10 Intervals, Range ($10T-$100T)

4.5.1 Description of Data

Prior to use in the analysis, all observations of variables were normalized to indicate relative levels. Table 4-4 shows the statistical description.

Table 4-4 Descriptive Statistics

Construct	Mean	Std. Residual	Std. Deviation	Kurtosis	Skewness
PEOU	0.415	0.015	0.214	0.981	1.152
PU	0.411	0.014	0.208	1.189	1.18
SI	0.207	0.016	0.231	4.15	2.121
SC	0.335	0.018	0.262	0.268	0.882
SU	0.248	0.013	0.185	5.873	2.139
AC	0.304	0.019	0.277	1.179	1.462
WTP	0.018	0.002	0.023	13.213	3.378

Legend: PEOU= Perceived Ease of Use; PU= Perceived Usefulness;
SI= Services Installed; SC= Stored Connections;
SU= Services Used; AC= Active Personal Connections;
WTP= Willingness-to-Pay

4.6 Analysis

4.6.1 Structural Equation Modelling

This study employed the structural equation modeling (SEM) technique to test and estimate the causal relationships between determinants of users' value using empirical data and theoretical causal assumptions adopted from related literature and represented in a structural model. The study utilizes the SEM technique's capacity to allow testing the fit of the empirical data to the model. Thus, the variance analysis of the sample size of 210 cases showed a good model fit. Chi^2/df =3.5 (a measure of a fit between the sample data and the hypothesized model→0) was acceptably insignificant (Wheaton, 1977); RMR=0.003 (standardized root mean square of residuals, the amount by which the sample variances from the estimates obtained under the assumption of the model→0), was insignificant (Hu and Bentler, 1999); and there was a high enough GFI=0.96 (goodness of fit of the model →1) (Gefen et al., 2000).

The study incorporated these analysis techniques into the proposed model to enable testing of the relationships between the concepts in the model against possible measurements. Therefore, the techniques supported confirming assumptions as well as developing theories.

4.6.2 Model Analysis and Hypothesis Testing

The model was tested using AMOS. The overall analysis was aimed at showing that the null hypothesis of the entire proposed model was reasonable, while rejecting path-specific null hypotheses of insignificant effects. As illustrated in Figure 4-3, the empirical data supports all of the hypothesized positive causal relationships. Among ten relationships hypothesized, H1, H2, H3, H4, H5, H7, H8, H10 were found to be significant at $p<0.001$ level and H6, H9 were confirmed to be significant at $p<0.005$ level.

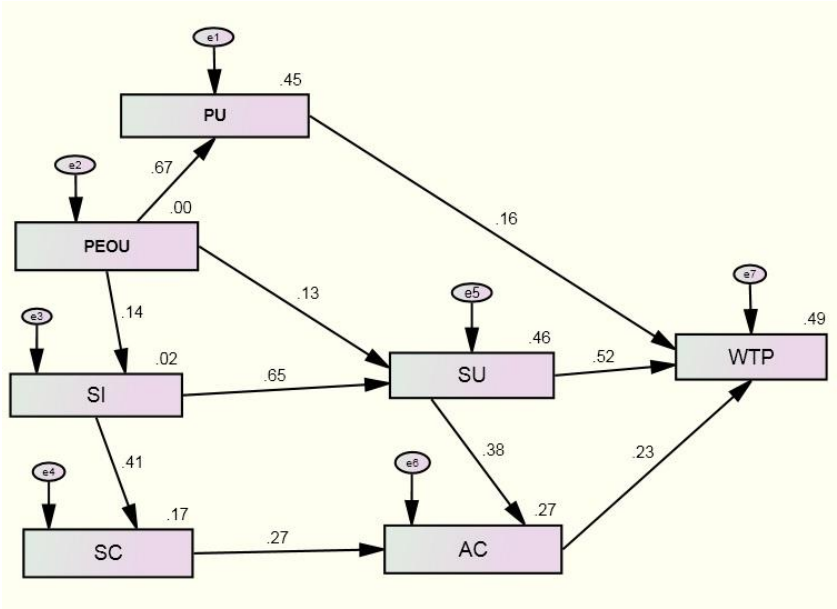

Figure 4-3 Standardized AMOS Solution

The tests confirmed hypothesis 1 with (β=0.52) and hypothesis 2 with (β=0.23), as services used (SU) and active connections (AC) were found to be significantly associated with willingness-to-pay (WTP) for services. Hypothesis 3 aims at evaluating the impacts of perceived usefulness (PU) on the users' willingness-to-pay (WTP). The results showed that the endogenous construct PU has a significant positive impact (γ=0.16) on the amount of time and money users spent on using the service platform. Therefore, hypothesis 1, 2 and 3 are accepted based on these evaluations.

Hypothesis 4 is also confirmed as services used (SU) shows a significant positive impact (β=0.38) on active connections (AC).

Hypothesis 5 was focused on the evaluation of the impact of perceived ease of use (PEOU) on perceived usefulness (PU). The results showed a significant impact (γ=0.67); thus hypothesis 5 is accepted. Hypothesis 6 also explored the impact of perceived ease of use (PEOU) on services used (SU). This hypothesis did yield a weaker positive impact (β=13); however the impact is significant enough to confirm the hypothesis.

Hypothesis 7 and 8 explored the impacts of services installed (SI) and stored connections on the indicators of use behaviour (services used (SU) and active connections (AC)). SI has a significant positive effect on SU (β=0.65) and SC also showed a significant positive effect on AC (β=0.27), resulting in confirming both hypothesis. The significance level

of hypothesis 4, the impact of SU on AC (β=0.38), indicates that the level of service usage predicts the level of active connections that users maintain better than the level of connections they have stored.

Hypothesis 9 focused on the impact of a factor of system usability, i.e. perceived ease of use (PEOU) on services installed (SI). Similar to the other impact of PEOU on services (hypothesis 6), the results showed that PEOU showed a weaker positive effect on SI (γ=0.14).

The impact of services installed (SI) on stored connections (SC) was evaluated through hypothesis 10, which was found to show a strong positive effect (β=0.41).

Table 4-5 Direct and Indirect Effects Estimated

Direct Effects						
Construct	**PEOU**	**SI**	**SC**	**SU**	**PU**	**AC**
SI	0.144					
SC		0.411				
SU	0.126	0.647				
PU	0.673					
AC			0.267	0.382		
WTP				0.52	0.165	0.227
Indirect Effects						
Construct	**PEOU**	**SI**	**SC**	**SU**	**PU**	**AC**
SI						
SC	0.059					
SU	0.093					
PU						
AC	0.1	0.357				
WTP	0.247	0.418	0.061	0.087		

Over 46% of the variance in services used (SU) is explained collectively by perceived ease of use (PEOU) and services installed (SI). Along with stored connections (SC), the two variables explained 27% of the variance in active connections (AC). Overall, the six variables studied in the research model explained 49% of the variance in the willingness-to-pay (WTP) for the usage of a software service platform, more through services used (SU). It was 52% compared to 23% for active connections (AC) and 13% for perceived usefulness (PU).

4.7 Analysis Conclusions

Motivated by the globally increasing attractiveness of software service platform use and the parallel increasing interest of developers in offering more services over these platforms, this study aimed at proposing a model explaining the value of software service platforms to users. We explained the relevance of the theoretical framework in service platform markets and analyzed their implications. We chose three explanatory variables based on extensive review of previous research: system usability, service variety, and user connectivity. Each of those variables can reasonably contribute to value creation for users. The dependent variable, user value, is proxied (substituted) through the users' willingness-to-pay, 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 by a user. Otherwise, if the return in user value was lower, the user would not use the platform at all. Therefore, the estimate gives a lower bound on the value expected.

Based on a survey conducted among smartphone users, the study evaluated a structural model of value obtained by software service platform users. Most of the explanatory power of the model resides in the constructs of the service variety and user connectivity determinants. It is remarkable that their explanatory power is stronger than the explanatory power of the constructs of system usability. The structural model analysis showed a strong impact of availability of services on the value obtained by users, confirming all the hypothesis of its positive impact significantly. This means that the availability of compatible services users can install strongly predicts the intensity of their usage of the software service platform, spending more time and money in the process. The results of hypothesis 6 and 9 confirm the findings by previous research regarding the decrease over time of the impact of ease of use on system usage. While it showed a strong positive effect on the perceived usefulness of the platform (γ=0.67), it didn't impact the willingness to use these services over time.

4.7.1 Implications

This study incorporated the value creation process in software service platforms; it identified the determining factors in the process and quantified their role in the value created. The findings suggest several courses of action for software service platform providers and service developers.

The implications for managers of software service platform providers are 1) providing a better understanding of the fundamental concepts in value creation for their stakeholders; 2) finding the drivers related to the costs and benefits of consuming software services that lead to improved value exchange; and 3) identifying the link between value creation and the growth and sustainability of their service platforms.

One implication of the findings regarding the major determinants of value creation is informing platform providers what should be taken into account when building their competitive advantage. Services installed generate a strong drive towards value creation through usage of services as well as connectivity. Therefore, providers need to utilize more marketing and communication methods to improve service discovery, in addition to improving the quality of services to make them more attractive to the users. Since the more quality services are offered, the more likely the users will

be willing to purchase and spend time on using the platform, indicates the importance of service developers for the sustainability of the service platform business. Therefore, ensuring there are incentives for the developers to continue developing quality services should be taken very seriously by the platform providers.

Usefulness was found to have a significant association with the willingness to use the service platform; this result is consistent with previous findings in IS usage research. To maintain or achieve a competitive advantage, platform service providers need to provide a level of quality of service that can enable effective and efficient usage of services. Similarly, developers need to take into consideration the importance of usability for their services to be noticed by the intended users. They should make their own evaluation of the effort and investment it requires to produce a service that can yield them a good return on investment in the market.

The findings regarding ease of use, which showed the weakest positive impact on services used, indicates that ease of use is not a primary concern in deciding to use services. However, confirming hypothesis 2 and findings from previous technology use studies, the perception of ease of use strongly predicted the perception of usefulness. This means the more the users perceive it to be easy to use, the more they will consider it useful as well. Therefore, even if the direct impact on decision to use was found

to be less significant, it is still an important factor of the overall experience of the users. Providers need to continuously put effort into the convenience and user friendliness of their platforms.

Value creation has mainly been dealt with in the field of business management, and in information systems to some extent. However, as new ways of developing and providing services are introduced, there will be new behaviors that will require conceptualizing and explaining. The implications of the study are that as new technological and business innovations emerge, there is a need for researchers to integrate multiple established theories to explain the phenomena associated with them.

4.7.2 Limitations of Analysis

Though efforts were made to include subjects revealing all possible behaviors in relation to the variables of interest, this study had limitations due to the small sample size. Further studies could be conducted involving a more representative sample size, analyzing the impact on multi-group analysis on the results of the model. Multi-group analysis can address if the effects of constructs vary between the different groups of users. For example, there may be variations of behaviors due to income levels, length of use experience, gender, occupation and level of education. Such an

analysis could produce useful information for service platform providers on whether the strongest determinants of value obtained vary across such user attributes.

Chapter 5 Implications and Conclusions

5.1 Summary

IT platforms have been studied extensively, mostly in the context of static models (Church and Gandal, 1992; Park, 2002; Armstrong, 2006), which often led to finding the existence of multiple balanced conditions due to network effects in these markets. As IT service platforms are among the most dynamic markets characterized by network externalities (Amit and Zott, 2001; Lee et al., 2010; Zhu and Iansiti, 2012), there is a need to develop dynamic models to address the value creation problem and understand the cost and benefits of the market participants. As users are the most valuable assets to platform providers and developers, it is important to further investigate the drivers of the benefits they obtain from service platforms.

This study makes several contributions to the literature on platform-based markets. First, it presents a dynamic model for value creation in service platforms. The proposed model was developed in three stages. We started by identifying the main stakeholders. The roles of these stakeholders in these service markets are the basis for their categorization.

The identified stakeholders were the platform provider, the service developers and the users. The next step was to study the value requirements of these stakeholders against the current economic exchange practiced in those markets. Combining these practical observations with existing research in related problems, the most important determinants of value in IT service platforms were identified. As a result, the installed base of the platform, service variety, quality of service and cost of using and offering services were found to be the common determinants of value for all stakeholders.

Based on this framework, a simulation model was developed and evaluated to see how a change in the level of one of the determinants affects the others and the interdependence between the values of the stakeholders. The findings indicated that the value of IT service platforms is mainly dependant on growing the installed base as that was found to be the key for attracting developers and more users. The platform providers obtain the largest share of the profits. However in the face of a limited number of users to be attracted, there is a need for finding ways to enhance value to be captured from the current ecosystem and maintain the incentives for all stakeholders. One of those ways could be finding out what features of the service platform the users value the most and what triggers their willingness to spend their time and money.

Having these findings as a starting point, we developed a structural equation model of the value for users to be empirically analyzed. We identified system usability, service variety, and connectivity as determining factors of user value. The model integrated concepts and assumptions from the technology acceptance model, network externalities and utility theories to structure the value of an IT service platform from the users' point of view. A survey questionnaire was designed to capture valuation of these factors by mobile software service platform users. Data were collected on perceived usefulness, perceived ease of use, services installed, services used, connections stored, active connections, and willingness-to-pay in time and money for services. The structural equation model analysis technique (Amos) was utilized to evaluate the model. According to the results of the analysis, service variety showed the highest positive impact on the users' willingness-to-pay, followed by connectivity and system usability.

The results of the survey were used to confirm the results from simulation on the value model developed. In both types of evaluations, the number of services used by the users showed the strongest impact on the value of users. The raw data from the survey was also utilized to obtain the values for the average number of services downloaded by service users and the average service usage fee, which were used as inputs for the simulation.

5.2 Implications

This work has a few implications for practice and academic research. They are listed here under managerial implications and theoretical implications.

5.2.1 Managerial Implications

This study suggests that despite the complexity of IT service markets, it is possible to model their value systems and predict the likelihood of value creation by combining empirical estimates with a theoretical foundation. The result of this empirical study indicated a strong valuation of service variety by the users, which is the basis for indirect network effect (Amit and Zott, 2001; Lee et al., 2010; Zhu and Iansiti, 2012). This suggests that IT service platform managers cannot rely on an installed base advantage to sustain their competitive advantage. Thus, they need to design strategies for growth and improved value creation accordingly.

The model provides the basis for measures of value sources. These measures evaluate the sustainability of business plans and practices, ultimately helping stakeholders to design better strategies. For example, these include strategies for promoting improved quality of services, improved user experience, marketing and communication methods to facilitate service discovery, pricing and revenue sharing plans.

5.2.2 Theoretical Implications

The theoretical framework developed by this study and the empirical results can help in understanding the dynamics of value creation in other platform-based markets, even if the required strength of the value determinants might show varying levels. For example, users of a social networking platform (e.g., Facebook) might value their connectivity the most, while users of a retail platform (e.g., Amazon) might prefer better system usability and app platform (e.g., Android) users might value the number of games available the most.

This work contributes to the existing literature on value creation and network externalities. It provides a framework to illustrate how one could use the magnitudes of various factors jointly to determine market dynamics. This study addressed the lack of theoretical models that can adequately explain the characteristics of the value creation process of service platforms. It also suggests combining different theories to develop a model that can capture the behavior of all stakeholders. To represent value created during the production of services, the study adopted earlier concepts of the technology acceptance model, which states that usage is decided by the beliefs of usefulness and ease of use embodied by the services. Value created during use (co-creation) is the most important characteristic of service platforms. Therefore, there is a need to

incorporate this behavior into the value model. In this regard, the study adopted network externalities to represent value created through integration of components of the ecosystem (i.e., services, users and providers). Utility theory assumes value to be a function of consumption and accepts willingness-to-pay as a measure of valuation of this consumption. This integrated model showed promise in explaining value of users in terms of factors based on these theories (49%).

5.3 Limitations of Study

A number of important study limitations need to be considered. The main one is the lack of real data to validate the models that have been designed based on literature. To overcome this problem, levels of value representing certain scenarios were used. In addition, a survey of users was conducted. However, the survey comprised a relatively small size of users, who were mostly students representing younger users. These circumstances limit the analytic capacity of the model.

5.4 Suggestions for Further Research

Future research could accomplish a generalization of these study results through a multi-group analysis of the models using a larger sample size. In this study, we prioritized further investigations of the user's value model. However, detailed models for service developers and for platform providers are also important to better understand the value creation process. Finally, it is also important to update the list of stakeholders and value determinants, following new roles and business models that might come up in the marketplace.

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Appendix A: Survey for Mobile Software Service Users

Respondent profile

Gender

Age

Occupation

Income level per year (in US dollars)

When did you start using smartphone for the first time?

Which mobile platform are you using?

Perceived Ease of Use

PEOU It is easy to find and use the applications you need among what is offered by your platform.

Perceived Usefulness

PU I find the applications offered on my platform useful.

Service Variety

SI How many apps do you have on your smartphone?

SU On average, how many apps do you use per day?

Connectivity

SC How many connections (number of friends) in total do you have in your social media apps (i.e., Facebook, google+, twitter, LinkedIn, Skype and others)?

AC Among the above connections (friends), how many people did you communicate with during the last month?

Value

WTP1 On average, how much time per day do you spend using apps on your smartphone?

WTP2 How much did you spend on average per month on usage for apps (e.g., for gaming, listening to music, watching movies)?

Glossary of Terms

Application Developer: Software service creators which use service platforms to offer application services.

Connectivity: The number of personal connections a user can form through an IT service platform.

Installed base: The current number of users of an IT service platform cumulated over time.

IT Service Platform: A marketplace and technology through which IT services are provided. Examples: Browsers (IE,Chrome), Platform services (Windows), Software service platforms (Android, iOS,AWS), Infrastructure service platforms(EC2).

Network effect on IT service platforms: The change in the value of benefits a user obtains from using an IT service platform due to the usage of others.

Platform Provider: A provider of technologies which enable the development, discovery, access and use of services. Example: Apple, Google, Facebook, ebay, Yahoo, Amazon.

Quality of Service: Efficiency of the IT service platform in achieving the intended functionalities.

Relative importance of value determinants: Comparison of the level of contribution of value determinants to the value created for each stakeholder.

Service variety: The number of services currently provided by the IT service platform.

Stakeholders: All participants of an IT service platform marketplace, which have interest in the value generated by the marketplace.

Structural equation modelling: Structural equation modelling is a statistical technique for testing and estimating causal relations using a combination of statistical data and qualitative causal assumptions. The most commonly used analysis techniques are LISREL and AMOS.

System dynamics: A method for understanding the dynamic behaviour of complex systems.

System usability: The level of efficiency and effectiveness a user can execute a job required over the IT service platform.

Two-sided network effect on IT service platforms: A network effect generated by both the supply and demand sides of the IT service platform. A direct network effect resulting from an increase in the number of users of services and an indirect network effect resulting from an increase in the number of services available due to the service developers attracted to join the service platform.

User: Consumers of services offered by platforms. Example: Application service users, Infrastructure service users. They can be end users, application developers or enterprise users based on the type of services consumed.

Value: The worth of the benefits of IT service platforms to providers and users of services.

Value Creation: The performance of actions that increase the worth of goods, services and businesses.

Value Determinants: Factors related to the IT service platform or the features of services offered which affect the value created for the stakeholders.

Value Distribution: Share of the benefits of value propositions in a value network received by each stakeholder as a portion of the total value created.

Value System (Value Network): The principles or schemes which are the basis for value creation and its distribution among the stakeholders.

Abstract in Korean (국문 초록)

IT 서비스 플랫폼의 가치창출 평가:

시뮬레이션과 구조방정식 모형에 기반하여

Netsanet Haile

IT 서비스 플랫폼은 그 안에서 사용자들이 서비스를 개발, 발전시키고 서비스를 구매해서 사용하는 기반을 마련해 준다. IT 서비스 플랫폼의 사용자의 수가 많아지고 플랫폼안에서의 서비스 수가 늘어나면서, 이 서비스 생태계의 모든 참여자가 이득을 볼 수 있는 현상이 지속될지에 관한 질문이 수면위로 떠올랐다. 더 많은 소비자를 끌기 위한 노력을 차지하고서라도, IT 서비스 플랫폼 제공자가 기존의 사용자와 가치 창출을 활발하게 하고 있는 서비스들을 유지하기 위한 노력을 기울이는 것 역시 필요한데 그것은 모든 참여자가 시장에 계속 참여하게 하기 위해서는 모든 참여자가 충분한 가치를 창출하는 것이 매우 중요하기 때문이다.

이 연구에서 우리는 IT 서비스 플랫폼의 생태계의 주요 참여자로서, 플랫폼 제공자, 서비스 개발자, 서비스 사용자를 고려한다. 이 논문에서 다루는 주요한 주제는 이 참여자들이 만들어내는 가치의 특징과 그것의 동태적 변화이다. 이러한 목적을 위해서 상호작용하는 가치창출 모델 을 구성하였다. 가치와 그것들 사이의 상호작용을 표현하기 위해 각각에 대한 파라미터를 부여하였다. 이 파라미터에 기반하여 이 파라미터들이 IT 서비스 플랫폼 참여자의 가치 진화에 어떻게 영향을 주는지를 보여줄 수 있도록 모델을 구성하였다. 그리고 시스템 다이나믹스를 시뮬레이션하는 소프트웨어를 사용하여 이 모델을 평가하였다. 그 결과 얀면 망의부성이가 존재함이 확인되었다. 그러나 성숙시장에서는 더 많은 개발자가 있을수록 서비스 플랫폼 제공자에게 더 이득이 돌아간다. 따라서, 모든 서비스 플랫폼 참여자가 어플리케이션 사용자들이 성장함에 따라 이득을 얻음에도 불구하고, 우리는 얀면 망의부성으로부터 많은 부분의 가치가 플랫폼 제공자에게 돌아간다고 주장할 수 있다. 이것은, 서비스 사용자가 모든 생태게 참여자에게 가치를 공급하는 진원잉을 의미한다. 그러므로, 우리는 IT 서비스 사용자를 위한 가치 모델을 더 깊이 연구하였다.

문헌조사에 기반하여 사용자 가치 모델에 관한 연구를 한 결과 시스템의 편리함, 서비스의 다양성, 서비스 플랫폼과의 연결성을 사용자에게 제공하는 가치의 주요한 결정 요인임이 밝혀졌다. 구조방정식 모델 (SEM)을 3 개의 결정요소와 사용자 가치를 반영하는 여섯개의 관찰된 항목으로 구축하였다. 모델에서 각 항목 간의 관계는 기술 수용모형 과 망외 부성, 효용 이론에 기반하여 가설을 세웠다. AMOS 를 이용한 구조 방정식 분석에 기반하여 도출된 공분산은 210 개의 모바일 플랫폼 사용자들을 설문조사 하여 만들어졌다. 이 연구의 결과는 우리가 가설을 세운 모델의 항목들과 사용자들로부터 얻은 가치의 분산 중 49% 간의 양의 상관관계가 올바르게 설명되고 있음을 보여준다. 이와 관련해서 각 개인의 결정요인들이 얻어진 가치를 설명하는데 기여하는 바는 각각 다음과 같은데 서비스 이용(52%), 연결성 (23%), 그리고 편리성 (16%) 순이었다.

시뮬레이션과 구조 방정식에 대한 평가는, 사요자들이 이득이 대부분 자신의 사용가능한 서비스의 수가 증가하는 것과 플랫폼을 통해 가능한 다른 사용자와의 연결이 증가하는 것에서 발생함을 보여준다. 종합적으로,

이 논문은 가치 창출과 IT 서비스에 관한 영역에서의 연구에 기여하는 바가 있다. 또한 이 연구는 서비스 플랫폼 관리자들을 지지할 수 있는 함의도 포함하고 있다.

주요어 : IT 서비스 플랫폼, 가치 창출, 시스템 다이내믹스, 양면 망의부성이, IT 사업, SaaS, 클라우드 컴퓨팅, 측량, SEM

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