NTNU – Trondheim
Norwegian University of
Science and Technology

Standardization of Online Social Network Services: Concepts, Network Effects and Market Impact

Jiarui Pang

Abstract

During the last decade, there is observed an increasing interest for Social Network Service (SNS) like Facebook, Google+ and similar online social networking platforms. It is clearly a trend that the number of SNS is growing increasingly. SNS have successfully migrated into people's lives and provide social online networking platforms with different features and design. Normally, SNS do not share information. Interoperability across SNS is unavailable. Therefore, many of SNS users own several accounts in order to access different services with duplicate account information. Under such circumstances, there has been a growing public fascination with the comprehensive standardization of SNS. What happens if standardization enters the current market?

SNS standard is defined as a technical standard that aims to provide a simplified and user-friendly environment that diminish the limitations of interoperability across different SNS. There are many attempts in order to realize SNS standardazation, but none of them have archive a globally success, as the drawbacks are plenty and a proper prototype is not officially recognized and deployed by any providers.

Based on the theoretical concepts and simulation analysis, this thesis has elaborate and analyze the effect on standardization on then SNS market, providers and competition. In order to generate a market analysis, a DEMOS-based simulation is modeled and used based on three market scenarios. Together with the simulation results, a business model and game theoretical analysis are presented for measurements on strategic management.

Acknowledgment

In thesis, I would like to express my gratitude toward my supervisor Gergely Biczók for his constant guidance and frequently feedback. I appreciate his valuable information associated with the thesis and encouragement that assists me in completion of this thesis.

Also, I would like to thank my professor Jan Audestad and associate professor Harald Øverby, for their valuable time and insightful contribution.

Finally, I would like to thank my parents and friends, especially to my boyfriend Han Wee Low, for their motivation and support.

Contents

Nomenclature

3G	Third generation of mobile telecommunications technology
4G	The fourth generation of mobile phone mobile communication technology
APIs	Application programming interface
CDMA	Code division multiple access
CEPT	The European Conference of Postal and Telecommunications Administrations
EDGE	Enhanced Data rates for GSM Evolution
ETSI	European Telecommunications Standards Institute
EULA	End-user license agreement
FB	Facebook
FDE	Frequency-domain equalization
FOAF	Friend-Of-A-Friend
Gbit/s	Gigabit per second
GPRS	General packet radio service
GSM	Global System for Mobile Communications
IMT-Advanced	International Mobile Telecommunications Advanced
IPR	Intellectual property rights
ITU	International Telecommunication Union
ITU-R	International Telecommunications Union-Radio communications sector
LTE	Long Term Evolution
Mbit/s	Megabits per second
MIMO	Multiple-input multiple-output

MIT   Massachusetts Institute of Technology

NMT   Nordic Mobile Telephone

OFDMA   Orthogonal frequency-division multiple access

SIOC   Semantically-Interlinked Online Communities

SNS   Social Network Service

ToS   Terms of service

UMTS   Universal Mobile Telecommunications System

W3C   World Wide Web Consortium

XRD   Extensible Resource Descriptor

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Chapter 1

Introduction

In this chapter, the background, motivation, limitation and structure of the thesis are presented.

1.1   Background

Social Network Service (SNS) was first introduced at the year of 1995, known as a online website and platform that provides service for social networking purpose. SNS has marked its growth through historical innovative improvements since its launch. The earliest SNS was Theglobe.com[1], which offered a generalization of simple online communities. The opportunities SNS could provide were limited due to technical limitations of internet at that time. As a result of the rapid growth and revolution of internet, through the years of development, it was flourished a new generation of SNS. SNS of various types are designed for unique networking purpose. SNS can now offer services from for example job hunting to exclusive dating. Not surprisingly, the new generation of SNS is gradually receiving increased attention by people.

There is not any common standard since the first SNS came into market. For instance, Facebook (FB)[2] and Google+[3] are operating on their own architecture, and it is impossible for interconnection between those services. From technical point of view, design and implementation of standardization is a major challenge. For example, this challenge could appear in information integration, in where one SNS needs to adopt information from another. Also, due to incompatibility of individual design architecture, some related users data could not be compatible.

Without standardization, the winner-takes-it-all situation may be a common market phenomenon, as the market development of any involved providers are depending on the network effects. Under such circumstances, the amount of users using same service affects the benefits of consumption. Some of the SNS could gain profits from their increasing amount of users at the influence of positive network effects. Positive network effects arise when the utility of a service increases as the number of users grows. Other benefits for SNS can also arise when the increasing amount of users

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[1]http://www.theglobe.com/
[2]http://www.facebook.com
[3]http://www.googleplus.com

leads to lock-in effect. Users could be gradually locked in to some services, as their valuable user information is centralized in those particular services. Competition between different SNS often results in which the SNS that already establishes a large base of users receives most returns, thus the competitors could be wiped out of the market. Consequently, SNS business model is greatly affected by the lack of standardization.

As the times goes, the public fascination with the comprehensive standardization of SNS is growing in which could solve the major user experience problems when using different SNS. SNS standard plays an important role in SNS industry. It is emerging as a significant innovative step of taking SNS to a better and higher level of user experience. Standardization is considered to be a rational game between the providers involved[1]. In management of decision-making under standardization, the seven key assets are used to exhibit major factor of winning a standard competition play an important role[2]. Apparently, standardization could also affect the firm's strategy to win the competition. Theories and strategy-making commonly used in standard competition are generally based on game theory. Game theory is designed to illustrate the outcomes of competitive parties decisions are depending on the interacting competitors[3]. In this thesis, it examines the SNS market with standardization as a strategy-making process and analysis of the possible impact that could occur as the outcome of standardization.

1.2 Motivation

Standard in SNS is not only dealing with the technical design architecture, it also combines with the management of strategy for actors involved. Standardization means a process of standard-making. As the existing market shows that a common standard is not been deployed, standardization could involve a challenge for related actors to adapt the new rules in order to encounter the competition.

The major challenge is lying on strategic management once the standardization is deployed. For competitors who are seeking economic benefits, it is clearly that they have to identify themselves through continually analysis of the market. What step it should be taken in terms of cooperation and reconstruction of strategic model remains in actors' focus. The potential for nowadays undertaken actor to win back the competition is as much as for the existing winner to lose its market share, since the rules could possibly change. The effects that standardization causes the market must be thoroughly elaborated and analyzed. And it is useful to address and calculate the consequences of each decision made by each actor. Despite standardization could change the situation of market share, prediction and comparison of decision-making could assist both large and small actors to improve their strategies. All these mentioned above are the main drivers for illustration of the market situation with standardization .

The most of actors nowadays are running their own business independently and simultaneously, as the technical limitations do not provide them to interconnect. The size of SNS is what it matters in the current market. The winner-takes-it-all situation seems to hide the potentials of SNS. Nonetheless, it is believed that the potential of gaining economic benefits and technical improve-

ments has not been completely realized due to the lack of standardization.

1.3 Limitation

This thesis will focus on the SNS standard and also its impact in terms of strategic management and benefits for providers in the market. It illustrates the SNS market evolution under the effects of standardization based on empirical study. Through author's research and observations, the data is collected from market simulation. In order to determine the outcome of each decision-making of actors, a simulation tool is used based on specific requirements of market situation and at a defined level of hyphenation. The generated market simulation data is also used in SNS companies' strategic management analysis and performance measurement. The elaboration of the impact is also examined based on combination of literature review, author's opinions and assumptions for future development.

Due to the limited time available for this thesis, the limitations will be listed as follow:

- Only a few actors will be considered in market simulation. They will, in other words, stand for actors in two groups, large and small.

- Assumptions are made in order to simulate the market situation. The assumptions are based on time perspective and size of services.

- Future development will also be depicted in simulation.

- Only the future strategic and development of SNS which take part into standardization will be elaborated. This thesis discusses the evolution as an outcome of SNS standardization.

- Capacity or other detail technical implementation and design of SNS standard will not be studied, as they are beyond the scope of this thesis.

1.4 Contribution

The contribution of the study is shown as follow:

- A theory part is consisting of theoretical definitions, descriptions of academic theory in economics, and distinct properties are described using relevant literature and research made by the author.

- Technical standards and SNS standard are differentiated and summarized through theoretical and empirical findings.

- SNS market with and without standardization and a mix market are illustrated as three different scenarios. They are modeled and simulated with DEMOS-based simulation.

- SNS market evolution is elaborated and discussed by referring strategic management according to game theory, as well as author's opinion and simulation result of future development of SNS market with standard. The result of simulation is also depicted under several circumstances.

1.5 Methodology

1.5.1 Demos simulation

The simulation will take several actors into consideration. Base on different inputs that include for example time and initial user amount, it simulates the development of entire market distribution for distinct providers. The simulation is basically used to demonstrate and exhibit the development of different providers under feedback and churning. The illustration will also suggest further steps in decision-making caused by standardization. The simulation code is based on a implemented simulation program developed by associate professor, Harald Øverby, from Norwegian Science and Technology University, which later improved and featured by the thesis's author.

1.5.2 Business model

The business model used to examine and analyze the providers' strategies is based on Osterwalder's business model ontology. The business model canvas is used as a framework to illustrate for example revenue stream, cost and etc. for SNS providers.

1.5.3 Game theory Analysis

In order to analyze the decision making of individual provider at a standardized SNS market, a reconstruction of strategic management is created for both large and small actors. For each actor it analyzes and compares the benefits of each movement of decision with and without standardization based on the theoretical evaluation of game theory.

1.6 Organization

The thesis refers to several academic literature and reports. It illustrates more specifically on the problem description based on the provided information collected from relevant academic textbooks and universities' library database.

The thesis is organized as follow. Firstly, a theory part of different definitions are studied and given a brief description. Secondly, it addresses the differences between general technical standard and SNS standard based on empirical and historical findings. Thirdly, the impacts of SNS standard are shown in simulation results and described based on game theory and business model. Finally, the conclusion and further work is addressed.

Chapter 2

Theory

In this chapter, it will present some general theoretical definitions of economic concepts related to SNS industry, as a fundamental needed for further empirical study. It also gives a picture about what kind of economic effects SNS are dealing with and typical strategic management in SNS business plan. Furthermore, it provides the knowledge and insights based on literature review.

2.1   Network effects

In many industries, individuals might appear to imitate the behavior of others. For instance, this phenomenon appears when a consumer, at some kinds of decision, receives an explicit benefit of economic or other factors when he/she coordinates his/her behavior with others' behavior. The reason behind this phenomenon is called network effects, also called direct-benefits effects. In general, network effects arise specially in compatible systems in where the interaction with other consumers is relative important. The effects are also addressed as externalities. An externality is in which the welfare of an individual have impacts on others without mutually compensation[3].

An obvious approach to examining network effects is to view the consumers' behavior in the market. Without network effects, consumers barely care about the amount of the same good other consumers are purchasing. For instance, there is a huge number of potential consumers, each of them have relative little influence on the aggregated consumption on the entire market. Each of individual purchases for example apple cares barely about if his consumption will affect anything of the current price of the apple. The impact of each individual's decision has relative small influence and effect on the good's popularity and price. Furthermore, consumers' personal need and interest plays an important role and is normally variable from one to others. The reservation price for a good a consumer is willing to pay for is the major factor in whether he will purchase the good. Nevertheless, a consumer's willingness to purchase a good is not affected by the amount of the good sold to others.

Unlike the market with no network effects, the economy with network effects is modeled regarding to the aggregated popularity of a good as well as consumers' personal intrinsic interest. With

network effects, a potential consumer will take into account both his own affordable level of price and the good or service's total number of consumers. Each individual's willingness to purchase a good is normally determined by the aggregated interest of the good. The aggregated popularity contributes effectively to the incline of the number of consumers joining the market. As noted earlier, an externality occurs when welfare of individual is affected by the behavior of others. The increasing amount of consumers in the shown area has affected the increment of others' welfare of purchasing the same good. In the sense of incremented welfare, it is called positive externalities. The effects associated with the positive externalities are basically the function of network size. As the consumers increases, means the size grows, which in turn affect the popularity. The positive externalities can usually be found in the markets where amount of consumers is driven by the good's total popularity, especially at a good that is new piece of technology or SNS. Microsoft product that owns a large installed base of consumers, attract an increasing amount of new consumers as its product receives a high demand from the market. Furthermore, each good or service has its own value based on the aggregated interest from entire market. An incremental consumer contributes to growth of the good's value. The concept of value is abstract in this context, but it can be exhibited in the sense of amount of total related objects. The value of a consumer network can be calculated using distinct network laws, shown as follow,

Value of a network, n = users:

- Sarnoff's law, $v(n) = n$

- Odlyzko-Tilly, $v(n) = n \log n$

- Metcalfe's law, $v(n) = n(n-1)/2 = O(n^2)$

- Reeds law, $v(n) = 2^n$

Figure 2.1 illustrates the development of network value over size of network using different calculating methods.

David Sarnoff[1] presented the Sarnoff's law that estimates the broadcast network value. As the function of Sarnoff's law illustrates, the value of a broadcast network is typically to be proportional to the number of users[5]. The audience of radio and television broadcasting creates a larger network of consumers that easily attract advertisers.

Metcalfe[2]'s law is applied in where communication networks allow free interactions between users. The value of a network is proportionate to the number of connections between users. Connections

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[1] David Sarnoff, the American radio and television pioneer.
[2] Robert Metcalfe, graduated from MIT in 1969 with two B.S. degrees, one in Electrical Engineering and the other in Industrial Management from the MIT Sloan School of Management.
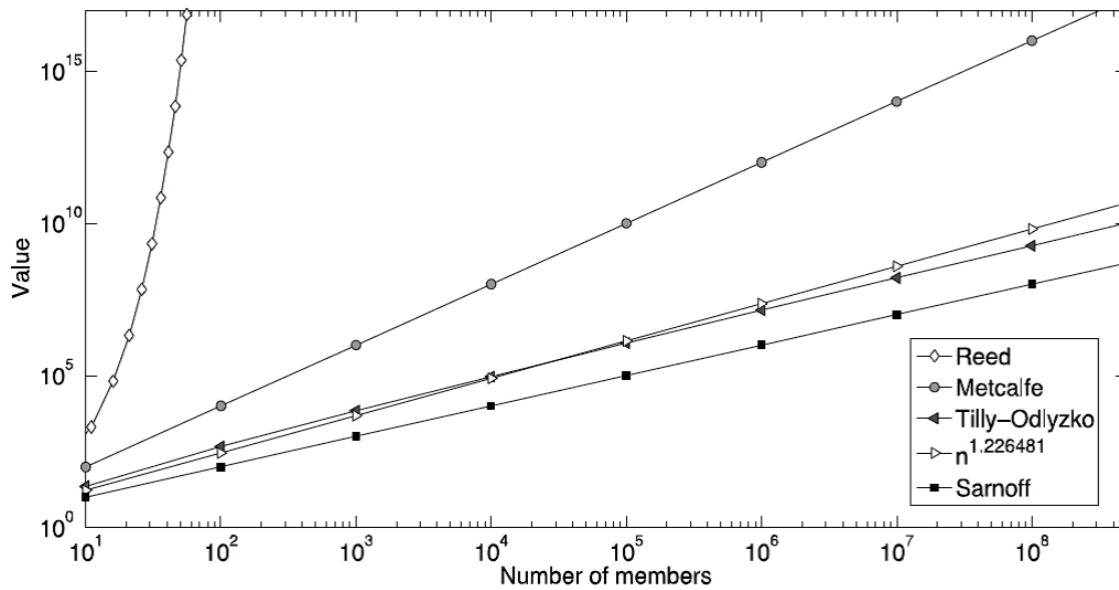
Figure 2.1: Effects calculated by different methods[4]

are basically made between pairs of involved users. Due to the failure of telecom booms, the growth in Metcalf's law, as noted, is much slower than the one based on Sarnoff's law[5].

Unlikely, Reed[3]'s law is intuitively applied in where communication network is consisting of groups. As the formulation states, the network value can scale more than the mentioned laws. The forming of 2^n groups is the concept behind Reed's law, and the value of network is growing in size of 2^n. The fundamental concept underlying the Reed's law is in assumption that the value of a network is proportionate to the number of groups. The valuation methods are provided for different types of purpose. They are addressed in figure 2.1 as follow.

Network layer	Social Base	Area
Political Network	Sarnoff's Law, N	Publishing
Social Network	Metcalfe's Law, N^2	Communication
Creative Network	Reed's Law, 2^N	Collaboration

Table 2.1: Different types of valuation of network and their applicable area[6]

A refutation of Metcalf's law was addressed by Odlyzko[4] and Tilly[5], states that a better estimate for value of networks through real world observations and interconnections can be improved by

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[3]David R. Reed,

[4]Andrew Odlyzko, Digital Technology Center, University of Minnesota 499 Walter Library , 117 Pleasan t St. SE Minneapolis, MN 55455, USA, odlyzko@umn.edu

[5]Benjamin Tilly, ben tilly@operamail.com

another rule, *nlogn*[5]. Tilly and Odlyzko's law is built on Zipf's law and scales the user value as *logn*. It describes a consistent rule of calculating network value of communication network.

The growth resulted by positive externalities could be considered as a disruptive movement, especially for providers that are not capable to incur a critical mass of consumers. Obtaining a critical mass of consumers means a firm is successfully attracting popularity to maintain the incline of total consumers over time. If it is fulfilled, the value of the providers' consumer network might be highly affected in such a manner that the growing path derives largely into a winner-takes-it-all situation. A critical mass of consumers is gathered to form a network, and a positive externality is effectively emerged which in turn creating a stronger incline of total number of consumers. As two providers compete a small lead in market share, it may heighten one's competitive position thus assist it further increase its lead. Along with the proportional increasing consumers on one side, the disruptiveness for the other one could be found intuitively. The growing path depicts the life cycle for providers affected by network effects in Figure 2.2.

The technology adoption life cycle rolls on towards a dominant market. Positive externality favors big providers with large installed base of consumers. The effects undermine efficiently the providers with less consumer network. Particularly in creating sustainable consumer network, according to the phenomenon of later network effects, consumers connected to the dominant firm will grow rapidly. Under such circumstances, the undermined firm will lose its the sufficient mass of consumers and also the competitive fundamental. As the market development exhibits over time, the different between providers will be clearly visible. Positive externalities magnify the effect of economic shift, and the weakest will be driven out of the competition. An example of positive externalities is video-cassette recorders. Two competing products were presented to consumers in the market with the approximately same price. Each system competes for the market share that increases the value of the given system thus also increase the probability of consumers purchasing the same product.

Conventional consequences caused by network effects are based on the assumption of positive externalities. Eventually, a negative externality could emerge to stabilize the economy for market shares. Equilibrium is engendered by the offset of any generated changes. An example of negative externalities is traffic congestion. As the traffic of broadband is overloaded, consumers could unfortunately experience loads of delay, thus decreasing the level of user-experience. The number of participants increases leads to the payoffs of participating in the underlying activity decreases[3].

Until now, positive and negative externalities are presented. But in many real situations, Both types of externalities would seem to appear simultaneously. As noted, the more consumers a firm could attract to its service, the better it will be, thus generating positive externalities. But it is pleasant provided it does not exceed the limit and emerge congestion. If congestion is occurred, that might decrease the user-experience thus causing negative externalities. The reason behind this is the user participation level of a certain service.
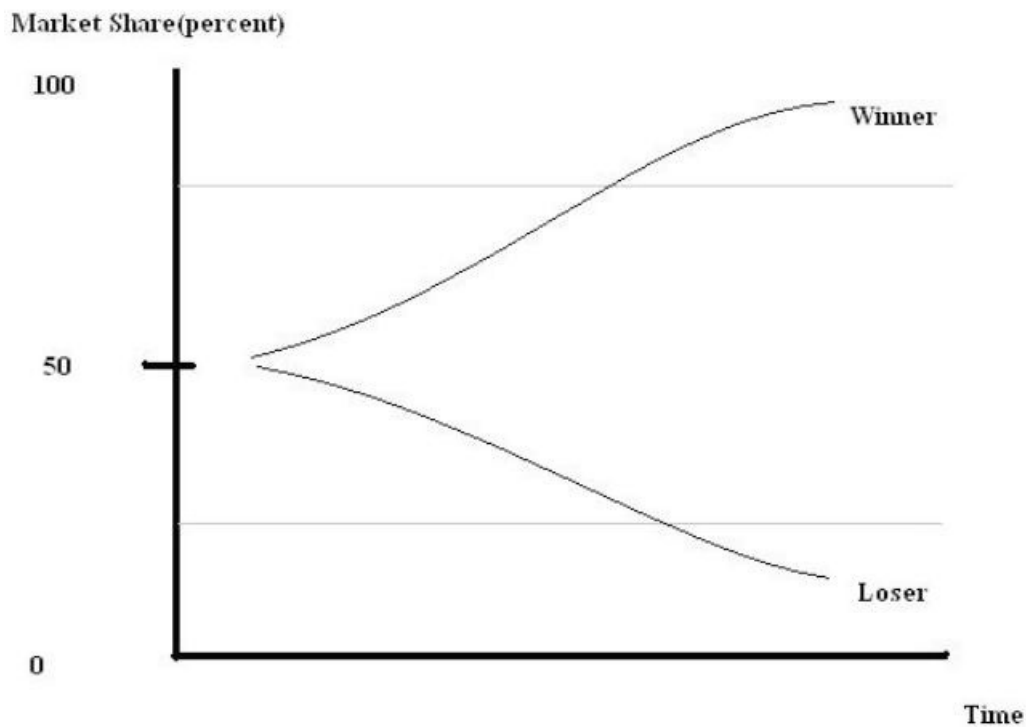
Figure 2.2: Positive externality

2.2   Lock-in effects and churning

Other relevant economic effects triggered by network effects are lock-in effects. Lock-in effects enable providers to lock consumers to their services or purchase their goods, as they offer exclusivity or reasonable prices to capture consumers. Strategies of lock-in effects are usually applied to consumers, and by providers that have intention to avoid or at least reduce the impact in terms of loss of users to competitors[7]. Churning is the result of lock-in effects, as it addresses the amount of consumers of a given firm switch to another service or product. Normally, providers would experience loss of a certain percentage of users depending on the strength of lock-in effects. To avoid churning, it means against the loss of users to other providers, the level of subsidization to consumers remains as a costly and challenging problem. Furthermore, the switching cost that assumes the cost of changing supplier is determent in lock-in effects.

An example of lock-in effects is occurred at the Bell Atlantic case[2]. Bell Atlantic purchased switches from AT&T in late 1980. The company paid approximately 3 billion dollars on the investment. Due to the proprietary solution of the system provided by AT&T, it only offered expensive software enhancements and monopolization at upgrades and aftermarket. The switching cost for Bell Atlantic was highly costly and caused that Bell Atlantic was lock-in to AT&T.

Typically, switching cost could be covered by many lock-in alternatives as providers are willing

to strengthen consumers' loyalty by subsidization. Some of them are illustrated in the table shown in Table 2.2.

	providers - Consumers
Hardware Industry	CD, DVD
Software Industry	Online updates
Mobile Network Industry	Loyalty programs

Table 2.2: Classification of lock-in

2.3 Business model

Alexander Osterwalder[6] has given the most common and basic definition of a business model according to Business Model Canvas[8]. Business model is modeled to illustrate the method and process an organization uses to create, deliver and capture its value in terms of economic, cultural and etc. The business model described here is based on "Business Model Generation"[8]. It depicts nine major building blocks in a business model and the relationships between them. Figure 2.3 is depicted based on Business Model Canvas.

- KEY PARTNERS, Who are the suppliers and partners?

- KEY ACTIVITIES, What are the important actions that must to be taken?

- KEY RESOURCES, What are the necessary assets?

- VALUE PROPOSITION, How to satisfy customer's need?

- CUSTOMER RELATIONSHIPS, How to maintain customer relationship?

- CHANNELS, How to reach customers?

- CUSTOMERS, Who is the customers?

- COSTS, Where does the cost come from?

- REVENUE, Where does the revenue come from?

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[6]Alexander Osterwalder, author of Business Model Canvas, read more at http://alexosterwalder.com/
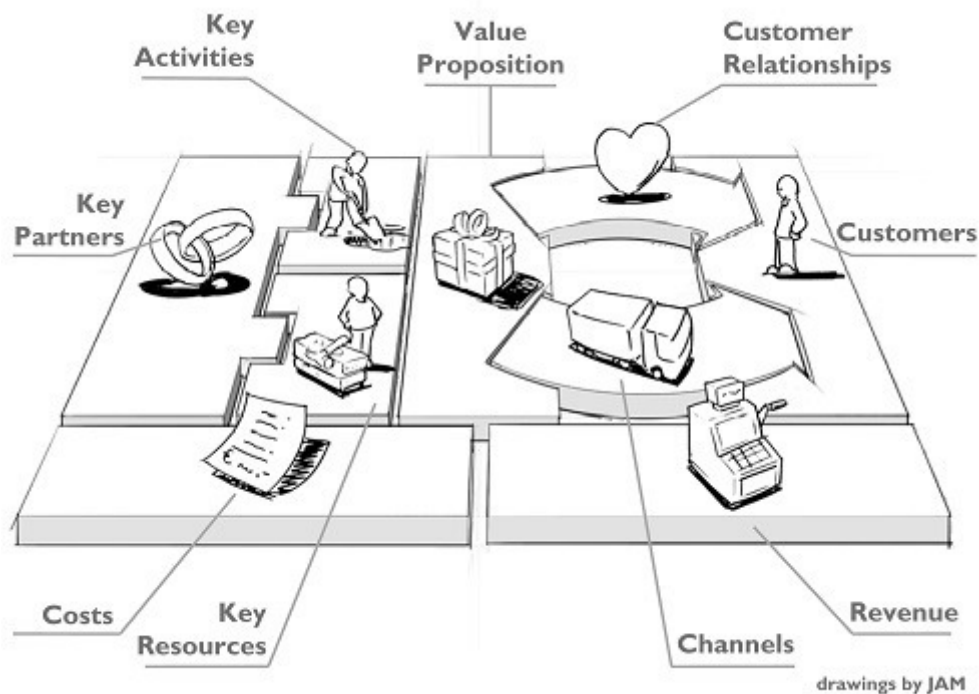
Figure 2.3: Business Model Canvas

2.4   Game theory

Interconnectedness in terms of behavior of several competitors is modeled in the language of game theory.

Game Theory is "The study of strategic making and mathematical models of conflict and cooperation between intelligent rational decision makers" [9]

Game theory is applied widely in decision-making, the situations in which the outcome of an actor's decisions is depending on and being effected by the interacting competitors' decision and behavior. The basic idea of game theory is used in many contexts. A typical example is pricing of a homogeneous product among various providers in the same industry, which involves game-theoretic ideas. Examples that regard to game theoretic ideas can be analyzed by the strategic element in game theory.

In the definition of game theory, it usually considers an interacting game consisting of a set of participants or actors before analyzing the consequence of a decision. Each actor has and can choose between different decisions for their strategic behavior. Thus, a payoff is followed by each selected choice of strategies and generally preferred to be maximized. As mentioned above, those are the underlying assumptions for game theory in a game. En example of a game and predicted outcome of each decision-making is described as follow in Table2.3.

	Player B		
		Presentation	Exam
Player A	Presentation	90,90	86,92
	Exam	92,86	88,88

Table 2.3: Exam or presentation?[3]

When analyzing the outcome illustrated above, it exhibits that player A has a strictly better option regardless of what player B choose. It refers to a strictly dominant strategy[3], *p143*. that will be played by player A in this case. A related problem that is similar to the mentioned case is the famous example of game theory, the Prisoner's Dilemma, illustrated in Table2.4.

	Player 2		
		Confess	Don't confess
Player 1	Confess	-6,-6	0,10
	Don't confess	-10,0	-1,-1

Table 2.4: The Prisoner's Dilemma

The Prisoner's Dilemma describes the payoff of the prisoners' decision. The goal is to achieve minimization of sanction, as the outcome is depending on the behavior of each prisoner. Based on this example, there are two fundamental concepts used in reasoning of game theory, the best response and dominant strategies [3] *p146*. A strategy of a paired strategy for one player is said to be best response to another strategy of the same paired strategy for the opposite player when it denotes at least a payoff as good as any other strategy of that paired. A strictly dominant strategy is a strategy that is strictly best response to every strategy of the opposite player. When a strictly dominant strategy is found, it is expected the player will play this strategy. Unlikely, a player can have multiple dominant strategies that do not illustrate which one he would prefer to play.

Nash Equilibrium [7]is developed to analyze a game when a strictly dominant strategy is not found in a two-player game. It proposes that, "if there are no dominant strategies, we should expect players to use strategies that are best response to each other."[3] *p150*. Based on the assumptions of a pair of strategies that are not best response to each other will not be believed by players to be used, given the player will have the incentive to deviate to another strategy.

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[7]Nash Equilibrium, developed and announced by John Nash who is an American scientist and mathematist. See more at http://en.wikipedia.org/wiki/Nash_equilibrium

Market entry game

Furthermore, for a large number of players to choose whether or not to undertake some activities or decisions, we refer it to the common problem of market entry game[10]. It is a study about equilibrium behavior of a game and strategy management that explains and predicts how the factors such as sufficiency and adequate interact. In a market entry game, there are a large number of players in where their decision of whether to join the market or not have to be made independently and simultaneously. Individual strategies about entering the market could generally affect the payoff of each player. The major problem is in the structure of profit and consumers surplus. Determination of the effect of probability of entry, payoff, benefits and other relevant factors is essential for analyzing a market entry game. It assists to develop and provide a fundamental insight about the market situation and prediction of future phases. Based on the strategy made by player, it results in different payoff, as illustrated in Table2.4.

$$\pi_i(\delta) = \begin{cases} v, & \text{if } \delta^i = 0, \\ v + r(c - m), & \text{if } \delta^i = 1. \end{cases}$$

Figure 2.4: Payoff of different strategy[10]

Coordination game

Coordination game considers the problem when there is more than one Nash Equilibrium. The goal of both players is to coordinate on the same strategy[3] *p151*. Generally, there is two or more Nash Equilibrium that maximizes their payoff of pair of decisions. Examples include when two machinery producers have to decide whether to go for the standard or not for the homogenous products. Focal point [8]was introduced to solve problems that arise in this context. According to focal points, it is not unusual that players focus on one Nash equilibrium based on the predicted conditions. For instance, convention of social or other type can be a reason for mutually agreed equilibrium without facing the difficulty of coordination problem.

Unbalance coordination games usually appear in reality, which means any equilibrium give higher payoff to one of the players, or among the existing Nash equilibrium there is one that gives higher payoff than others. The former one is traditionally called the Battle of the Sexes. Prediction on the equilibrium is basically hard based on social convention. In these contexts, it becomes helpful to gain information about the players and suggestions of coordinating variations. For the latter one, a feature called intrinsic can be used to predict the equilibrium chosen by the players based on individual social convention.

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[8]Focal point was introduced by Thomas Schelling.

Chapter 3

Technical standards and Standardization

In this chapter, it will describe the definition of technical standard and standardization. It also illustrates some examples of standards and standardization of telecommunication technology.

3.1 Definition of standard and technical standard

Generally, standard is defined as the outcome of standardization, a process of standard making. Standardization is "the activity of establishing and recording a limited set of solutions to actual and potential matching problems, directed at befts for the party or parties involved, balancing their needs and intending and expecting that these solutions will be repeatedly or continuously used during a certain period by a substantial number of the parties for whom they are meant."[11] Standards can be classified by the definitions concerning standards and interfaces[12] *p191*, and it is addressed as follow,

- Standard, a set of technical specifications that can be adhered by a producer, tacitly or formally.

- Compatibility standard, that defines one or more interfaces that enables interoperability.

- Open Standard, that defines a compatibility standard which is publicly available.

- Proprietary standard, those specifications are not publicly available.

- Sponsored standard, that covered by essential intellectual property rights

- De-jure standard, that is enforced by law.

- De-facto standard, that is broadly used in a certain industry.

- Formal standard, standarded by officially recognized standards body

- Interface, a set of specifications that defines the interoperability between certain entities of a network

- Open interface, that is publicly available.

For IT and telecommunication sector, specifications are usually defined by a provider or manufacturer, hence form a technical standard, which is not included in the definition above. According to David and Steinmüller, a technical standard is therefore defined as the following,

"A set of technical specifications adhered to by a producer, either tacitly or as a result of a formal agreement."

Technical standards may exist in various forms, such as documents for both private and public use. It can apply to for example operative systems, telecommunication infrastructure system such as Global System for Mobile Communications(GSM) and Universal Mobile Telecommunications System(UTMS), video cassette recorders and CD players. Products that share the same standard are presented as compatible, in which interchangeability is commonly available. The geographically coordination problem such as technical barriers across borders, can be solved by deploying a standard in different geographic levels as it offers a mutually compatibility. It can be defined formally in categories of national, regional or international.

The primary types of technical standards are derived into the following[1],

- Standard specification, that defines the requirements of physical material and performance.

- Standard test method, that applies a comprehensive description for method used to formalize a test result.

- Standard practice or procedure, that defines a set of exact instructions or operation procedure.

- Standard guide, that contains information which is not required for specific action.

- Standard definition, that describes established terminology.

- Standard units, that refers to physical measurements.

Among the types of technical standards, they are classified in use of different way[11],

- Market competition involving products embodying unsupported standards.

- Market competition among sponsored standards(or proprietary standards).

- Agreements within voluntary standards-writing organizations

Other classifications of standards take the origin, level of enforceability, inclusion of Intellectual property rights(IPR) and availability of a standard into account. The rise of technical standards offers consumer benefits in numerous ways, such as higher flexibility while using products of one standard and lower cost on interchanging of similar goods.

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[1]http://en.wikipedia.org/wiki/Technical_standard

Through a set of development and implementation process, technical standards are presented as a final result of standardization. Standardization is a procedure and exhibits the major challenge of achievement of standard-making. For industries such as information technology, the influence of technical standards has a huge potential impact on the relevant market. Slightly change in a standard or standard-making could have highly affected the business strategies and the firm's life of survival in a competition. The creation of technical standards is a process of three activities[13], shown as the following,

1. Involved actors create an artifacts that live up to the qualifications and requirements that integrated the standard specifications.

2. A form of innovation from the existing technology.

3. Involved actors' willingness to participate and support the new solution of current technology that forms standardization.

Emergence of standardization is basically due to many factors such economic, strategic management, social and political arguments. Technology that has been developed for a long enough period and gradually being similar to each other, it is generally adapted by most of users and achieved significant success. Environmental and socio factors potentially lead to the emergence of standardization, as the technical standards provide compatibility that is logically necessary for sustaining benefits.

3.2 Technical standard in mobile network

In telecommunication industry, the development of technical standard plays an increasing important role. GSM and UMTS are the typical mobile communication standards that mark the evolution of telecommunication history. Mobile standards and standardization went through various phrases and involves different types of actors. History of standardization of GSM and UMTS are described in the following sections.

3.2.1 The emergence of GSM

Typically, only some selective groups of users had access to mobile telephony in the early 1980s. During the decades mobile telephony was available for users, the capacity and coverage of the system was limited. Due to the large consumption of power, it was only suitable for installation in large equipments, vehicles or use in industries. The technical disadvantages caused by availability of frequencies and radio base station, had continuously restricted the number of the users.

Nordic Mobile Telephone(NMT) introduced two new concepts in mobile communications: roaming and handover. Roaming means that the user can move between different parts of the network, in particular between networks of different operators, making or receiving calls without manually updating the current location of the mobile terminal and this was impossible in the earlier manual mobile systems. The location management is an automatic and autonomous process taking place between the mobile terminal and the network without involvement of the user. Handover means that if the terminal is moving from one radio cell to another during conversation, the call is not interrupted but automatically handed over to the new base station. The user will not recognize that this action takes place. NMT was put in operation in 1981 in the Nordic countries, and was the world's first automatic mobile telephone system. However, NMT never became a common European standard because different and incompatible systems were introduced in UK, Germany, France, and Italy. NMT was also implemented in the Netherlands, Switzerland, and Spain. This situation led the Netherlands PTT to propose that the European PTTs joined forces and specified a common system for Europe in 1982. Roaming and handover as developed for NMT formed the basis of the GSM system specifications. In the GSM system, the functions were improved, extended and supplemented with several other autonomous functions. The work on the GSM standard started in 1982 in the European standards and policy organ The European Conference of Postal and Telecommunications Administrations(CEPT) (later European Telecommunications Standards Institute(ETSI)). The specification was finished in 1989 and the system was put in operation in 1991. While NMT was a pure telephone system, GSM supported also data communication with speed up to about 10 kbps (limited by the bandwidth of the radio channel). Throughout the 1990s the data capacity was extended by General packet radio service(GPRS) (where several basic radio channels were coupled together) and EDGE (where less bandwidth-consuming modulation was introduced)[14].

3.2.2 The rise of 3G and LTE

GSM has been the most common mobile standard that dominates the market, until Third generation of mobile telecommunications technology(3G) is gradually deployed by the most of the countries. It was first developed by the International Telecommunication Union(ITU) in the beginning of 1980s. The specifications and standards of 3G were nearly developed for 15 years and there are many network systems that developed and branded as 3G. The first pre-commercial 3G network was launched in Japan in 1998[2]. UMTS that launched in 2001 and Code division multiple access 2000(CDMA2000) in 2002 are some of the examples. Higher data rates and new frequency bands are the most common characterizations of those mentioned 3G network systems. But the adoption of 3G networks were slowly worldwide due to the unique radio frequencies. It required new network infrastructure and license of new frequencies in order to provide higher transmission rates. Therefore, the mentioned difficulties had become a barrier and halted the deployment of 3G. During the last decades, 3G networks have experience a massive expansion and adopted by many countries worldwide. An it was introduced gradually by the smart phones that combines mobile broadband to the networks. The higher transmission speed and capability have make the growth of 3G becoming increasingly.

Furthermore, The fourth generation of mobile phone mobile communication technology(4G) came as a successor of 3G networks thus presents the fourth generation of mobile phone mobile communication technology standards. It was first introduced by International Telecommunications Union-Radio communications sector(ITU-R), as a International Mobile Telecommunications Advanced(IMT-Advanced) specifications that provide peak speed at 100 Mbit/s and 1 Gbit/s for high and low mobility communication. 4G networks are known for providing mobile ultra-broadband, as it supports high speed transmission that enables high definition mobile TV, video conferencing and etc. In Norway and Sweden, Long Term Evolution (LTE) is the first-release 4G network. Mobile WiMax, was first deployed in South Korea in 2006, later also deployed in U.S in 2010. 4G abandoned the spread spectrum used in 3G and used Orthogonal frequency-division multiple access(OFDMA) multi-carrier transmission and other Frequency-domain equalization(FDE) schemes in stead. Those enable the high transmission rates together with Multiple-input multiple-output(MIMO) communications. The technologies used in 4G require less complexity for equalization at receiver. The motivation for developing 3G and 4G systems was to increase the data rate over the radio connection, the reason being that GSM was unable to offer data rates that mobile internet applications demanded. Nowadays, many countries have taken part into deployment of 4G networks and it is believed that the technology will gradually adopted by the market.

As mentioned above, standardization of mobile network in Europe had been through several long-term phases that required active involvement and contributions from many actors. Actors include network operators; manufactures and European Community have played an important role in implementation and deployment. Adoption of technology by users outlined the success of the common standard. The standard of mobile network is a complex system, the process of standardization can be distinguished in following phases[12], (1) The development phase, in which technical, economic

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[2]NTT DoCoMo launched the first 3G network and branded it as FOMA.

and strategic design issues are considered and determined. (2) The Adoption Phase, in which the involvement and contributions of relevant actors are in action. (3) The Diffusion phase, in which the competitive technology must meet the market expectations.

Chapter 4

SNS standard

SNS standard is categorized under technical standard, as it requires a set of technical specifications adhered to a provider or a formal agreement to be fulfilled and implemented. In information technology industry, standards play a highly significant role. SNS, as a newly developed IT service, has received a rapid growth in number and acceptance. Despite the service is gaining enormous attention, their proprietary standards restrict the interaction between different services. A common standard is remained to be implemented and deployed. Consequently, the increasing number of SNS has created an intense battlefield for any new incumbents and current providers, hence triggers a typical winner-takes-it-all situation. A common standard of SNS would seem to diminish this phenomena. SNS standard can emerge in different ways, and the form of these standards may vary based on the main factors that carried out during standardization process. It is proposed in the following section some variations of SNS standards by exploring the economic theory and technology measurements.

4.1 Variation of SNS standards

4.1.1 De-facto standard

De-facto standards used to emerge in market with a leading provider that owns a large installed base of customers. It is described as a custom standard that achieved an initial lead in the market by adoption of the customers; hence in turn increase the attractiveness to third parties to support the standard. The network effects that amplify the popularity and encourage even more new customers until other standards are driven out of the competition. It is used to describe the dominant standard when the number of standard are more than one and working for the same purpose. The examples of de-facto standards include the driver's seat side, the QWERTY keyboard system, the Adobe Postscript language, Microsoft Word format for documents and etc. Personal computer did not have a standard as it began to be manufactured in early 1980s. Various equipment was developed by different manufactures, and they only could be used with their own particular system. IBM was the dominant player in the industry and created a personal computer that encouraged other vendors to make compatible equipment with IBM PC. De-facto standard was therefore created by IBM in

computer industry.

The current situation exhibits that there are many SNS in the market, but a common standard does not exist. The actors' motivation for attracting customers is high due to the lack of standardization that amplifies the market impact of network effects. Those who are successful in creating a large installed base of customers seize the initial lead in the market. Nowadays, FB is counted as the largest SNS. It has become a dominant actor. Despite the lack of standardization, each SNS is operating on its own design architecture. Those architectures are considered to be independent and acting as a standard for its own service. However, some of them have developed with interconnection to the largest providers. Several studies illustrates that some services allow users to log in with their FB accounts. This enables the users to create a profile of duplicate information by transferring their account information from FB. The intension of providing a shortcut of registration is to attract users using the services. Simultaneously, it may accelerate the dominant of the largest actor, and the relevant technical characteristic of its standard may gradually become the standard of the market.

4.1.2 Data portability

Several studies have revealed that a common standard of a technology may not follow the footstep of the dominant provider. GSM standard was an example of creating a new standard regardless of the market share of the existing actors. The main challenge in standardization of SNS is the proprietary architecture of system. User information is generally not available for transferring among services. It has been suggested that standardization of SNS can be realized by resolving the problem in data portability. This requires mechanism that for example can enable the portability of data in each SNS. The technologies that support such mechanism are found in Semantic Web, as it is suggested as an efficient solution in data portability.

Data portability enables user data to be reused between multiple services, in such a manner that users' access to different services is achieved. For instance, portability of identification including personal profiles and lists of friends, users' generated content including posts, comments, photos and related data type, is needed to be implemented and deployed. To better achieve portability of the user data, representation mechanisms are needed to establish interconnection between related objects. Several studies have reported that[15], for providing mechanism mentioned above, the Semantic Web offers representation mechanisms that meet the requirements. The Semantic Web is defined as, "an extension of the current Web in which information is given well-defined meaning, better enabling computers and people to work in cooperation."[15]. Furthermore, the advantages of the Semantic Web enable the interchange of infrastructure, information integration and innovative way in reusing user data, as some of the restrictions of Web 2.0[1] can be solved. By combining the semantics to Web 2.0 sites, it provides an interlinked web that SNS can collaborate and interconnect using the same semantics. An enhanced view of interconnected SNS is therefore provided through

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[1]Web 2.0 refers to a wide range of common web-based tools that used to strengthen the communication and interconnection between users. Examples of Web 2.0 include SNS, blog and etc.

semantically-linked data.

There are several projects that contribute to achieve an interlinked environment of SNS based on the technologies of the Semantic Web. Both the Friend-Of-A-Friend(FOAF)[2] and Semantically-Interlinked Online Communities(SIOC)[3] project have shown their initiative by offering different solution to meet the requirements of data portability[15]. Generally, FOAF defines an ontology in such a manner that a user-profile and its relationships to others can be represented. In addition, it also presents to be an entry point for individual user data across various SNS. Simultaneously, the SIOC's initiative is to describe the Web-based communication and content-sharing. User-created content can be linked to related content through a SIOC import tool. This enables users, together with FOAF; port all the user-created content from one SNS to another.

4.1.3 The ideal standard

Despite the advantages of the Semantic Web, process of development and implementation may be costly and inefficient. Not all of the SNS have express structured information through open Application programming interfaces(API) and microformats, and the restrictions remain to be improved. The overall structure of SNS is not change despite the data is being portable. The servers of storing user information are still proprietary. A user must have sign up for different accounts in order to combine them together. The ideal standard of SNS may present an environment that information will be shared between SNS. In other words, the proprietary solution of each SNS would not exist. This may diminish the limitations and archive a more efficient way of interoperability. What a standardization of SNS can offer are ideally listed as the following, (1) mutually interconnection of users across different services with one single sign-in. (2) User-generated content can be available across services. (3)SNS servers share the user data in such a manner that information integration and information adoption are successfully achieved. These specifications require a mutually agreement of current SNS and technology contributions and adoption of each provider.

4.2 SNS- and standardization history

Despite the increasing popularity of SNS, it is still considered to be a relative new technology. The development of SNS has been through several decades, but it was only in 2003 that SNS become remarkably active for online socialization. And the possibility of interoperability has been a major challenge from the beginning. Recently, several attempts have been made to realize the standardization of SNS either through an agreed-upon protocol or third-party tool. However, approaches of this kind carry with them various limitations and none of them have been successful deployed globally. In order to better understand the reasons of major challenges behind SNS standardization, the SNS and SNS standard history will be described as below.

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[2]Friend-of-a-Friend - http://www.foaf-project.org

[3]Semantically-Interlinked Online Communities - http://sioc-project.org

4.2.1 SNS history

The term SNS is defined as, a platform to build social networks or social relations among people who share interests, activities or real life connections (ref). The first available services on internet were Usenet groups and bulletin boards, as online communities to discuss about specific topics [4]. In the year of 1995, TheGlobe.com[5] was launched, and known as a form of generalized online community. The purpose of the community was to bring people to interact by providing chat rooms and online sharing of personal information and ideas. The technology was based on simple publishing tools and less costly or free web spaces.Later, social network site is distinguished from the earlier form, and defined as, "a web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system."[16]. It is clearly that the social networking site as part of the SNS provided a more user-friendly and featured SNS. In the year of 1997, SixDegrees.com[6] was launched in US, as the first recognizable social network site[16]. Another example was Classmate.com[7], as it enabled people to interact with others from the same education facilities such as high school or college. Simultaneously, SixDegrees was ahead in the market with its additional features of user-generated personal profiles and list friends. It experienced a rapid growth in number of users in the later years. At this period, SNS was initially few in number.

At this period, SNS was initially few in number. As the time passed, more providers came into the market. A few years after the launch of SixDegrees, the number of SNS increased rapidly, as more and more community tool provided various features of online social networking. It accelerated the competition among SNS. Due to the lack of improved user-experience and competition, SixDegrees closed its business in the year of 2000. The rise and fall of SixDegrees did not take many years, as it gradually lost the attention from people. The launch of numerous community tools spread worldwide during the years of 1997 to 2001. Many community tools refreshed themselves with various SNS features that distinguished themselves from each other[8].

New generation of SNS began to flourish in the year of 2000. Remarkably, Ryze.com[9] was launched in the year of 2001. The main purpose of the service was to help people connect their business networks. Likewise, Friendster came into the market in 2002 and being a social complement to Ryze and competitor to Match.com, it became a success and attracted numerous of users. Surprisingly, it later suffered technical difficulties due to its increasing growth of users. Several problems were also triggered by the exponential increasing popularity. User activities were regulated by the stage of usage. Many phantom profiles were made in order to level up the user stage and cross the restrictions. The popularity of the service faded gradually, as Friendster initially set

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[4]http://connection.ebscohost.com/technology/social-networking-sites/history-online-social-networks

[5]http://www.theglobe.com

[6]http://www.sixdegrees.com

[7]http://www.classmate.com

[8]Examples include, LunarStorm in Sweden(D. Skog, personal communication, September 24, 2007).;Cyworld in Korea;LiveJournal (B. Fitzpatrick, personal communication, June 15, 2007)and etc.

[9]http://www.ryze.com

up measurements to hinder the profile-faking but it turned out to accelerate the collapse in users interests.

Despite numerous SNS were launched from the year of 2003, the popularity was increasing continually. MySpace was launched in 2003, as a competitor for Friendster or similar. Users were convinced to switch to MySpace from other SNS, especially Friendster, as rumors emerged about a fee-based system that Friendster was going to adopt. Therefore, MySpace gained a large base of users from estrangement of Friendster's users. Additional, MySpace began to build its relationship to users by supporting various users' interests. Further, it expanded beyond Friendster and added regularly features in order to provide better user experience. In the later years, MySpace attracted millions of teenagers and became the majority of media attention globally. Despite the fall of Friendster in U.S, it gained attention in other parts of the world, such as in South-East Asia and Pacific Islands. Similarly, Chinese QQ[10] grew rapidly in number of users and became the biggest SNS. Other SNS such as LunarStorm in Sweden and Bebo[11] in United Kingdom also developed to newer form and attracted more usage. Alongside these services, many blogging services also began to include SNS features and became part of the market. FB came into the market in 2004. Initially, the main purpose of the service was to help people to connect with distinct college or university networks. It was a Harvard-only SNS until it began to support other schools. Further, it focused on growing globally and broadly with additional applications that enabled users to customize user-profiles and other related features. From the early online communities to current services, the development of SNS grew alongside its popularity. The history of SNS has illustrated both rise and fall of distinct services in Figure 4.1.
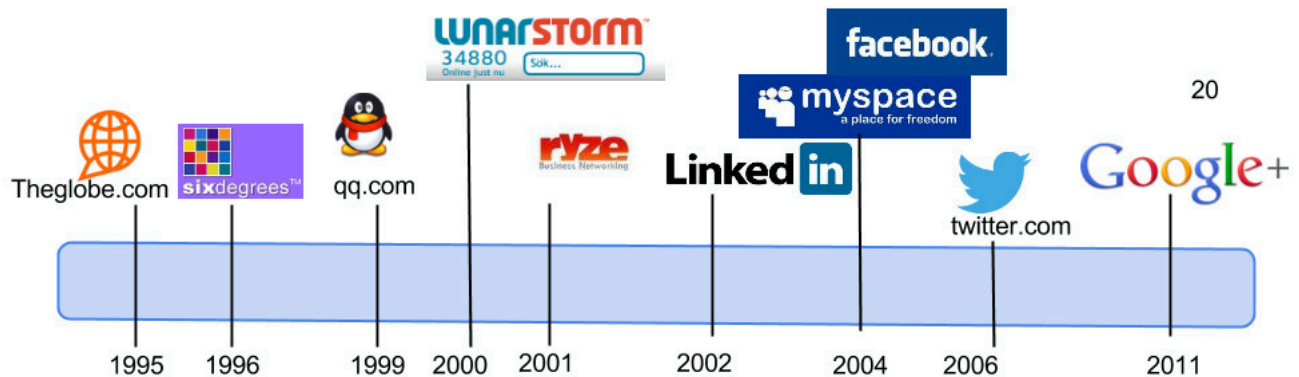

Figure 4.1: History of SNS

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[10]http://www.qq.com
[11]http://www.bebo.com/

4.2.2 Standardization history

As SNS are increasingly attracting majority of media attention and growing fast in number, people realize that the standardization of SNS become more and more important. A number of attempts have been made to realize standardization of SNS. One of the projects is the Data Portability Project. In November 2007, the Data Portability Project was established by a group consisting of people from all over the world. The project was found by Chris Saad[12], and the majorities of the project group is consisting of people who have work experience from various SNS. The intention of the project is to help people to reuse and secure their personal data on different SNS. It allows portability of user-generated data across various SNS, thus create indirectly standardization. The DataPortability project is a proponent organization that contributes toward the project's goal. W3C[13], Open Web Foundation[14] and similar organizations have relationship to this project.

As parts of the DataPortability project, several authentication systems such as OpenID[15], OAuth[16], microformats and etc., are required to approach the goal. While OpenID offers federated login that enables users to log on distinct SNS using OpenID without creating duplicate accounts, OAuth provides a standard protocol that enables users to access personal resources across services without exposing their account information. Together, a good solution of federated authentication and portability of user personal information is provided. Open standard formats and protocols for APIs enables standardization as providers choose to implement them into the services. However, the project faces a number of legal and policy issues. Further research and formulation of a EULA's template and ToS agreements may solve the mentioned problem by defining the portability polices for related providers.

Other contributions of standardization include for instance, FOAF project that started in 2000 by Libby Miller and Dan Brickley, and SIOC that started in 2004 by John Breslin and Uldis Bojars. FOAF provides an open and decentralized technology that enabling users to connect SNS. Further, SIOC offers a uniform way of expressing user personal data generated at different SNS. Additional, in cooperation of Google, Yahoo[17] and MySpace, it proposed the OpenSocial foundation that developers can write social applications that enables accessibility of data from various SNS. It has open for participation from anyone who wishes to contribute to the organization. Various projects that found by either individual students or universities have also contributed to standardization of SNS. Tent was a project that licensed by Massachusetts Institute of Technology(MIT), that develops a protocol that enables users to control their personal data even they change SNS provider. It is mainly focus on distributed social network that is defined as decentralized and distributed across various providers. OpenID authentication, XRD metadata are included for supporting the technology. Many of the projects generate similar protocols and they are usually free and open.

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[12]Chris Saad, co-Founder of APML.org, DataPortability.org, SynapticWeb.org and others. He is also currently VP Strategy AboutEcho.com

[13]http://www.w3.org/Submission/2007/02

[14]http://www.openwebfoundation.org/

[15]http://openid.net/

[16]http://oauth.net/

[17]http://www.yahoo.com

Chapter 5

SNS Market Simulation

In this chapter, several assumptions for simulation are described and illustrated. Based on the assumptions, The simulation is modeled with various settings of parameters. Additional, results are compared and analyzed by sensitivity analysis.

5.1 Simulation Model

Before performing the simulation, some assumptions are described. To distinguish between the following market types, it presents there different scenarios. Scenario I shows a market without standardization, Scenario II illustrates a market with standardization and Scenario III presents a market with both standardized and non-standardized providers.

5.1.1 Start conditions[4]

Homogenous service   The service is the implemented in the same way by all providers in the market.

Exclusive market   Each user can maximally subscribe to one provider until the user switch to another provider

Equal value   Initially, the value and price is assumed to be the same on each product.

5.1.2 Basic parameters setting

Users   The amount of total users is assumed to be 100 000.

Provider   It is assumed that total providers in the market are four or two in each category based on the market type.

Initial user distribution Initial user distribution are categorized in 4 types. Each provider own the same or different amount of users in the beginning based on scenario. In scenario I and II, Type 1 and Type 2 of initial user distribution are used, and they are illustrated in Table 5.1 and Table 5.2 . In scenario III, all types initial user distribution are illustrated. Type 3 and Type 4 are depicted in Table 5.3 and Table 5.4.

Provider	A	B	C	D
Percentage of user distribution	25%	25%	25%	25%

Table 5.1: user distribution Type 1

Provider	A	B	C	D
Percentage of user distribution	45%	30%	10%	15%

Table 5.2: user distribution Type 2

Provider	A	B	C	D
Percentage of user distribution	10%	20%	10%	60%

Table 5.3: user distribution Type 3

Provider	A	B	C	D
Percentage of user distribution	10%	15%	45%	30%

Table 5.4: user distribution Type 4

Feedback It is assumed that the feedback is positive based on Polya's urn problem illustrated in Figure 5.1, and can be expressed as the following with parameter y,

$$p_{i,t} = \frac{s_{i,t}^{y}}{\sum_{j=1}^{k} s_{j,t}^{y}}$$
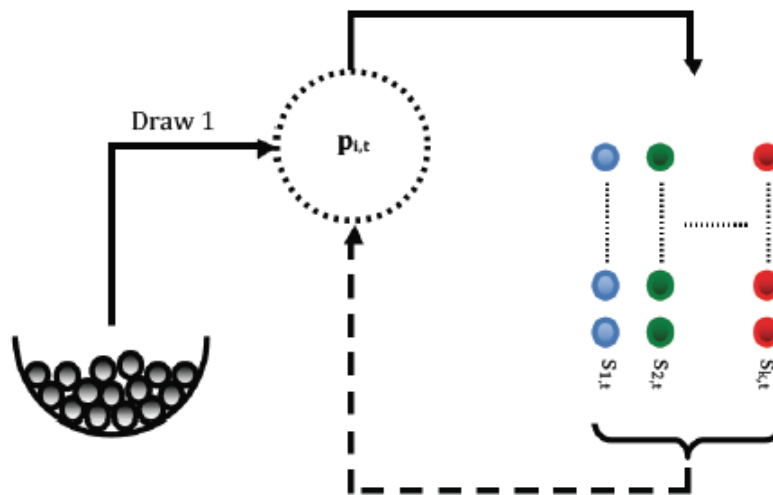
Figure 5.1: Polya's urn problem

Time frame   In order to estimate the development of the market, the time for each simulation is assumed to be based on "the time for the accumulated volume to grow from 10% to 90%"[17]. The total time frame is assumed to be approximately 18 years. The overall parameter setting is illustrated in Table 5.5.

Parameter	Description	Value
N	Total number of users in the market	10 000
p	The number of SNS provider	4
y	Positive feedback parameter	Based on market type
c	Churning parameters	Based on market type
R_0	Initial user distribution at time $= 0$	Based on market type
$\triangle T$	Time for the accumulated volume to grow from 10% to 90%	5
E	Number of Example churning	100

Table 5.5: Table of basic parameters setting

5.1.3   Scenario I, Without Standard

In Scenario I, the simulation is based on a market without a common standard.

Individual parameters setting

Feedback   According to chapter 2, a rational feedback of SNS is within the range of 1.0 to 2.0 depending on the strength of network effects. Table 2.1 illustrates categorization of different network effect valuation, and Metcalfe's law applies usually to SNS.

Churning   As a result of lock-in effects and negative feedback effects, churning is assumed to be 30% for each SNS per year in the market. Due to the lack of standardization, users usually experience different levels of lock-in to current providers, hence churning could be low.

5.1.4   Scenario II, With Standard

In Scenario II, the simulation is based on a standardized market. A common standard is deployed and each SNS is interconnected with each other.

Individual parameters setting

Feedback   Feedback is assumed to be 1.005 due to the reduction caused by standardization.

Churning   Churning is assumed to be 50% for each SNS per year in the market. Due to the standardization has reduced the effects of lock-in, churning in this case might be relative high.

5.1.5   Scenario III, Mix Market

In Scenario III, the simulation is based on a market that consists of both standardized and non-standardized providers. Some of the providers participate into standardization, while the others do not.

Individual parameters setting

Provider   There are two types of providers, standardized and non-standardized. The scenario is divided into two cases. In Case 1, there are two providers in each category. It is illustrated in Table 5.6. In Case 2, there is only one non-standardized providers, while the rest is standardized. Table 5.7exhibits the user distribution for Case 2.

Type	Providers	
Standardized	A	B
Non-standardized	C	D

Table 5.6: Providers distribution for Case 1

Type	Providers		
Standardized	A	B	C
Non-standardized	D		

Table 5.7: Providers distribution for Case 2

Feedback   According to the parameters setting in scenario I and II, feedback 1 is assumed to be 1.2 and for non-standardized providers, while feedback 2 for standardized providers is assumed to be 1.005.

Churning   As a result of negative feedback effect, churning is assumed to be 50% between standardized providers and defined as churning 1; 5% for churning from standardized to non-standardized providers and define as churning 2; 30% for each non-standardized providers and defined as churning 3; Churning 3 and churning 4 is the same churning value, but they differentiated from which type of providers they go to. The overall churning is depicted in Figure 5.2.
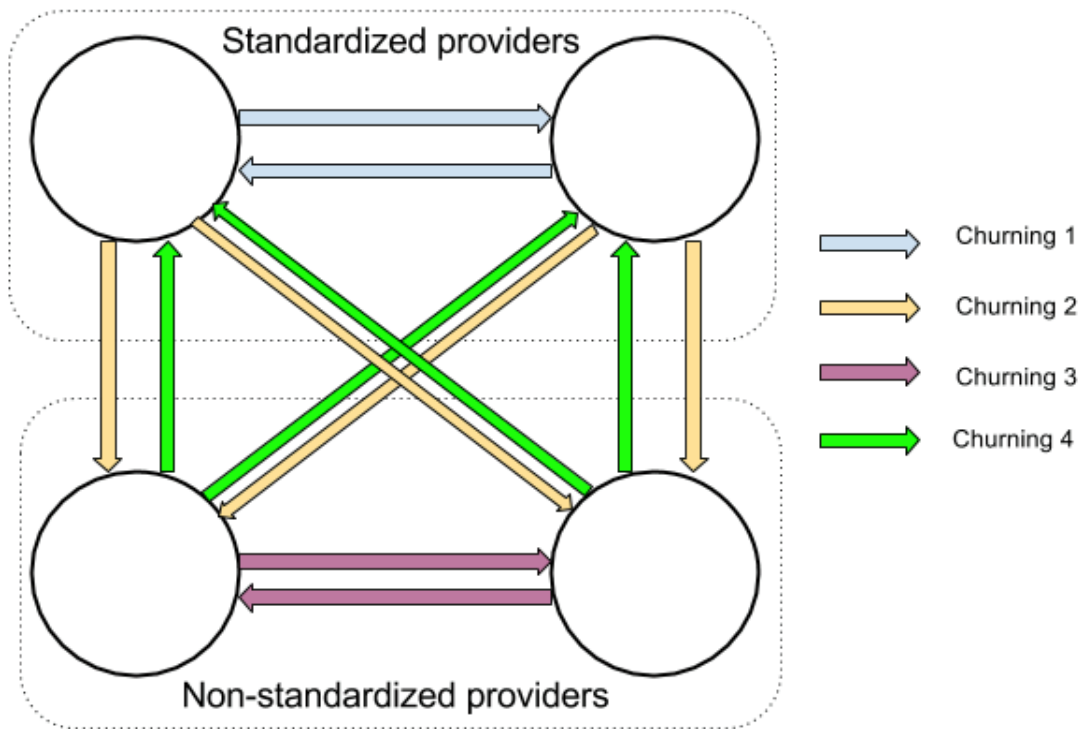
Figure 5.2: The overall churning of Scenario III

5.2 Simulation Results

In this section, the results for three different scenarios are obtained from simulation and categorized as below. The column diagrams exhibits the development of SNS providers during the given time frame, and the development line diagram express the development flow, while the pie charts depict the breakdown of development according to the percentage of accumulated users.

5.2.1 Scenario I, Without Standard

In scenario I, the market is without standardization. With feedback value at 1.4 and 1.9, and fixed churning at 30%, the results are illustrated in figures below. Figure 5.3 and Figure 5.4 exhibit the market development with column diagrams based on initial user distribution Type 1. Figure 5.5 is based on initial user distribution Type 2. Further, Figure 5.6 and Figure 5.7 display the detail development for market with feedback 1.4, while Figure 5.8and Figure 5.9 display the detail development for market with feedback 1.9. In addition, Figure 5.10 and Figure 5.11 express the detail development.
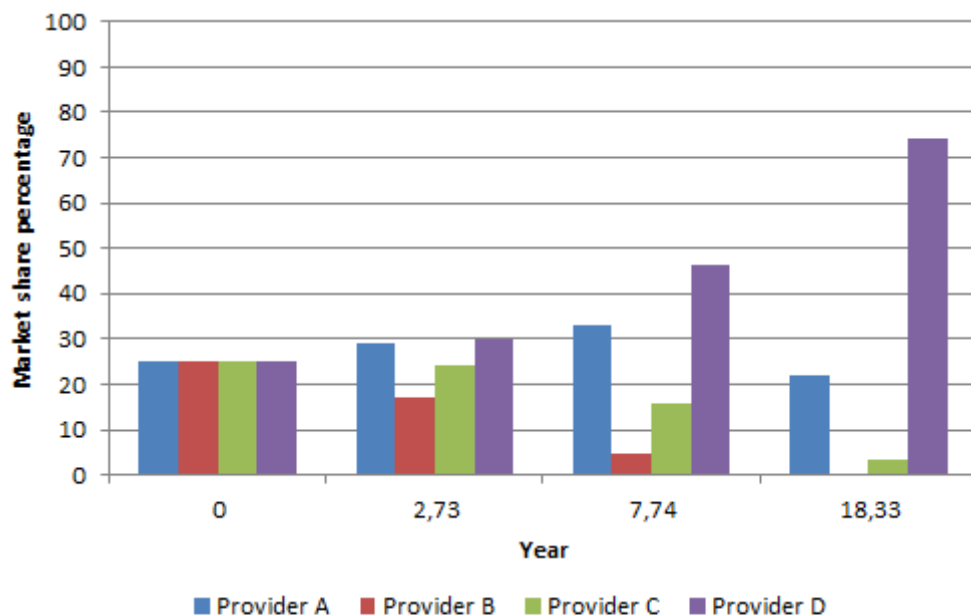
Figure 5.3: User distribution at different development time with feedback 1.4 illustrated in column diagram
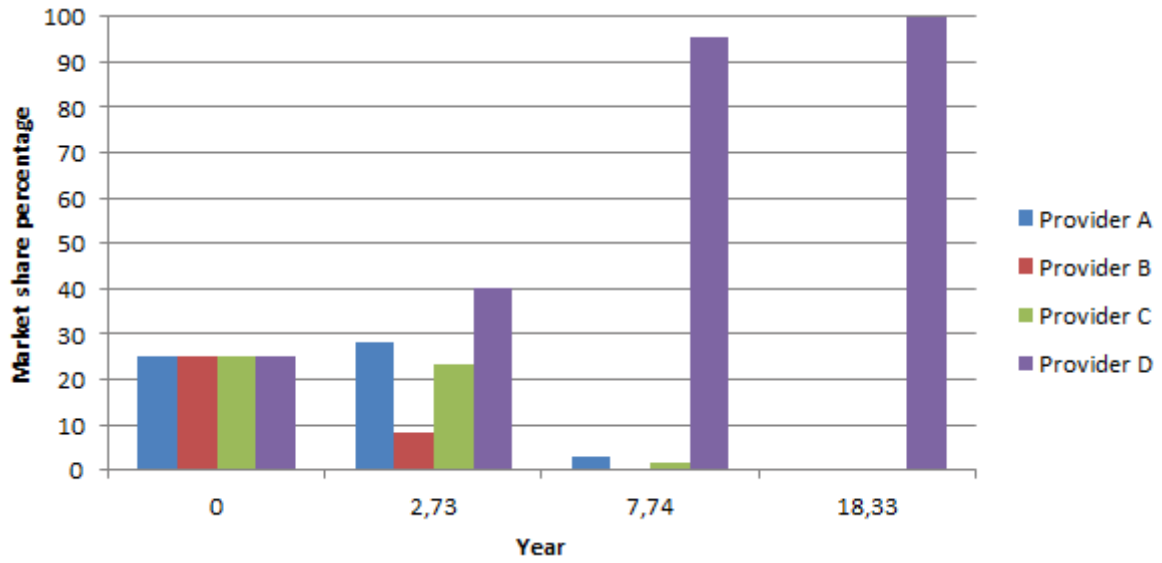
Figure 5.4: User distribution at different development time with feedback 1.9 illustrated in column diagram

Figure 5.5: User distribution with feedback 1.4 and initial user distribution Type 2, illustrated in column diagram
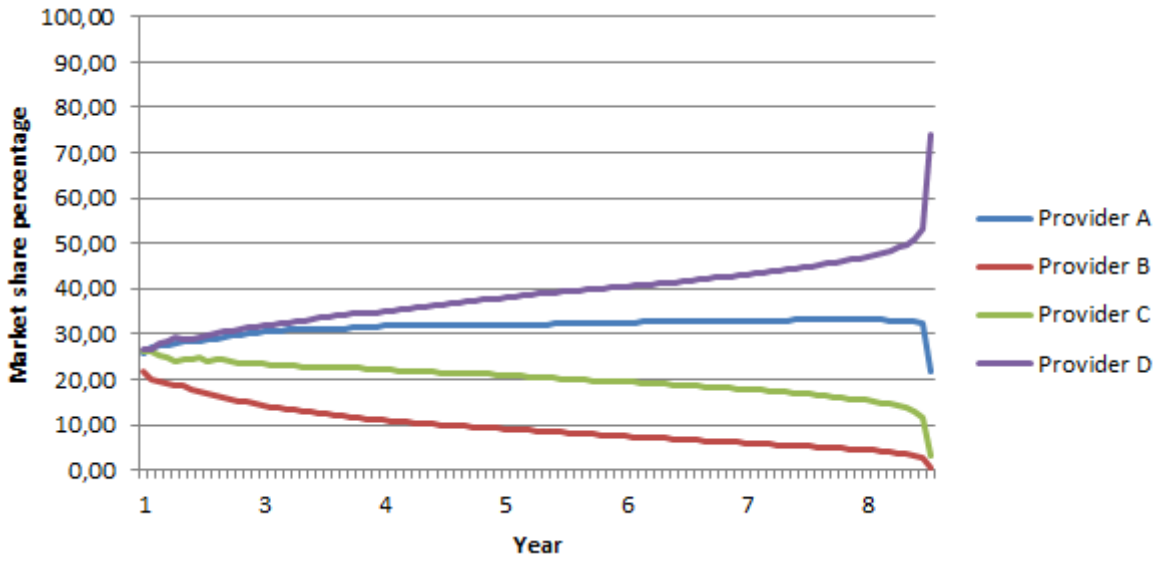
Figure 5.6: Market development with feedback 1.4

Figure 5.7: Market share distribution at 2.7th and 7.7th year with feedback 1.4

Figure 5.8: Market development with feedback 1.9

Figure 5.9: Market share distribution at 2.7th and 7.7th year with feedback 1.9

Figure 5.10: Market development with feedback 1.4 and initial user distribution Type 2
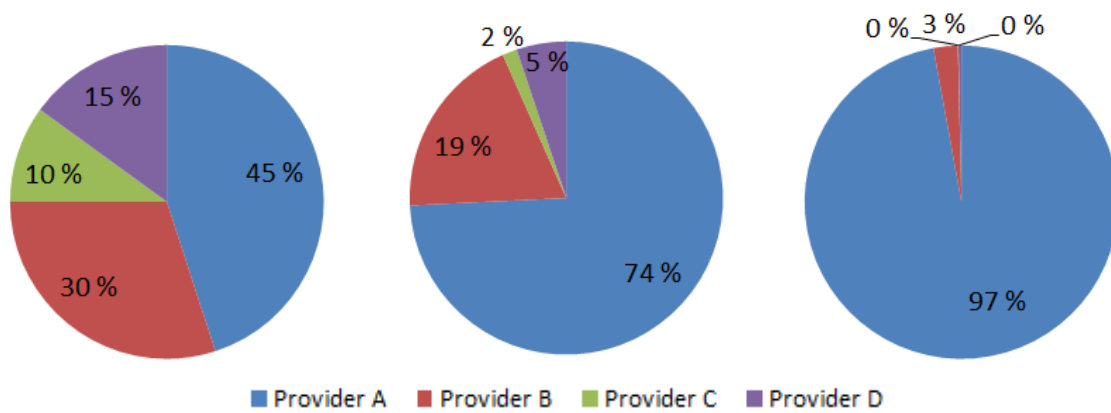
Figure 5.11: Market share distribution at 2.7th and 7.7th year with feedback 1.4 and initial user distribution Type 2

5.2.2 Sensitivity analysis for Scenario I, Without Standard

In this section, the sensitivity analysis presents and compares the variations of feedback based on initial user distribution Type 1.

Feedback

Based on the predefined feedback 1.4, feedback varies between 1.1 and 2.0. Figure 5.12 displays the user distribution. An incline of 0.1 at feedback value results in exponential growth in the number of users of the dominant provider D. Simultaneously, the number of users of smaller providers such as A, B and C, decreases rapidly. A dominant actor is found especially in when feedback is from 1.6 and above, as provider D captures more than 90% of total users. . The simulation results indicate that the increasing of feedback causes an acceleration of winner-takes-it all situation, as the feedback varies from 1.1 to 2.0. The results also show that the user distribution is relative sensitive due to the alteration of feedback. The feedback is caused by positive network effects that accelerates the growth of the provider with leading position and trigger the winner-takes-it-all phenomena.
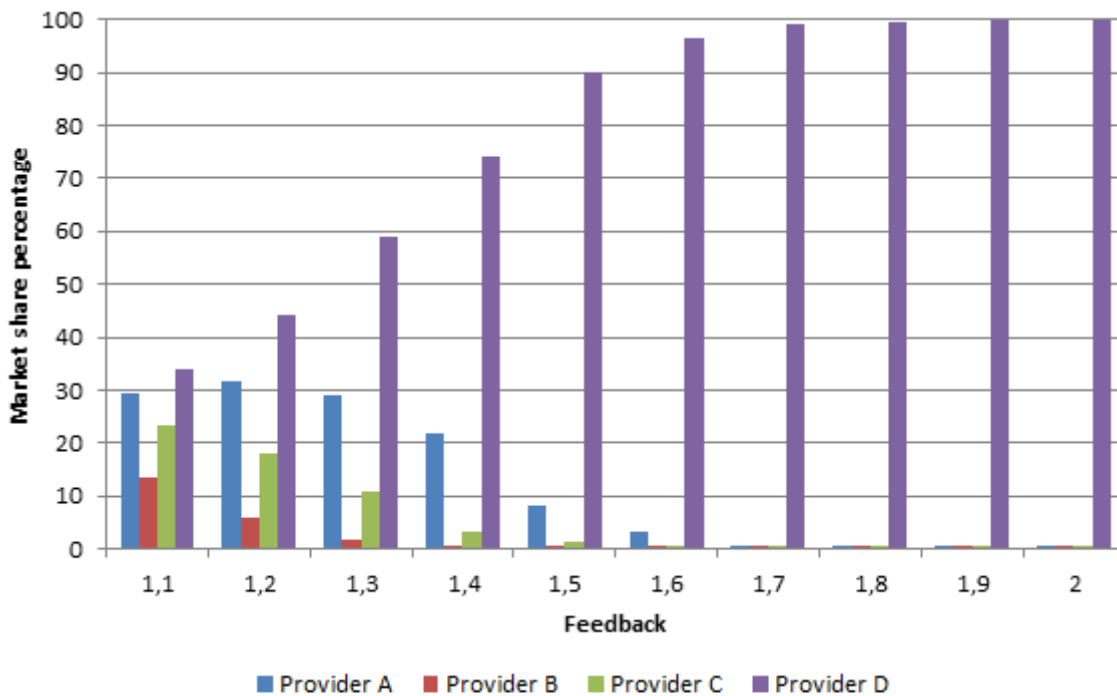
Figure 5.12: User distribution with different feedback

5.2.3   Scenario II, With Standard

In scenario II, a common standard is deployed and the market is affected by standardization. With churning at 50% and 100%, and fixed feedback at 1.005, the results are illustrated in figures below. Figure5.13 and Figure 5.14 exhibit the market distribution among the providers at different time based on churning at 50% and 100% with initial user distribution at 25% each provider based on Type 1. Figure 5.15 is based on initial user distribution Type 2. Furthermore, Figure 5.16and Figure 5.17 display detail market development with churning 50%, while Figure 5.18 and Figure 5.19 are based on churning 100%. Similarly, Figure 5.20 and Figure 5.21 express the detail development.
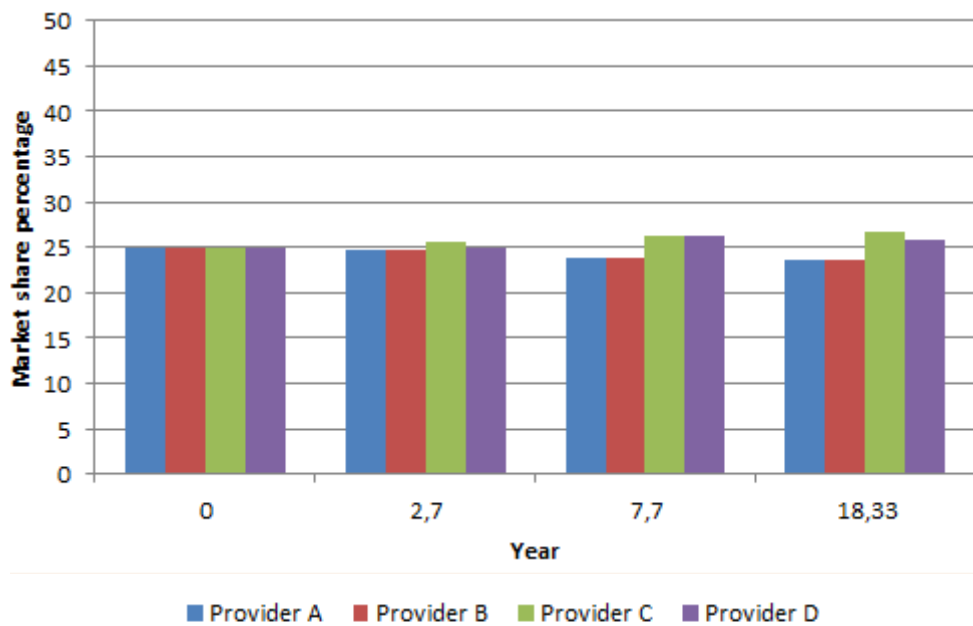
Figure 5.13: User distribution at different development time with churning 50% illustrated in column diagram
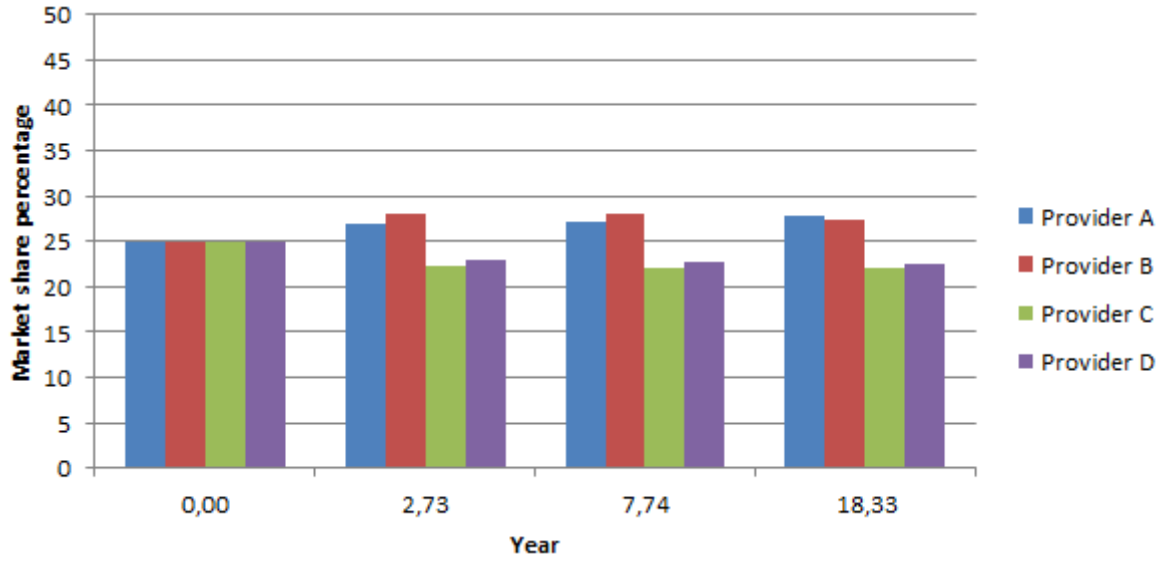
Figure 5.14: User distribution at different development time with churning 100% illustrated in column diagram
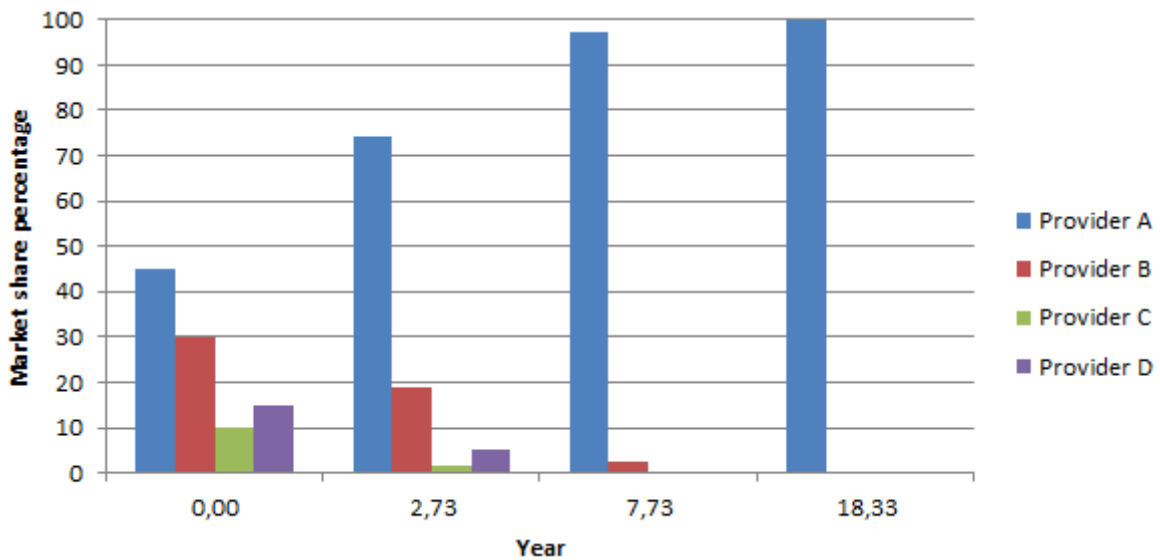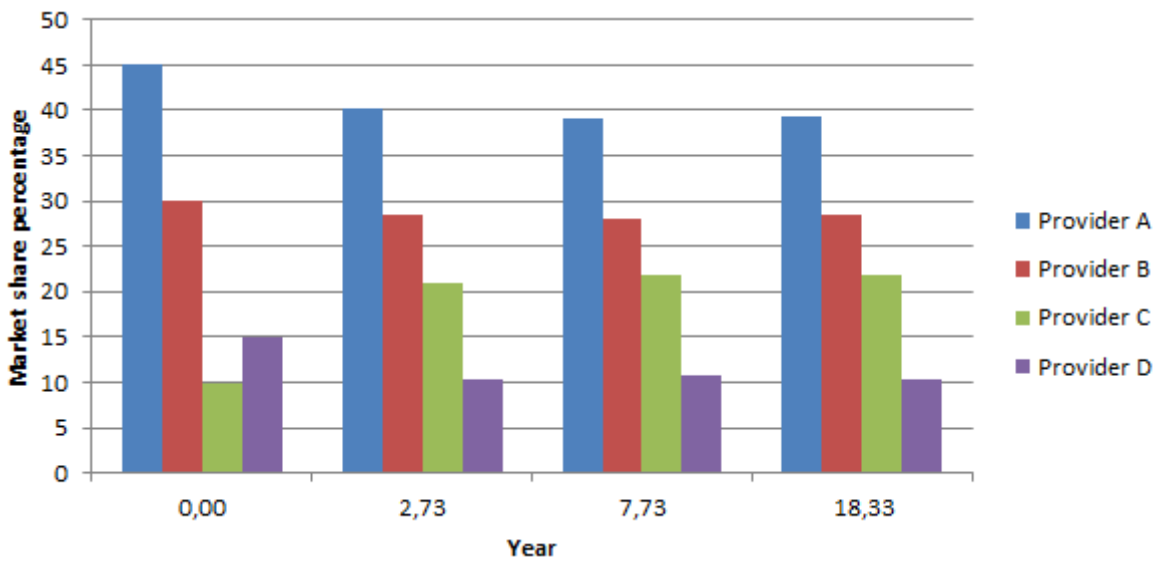

Figure 5.15: user distribution with churning 50% and initial user distribution Type 2, illustrated in column diagram
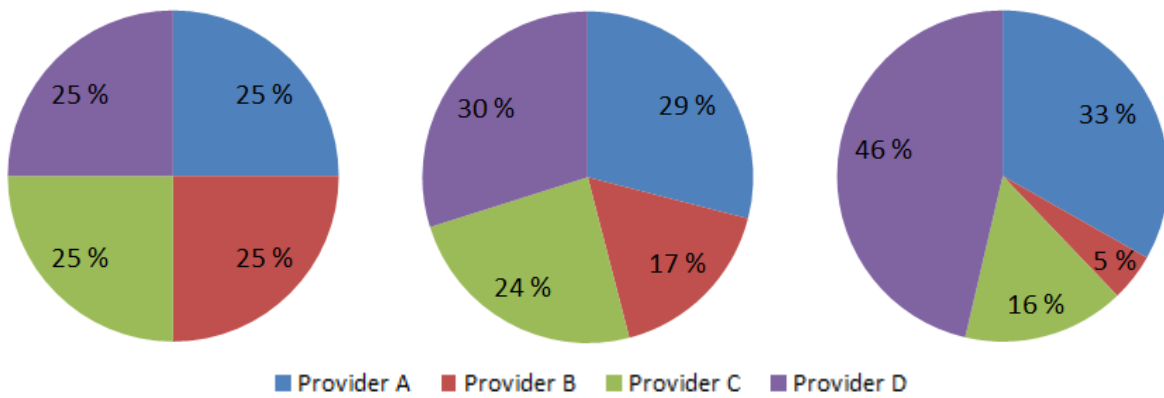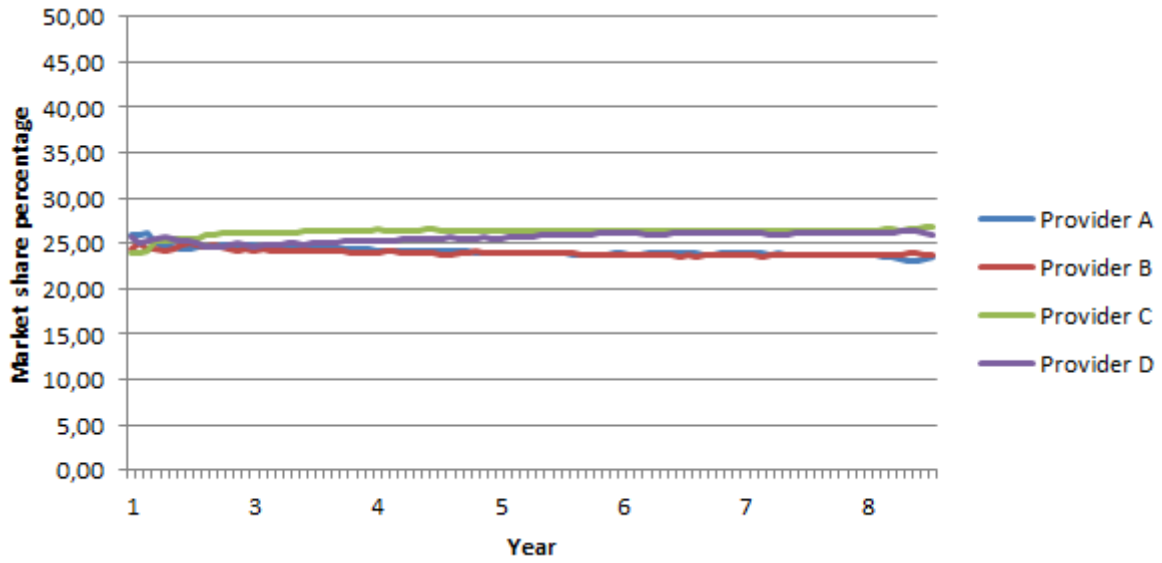
Figure 5.16: Market development with churning 50%
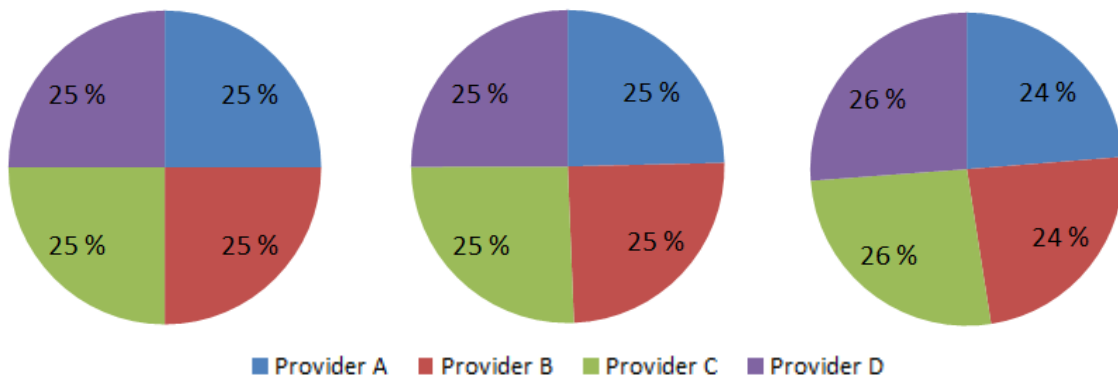
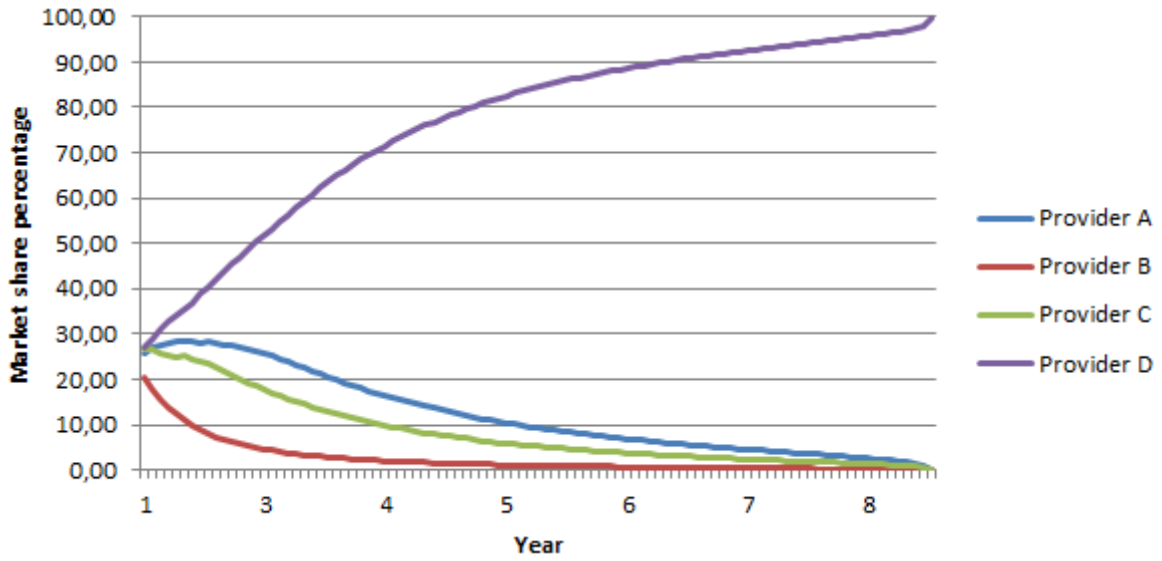Figure 5.17: Market share distribution at 2.7th and 7.7th year with churning 50%
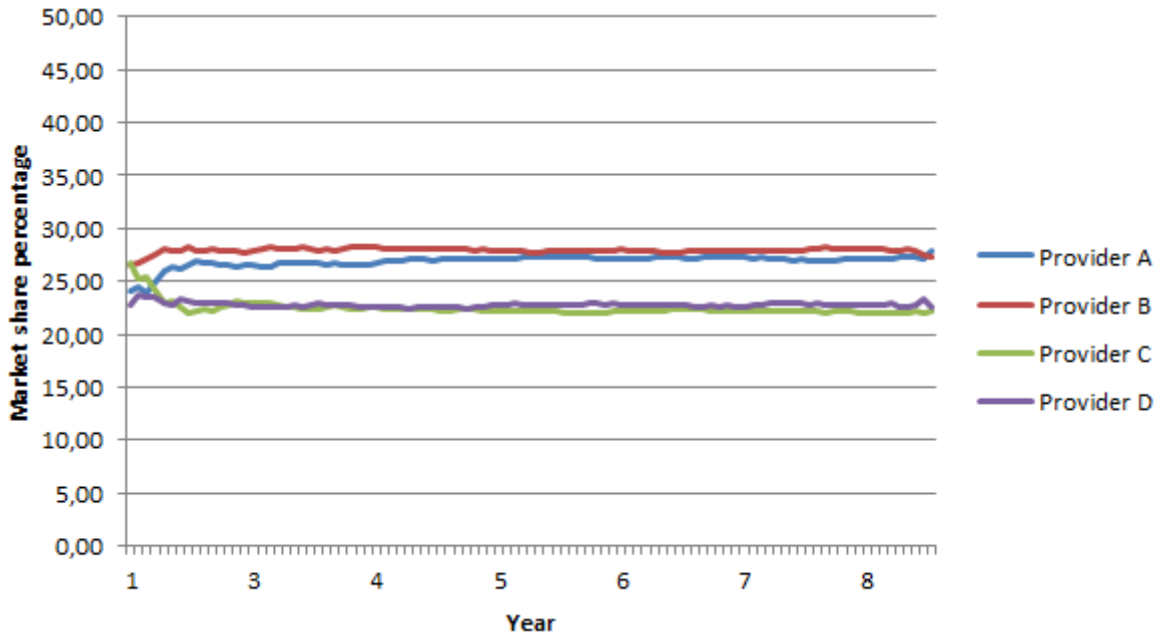
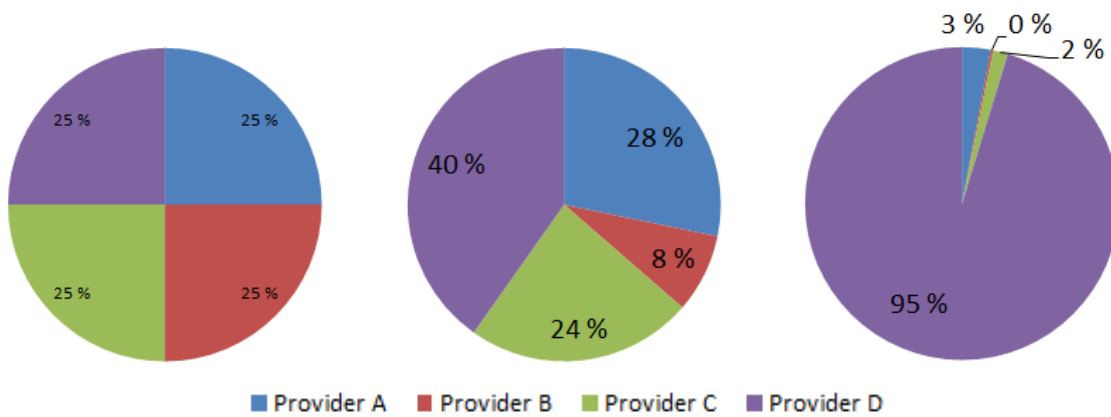Figure 5.18: Market development with churning 100%
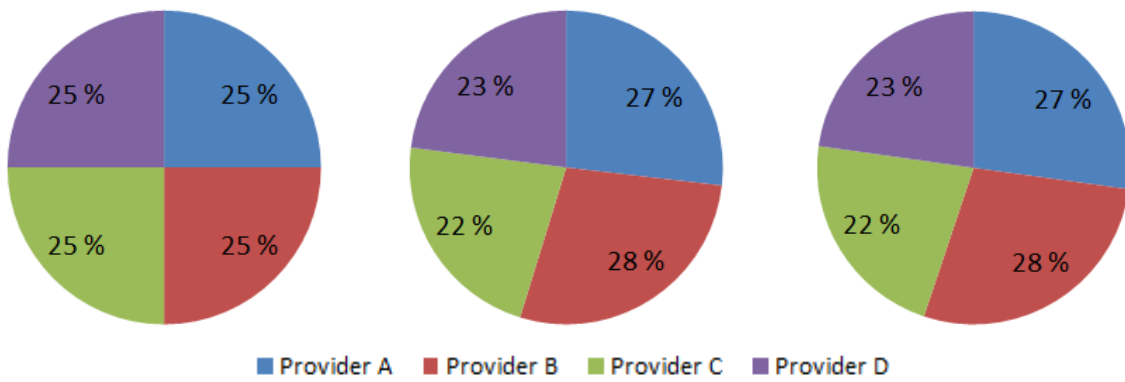
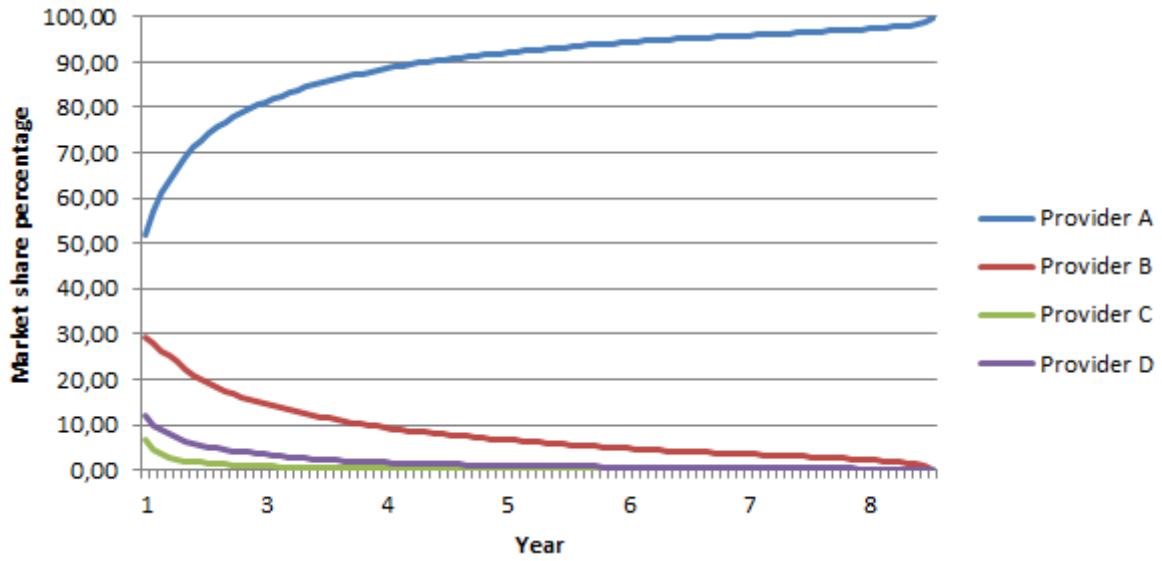Figure 5.19: Market share distribution at 2.7th and 7.7th year with churning 100%
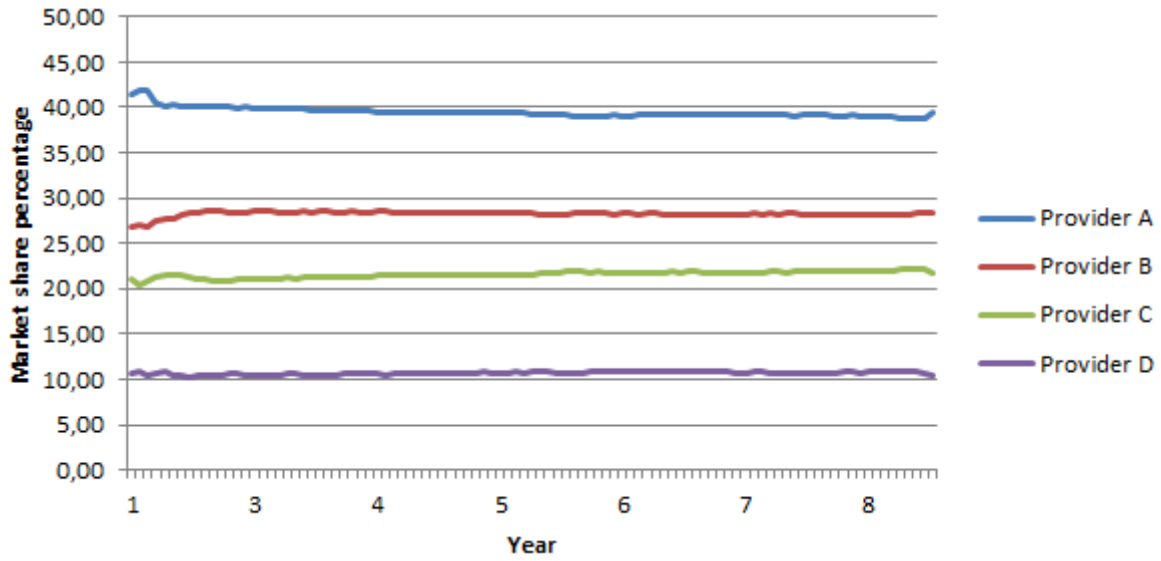
Figure 5.20: Market development with churning 50% and initial user distribution Type 2
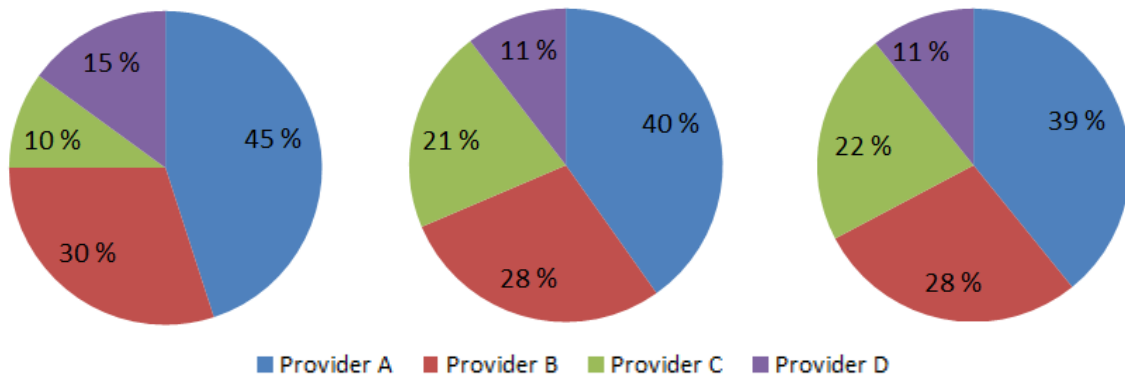
Figure 5.21: Market share distribution at 2.7th and 7.7th year with churning 50% and initial distribution Type 2

5.2.4 Sensitivity analysis for Scenario II, Without Standard

In this section, the sensitivity analysis presents and compares the variations of churning based on user distribution Type 1.

Churning Based on the predefined feedback 1.005, churning varies between 10% and 100%. Figure 5.22 displays the user distribution based on various churning parameters. From the data in Figure 5.22, it is apparent that the changes of churning parameter do not have a significant impact on the market share distributions between providers. The distribution is constantly even from the churning value at 10% to 100%. None of the providers has a dominant position during the market development. There is a slightly increase of total users of some of the provider as the value of churning increments, but there is not any difference greater than 10% of growth is observed. Comparing the results generated by different churning values, it can be seen that with a feedback value at 1.005, the distribution of users is little sensitive due to the variation of churning parameter.
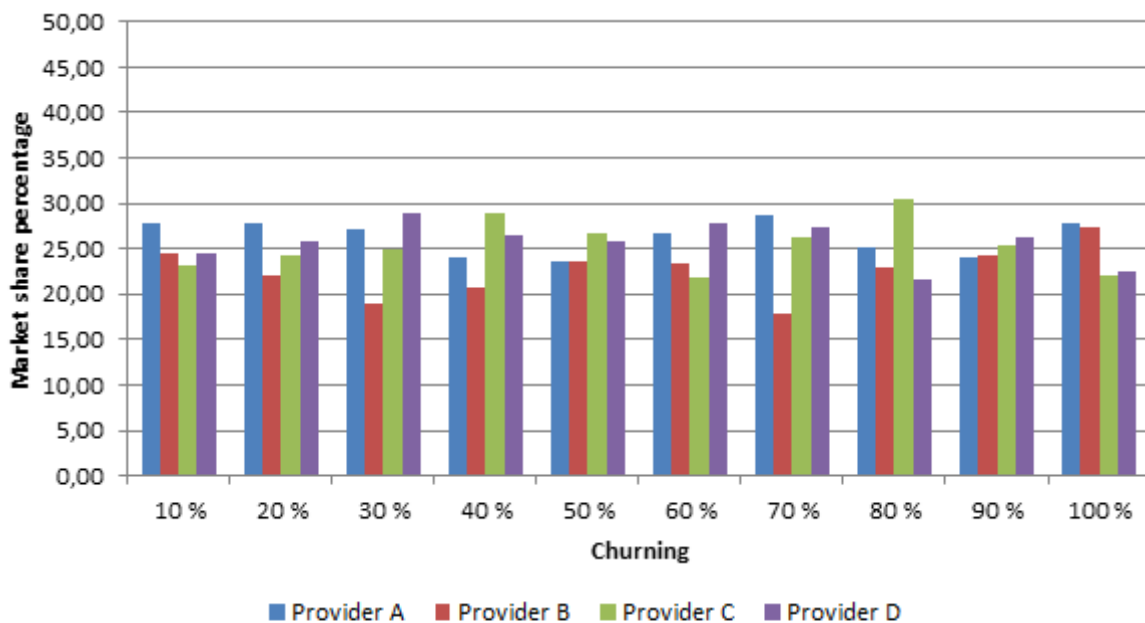
Figure 5.22: User distribution with different churning

5.2.5   Scenario III, Mix Market

In scenario III, simulation results are illustrated with diagrams as below. The results are divided into two cases. Case 1 and Case 2 are based on basic conditions that given in Table 5.6 and Table 5.7. Figure 5.23, Figure 5.24, Figure 5.25 and Figure 5.26 depict the user distribution during different simulation time. In addition, Figure 5.27 and Figure 5.28 display the detail market development for Case 1 with initial user distribution Type 1. Figure 5.29 and Figure 5.40 illustrate the detail market development for Case 2 with initial user distribution Type 3. Figure 5.31 and Figure 5.32 illustrate the detail market development for Case 1 with initial user distribution Type 2, while Figure 5.33 and Figure 5.34 show the detail market development for Case 1 with initial user distribution Type 4.
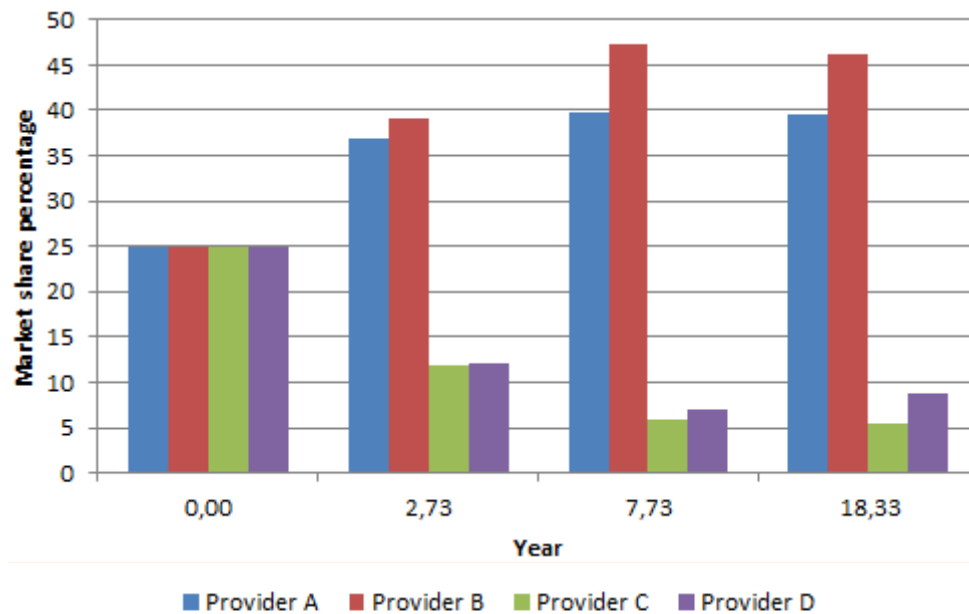
Figure 5.23: User distribution during different time period for Case 1 with initial user distribution Type 1
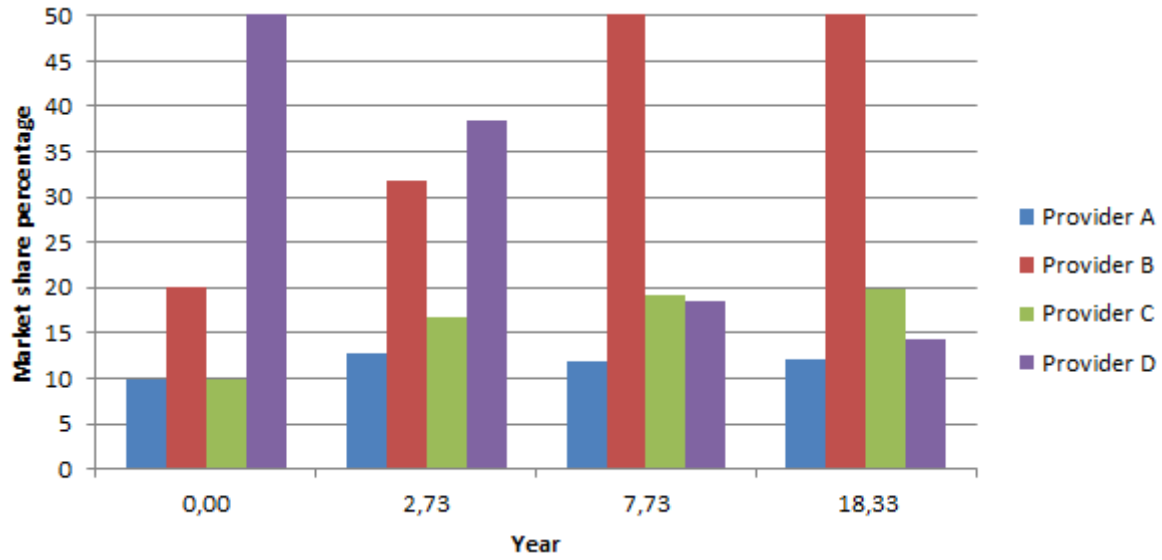
Figure 5.24: User distribution during different time period for Case 2 with initial user distribution Type 3
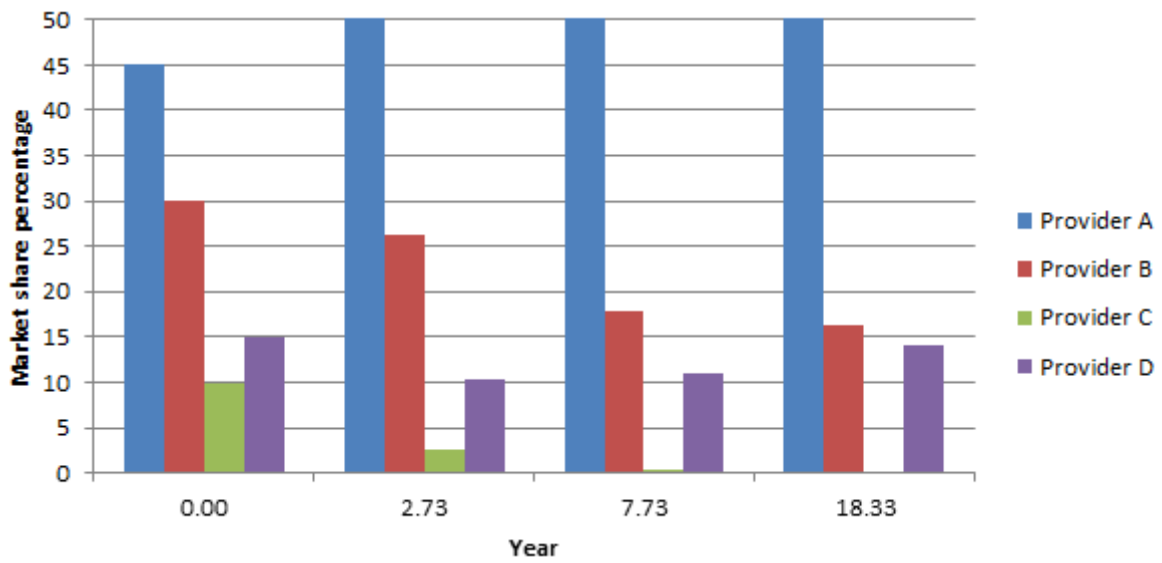
Figure 5.25: User distribution during different time period for Case 1 with initial user distribution Type 2
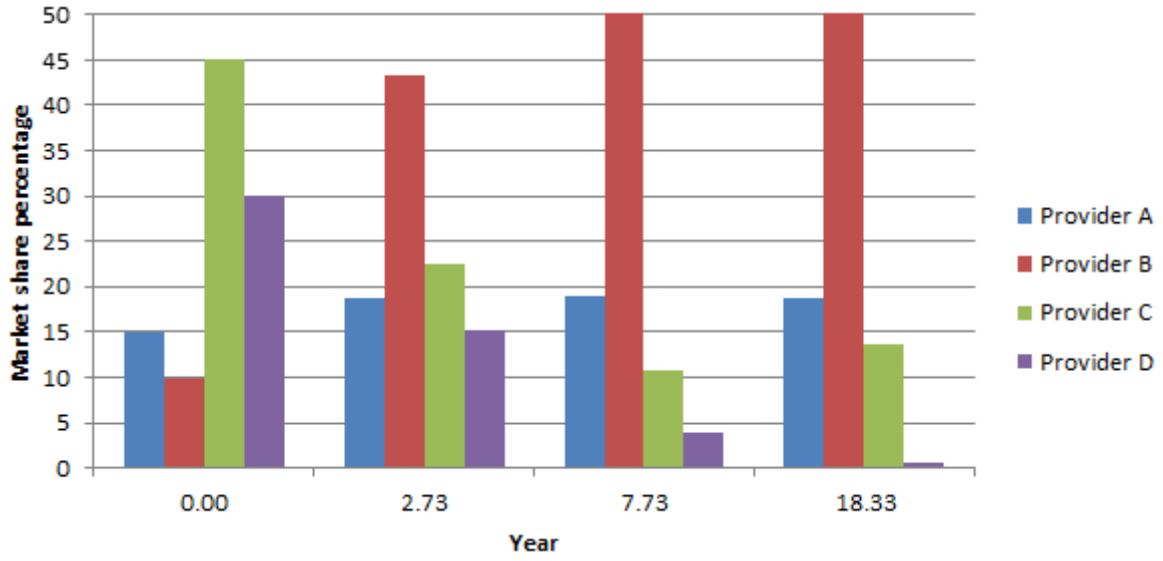
Figure 5.26: User distribution during different time period for Case 1 with initial user distribution Type 4
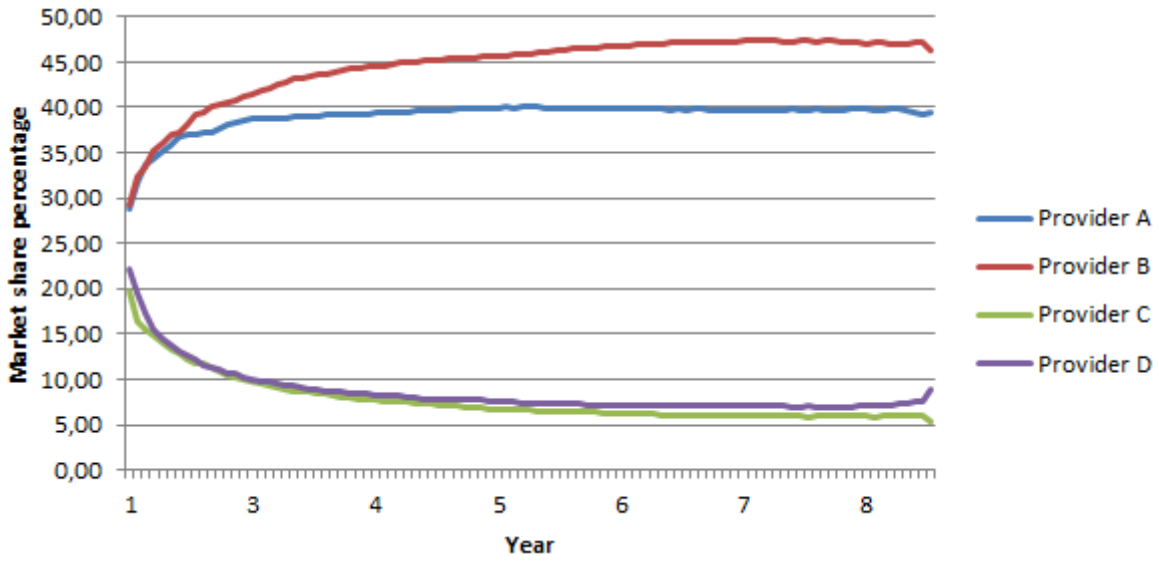
Figure 5.27: Market development for Case 1 with initial user distribution Type 1
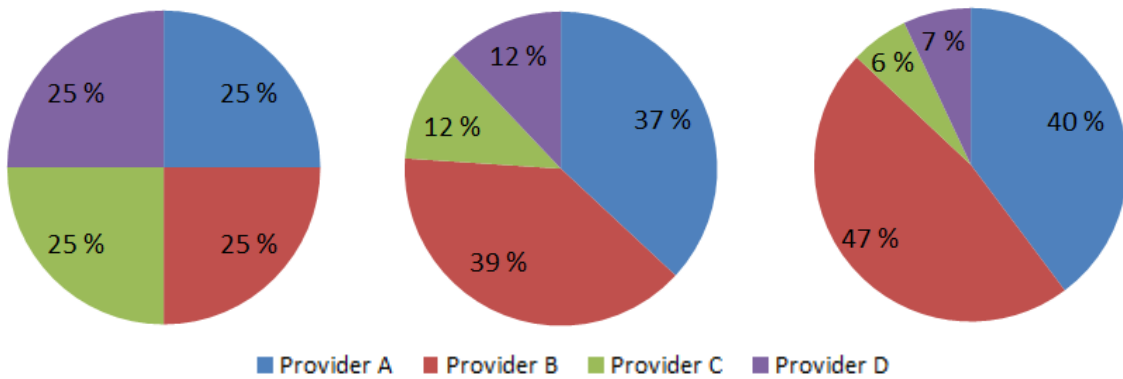
Figure 5.28: Market share distribution for Case 1 with initial user distribution Type 1
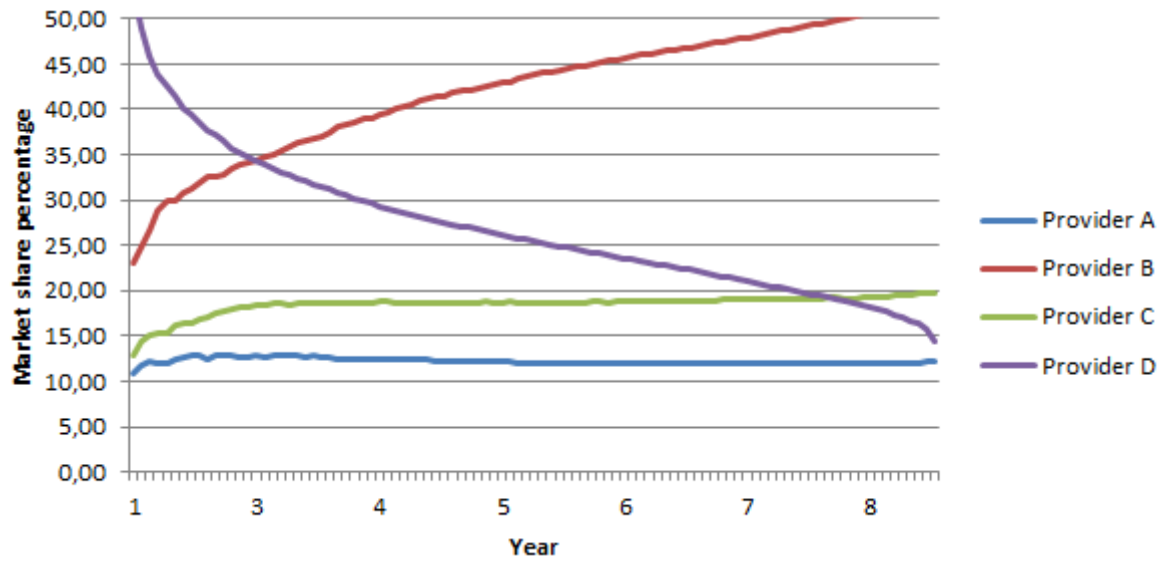
Figure 5.29: Market development for case 2 with initial user distribution Type 3
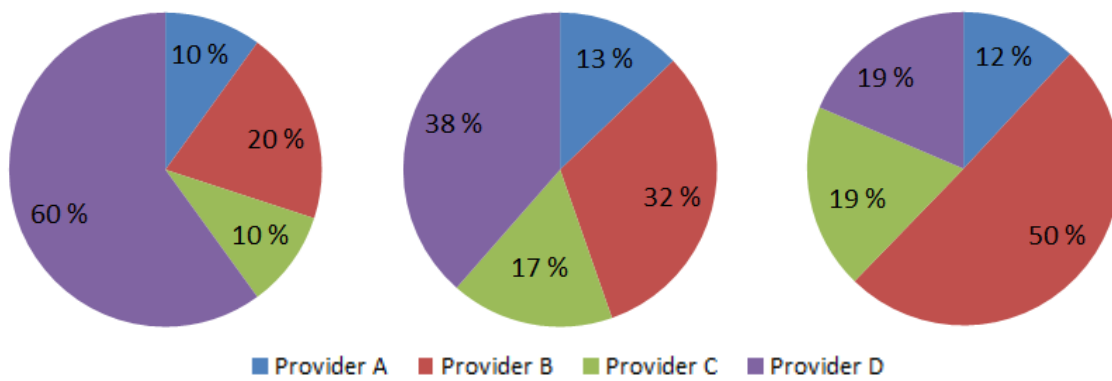
Figure 5.30: Market share distribution for Case 2 with initial user distribution Type 3
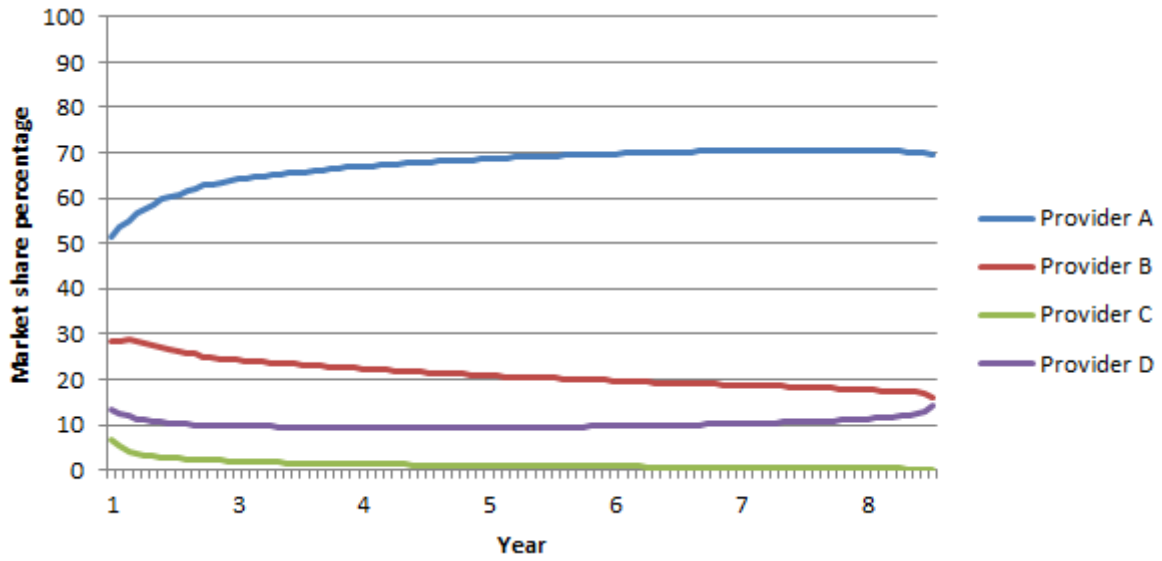
Figure 5.31: Market development for Case 1 with initial user distribution Type 2
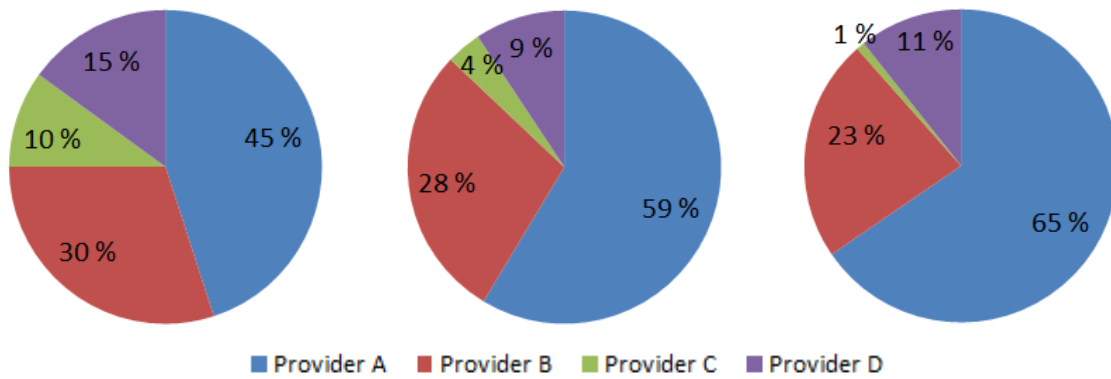
Figure 5.32: Market share distribution for Case 1 with initial user distribution Type 2
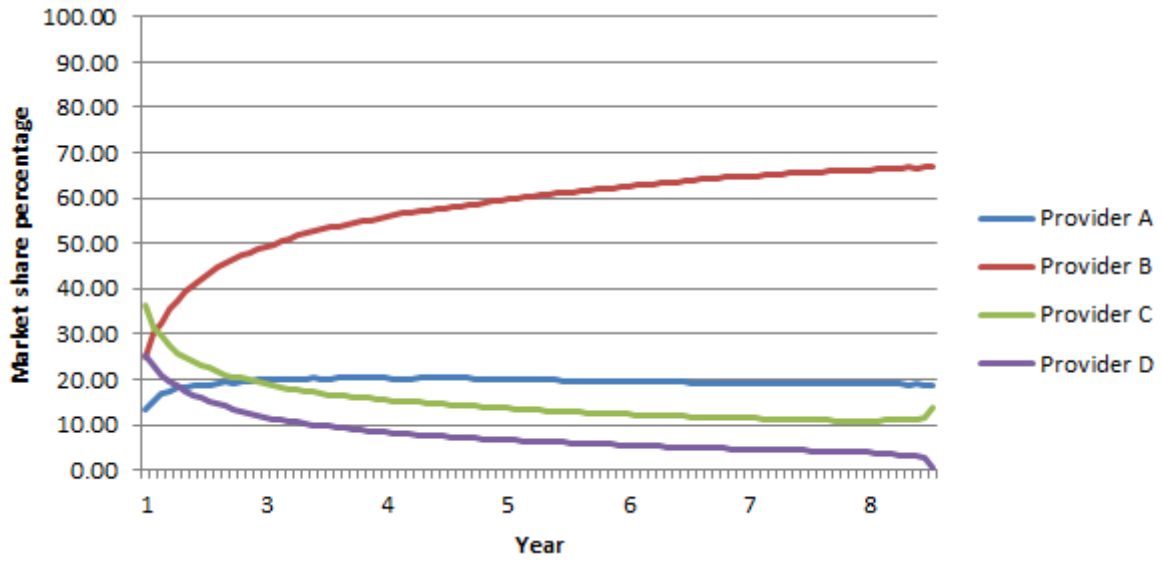
Figure 5.33: Market development for case 1 with initial user distribution Type 4
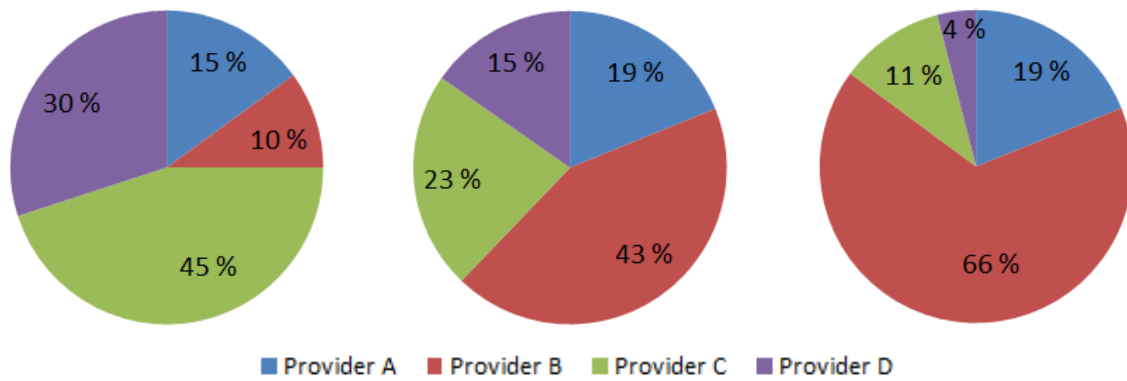
Figure 5.34: Market share distribution for Case 1 with initial user distribution Type 4

5.2.6 Sensitivity analysis for Scenario III, Mix Market

In this section, the sensitivity analysis presents and compares the variations of both feedback and churning based on Case 1 with initial user distribution Type 1.

Feedback The variation of feedback is divided into 3 types. Type 1 display the sensitivity by variation of all feedback values. Type 2 illustrates the sensitivity by variation of only one feedback value(feedback of non-standardized providers), while the other remains fixed. Finally, Type 3 express the sensitivity by presenting equivalent feedback values. Table5.8, Table 5.9 and Table 5.10 exhibits the variations of feedback values in three categories.

Feedback 1	Feedback 2
1.4	1.1
1.6	1.2
1.8	1.3
2.0	1.4

Table 5.8: Type 1 of feedback values

Feedback 1	Feedback 2
1.6	1.005
1.8	1.005
2.0	1.005

Table 5.9: Type 2 of feedback values

Feedback 1	Feedback 2
1.2	1.2
1.4	1.4

Table 5.10: Type 3 of feedback values

From the data shown in figures below, once the values of feedback 1 and feedback 2 increase simultaneously, it accelerates the growth of the dominant standardized provider and one of the non-standardized providers. As more feedback 1 increases in value, the more users standardized providers are able to capture. This can be referred to the situation in Scenario Iwhere the network effects are the essential factor of emerging of dominant actor. Figure 5.35, Figure 5.36 and Figure 5.37 display how provider grows to be the dominant actor alongside with the increasing value of feedback 1 and feedback 2.
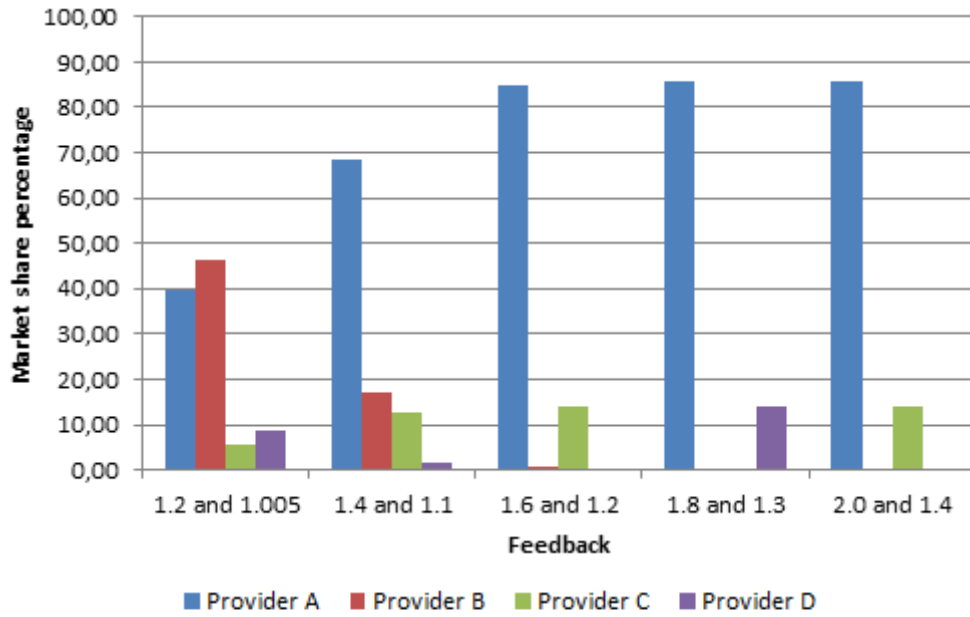
Figure 5.35: User distribution with different feedback values, Type 1
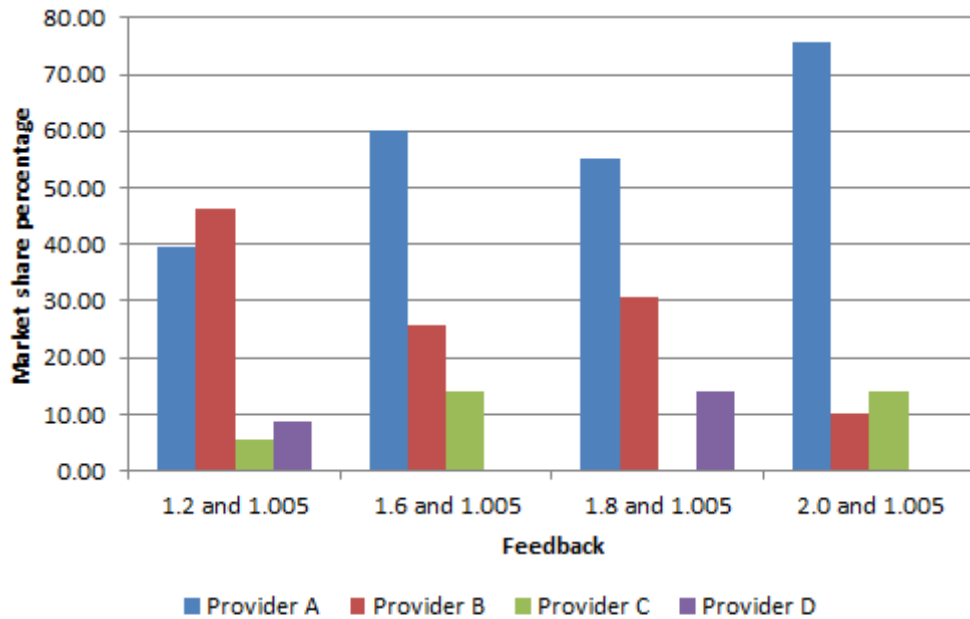
Figure 5.36: User distribution with different feedback values, Type 2
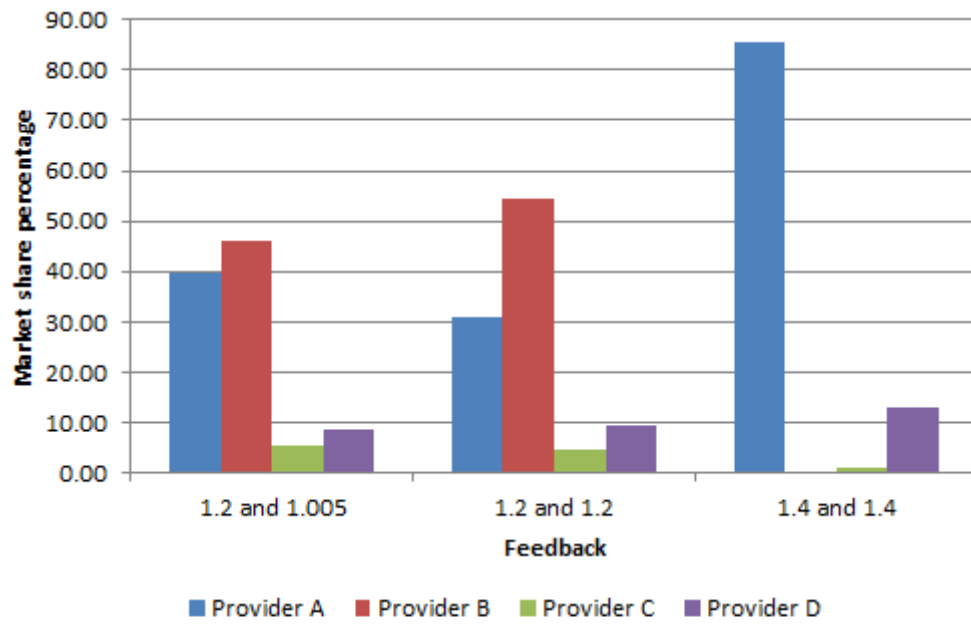
Figure 5.37: User distribution with different feedback values, Type 3

Churning   Similarly, the variation of churning is divided into 4 types . Type 1 express the sensitivity by increasing all churning. Type 2, Type 3 and Type 4 exhibit the sensitivity by variation of only one churning value while the others remain fixed. Table 5.11, Table 5.12, Table 5.13 and Table 5.14 illustrate the different variations of churning.

Figure 5.38 exhibits the user distribution at different level of churning. As the figure shown, the higher the three churning variables increase in value, the more even the user distribution becomes between provider A, B and C, while provider D in non-standardized market is driven out of the market. It indicates that high churning also results a faster growth in number of users for some SNS providers, as there is high probability the users switch to another SNS. Figure 5.39, Figure 5.40 and Figure 5.41 show the user distribution when only one of the churning values varies. Comparing the variation of churning 1, churning 2 and churning 3, the increment in churning 3 results that standardized providers capture more and more users, while the change in churning 1 does not show any significant difference greater than the differentiated percentage of churning value. There is a obvious change of user distribution, while the value of churning 2 increase. The amount of users for standardized providers decrease strongly as the value of churning increases with 10%. Figure 5.38, Figure 5.39, Figure 5.40 and Figure 5.41 illustrate the detail market development for Type 1, Type 2, Type 3 and Type 4 based on different churning values.

Churning 1	Churning 2	Churning 3
50%	5%	30%
60%	10%	40%
70%	20%	50%
80%	30%	60%
90%	40%	70%

Table 5.11: Type 1 of churning values

Churning 1	Churning 2	Churning 3
50%	5%	40%
50%	5%	60%
50%	5%	80%

Table 5.12: Type 2 of churning values

Churning 1	Churning 2	Churning 3
60%	5%	30%
80%	5%	30%
100%	5%	30%

Table 5.13: Type 3 of churning values

Churning 1	Churning 2	Churning 3
50%	10%	30%
50%	40%	30%
50%	50%	30%

Table 5.14: Type 4 of churning values
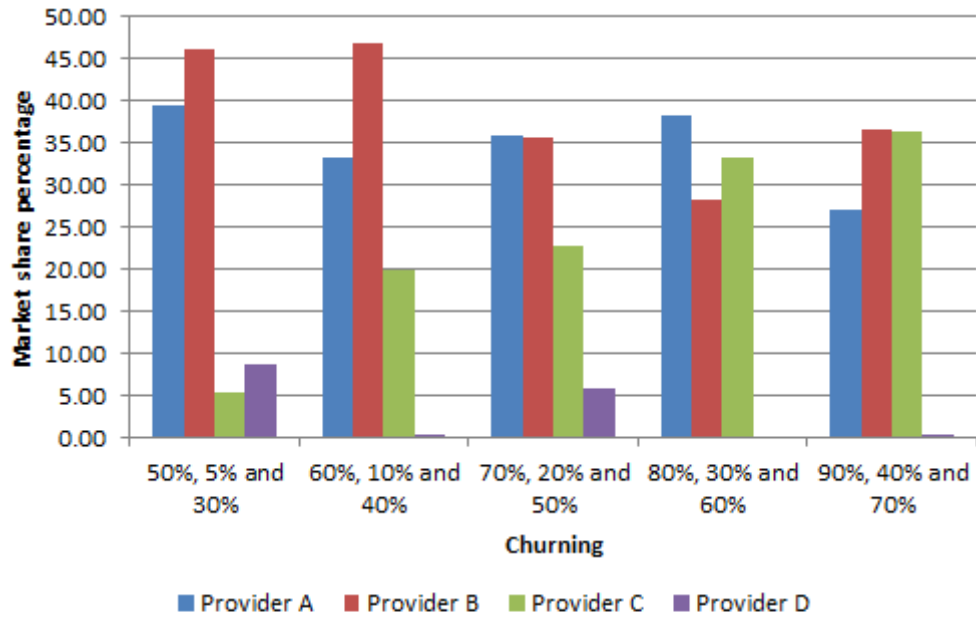
Figure 5.38: User distribution with different churning values, Type 1
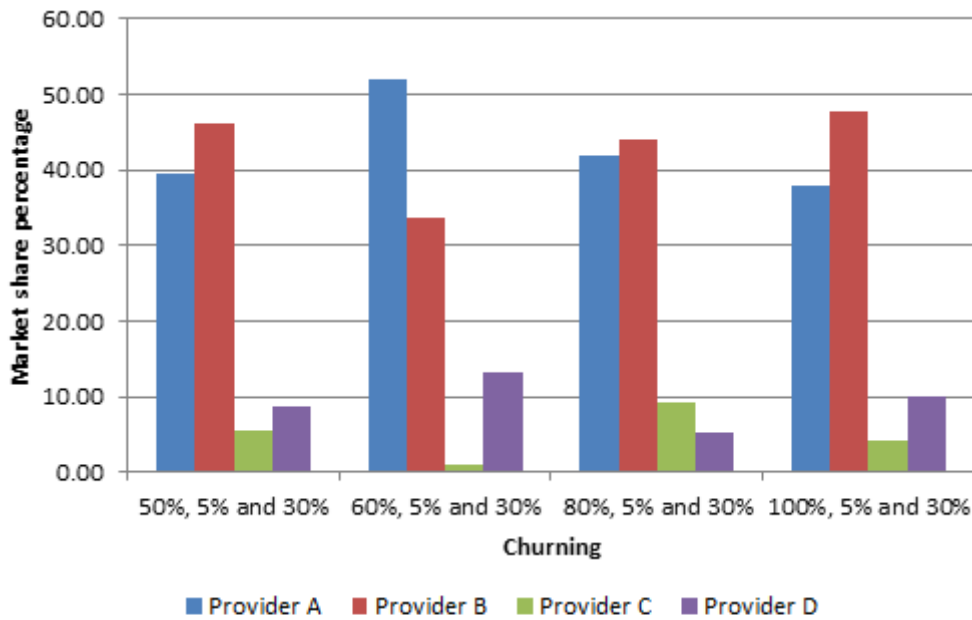
Figure 5.39: User distribution with different churning values, Type 2
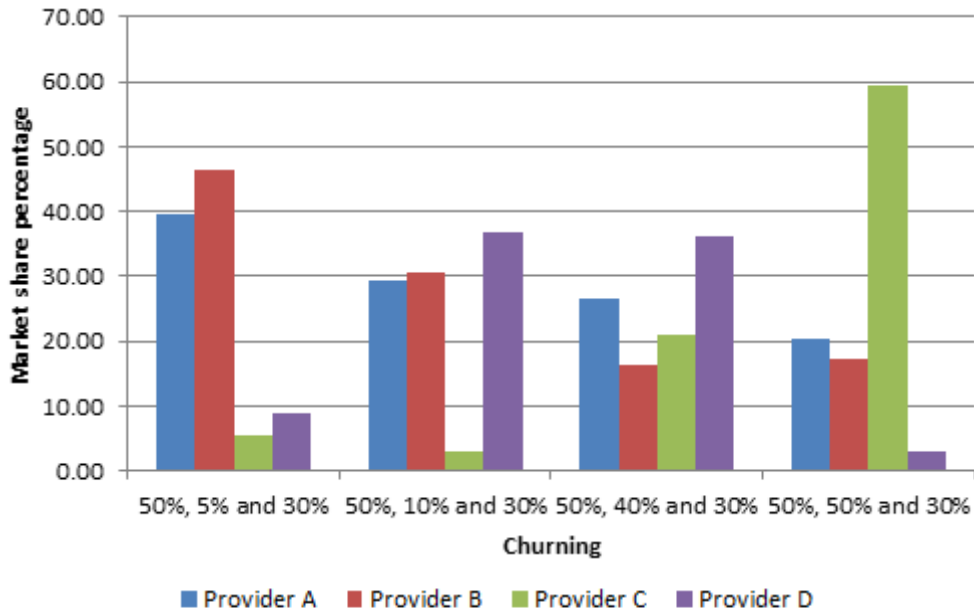
Figure 5.40: User distribution with different churning values, Type 3
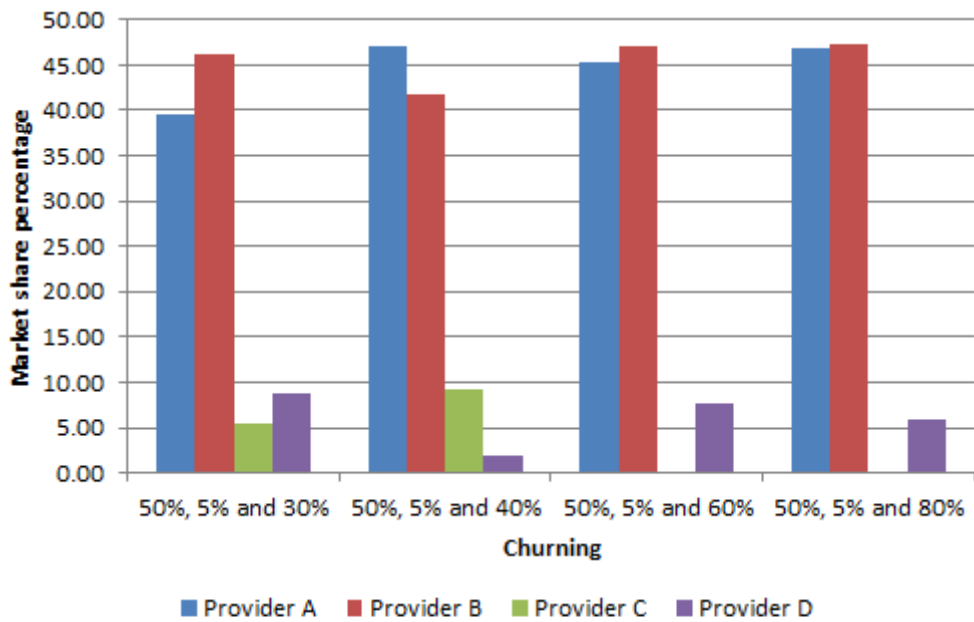
Figure 5.41: User distribution with different churning values, Type 4

Chapter 6

Business Model

Based on the Osterwalder's Business Model[8], the strategy management of providers in three market types will be presented.

6.1 Customer Segment

6.1.1 Scenario I, Without Standard

Large providers   For providers with large installed base of users, the major customer segment is people over the age of twelve, especially between the ages of 14 to 30, who are the most active users on the internet. Additional, organizations, groups and business cooperation are one of the customers, as they may participate into advertisement on SNS. For professionals such as application developers, SNS may also be a platform for them to develop their business.

Small providers   Generally, the customer segments for small providers will be similar to those mentioned above. Some of them may include people that seek for particular purposes. For instance, some providers that offer a meeting place for people to make a date, the customers will therefore be those who are looking for a relationship.

6.1.2 Scenario II, With Standard

Large providers   Similar to the non-standardized market, the main customer segment may be people over the age 14. In order to capture more customers, it includes not only teenagers but also whoever used to surf on internet. Companies and organizations are still one of the customer segments, in addition to developers.

Small providers   The customers will generally be similar to those listed above, it may focus on capturing the forth group of customers as well.

6.1.3   Scenario III, Mix Market

Non-standardized providers   For providers that do not participate into standardization, their main customers may be a specific group of users, specially people with common interests. Generally, the customers are a group with similar needs.

Standardized providers   For standardized providers, the major customers would seem to be whoever the services can reach on internet. The providers are serving a mass and big market that includes everyone who are interested in using SNS. The general coverage of customer segments is large.

6.2   Value Proposition

6.2.1   Scenario I, Without Standard

Large providers   For the major customers of the service, providers create value through offering various features in addition to the basic online social platform. For normal users, photo and event sharing is usually the main features. Further, games may be provided to satisfy users' need for entertainment. For organizations and companies, targeted advertisements and statistics sales are supplied. With a large base of users, the providers are able to offer application developers a market to promote their games and applications.

Small providers   Those mentioned values above may also be deployed by small providers. In order to differentiate themselves in competition with large providers, small providers usually offer distinct and customized features and membership. Such membership would be based on either payment or users' active time on the service. These approaches increase the exclusivity that large providers are unable to offer, hence attract users to participate.

6.2.2   Scenario I, With Standard

Large providers   Due to the limitations are diminished by standardization, the main focus of value proposition is seem to be changed, as the position of large and small providers tend to be more equal. In additional to the features mentioned above in a non-standardized market, large providers may attempt to offer a more comprehensive service. To archive this purpose, large providers will probably expand the coverage of current features. It can be applied to all kinds of subscribers, including normal users, advertisers and developers.

Small providers   With a smaller size of resources, expanding the current service to optimized comprehensibility may not be a good strategy for small companies. Small providers appear to provides their values through more effort in customization and personalization of the services. By providing a unique and differentiated way of online social networking, it creates the main value proposition.

6.2.3   Scenario III, Mix Market

Non-standardized providers   Providers may deliver value through a more enhanced and personalized online social networking platform. In order to distinguish themselves from standardized providers, they appear to provide a more dedicated and customized service that satisfies different individual needs. An outstanding technology and unique user experience would seem to be the main value proposition.

Standardized providers   With a common standard deployed among the providers, the values mentioned above would generally be introduced, also the comprehensibility that support that variations of the service would be provided. A wider range of features will be offered to customers, thus creating a comprehensive service that benefits the customers in different ways. With the increased amount of various features and multiple functions, the service would be able to cover the most of users need.

6.3   Channels and Customer Relationship

6.3.1   Scenario I, Without Standard

Large and small providers   For both large and small providers, there are the same measurements applied for both. Usually, providers promote themselves through various advertisements on websites, games and other online platforms. Users can easily access SNS through different channels such as web portal and mobile phones. For advertisers, they can be reached by related sales department of SNS providers. Providers are usually dedicated to maintain users' loyalty through enhancing the services with additional new features and updates and through contact in a way such as FAQ.

6.3.2   Scenario II, With Standard

Large and small providers   In order to provide a service that maximizes the comprehensibility, providers appear to provide services through various channels. To ensure users can access SNS anytime, providers will probably presents more integrated log-on protocols on other websites. A full-featured and reliable application that not only apply to mobile phones but also other mobile devices such as mobile tablet or pad, that enables users to access SNS anywhere, may help to deliver the value proposition to users. Further, providers may offer various types of contacts that include not only FAQ and online customer service, but also personalized customer service that based on individual need. For instance, based on statistic of SNS usage for individual users, customized electronic survey and personal assistance through telephones may be a good approach to better reach customers need. For developers, supporting their copyrights on developed applications and providing a reliable and inspiring platform is important.

6.3.3   Scenario III, Mix Market

Non-standardized and standardized providers   With and without a common standard solution, all the mentioned channels and methods of customer relationship building above will generally apply to the mix market.

6.4   Revenue Stream

6.4.1   Scenario I, Without Standard

Large and small providers   For the most of the SNS providers, the revenue stream is generally collected from two areas. Firstly, the main revenue comes from advertisements and promotions, especially for the large providers. As the service creates its value by attracting a certain amount of users, it also increases the willingness from advertisers to pay for advertisements. Secondly, some SNS may charge users for membership or items of any exclusivity. A general item users normally can utilize in using SNS is credit that enables access to various additional features and games.

6.4.2   Scenario II, With Standard

Large providers   The main stream of revenue may be based on membership fee and various advertisements. Instead of a winner-takes-it all situation that drives the main revenue toward advertisements, standardization appear to diminish this phenomenon and the services will mainly collect the revenue from users. User credits and exclusive membership fee may become the mainly revenue resource.

small providers   Unlike large providers, the effects of standardization may bring small providers to utilize another method of collecting revenue. Small providers may distinguish themselves by providing free membership or exclusivity based on the level of users activity. Therefore, they may be more depending on revenue from advertisers.

6.4.3   Scenario III, Mix Market

Non-standardized providers   The major revenue stream for providers may come from advertisements and promotions. Additional fee for membership may not become the main stream of revenue, as the providers are depending on the amount of users to gain benefits.

Standardized providers   The revenue structure for standardized providers may become various. Both advertisements and member fee is the main stream of revenue, but the focus on benefits from advertisements would not dominate the general revenue.

6.5 Cost Structure

6.5.1 Scenario I , Without Standard

Large providers and small providers The cost structure for most of the SNS providers is similar and mostly including personnel cost, maintenance of physical equipment such as servers, R&D and marketing.

6.5.2 Scenario II , With Standard

Large providers In general, the same cost structure mentioned above is applied to standardized market. In order to increase the comprehensibility and possibility of customization of the services, the main cost structure will probably be consisting of development, R&D and marketing.

Small providers To be able to provide a personalized and customized service, the cost structure for small providers will probably be mainly consisting of development and personnel. This is the cost from continually updates and maintenance of the service structure.

6.5.3 Scenario III, Mix Market

Non-standardized and standardized providers Generally, all the mentioned cost structure can be applied to the mix market. Additional, for standardized providers, the cost of marketing may be reduced due to standardization. On the other hand, the cost structure for non-standardized providers will be clearly separated into development and marketing that including expenses on personnel and R&D.

6.6 Key Partner, Key Resource and Key Activities

6.6.1 Scenario I , Without Standard

Large providers and small providers SNS providers have normally several partners, both alliance partners and supplier partners. The performance of SNS is relying on the physical servers, and therefore there is need for creating a partnership with server supplier. Compatibility with mobile equipment is also an important element, as mobile devices are becoming more significant for distribution of SNS. Additional, alliance partners such as integrated services, application developers and external web portal are strategically important for SNS providers.

For value creation, SNS providers usually have three types of key resources. There are physical, human and intellectual assets. Physical assets include those servers and machines. While human and intellectual assets consist of developers, administrative personnel, brand, knowledge, copyrights and customer database.

The activity for SNS providers to achieve their value creation is through continuous development

and improvement of existing platform. These will be performed by developers based on continuous feedback and contact with customers. Innovative activity is also significant for further development, and performed by the knowledge database of SNS providers.

6.6.2   Scenario II , With Standard

Large providers and small providers   Both large and small providers have generally similar partners in terms of technical and financial. Since the large providers have to ensure their resources to provide certain level of service comprehensibility, they may be more willing to strengthen the amount of key partners that support the services. The key partners may vary in such a manner that the service is able to provide various functions in different ways. In contrast, small providers may focus on some of the key partners in order to strengthen the service customization. The user group and developers appear to become one of the most important key partners under such circumstances.

The main key resources for providers are generally similar to market without standardization. The large providers may differentiate themselves from expanding their key resources in terms of physical and intellectual assets as well as current customer databases, while the main key resources for small providers would seem to be human including developers, knowledge and copyrights.

The main activity in realizing an online social service is implementation of ideas and development of technology. For large providers, development is the main focus of their activities, while for small providers the interaction with users is the major activity.

6.6.3   Scenario III, Mix Market

Non-standardized and standardized providers   Key partners for both non-standardized and standardized providers may generally be similar. Alliance is important for standardized providers, and the main key partners for standardized providers would seem to be those participators of standardization. It includes both SNS providers and other suppliers that directly or indirectly support the common standard. For non-standardized providers, the key partners may be the team of developers, equipment and financial suppliers.

The installed base of users, knowledge and copyrights may be the important key resources for non-standardized providers, while the standardized provider's key resource is consisting of various assets.

For both non-standardized and standardized providers, the key activity include mainly development, innovation and implementation. These activities are performed by the successful cooperation of both users and developers. Also, the management of service is necessary, in terms of resource allocation and future planning. This is performed and operated by the administrative personnel.

Chapter 7

Game Theoretical Analysis

In this section, the simulated market will be analyzed based on the concept of game theory. The values shown below are based on the simulation results in Scenario I, II and III in Chapter 5. The total user amount for each type of providers is considered to be the value of the services, these accumulated value on providers can be illustrated in the following tables.

Table 7.1 is based on initial user distribution Type 2, in where provider A and B are assumed to be the large providers, and provider C and D are assumed to be the small providers. Table 7.2 is based on Type 1, that presents an equal initial distribution of users. The values given in the tables are based on the aggregated user amount for each type of providers from the simulation results. Table 7.2 consists of Group 1 and Group 2 providers. Group 1 is a simplification of provider A and B, while Group 2 includes provider C and D. Table 7.1 and Table 7.2illustrate the values of each providers participates standardization regarding to each decision made by the opposite competitors. While Table 7.3 and 7.4exhibits the management of strategies for large and small providers at different situation of the market.

		Large providers	
		Standardized	Non-standardized
Small providers	Standardized	33, 67	85, 15
	Non-standardized	12, 88	3, 97

Table 7.1: Standardized or non-standardized?

		Group 1 of providers	
		Standardized	Non-standardized
Group 2 of providers	Standardized	50, 50	87, 13
	Non-standardized	13, 87	21, 79 or 79, 21

Table 7.2: Standardized or non-standardized?

As the Table 7.1, since the initial user distribution is uneven, the large providers usually lead the market. But small providers still have a strictly dominant strategy and it is presented by entering standardization regardless of the participation of large providers. Further, large providers' best response in this game is to remain non-standardized, as they have the dominant position in non-standardized market. But it may leads to another problem if small providers enter standardization and large providers do not follow. They would in this case lose their lead. However, it would be wise for small providers to enter standardization regardless of the decision of large providers.

In Table 7.2 there is a significant difference while Group 1 or 2 make a decision that is opposite to the competitor. Either Group 1 or Group 2 would seem to become dominant providers in the market while one of them enters standardization and the others do not follow. Nash equilibrium is therefore found, while both Group 1 and 2 participate standardization simultaneously, as the value would seem to become approximately equal for both groups of providers and no dominant strategy is found. The finding shows that participation of standardization would seem to be a relative good coordination between both groups of providers.

As the analysis illustrates above, due to the different levels of installed base of users, small providers appear to benefit from standardization. While large providers would seem to remain non-standardized until the emergence of standardization. Under the equal condition of initial user distribution, providers would seem to prefer standardization, as the coordination would rather benefit them from a sustainable and equal development. Table 7.3 and Table 7.4 illustrate the main strategic management of large and small providers in both non-standardized and standardized market.

	Large providers
Non-standardized	Provide basic and general platform
	Offer continuous development
	Build reputation and brand
	Focus on advertisements and promotions
Standardized	Provide comprehensive service
	Increase resource in development
	Build reputation and brand
	Build alliance
	Expand scale

Table 7.3: Strategic management for large providers

	Small providers
	Provide innovative solution
Non-standardized	Allocate limited resource to development
	Build alliance with other providers
	Focus on payment business
	Provide personalization and customization
	Increase resource in customization
Standardized	Increase advertisements
	Build reputation and copyrights
	Build alliance

Table 7.4: Strategic management for small providers

Chapter 8

Conclusion and Further Work

In this chapter, it will first conclude the study and finding in previous chapters and followed by the suggested further work.

8.1 Conclusion

This thesis has presented the main theoretical concepts and analysis method related to SNS industry, which include network and churning effects, business model and game theory. Definitions of technical standards and SNS standard are described. Based on the simulation results generated by DEMOS SIMULA, a sensitivity analysis of market is also introduced. A business model and game theoretical analysis is proposed to present the empirical findings and research for market impact of realization of SNS standardization.

As an example of technical standards, mobile telecommunication standards are presented and followed by the standardization history. A comparison of possible SNS standards are listed based on the current situation, also followed by the history of standardization attempt of SNS.

The simulation model and concepts are based on different market scenarios. Firstly, the results from scenario I show that the absence of standardization may lead to a winner-takes-it-all market, the increased of network effects would seem to accelerate this phenomena. Secondly, from the results in scenario II there is a clear trend of a more evenly market distribution between distinct providers. Finally, the results from scenario III presents a mix market that shows the standardized providers obviously benefits from the competition with non-standardized providers. This also lead to the dominant provider would seem to lose its leading position if it refuses to enter standardization while the others do.

A business model addresses the strategic elements and game theoretical analysis presents a decision management of distinct types of providers based on the previous findings.

8.2 Further Work

As the simulation results are mainly based on the variation of network effects and churning, a wider combination of these parameters should be considered to present a more comprehensive market analysis. It would improve the market simulation in different way.

This thesis has study several possible types of SNS standard and it may be an interesting extension for further study. It can be measured by further research of implementation of SNS standardization. A broader study of standard-related protocols that needed in order to realized a common standard of SNS would also be a significant step in terms of establishing technical specifications of SNS standard. It should also include a study of implementation of a prototype of common standard that enabling interoperability. Furthermore, A more broader study of current solutions of SNS standard regardless of geographical area should be taken into account in further work.

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Source Code

This section contains the programming code used in DEMOS for simulation purpose. It contains SIMULA code for generating a simulation for various market type that described above. An example of parameters is also listed below.

```
BEGIN

external class demos="c:\cim\demos\demos.atr";

demos begin

REF (infile) file1,file3;
REF (outfile) file2,file4,file5;
REF(idist) seedGen;
REF(rdist) uniformGen;
REAL feedback_1,feedback_2,test,test2,test3,pool_1,pool_2;
REAL churn_1,churn_2,churn_3,churnprob,b,start,t,churn_counter;
REAL inRead,startShare;
INTEGER ARRAY market(1:100);
INTEGER customer,actor,pool,seed,i,j,m,n,samplingPoint;
INTEGER doublingTime,samplingCounter,samplingFreq;
INTEGER NumOftypeStandard, NumOftypeNoStandard;


entity class addCustomer_1;
Begin
        test:=uniformGen.sample;
        test2:=0;
        test3:=0;

        pool_1:=pool_1+1;

        FOR i:=1 STEP 1 UNTIL NumOftypeStandard DO BEGIN
                test3:=test3+market(i)**feedback_2;
        END;

        FOR i:=1 STEP 1 UNTIL NumOftypeStandard DO BEGIN
                test2:=test2+market(i)**feedback_2;
                IF test*test3<test2 THEN BEGIN
                        market(i):=market(i)+1;
                        GOTO W;
                END;
```

```
        END;
W:

END;


entity class addCustomer_2;
BEGIN

        test:=uniformGen.sample;
        test2:=0;
        test3:=0;

        pool_2:=pool_2+1;

                FOR i:=NumOftypeStandard+1 STEP 1 UNTIL actor DO BEGIN
                            test3:=test3+market(i)**feedback_1;
                END;


                FOR i:=NumOftypeStandard+1 STEP 1 UNTIL actor DO BEGIN
                        test2:=test2+market(i)**feedback_1;
                        IF test*test3<test2 THEN BEGIN
                                market(i):=market(i)+1;
                                GOTO B;
                        END;
                END;
B:
END;


entity class addCustomer;
Begin
        test:=uniformGen.sample;
        test2:=0;
        test3:=0;

        FOR i:=1 STEP 1 UNTIL actor DO BEGIN
                test3:=test3+market(i)**feedback_1;

        END;

        FOR i:=1 STEP 1 UNTIL actor DO BEGIN
                test2:=test2+market(i)**feedback_1;
                IF test*test3<test2 THEN BEGIN
                        market(i):=market(i)+1;
                        GOTO W;
                END;
        END;
W:
IF i<=NumOftypeStandard THEN pool_1:=pool_1+1;
IF i>NumOftypeStandard THEN pool_2:=pool_2+1;
```

```
END;


entity class churning_1;
Begin

        WHILE TRUE DO BEGIN
                hold(100/(pool_1*churn_1));

                test:=uniformGen.sample;
                test2:=0;

                FOR i:=1 STEP 1 UNTIL NumOftypeStandard DO BEGIN
                        test2:=test2+market(i);
                        IF test*pool_1<test2 THEN BEGIN
                                market(i):=market(i)-1;
                                pool_1:=pool_1-1;
                                GOTO D;
                        END;
                END;
        D:
                new addCustomer_1("adding customer_1").schedule(0.0);
        END;
END;


entity class churning_2;
Begin

WHILE TRUE DO BEGIN
        hold(100/(pool_1*churn_2));

        test:=uniformGen.sample;
        test2:=0;

        FOR i:=1 STEP 1 UNTIL NumOftypeStandard DO BEGIN
                test2:=test2+market(i);
                IF test*pool_1<test2 THEN BEGIN
                        market(i):=market(i)-1;
                        pool_1:=pool_1-1;
                        GOTO E;
                END;
        END;
E:
        new addCustomer_2("adding customer_2").schedule(0.0);
END;
END;


entity class churning_3;
Begin
WHILE TRUE DO BEGIN
```

```
        hold (100/( pool_2 * churn_3 ));

        test := uniformGen . sample ;
        test2 :=0;

        FOR  i := NumOftypeStandard +1  STEP  1  UNTIL  actor  DO  BEGIN
                test2 := test2 + market ( i );
                IF  test * pool_2 < test2  THEN  BEGIN
                        market ( i ):= market ( i ) -1;
                        pool_2 := pool_2 -1;
                        GOTO  F ;
                END ;
        END ;
F :
        new  addCustomer_1 ( "adding  customer_2" ). schedule (0.0);
END ;
END ;




entity  class  churning_4 ;
Begin
WHILE  TRUE  DO  BEGIN
        hold (100/( pool_2 * churn_3 ));

        test := uniformGen . sample ;
        test2 :=0;

        FOR  i := NumOftypeStandard +1  STEP  1  UNTIL  actor  DO  BEGIN
                test2 := test2 + market ( i );
                IF  test * pool_2 < test2  THEN  BEGIN
                        market ( i ):= market ( i ) -1;
                        pool_2 := pool_2 -1;
                        GOTO  F ;
                END ;
        END ;
F :
        new  addCustomer_2 ( "adding  customer_1" ). schedule (0.0);
END ;
END ;




entity  class  sampling ;
Begin

        FOR  i :=1  STEP  1  UNTIL  actor  DO  BEGIN
                file5 . outfix (100* market ( i )/( pool_1 + pool_2 ),5 ,10);
                file5 . outtext ("   ");
        END ;
```

```
        file5.outfix(100*(pool_1+pool_2)/customer,5,10);
        file5.outtext("   ");

        file5.outfix(Time,5,10);
        file5.outimage;
End;



file1:-NEW infile("params.txt");
file1.open(blanks(180));

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
customer:=file1.inint;
outint(customer,12);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
actor:=file1.inint;
outint(actor,12);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
NumOftypeStandard:=file1.inint;
outint(NumOftypeStandard,12);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
NumOftypeNoStandard:=file1.inint;
outint(NumOftypeNoStandard,12);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;

pool:=0;
pool_1:=0;
pool_2:=0;

FOR i:=1 STEP 1 UNTIL actor DO BEGIN
        inRead:=file1.inReal;
        market(i):=customer*inRead/100;
        IF i<=NumOftypeStandard THEN BEGIN
                pool_1:=pool_1+market(i);
        END;
        IF i>NumOftypeStandard THEN BEGIN
                pool_2:=pool_2+market(i);
```

```
        END;
        pool:=pool_1+pool_2;
                outtext("Actor customers: ");outfix(inRead,3,6);
                outtext("%, equals:");
                outint(i,2);outtext(":");outint(market(i),7);outimage;
END;
outtext("Total start customers: ");outint(pool,7);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
feedback_1:=file1.inReal;
outfix(feedback_1,2,5);outimage;


feedback_2:=file1.inReal;
outfix(feedback_2,3,5);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
churn_1:=file1.inReal;
outfix(churn_1,2,5);outimage;

churn_2:=file1.inReal;
outfix(churn_2,2,5);outimage;


churn_3:=file1.inReal;
outfix(churn_3,2,5);outimage;


file1.inimage;
outtext(file1.intext(80));
file1.inimage;
doublingTime:=file1.inInt;
outInt(doublingTime,4);outimage;

file1.inimage;
outtext(file1.intext(80));
file1.inimage;
samplingFreq:=file1.inInt;
outInt(samplingFreq,6);outimage;


file3:-NEW infile("seed.txt");
file3.open(blanks(180));
file3.inimage;
seed:=file3.inint;
outtext("Seed: ");outint(seed,12);outimage;

SETSEED(seed);
```

```
!SETSEED(1);



seedGen:-NEW RANDINT("Seed generator",1,100000000);
uniformGen:-NEW UNIFORM("User type generator",0.0,1.0);



startShare:=pool/customer;



file5:-new outfile("results.txt");
file5.setaccess("noappend");
file5.open(blanks(180));



samplingPoint:=customer/samplingFreq;
samplingCounter:=0;



        IF churn_1 >0 THEN BEGIN
                new churning_1("Start churn").schedule(0.0);
        END;

        IF churn_2 >0 THEN BEGIN
                new churning_2("Start churn_1").schedule(0.0);
        END;

        IF churn_3 >0 THEN BEGIN
                new churning_3("Start churn_2").schedule(0.0);
                new churning_4("Start churn_4").schedule(0.0);
        END;




WHILE (pool_1+pool_2)<customer DO BEGIN;
        hold((doublingTime/(2*LN(9))*LN(((startShare**-1)-1)/
        ((((pool_1+pool_2)/customer)**-1)-1)))-Time);
        new addCustomer("adding customer").schedule(0.0);



        samplingCounter:=samplingCounter+1;

        IF samplingCounter>samplingPoint THEN BEGIN
```

```
                    new sampling("Sample").schedule(0.0);
                    samplingCounter:=0;

          END;
END;




FOR i:=1 STEP 1 UNTIL actor DO BEGIN
        IF i <= NumOftypeStandard THEN BEGIN
                outtext("No. of users for actor ");outint(i,2);
                outtext(" with standard: ");outint(market(i),13);
                outtext("  Percent: "); outfix(100*market(i)/customer,2,6);
                outtext(" %");outimage;
        END;
        IF i > NumOftypeStandard THEN BEGIN
                outtext("No. of users for actor ");outint(i,2);
                outtext(" without standard: ");outint(market(i),10);
                outtext("  Percent: "); outfix(100*market(i)/customer,2,6);
                outtext(" %");outimage;
        END;

END;




FOR i:=1 STEP 1 UNTIL actor DO BEGIN
        file5.outfix(100*market(i)/(pool_1+pool_2),5,10);
        file5.outtext("  ");
END;

file5.outfix(100*(pool_1+pool_2)/customer,5,10);
file5.outtext("  ");
file5.outfix(Time,5,10);
file5.outimage;




file4:-new outfile("seed.txt");
file4.setaccess("noappend");
file4.open(blanks(180));
file4.outint(seedGen.sample,12);
file4.outimage;

end demos;
End;
```

NumberUsers
100000

NumberActors
4
NumberActorsWithStandard
2
NumberActorWithoutStandard
2
StartCustomersIn%
0.10 0.15 0.45 0.30
FeedBackParameter
1.2
1.005
ChurnPerYearIn%
50
5
30
DeltaTiAar
5
NoOfSamplesExChurn
100

Appendix

The appendix include all the related data in the thesis.

Scenario I - Without Standard

Years	Provider A	Provider B	Provider C	Provider D
0	25%	25%	25%	25%
2.73	29%	16.94%	24.19%	29.86%
7.74	33.20%	4.65%	15.79%	46.36%
18.33	21.98%	0.43%	3.37%	74.21%

Table 8.1: user distribution at different development time with feedback 1.4

Years	Provider A	Provider B	Provider C	Provider D
0	25%	25%	25%	25%
2.73	28.24%	8.14%	23.42%	40.19%
7.74	2.93%	0.26%	1.53%	95.28%
18.33	0.12%	0.01%	0.06%	99.81%

Table 8.2: user distribution at different development time with feedback 1.9

Feedback	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
1.1	29.51	13.31	23.44	33.75
1.2	31.66	5.89	18.19	44.27
1.3	29.04	1.56	10.62	58.78
1.4	21.98	0.45	3.37	74.21
1.5	8.29	0.11	1.42	90.18
1.6	3.10	0.04	0.49	96.38
1.7	0.69	0.02	0.20	99.09
1.8	0.28	0.02	0.12	99.58
1.9	0.12	0.01	0.06	99.81
2.0	0.08	0.01	0.04	99.88

Table 8.3: Sensitivity analysis of feedback

Scenario II - With Standard

Years	Provider A	Provider B	Provider C	Provider D
0	25%	25%	25%	25%
2.73	24.63%	24.74%	25.60%	25.40%
7.74	23.75%	23.77%	26.30%	26.18%
18.33	23.61%	23.69%	26.82%	25.88%

Table 8.4: user distribution at different development time with churning 50%

Years	Provider A	Provider B	Provider C	Provider D
0	25%	25%	25%	25%
2.73	26.84%	27.93%	22.26%	22.97%
7.74	27.18%	27.97%	22.09%	22.77%
18.33	27.93%	27.36%	22.12%	22.56%

Table 8.5: user distribution at different development time with churning 100%

Churning	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
10%	27.87	24.42	23.24	24.48
20%	27.82	22.17	24.29	25.72
30%	27.18	19.02	24.88	28.93
40%	23.98	20.63	28.96	26.44
50%	23.61	23.69	26.82	25.88
60%	26.70	23.49	21.95	27.86
70%	28.69	17.80	26.22	27.29
80%	25.17	22.85	30.40	21.59
90%	24.15	24.30	25.35	26.20
100%	27.93	27.36	22.15	22.56

Table 8.6: Sensitivity analysis of churning

Scenario III - Mix Market

Years	Provider A	Provider B	Provider C	Provider D
0	25%	25%	25%	25%
2.73	36.90%	39.15%	11.84%	12.11%
7.74	39.78%	47.23%	6.00%	6.99%
18.33	39.53%	46.23%	5.44%	8.80%

Table 8.7: user distribution at different development time, Case 1, Type 1

Years	Provider A	Provider B	Provider C	Provider D
0	10%	20%	10%	60%
2.73	12.82%	31.81%	16.83%	38.54%
7.74	11.92%	50.34%	19.15%	18.60%
18.33	12.19%	53.62%	19.81%	14.38%

Table 8.8: user distribution at different development time, Case 2, Type 3

Years	Provider A	Provider B	Provider C	Provider D
0	45%	30%	10%	15%
2.73	60.89%	26.29%	2.57%	10.26%
7.74	70.53%	17.92%	0.47%	11.09%
18.33	69.58%	16.22%	0.01%	14.19%

Table 8.9: user distribution at different development time, Case 1, Type 2

Years	Provider A	Provider B	Provider C	Provider D
0	10%	15%	45%	30%
2.73	18.85%	43.31%	22.54%	15.30%
7.74	18.92%	66.20%	10.86%	4.02%
18.33	18.76%	66.96%	13.68%	0.60%

Table 8.10: user distribution at different development time, Case 1, Type 4

Feedback	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
1.2 and 1.005	39.53	46.23	5.44	8.80
1.1 and 1.4	68.62	17.22	12.50	1.66
1.6 and 1.2	84.92	0.94	14.14	0.00
1.8 and 1.3	85.66	0.22	0.00	14.12
2.0 and 1.4	85.88	0.01	14.11	0.00

Table 8.11: Sensitivity analysis, Type 1 of feedback

Feedback	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
1.2 and 1.005	39.53	46.23	5.44	8.80
1.6 and 1.005	59.98	25.88	14.14	0.00
1.8 and 1.005	55.27	30.60	0.00	14.13
2.0 and 1.005	75.65	10.24	14.11	0.00

Table 8.12: Sensitivity analysis, Type 2 of feedback

Feedback	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
1.2 and 1.005	39.53	46.23	5.44	8.80
1.2 and 1.2	31.10	54.66	4.70	9.54
1.4 and 1.4	85.70	0.14	1.18	12.98

Table 8.13: Sensitivity analysis, Type 3 of feedback

Churning	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
50%, 5% and 30%	39.53	46.23	5.44	8.80
60%, 10% and 40%	33.25	46.76	19.89	0.10
70%, 20% and 50%	35.82	35.60	22.76	5.80
80%, 30% and 60%	38.37	28.29	33.33	0.00
90%, 40% and 70%	27.15	36.49	36.36	0.01

Table 8.14: Sensitivity analysis, Type 1 of churning

Churning	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
50%, 5% and 30%	39.53	46.23	5.44	8.80
50%, 5% and 40%	47.18	41.73	9.15	1.94
50%, 5% and 60%	45.29	47.02	0.00	7.69
50%, 5% and 80%	46.82	47.29	0.00	5.88

Table 8.15: Sensitivity analysis, Type 2 of churning

Churning	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
50%, 5% and 30%	39.53	46.23	5.44	8.80
60%, 5% and 30%	52.04	33.71	1.09	13.16
80%, 5% and 30%	41.76	44.00	9.13	5.11
100%, 5% and 30%	37.93	47.83	4.23	10.01

Table 8.16: Sensitivity analysis, Type 3 of churning

Churning	User' distribution (%) at 100% of accumulated users			
	Provider A	Provider B	Provider C	Provider D
50%, 5% and 30%	39.53	46.23	5.44	8.80
50%, 10% and 30%	29.31	30.70	3.14	36.86
50%, 40% and 30%	26.50	16.36	21.01	36.14
50%, 50% and 30%	20.36	17.13	59.554	2.947

Table 8.17: Sensitivity analysis, Type 4 of churning