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HOW NEW BUSINESS ECOSYSTEMS EMERGE: A STUDY ON FINNISH CLOUD BUSINESS ECOSYSTEM

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Abstract

It is an emerging phenomenon that the leading multinational companies are studying how to use the engagement experiences of customers and communities as the foundation of value co-creation. To achieve this, the business leaders have increasingly adopted an ecological organizational form, namely business ecosystem. Google, Amazon and Microsoft are the real world examples and pioneers in this field. However, in the academic research, it is addressed by a number of researchers that there is significant lack of empirical studies that examines the emergence and formation of business ecosystem, especially in ICT industry. In essence, this study takes Cloud as the context to develop concepts on the emergence of business ecosystem and examine the manifestation of such evolution in the emerging business field.

Through extensive literature reviews and empirical interviews, the current study developed answers to the research question, “How do new business ecosystems emerge, in the context of Cloud computing?” at qualitative level. In general, it is considered in the study that business ecosystem is a type of more advanced business form emerged recently. It has the characteristics as follow: provision of value, integration with external partners, requiring multiple participants, shifting from individual to collaborative thinking, interdependence of the participants, value co-creation, co-petition, open innovation and shared fate of success or failure.

From a macro level viewpoint, the emergence of business ecosystem is the result of the continuous evolution of business forms, from linear type towards a more complex networked type. At a micro level, for an ecosystem to emerge in a given industry, it involves strategic design and appropriate execution. Furthermore, a set of critical elements need to be in the right place for a business ecosystem to emerge, which including: prerequisite conditions for ecosystem to emerge, external environmental and resource, shared vision, leadership of the ecosystem, common platform, mechanisms of the ecosystem, ecosystem healthiness, and IT infrastructure.

The study further suggests that the emergence of business ecosystem as a new business form is not out of luck or probability. It is a natural path that under governance of the evolution forces existing in the social-economic contexts, just as the evolution of all the living creatures in the natural environment. For this broader perspective, the emergence of ecosystem is inevitable due to the social-economic and technological driving forces.

Keywords
Cloud Computing Ecosystem, Emergence, Variation and Selection

Additional information
This thesis was carried out in collaboration with TIVIT Cloud Software research programme.
## CONTENTS

1 INTRODUCTION .................................................................................................................. 6

1.1 What is Business Ecosystem ......................................................................................... 10

1.2 Cloud Computing and Ecosystem ............................................................................... 10

1.3 Research Question and Objectives ............................................................................. 12

1.3.1 Research Motivation ................................................................................................. 12

1.3.2 Research Objectives ................................................................................................... 15

1.4 Overview of the Research and Analysis ..................................................................... 16

1.5 Structure of the Paper .................................................................................................. 17

2 LITERATURE REVIEWS .................................................................................................. 19

2.1 Business Forms for Value Creation ............................................................................ 19

2.1.1 Value Chain as a Business Form ............................................................................ 19

2.1.2 Value Network as a Business Form ........................................................................ 20

2.2 Defining Business Ecosystem ...................................................................................... 21

2.2.1 Generic Ecosystems in Literature ........................................................................... 22

2.2.2 Business Ecosystems in Literature .......................................................................... 23

2.2.3 The Properties of Business Ecosystem .................................................................... 28

2.3 Defining Cloud Ecosystem ......................................................................................... 29

2.3.1 Defining Cloud Computing ..................................................................................... 29

2.3.2 ICT Ecosystem .......................................................................................................... 31

2.3.3 Cloud Ecosystem ...................................................................................................... 31

2.4 Emergence and Evolution ............................................................................................ 33

2.4.1 Emergence ................................................................................................................. 34

2.4.2 Evolution and Co-Evolution ..................................................................................... 35

2.5 Emergence of the Cloud ............................................................................................... 37

2.5.1 Cloud’s Drivers and Benefits ................................................................................... 38
2.5.2 Change of Cloud Industry .............................................................. 38

2.6 Emergence of Cloud Ecosystem ....................................................... 40
  2.6.1 Emergence of Business Ecosystem (Macro Level) ....................... 41
  2.6.2 Emergence of Individual Ecosystem (Micro Level) ....................... 46
  2.6.3 Key Elements for the Emergence of Cloud Ecosystem ................. 49

2.7 Summary of the Literature Reviews .............................................. 53

3 RESEARCH METHODOLOGY ............................................................. 55
  3.1 Background of Cloud Finland ...................................................... 56
  3.2 Background of CloudSoft Finland ................................................ 59
  3.3 Background of Ecosystem Finland ............................................... 59

4 RESEARCH ANALYSIS ........................................................................ 61
  4.1 Emergence of Cloud Finland and Beyond (Macro Level) ............... 63
  4.2 Emergence of Cloud Finland (Micro Level) ................................... 66
  4.3 Key Elements for the Emergence of Ecosystem .............................. 68

5 DISCUSSION AND CONCLUSION ...................................................... 76
  5.1 How Do Business Ecosystems Emerge? ........................................ 76
    5.1.1 Business Ecosystems Emerge Out of Business Form Evolution (Macro Level) ................................................................. 76
    5.1.2 Business Ecosystems Can be Built with Appropriate Design and Execution (Micro Level) ......................................................... 77
    5.1.3 Key Elements for the Emergence of Business Ecosystem ........... 78
    5.1.4 New Proposition Emerged from the Study ............................... 79
  5.2 Evaluation of the Study’s Reliability and Validity .......................... 85
  5.3 Suggestion for Future Research ..................................................... 87

REFERENCE ........................................................................................ 89
FIGURES

Figure 1. Socio-economic impact of IT evolution (adapted from Udhas et al., 2011).................. 9
Figure 2. Business Ecosystem (adapted from Moore, 1996)....................................................... 24
Figure 3. Business Ecosystem Types (adapted from Bailetti and Hudson, 2009)...................... 27
Figure 4. The Cloud Value Chain. Cloud vendors offer services to consumers, while Cloud partners help to facilitate interactions between the two (adapted from Zhang et al, 2010). 32
Figure 5. A Cloud Ecosystem (adapted from Zhang et al, 2010)......................................... 33
Figure 6. Historical Timeline of Cloud Development (adapted from Petar, 2011)................ 40

TABLES

Table 1. Current Cloud Computing Researches (adapted from Wang et al., 2011).............. 14
Table 2. Generalized Properties of Business Ecosystem.............................................................. 28
Table 3. Property Comparison of Value Chain, Value Network and Business Ecosystem... 43
Table 4. Google's Initiative Actions to Create Cloud Ecosystem in Taiwan......................... 49
Table 5. Properties of Cloud Finland. ......................................................................................... 57
Table 6. Property Comparison of Various Business Forms in Theory and Practice............ 64
Table 7. The Comparison between the Ecosystem of Google and Cloud Finland.............. 67
Table 8. Comparison between Theoretical Business Ecosystem and Cloud Finland......... 81
1 INTRODUCTION

Ramaswamy (2009) once told a story when referring to value creation: a physics student complained to Albert Einstein about his course examination. “Professor Einstein, your questions are the same like last year!” Einstein responded, “Yes, it is, but this time the answers are different.” Quite similar to this story, in the real-life business context, one of the most critical questions for business practitioners is how to create value for customers. In this case, although across different industries, the questions are the same. However, when the disruptive technologies are prevailing and affecting present business environment and when customers are given the opportunity to participate in value creation, the answer becomes different, as Ramaswamy addressed.

Wise et al. (2012) suggest that internet technology continues bringing innovative value to business world. Numerous organizations and companies are leveraging this online technology to foster innovation and re-create value propositions. This growing phenomenon can be witnessed from the work of a number of researchers, for example, Chesbrough and Teece (2002). In the real world, multinational companies are also paying greater and greater efforts to adapt to the emerging trend of value creation in this information economy. For example, Proctor and Gamble shifts from command and control to collaboration and connecting (Hagel III et al., 2010); IBM is currently pursuing co-development of the smarter planet vision (Paton and McLaughlin, 2008).

In order to meet the emerging business challenges, or “passing the examination”, business practitioners must recognize and learn how to facilitate the new approach of creating value, such as value co-creation within the organization. In fact, the leading multinational companies are studying how to use the engagement experiences of customers and communities as the foundation of value co-creation. According to the findings from these business leaders, one solution is to become a value co-creation platform. This rationale means that a co-creative organization changes the nature of user engagement as well as customer relationship management between the companies, employees, customers, and other stakeholders (Ramaswamy, 2009).
Facing this emerging paradigm, a series of researchers have attempted to come up with proper definition of value co-creation. Wise et al. (2012) exemplify some of the well-known concepts from previous literatures, for instance, Chesbrough (2003)’s Open Innovation perspective, Howe (2008)’s Crowdsourcing and Tapscott and Williams (2006)’s Wikinomics, to name a few. One interesting observation from reviewing these literatures is that all of the listed definitions emphasize the importance of web and Information and Communication Technologies (ICT) in the process of value co-creation. In general, according to Wise et al., this emerging paradigm has affected the process in which customer value is created. Researchers, such as Graham et al. (2009) and Le and Tarafdar (2009) also claim that “value co-creation” symbolizes the advent of the era of information economy.

To demonstrate the relationship between value co-creation and ecosystem thinking, Tanev et al. (2011) first researched the unique characteristics of value co-creation, suggesting that value co-creation is an emerging marketing and innovation ideology emphasizing the end customer’s involvement in the design and development process of products and services. This concept is supported by a number of researchers, such as Etgar (2008) and Payne et al. (2008).

Tanev et al. (2011) then entail five shifts of thinking from serving customers to creating value with customers. To achieve this, it is critical to migrate from individual company thinking to strategic thinking of the entire value ecosystem, as proposed by Tanev et al. It is also suggested that the ecosystem thinking brings the customer centric ideology even further than the well-known value network concept. Moreover, from a technological view point, Tanev et al. prove again that the participation of end customers is realized via multiple interaction channels, especially by the creation of ICT platforms through the internet.

*Information Economy and Business Ecosystem*

When referring to the information economy, Huang et al. (2009) suggest that a rising phenomenon in the information economy is the platform-based business model. It is also suggested by Huang et al. that, the personal computer (Bresnahan and Greenstein, 1999), personal digital assistant (Boudreau, 2007), and video game
console (Zhu and Iansiti, 2007) are symbols of the system consisting of a core technology platform and the complementary applications designed for the platform. One may ask, “How platform model is related to ecosystem thinking?” Taking software industry as a case to answer the question, Adomavicius et al. (2007) observe that communities of innovation networks are equivalent to ecosystems. These ecosystem-like networks have been increasingly utilized by multinational companies with platform business model to meet user needs from different segments.

Adner (2006) recognizes that the ICT ecosystems have emerged especially in the computer software industry. IT business leaders gradually build up ecosystems by coordinating and harnessing the collective power of developers, partners, and other contributors.

**Global Economy, ICT Evolution and Cloud**

Evidence shows that technology has always played the role of a disruptive force that connects discontinuities and refines business models and ecosystems, according to Udhas et al. (2011: 5)’s observation. Ambitiously, Udhas et al. claim that today’s technology has enough influence to transform the world into the virtual space, enabling endless cycle of innovation. Their argument is as follow: “what helped the adoption of the advances in IT was that each new avatar was preceded by a recessionary phase. Recessions brought about a greater need for businesses to improve efficiency levels and increase profitability.”

Udhas et al. (2011) further present the following evidence to back their argument: the economic recession in the first half of the 1990s was followed by the growth of the Client Server Architecture and the internet. Recently the world has gone through an economic downturn and there is a stronger need for business and organizations to improve efficiencies by using collaborative solutions and real time information exchange. Udhas et al. suggest that the Cloud computing (also referred as Cloud) could potentially be the next big thing with it gaining presence during the recent credit crisis. Generally, the promise of Cloud lies in the flexibility, scalability and cost benefits made available through the “as-a-service” concept.
Apart from the economic recession perspective, the recent emerging domains, such as online social media, online social networking, and virtual communities have become another factor for the booming of Cloud. Wise et al. (2012) mention that Facebook, Twitter, LinkedIn and other virtual platforms have enabled millions of people to connect, share and use technology to improve life experiences. Taking Facebook as an example, Udhas et al. (2011) estimate that it grows from 100 million active users to over 500 million active users in just a span of three years. Behind the scenes, these social platforms are all leveraging the different shapes of the Cloud which enables rapid development and scalability. Therefore, as an emerging technology, the business value of Cloud computing is causing a market revolution to help various organizations, business or public organizations to improve their structure of revenue and expenses, and eventually reshape the customer experience. (Udhas et al., 2011).

In essence, this study takes Cloud as the context to develop concepts on the emergence of business ecosystem and examine the manifestation of such evolution in the emerging business field.

Figure 1. Socio-economic impact of IT evolution (adapted from Udhas et al., 2011).
1.1 What is Business Ecosystem

To put the concept of ecosystem in simple terms, Moore (2005) takes Apple’s ecosystem as an example, explaining that manufacturers making accessories for the Apple iPod can be considered as members of the iPod business ecosystem. The same can be applied for the entertainment companies that license music through iTunes, the iPod music downloading site, as well as the consumers who purchase and download the music.

Nearly two decades ago, Moore (1993) claims the “end of industry as a useful concept in contemplating business” and suggests “business ecosystem” as a more insightful alternative for the concept. Moore notes that every business ecosystem develops in different stages, including birth, expansion, leadership, self-renewal, and death. Each stage presents different and unique challenges and opportunities in the ecosystem. When referring to ICT sectors, Javalgi et al. (2005) suggest that the internet itself can represent the start-up of a new ecosystem that is rapidly growing. Furthermore, it is a new system that grows at an unexpected rate and changes the existing international market boundaries. This is why business ecosystem concept could potentially change and expand the current understanding of international business theories.

Carbone (2009) recognizes that the ecosystem has tremendous potential to help companies, especially during the current recessionary period. One of the reasons is that the dynamic environment that facilitates real time information requirements could help businesses not only meet existing business objectives, but also set up new ones, which supports Udhas et al. (2011)’s viewpoint. Another reason can be that partnerships and collaboration are critical to the survival and growth of the companies (Carbone 2009).

1.2 Cloud Computing and Ecosystem

“Cloud” is increasingly talked about. Business applications are moving to the Cloud. But what does it mean? Cloud represents the shift from traditional software model to the internet model. The life before Cloud is like this: applications are relatively
costly for customers. Especially for business applications, it does not only require business to purchase a large amount and variety of hardware and software, companies also need a full team of IT staff to install, configure, run, and maintain the system.

In Lyons (2005)’s study on emerging ICT systems, the success of several major suppliers, such as SAP and Oracle, has led to a shift from separated functional systems to an integrated systems within the organization. At the same time, the availability of the advanced IT architectures means that the computing power is becoming commoditized. As a result, the suppliers are seeking new ways to add value by offering additional services, such as consulting and integration service. At the same time, their customers are facing a new environment that widespread use of IT is in the process of becoming a utility. Thus, it can be seen that the trend of IT system development collides with the introduction of Cloud.

Referring to empirical data, Azhar (2009) provides that in a survey conducted with 696 IT executives and CIOs across Asia/Pacific region, it was found that 11% of the respondents are already using Cloud-based solutions. A further 41% of the respondents indicated that they are either evaluating Cloud solutions for using in their businesses, or already piloting Cloud solutions. When asked about their opinion of the current state of Cloud computing, 17% of the respondents stated that although Cloud is very promising, there are currently not enough services available to make it compelling.

To look at the real-life deployment cases, according to Dwivedi and Mustafee (2010), in addition to Cloud services such as Gmail and Google Drive, Google has plans to offer a Cloud-based Operating System (Chrome OS) in the coming future. In public sectors, governments of several countries have realized the potential of Cloud computing. The UK government, for example, commissioned a report on Digital Britain that has established a road map towards creation of a private Cloud computing infrastructure for the government called as “G-Cloud” (Dwivedi and Mustafee, 2010).
In terms of Cloud ecosystem, Prasad (2010) suggests that the Cloud is not only to build data center, infrastructure and services, but also working with the ecosystem partners. From this perspective, it is crucial to have a comprehensive suite of services that help customers adopt Cloud, building out a road map, helping customers look at applications landscape and migrating to Cloud platform. By doing so, Cloud companies are able to create ecosystem, which helps customers leverage Cloud technologies.

Overall, “the heart of Cloud computing is the integration of Cloud services, and an ecosystem integration, inter-space across the enterprise, open up a customer-centric business processes”, said Wu Yimin, CEO of News Bird Software. (VentureData, 2012).

1.3 Research Question and Objectives

In Xu (2011)’s previous work, “From competitiveness to collaborativeness: integrating innovative business models in ICT ecosystem”, the key focus is to study and analyze how companies operates in the same ecosystem can use innovative business models as foundation to design and build more successful business individually, and eventually benefiting the business ecosystem as a whole.

However, the limitation of the former study is that it only focuses on the existing business ecosystem as well as the roles of different actors within. The missing and more interesting piece is how such ecosystem emerges and evolves from the beginning. Therefore, in this research, the following question is addressed and studied thoroughly with the focus on Cloud, an emerging industry.


1.3.1 Research Motivation

Referring to Peltoniemi and Vuori (2005), although business ecosystem is a relatively new concept in the field of business research, it is a highly descriptive
expression for the complex business environment which is the reality for most companies at present time. Just as Peltoniemi (2004) suggests, by treating business ecosystems as complex adaptive (or complex evolving) systems, it is possible to understand the principles of their emergence, evolution and interdependence in a broader context and exploit the research made in other sciences. This area requires much more research, but it could bring valuable insights for managers in complex environments. The current study is driven by the idea of aiming to explore and find new ideology and model to assist businesses build competence, and to enhance country’s competitiveness on industry-level by coping with the ever-changing and increasingly complex business environment as well as the coming of the information economy era.

Thinking of the Evolutionary Process Theory, it makes sense for the weaker ones to be dropped out of the competition and selection process. Van de Ven and Poole (1995) suggest that the Evolutionary Process Theory has the core process of variation-selection-retention (VSR). It is explained that variations in existing unit characteristics occur, and those that enable the unit to compete for scarce resources in the environment are selected for survival. Surviving units give birth to others that are like them and retain the “blueprint” for the competitive survival in the population.

However, one important question should be asked: “Is today’s economy a purely biological ecosystem, or does it merely resemble the biological environment or the “mother nature” in numerous aspects?” As Frosch and Gallopoulos (1989: 144-152) introduced the concept of industrial ecosystem, the basic idea of the ecosystem is simply an analogue of biological ecosystem. In this case, it can be stated that today’s business competition is no longer as simple as technology advancement, strategy or business model. It is a race about developing a holistic system that improves the success of many businesses as a whole, on industry or national level, in other words, creating a prosperous business ecosystem that sustains well-being for all the participants within the system.

In the context of Cloud, Wang et al. (2011) has compiled the status of current Cloud computing research, suggesting that current research agenda in Cloud computing
revolve around the adoption, diffusion, implementation and impact of Cloud computing on IT development practices. The current literature mainly focuses between two major categories, namely organization and technical issues. Topics included in the organization category are generally concerned with adoption, diffusion, service level agreement creation, social issues in Cloud computing, and pricing models for Cloud computing services. In the technical category, topics are focused on the Cloud service application, workflow scheduling in Cloud computing, Cloud workflow and resource management, programming models, and, security/trust issues in Cloud computing.

Table 1. Current Cloud Computing Researches (adapted from Wang et al., 2011).

<table>
<thead>
<tr>
<th>Topic</th>
<th>Related Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytics (Business Intelligence) using Cloud</td>
<td>Mircea et al., 2011</td>
</tr>
<tr>
<td>Reliability of Cloud</td>
<td>Vogels, 2008</td>
</tr>
<tr>
<td>Social Issues in Cloud Computing</td>
<td>Kim et al., 2008; Provos et al., 2009</td>
</tr>
<tr>
<td>Cloud Workflow Management</td>
<td>Liu et al., 2010; Wu et al., 2010</td>
</tr>
<tr>
<td>Privacy, Security and Trust issues in Cloud Computing</td>
<td>Anthens, 2010; Carlin and Curran, 2011; Grobauer et al., 2011; Kaufman, 2009</td>
</tr>
<tr>
<td>Service Oriented Design and Development</td>
<td>Chen and Meixell, 2003; Curley, 2006; Elfatatry and Layzell, 2004; Huhns and Singh, 2005; Hirschheim et al., 2010; Perepletchikov, 2008</td>
</tr>
<tr>
<td>Cloud Computing Adoption</td>
<td>Grossman et al., 2009; Low et al., 2011; Misra and Mondal, 2010; Tuncay, 2010</td>
</tr>
</tbody>
</table>

From Wang et al. (2011)’s compiling of current literature related to Cloud (summarized in Table 1), it can be seen that there is a lack of literature focusing specifically on the emergence of business ecosystem within Cloud industry. Huang et al. (2009) also confirm that the significant lack of empirical studies that examines the formation of ICT business ecosystem is overlooked by researchers. However, referring to various literatures and the empirical interview with Finnish Cloud
companies, a great number of multinational ICT leaders have been actively establishing business ecosystems for their own Cloud platforms, for example, Microsoft, Amazon, Google and Apple, just to name a few. Therefore, the rationale behind studying the emergence of business ecosystem also lies in the motivation of presenting an upcoming shift in the conceptualization of value creation.

In general, to bridge the academic research and reality gap, this paper aims to explore and shed lights on the new territory of business ecosystem with a qualitative research.

1.3.2 Research Objectives

Peltoniemi and Vuori (2005) suggest that although the concept of ecosystem has existed for decades, in many writings it is ill-defined. Many authors have ideas about business ecosystem but fail to give a concrete definition for this concept. The lack of a precise definition causes confusion. As seen in various literatures, the word “ecosystem” has been widely used for describing different kinds of structures and processes under numerous contexts. For example, industrial ecosystem and digital business ecosystem are only applicable in certain contexts. As Peltoniemi and Vuori (2005) suggest, the numerous concepts can offer insights for using the ecosystem analogy but they cannot be drawn together to form a theory of ecosystem analogies. Therefore, the primary task of this paper is to thoroughly distill and clarify the definition of business ecosystem through literature review.

The second objective of the research is to explore how the emergence and evolution of business ecosystem have been described and studied previously. The purpose is to establish a theoretical foundation for the empirical part of the study later in the research.

The last and most important focus of the study is to gain realistic insight on how business ecosystem emerges. This objective is achieved by studying and analyzing the emergence of Finnish Cloud ecosystem in the real life, in order to evaluate if there is a match between the business ecosystem concept in theory and in the real world.
In the empirical part of the study, the real-life case is taken from Finnish Cloud industry. Specifically, the study analyzed the case of Cloud Finland (for the purpose of confidentiality, the name here is an alias), a Finnish government supported ecosystem. The key focus of the Cloud Finland is on the business opportunity development for the emerging Finnish Cloud industry and various ICT companies. This case is chosen for the reason that Cloud Finland is utilizing the ecosystem concept as the cornerstone, aiming at building an ecosystem structure right from the beginning. Another reason to study Cloud Finland is that it is a recently launched initiative for less than a year. The data and information collected from this study can be possibly traced back right from its initiation. It is consistent with the need and purpose of the study, which is to analyze the emergence of a business ecosystem from its beginning.

1.4 Overview of the Research and Analysis

The Cloud Finland ecosystem studied for this study is consisted of the following members:

i. The moderator: it is the consulting company that organizes the ecosystem events and maintains the connection among ecosystem members. The interviewed respondent is the director of business ecosystem. For confidentiality purpose, the moderator is named with an alias as “Organizer” in this study.

ii. The keystone member: it is a reputable Finnish software company, which presumably takes the keystone type of role within the ecosystem. The interviewed respondents are the business development director and a technical researcher. Again, for confidentiality purpose, the keystone member is named with an alias as “Software Leader Company” in this study. Two respondents from this organization were interviewed, including the product development director and a lead engineer.

iii. The niche member: it is an open source software start-up. the Cloud solution specialist of this company is interviewed
During the empirical study, the respondents were first contacted through invitation emails. Upon the consent of the respondents, a scheduled appointment was then decided between the researcher and interviewee. Face-to-face interviews were conducted with interviewees by following a pre-created question guideline. During the interview, respondents were interviewed under a relaxing and conversational-style setting. So the researcher’s primary role is to be a good listener to respondents’ answers regarding Cloud Finland ecosystem and how it emerged.

Although the interviews were largely semi-structured, all the questions written in the guideline were successfully covered. All the interviews were conducted within one hour to avoid causing respondent fatigue, which may lead to errors and inaccuracy. The timing of the interview was maintained so that the respondents were comfortable throughout the interview process. In the case that the interviewees could not finish answering certain questions, follow-up answers were sent to the researcher afterwards.

1.5 Structure of the Paper

In this paper, the in-depth understanding on the concept of business ecosystem and how an ecosystem emerges was researched and developed.

Prior to the formation of the theoretical framework, Chapter two focused on the process of literature review and theory development. Both conceptual frameworks from academic world and the empirical cases of the existing ecosystems were jointly utilized for the analysis. The definitions of ICT ecosystem and Cloud ecosystem were defined and condensed from the main definitions used in various literatures. The concept of emergence and evolution, especially the emergence of business ecosystem were studied and discussed in details. Furthermore, a list of elements that are critical to the emergence of Cloud ecosystem was summarized from the literature study.

Chapter three primarily focused on describing the empirical research design at a qualitative level. In addition to this, the background information of Cloud Finland
and other related cases including CloudSoft Finland and Ecosystem Finland were also introduced in the same chapter.

In Chapter four, where most of the analysis took place, the analysis was divided into three key focuses, including the emergence of business ecosystem at macro and micro levels as well as the key elements that are critical to the emergence of business ecosystem.

The research findings and the new proposition developed from the analysis were presented in the final conclusion part of the paper, or Chapter five. Additionally, the suggestion for future researches in the relevant areas was given at the end of the discussion and conclusion.
2 LITERATURE REVIEWS

In Chapter two, the discussion is focused on defining the key concepts of this study, including business form, business ecosystem, emergence and evolution as well as how these concepts can be applied for the case of Cloud computing.

2.1 Business Forms for Value Creation

Moore (2005) suggests that for more than sixty years, markets and hierarchies have been the dominant thinking of economic organization. There is a number of business forms emerged around value creation, for instance, Michael Porter (1985)’s concept of value chain and the well-known theory of value network. However, Moore (2005) suggests that there is an emerging business form, or it can be called the ecosystem organizational form that has now become important in practice. Before discussing the concept of business ecosystem, it is important to first look at a number of well-established business form concepts, including value chain and value network.

2.1.1 Value Chain as a Business Form

Porter (1985) defined value as the amount that buyers are willing to pay for what a company provides, and he formulated the “value chain” as the combination of nine generic value added activities operating within a company to jointly create and provide value to customers. Feller et al. (2006) explain that value occurs when needs are met by means of provision of products, resources, or services. Value is an experience that flows from resources to the value creator or provider. Finally, it flows to the customer, as Feller et al. suggest. According to Hearn and Pace (2006), a value chain suggests that each phase in the chain, there may create and add value to the products or services. In contrast to the more generic concept of supply chain, value chains emphasize cost optimization and value maximization, while the key emphasis in supply chains is solely on cost minimization.

Although the idea of value chain has been widely applied in many industries, the core metaphor of a chain form creates a number of limitations, particularly when applied to ICT and creative industries, as claimed by Hearn and Pace (2006), it:
i. suggests a single linear process from one stage to the next;
ii. does not analyses the fact that value chain creation may be a competitive as well as a cooperative process;
iii. suggests static rather than dynamic processes, as supported by Gossain and Kandiah (1998);
iv. assumes value remains “in the product or service”, but ignoring externalities, such as product value derived from the relationship of the product to a system or other products); and
v. does not properly recognize the symbiotic relationship between a company and its customers, suppliers, and partners (Gossain and Kandiah, 1998).

Thus, it is evident that the idea of value chain was once useful, and now limiting, because it does not show the full picture of the dynamics in value creation.

2.1.2 Value Network as a Business Form

To deal with the limitation of value chain, several new approaches have been developed. Stabell and Fjeldstad (1998) use the terms “value shop” and “value network” to emphasize value creation at organizational level. In value networks, companies share a common interest, which motivates them to develop relationships with each other for their mutual benefit (Johanson and Vahlne, 2003). According to Allee (2000), in e-commerce businesses, where the product is intangible, and where knowledge is one of the main resources of the companies, the term “value network” is a useful alternative to the term “value chain”. What can be inferred from Allee’s suggestion is that while value chain is commonly used in industrial economy, the value network is a more appropriate business form for information economy. These value network share dynamic and may change when a company strengthens its existing relationships, establishes new ones, or ends the ones with issues (Griffith and Harvey, 2004).

Referring to Ojala and Tyrväinen (2011), for a company, it is important to identify who the actors are or will be in the company’s value network. The company needs to identify the value of its offering, and how the value can be provided in order to benefit all the participants in the network. By defining the value network, a company
can map all the participants that could benefit from its value offering, and in that way add value to the end customers. By doing so, it can help a company avoid unnecessary partners. As Allee (2008) suggests, the company’s value network may include suppliers, customers, and strategic partners who are capable of adding value to each other’s offerings (e.g. products or services). Therefore, in the value network, the ideal partner adds value to other business’ market offering, while at the same time minimizing the risk connected with partnering (Kothandaraman and Wilson, 2001).

Allee (2008) further suggests that the term “value network” is being adopted in as general business practice in many industry leading organizations. For example, business leaders like SAP, IBM, Wal-Mart, Amazon and others refer to their value networks as a way to describe their efforts to bring coherence to their business operations.

According to Moore (2005), ecosystem business form has now become important in practice. From various authors, such as Hearn and Pace (2006) and Tian et al. (2008), it is suggested that this ecological business form is more advantageous in creating value under today’s business context, or information economy. As the foundation of this study, the concept of business ecosystem is discussed in details in the following section.

2.2 Defining Business Ecosystem

When defining the generic concept of ecosystem, Peltoniemi (2005) examined the formal definition for ecosystem from several dictionaries. Gove and Merriam-Webster, Inc. (1986)’s The Merriam-Webster Third New International Dictionary of the English Language defines biological ecosystem as “a community of living organisms with air, water and other resources”. According to Brown (1993)’s “The New Shorter Oxford English Dictionary”, biological ecosystem is “a system of organisms occupying a habitat, together with those aspects of the physical environment with which they interact”. The above definitions provide a very basic description for the meaning of ecosystem, specifically in the biological world.
2.2.1 Generic Ecosystems in Literatures

Based on the review of Peltoniemi (2005), the word “ecosystem” provides insights for using the ecosystem analogy. However, they cannot be drawn together to form a theory of business ecosystem. To expand the theoretical review of this study, in the following part, a number of definitions of business ecosystems are explored.

*Industrial Ecosystem (1989)*

Industrial ecosystem concept was originally suggested by Frosch and Gallopoulos (1989). The fundamental idea is about environmental protection by the means of nature. Industrial ecosystem is then an analogue of biological ecosystem. The concept is that all material is recycled infinitely and efficiently. According to Frosch and Gallopoulos (1989: 145), in fact, the ideal outcome is hardly attained in any industrial operations. However, the change of behaviors of both manufacturers and consumers would help to maintain the standard of living without deteriorating the environment.

The concept of change in this context means that different parties should “co-operate by using each other’s waste material and waste energy flows as resources” (Korhonen et al. 2001: 146).

*Economy as an Ecosystem (1990)*

Rothschild (1990: xi) suggests that a capitalist economy can be best understood as a living ecosystem. The key identifications are competition, specialization, co-operation, exploitation, learning, growth. As Rothschild (1990) states, the basic mechanisms of economic changes are surprisingly similar to those ecosystems in biological environment.

“Every organism is defined by the information in its genes, but a living thing also is defined by its relationships to its prey, competitors, and predators. In the same way, an organization is defined by its technology and by its associations with its suppliers, competitors, and customers.” (Rothschild, 1990: 213).
What sheds light on this study from the above statement is that Rothschild (1990) recognizes that companies serve as organisms and industries as species. Like the organisms and species that make up the ecosystem, the companies and industries around the world have spontaneously co-evolved to form an interconnected living ecosystem.

2.2.2 Business Ecosystems in Literatures

In this sub-chapter, the commonly recognized definitions of business ecosystems are reviewed.

Moore’s Business Ecosystem (1996)

Moore (1996: 15) defines business ecosystem as “an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world”. Furthermore, Moore suggests that the “industry” should be replaced with the term of “business ecosystem, since nowadays one cannot divide economic activities under “specific industries. Business ecosystems are based on core capabilities, which are exploited in order to produce the core product. In addition to the core product, a customer receives “a total experience” which includes a variety of complementary offers. (Moore, 1996: 15).

Regarding the various actors in business ecosystem, it is suggested that seven categories of actors can be observed within the system (Moore, 1993; Moore, 1996): Customers, Markets, Products, Processes, Organizations, Stakeholders, and Government and Society. Moore (1996) makes further theory development that the key to a business ecosystem are those leadership companies, “the keystone species”, who have a strong influence over the co-evolutionary processes. It can be seen that the first definition highlights decentralized decision-making and self-organization, while the second one emphasizes interaction within a business ecosystem. Moore (1996: 9) also suggests that these ecosystem definitions are just metaphors which can clarify certain issues and help understanding them.
A typical business ecosystem is depicted in Figure 2. Moore (1996) explains that the business ecosystems can be considered as small business initiatives or large collections of companies, where the boundaries can be fuzzy. Moreover, in the early study, Moore (1996) emphasizes the evolutionary stages of the ecosystem, its evolvement and the challenges in each stage.

**Business Ecosystem**

![Image of a business ecosystem diagram](image)

**Figure 2. Business Ecosystem (adapted from Moore, 1996).**

The life-cycle of a business ecosystem can be classified into four stages, namely, *birth, expansion, leadership, and self-renewal or death* (Moore 1993). In the birth stage, it is essential to do more than just satisfying customers. In the expansion stage the scale-up potential of the business concept is tested. In the leadership stage the business ecosystem reaches stability and high profitability. The final stage, self-renewal or death, is caused by the threat of rising new ecosystems. (Moore 1993: 76).

One important element to note is that although Moore (1996) claims that the word “industry” should be replaced with the word “business ecosystem”, it is apparent that Moore’s business ecosystem is closer to the concepts of cluster and value network, as suggested by Peltoniemi (2005).
**Power and Jerjian’s Business Ecosystem (2001)**

Being different from others, Power and Jerjian (2001) are against the linear way of thinking. In their book “Ecosystem: Living the 12 Principles of Networked Business”, they state that business people cannot just manage a business on its own, but eventually managing the ecosystem as a whole. They also make claim that ecosystem is consisted of integrated electronic business and the formal definition for a business ecosystem is “a system of websites occupying the World Wide Web, together with those aspects of the real world with which they interact. It is a physical community considered together with the non-living factors of its environment as a unit”. (Power and Jerjian, 2001: 13).

Further referring to Power & Jerjian (2001: 263), in natural ecosystems, energy is passing through different forms. In a business ecosystem, resources, which include capital, are similar to energy in natural ecosystem. Therefore, they should be used efficiently for the ecosystem to prosper. Ecological selection happens on the macro level and a critical part of fitness is the ability to adapt to new channels of information, “the strands of telecommunication connect our communities and inevitably cause the gradual birth of new businesses and the death of old ones” (Power & Jerjian 2001: 6).

At last, according to Power and Jerjian (2001)’s thinking, there are four stakeholders to any ecosystem, which should be taken into account: communities of shareholders, employees, businesses and customers. Different “species” or organizations help each other to produce wealth and prosperity to whole community. In their literature, Power and Jerjian use example to demonstrate, namely a coral reef, where the structure for the whole community is created by coral polyps. In the same way business ecosystem is often built on one single company, who is highly connected.

**Iansiti and Levien’s Business Ecosystem (2004)**

According to Iansiti and Levien (2004), business ecosystem is defined as the loosely related networks of suppliers, distributors, outsourcer, makers of related products or services, technology providers, and other stakeholders. “We found that perhaps more
than any other type of network, a biological ecosystem provides a powerful analogy for understanding a business network. Like business networks, biological ecosystems are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival. And like business network participants, biological species in ecosystems share their fate with each other. If the ecosystem is healthy, individual species thrive. If the ecosystem is unhealthy, individual species suffer deeply.” (Iansiti & Levien, 2004: 8-9).

By examining the ecosystem definition from Iansiti and Levien (2004), it is evident that there are three critical success factors of a business ecosystem. First, the basic element is productivity. It defines the success of each participant. Robustness is the second element, it generally means creating competitive advantage from as many sources as possible and being adaptive when the environment changes. The third factor, a business ecosystem should have the ability to create niches for new participants. To make this happen, participants of the ecosystem need to have cooperative attitude.

Iansiti and Levien (2004) also suggest four different roles that organizations can assume in business ecosystems. First of all, it is the keystone actors, which is similar to Moore (1996)’s proposition. Keystone members are the companies which serve as the enablers and have a strong impact on the overall system. However, they usually stand for a small number within the ecosystem. Niche players, on the other hand, make up the largest population of the business ecosystem.

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Peltoniemi and Vuori’s Business Ecosystem (2005)

Peltoniemi and Vuori (2005) recognize business ecosystem as a dynamic structure. It consists of an interconnected population of organizations. These organizations can be small companies, large enterprises, universities, research centers, public sector organizations, and other stakeholders that influence the entire ecosystem. Moreover, Peltoniemi and Vuori (2005) suggest that even individual organization should operate as an ecosystem, in order to survive.
Peltoniemi and Vuori (2005) further claim that business ecosystem, especially the more complex ones, should be self-sustaining. It means that no government interventions would be necessary in order to survive in local or global markets. In general, business ecosystem develops through self-organization, emergence and co-evolution, which help it to acquire adaptability. Both competition and cooperation present in a given ecosystem.

*Bailetti and Hudson’s Business Ecosystem (2009)*

Bailetti and Hudson (2009)’s contribution to the business ecosystem theory is that they classify business ecosystem into four different types:

i. Type 1: It is dominated by a single player and it is open to those who meet specific criteria which are transparent to the public.

ii. Type 2: It is dominated by a single player and it is not open to those who meet specific criteria which are transparent to the public.

iii. Type 3: It is not dominated by a single player and it is open to those who meet specific criteria which are transparent to the public.

iv. Type 4: It is not dominated by a single player and it is not open to those who meet specific criteria which are transparent to the public.

![Figure 3. Business Ecosystem Types (adapted from Bailetti and Hudson, 2009).](image-url)
2.2.3 The Properties of Business Ecosystem

In summary, the context of business ecosystem is often associated with today’s rapidly changing social-economic and technological environments. For example, Tian et al. (2008) suggest that an ecosystem can be considered as a value co-creation configuration of people, technology, shared information, and value propositions connecting internal and external service systems. This statement suggests that there is a new development or evolution from the wide-spread value chain and value network concepts, describing the tangible (such as products and revenue) and intangible (such as knowledge and service) transactions between different business entities.

To address the above point, Hearn and Pace (2006) provide another evidence between business ecosystem and value chain, suggesting that unlike supply and value chains, the value ecological study maintains that value creation is not a simple one-way, linear process, but involves processes of reiteration and feedback. In general the following list of characteristics or properties of a business ecosystem are identified after reviewing a series of commonly known ecosystem concepts from various literatures. It is presented in Table 2 below.

Table 2. Generalized Properties of Business Ecosystem.

<table>
<thead>
<tr>
<th>Characteristics / Properties of Business Systems</th>
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<tbody>
<tr>
<td>Provision of Value</td>
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<tr>
<td>Integration with External Partners</td>
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<td>Require more than one participants</td>
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<td>Shift from individual to collaborative thinking</td>
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<tr>
<td>Interdependence of the participants</td>
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<td>Value co-creation</td>
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<td>Co-petition</td>
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<td>Open innovation</td>
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<td>Shared fate of success or failure</td>
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2.3 Defining Cloud Ecosystem

After reviewing the existing schools of ecosystem theories, it is important to develop the understanding in Cloud ecosystem before moving further. The rationale of this sub-chapter is to recognize and understand the use of business ecosystem concept in the ICT industry, in order to form the contextual ground of the study.

2.3.1 Defining Cloud Computing

As mentioned earlier in Chapter one, Cloud offers different value propositions, for example, instead of installing software for each computer, people now only need to load one application. That application would allow users to log into a web-based service that runs all the programs needed for work and other purposes. It's called Cloud computing.

According to Wang et al. (2011), traditionally, organizations need to acquire hardware, software to automate and improve their business processes. Additionally, IT teams were required to support the information systems infrastructure. A rapid growth in technology stages huge challenges for companies to keep up with the most up-to-date and concurrent technology.

In a Cloud computing system, there's a significant shift from local computer to using the computation power of the network of computers that make up the Cloud. Overall, it can be seen that hardware and software requirements on the user's side decrease. The only thing the local computer needs to be able to run is the Cloud computing system's interface software, which can be as simple as a web browser, for example, running Google Docs on web browsers.

It is stressed by Dwivedi and Mustafee (2010) that an important perspective that Cloud presents is a “pay-per-use model”, as it enables dynamic provisioning of resources based on the requirements of the user. This is supported by various researchers (Fruhling and Digman, 2000; Brynjolfsson et al., 2010), suggesting that the fundamental idea of Cloud is that computing is used similarly to the way of utility consumption, for example, electricity.
According to Ryan and Loeffler (2010), the U.S. Commerce Department’s National Institute of Standards and Technology (NIST) defines the basic types of service models for Cloud computing as follow:

i. Cloud Infrastructure as a Service (IaaS), involving the provisioning of fundamental computer resources (e.g., processing, storage, networks);

ii. Cloud Software as a Service (SaaS), involving access to a provider’s software applications running on a Cloud infrastructure; and

iii. Cloud Platform as a Service (PaaS), involving the provision to users of the capability to deploy onto the Cloud infrastructure applications created by the user with provider-supported programming languages and tools.

The NIST also describes four models for deployment of the Cloud infrastructure:

i. “Private Clouds” manage all the technology components, servers, and software for a single organization. The solution may be maintained by the user or a third party but is provided for the benefit of only one organization;

ii. A “public Cloud”, such as Salesforce, Amazon’s Cloud offering, or Google Apps, is available to anyone or to large industry groups and in either case is owned by the provider of the service. This model offers the greatest potential flexibility and savings;

iii. The service models may be deployed using a “community Cloud”, which according to NIST, is a Cloud infrastructure shared by a number of organizations across the board. It supports a specific community that has shared concerns. The shared concerns could be the mission of the organizations or security, privacy, policy, or regulatory compliance; and

iv. The fourth delivery model is a “hybrid Cloud”, which involves a composition of two or more of the three preceding models.

In addition to the four models proposed above, there is a further category of Personal Cloud currently undergoing the development.
2.3.2 ICT Ecosystem

Numerous ecosystem studies refer to the value network perspective when addressing the connection between ICT value network and ecosystem. According to these studies, the ICT ecosystem is considered as consisting of eight types of actors along with the end-users to create technology and application value flows. These actors include: consultants, application software developers, infrastructure software developers, system and infrastructure integrators, infrastructure service providers, application service providers, hardware developers, and channels. (Messerschmitt and Szyperski, 2003; Seppänen and Warsta, 2007; Ahokangas et al., 2010).

Based on the above definition, Quatraro (2009) also provides a simplified classification, suggesting that the simplified version of the ICT ecosystem is made of four types of players, namely network element providers, network operators, content and application providers, and final consumers. These are linked to one another through a set of relationships established within a context shaped by a variety of institutional devices.

Cohen et al. (2000) have used ICT ecosystem to describe the pattern of launching new technologies that has emerged from Silicon Valley. Cohen et al. suggest that as a more productive set of processes for developing and commercializing new technologies, ICT ecosystem is critical to the success of Silicon Valley. The reason is that the ecosystem facilitates the rapid prototyping, short product-development cycles, early test marketing, options-based compensation, venture funding, as well as early corporate independence.

2.3.3 Cloud Ecosystem

As Zhang et al. (2010) suggest, Cloud is becoming a scalable services consumption and delivery platform in the field of services computing. It aims to share resources among Cloud-service consumers and Cloud partners and vendors in the value chain, as shown in Figure 4. The resource sharing at different levels results in various Cloud offerings:
i. Infrastructure as a service (IaaS) focuses on hardware and IT infrastructure management;

ii. Platform as a service (PaaS) concentrates on middleware and design tools as a service; and

iii. Software as a service (SaaS) deals with traditional software applications such as customer relationship management, or business process as a service that offers value-added services.

Figure 4. The Cloud Value Chain. Cloud vendors offer services to consumers, while Cloud partners help to facilitate interactions between the two (adapted from Zhang et al, 2010).

In addition to Cloud value chain, Zhang et al. (2010) illustrate a Cloud technological ecosystem for integrating the various participants of the Cloud value chain. The technical foundations of Cloud computing include service-oriented architecture (SOA) and virtualizations of hardware and software.

In Figure 5, it shows a number of interesting topics in the configuration of the Cloud ecosystem. For example, hardware and software virtualization and infrastructure management provide the fundamental platform (in layer 2). SOA covers the service orientation layer in layer 3. All reusable services for the Cloud computing platform and application-specific services should be defined based on the SOA to enable the
Cloud’s reusability and extensibility. Software offerings and applications are important related issues (in layer 4), as are the business solutions (in layer 5). Cloud information architecture covers data models as well as the Cloud service construction and deployment platform (in layer 6). Cloud computing maintenance and management, as well as best enabling practices, are hot focuses for the Cloud quality and governance layer (in layer 7). This layer covers security, collaboration, and standards. (Zhang et al, 2010).

Figure 5. A Cloud Ecosystem (adapted from Zhang et al, 2010).

The above technical Cloud ecosystem blueprint comprises seven layers (labeled in numbers) for integrating the four components of the Cloud value chain (labeled as 1A, 1B, 1C and 1D).

2.4 Emergence and Evolution

After discussing the concepts of ecosystem in general and Cloud ecosystem in particular, it is the time to bring this study forward to another theory domain, which is the study of Change, Emergence and Evolution. Referring to Young (2009) and Beckhard and Pritchard (1992: 14), change is a learning process and learning is considered as a change process. The question is “how are organizations changed?”
To answer this question, “we need some way of thinking about organizations”, as Nadler (1982: 38) suggests. Various researchers adopt a system perspective by viewing organizations as: the coordination of different activities to carry out planned transactions with the environment (Lawrence and Lorsch, 1969); a mechanism for transforming needs and raw materials into services and products (Beckhard and Harris, 1977); or for taking input and turning it into patterns of performance or output (Nadler and Tushman, 1990). It can be seen that such a process-oriented conceptualization enables a systematic approach to planning change. To further discuss the definition of Emergence and Evolution, several key aspects are looked into in the following sections, such as emergence, evolution and co-evolution.

2.4.1 Emergence

Several scholars, such as Mintzberg and Waters (1985) and Young (2009) suggest that when the implications of localized changes are generalized into more broadly held concepts “emergent” change can occur. Senge (1997) claims that in a world of increasing interdependence and rapid change, the possibility to figure it out from the top is quite low, while Wheatley (2006) goes further by suggesting that relationships are the basis of existence, and disorder must be embraced as the source of new order.

Casti (1997) finds emergence as a “surprise-generating mechanism dependent on connectivity”; “this refers to the way the interactions among system components generates unexpected global system properties not present in any of the subsystems taken individually” (Casti 1997: 91). Theoretically, emergence is a notion of causality. In despite of being controversial in application, it is based on evidence that patterns arise within large, complex systems that are a result of the activity of independent, unrelated small parts (Corning, 2002).

The ideology from various authors is basically complementary to each other. On the other hand, there is still something that could be distilled. For example, if emergence is defined by unexpectedness, it raises a question about subjective observer, who expects something to happen.
What closely relates to this study is the perspective suggested by Mitleton-Kelly (2003: 40). It states that “emergence is the process that creates new order together with self-organization”. It is to say that the emergent properties are the result of self-organization, while adaptation links these properties to the environment, and evolution concerns their long-term achievements, as Peltoniemi and Vuori (2005) explain. This whole emergence and evolution process is discussed in the following part.

2.4.2 Evolution and Co-Evolution

In this section, the definition of evolution and co-evolution are presented and reviewed, which echoes to the previous discussion that the emergence of the ecosystem involves evolution and co-evolution of the organizations within.

According to Bechtold (1997: 194), “self-organization means not only emergent order and self-generation but also co-evolving with the greater environment”. Moore (1993: 75) in his literature agrees that co-evolution is, “a process in which interdependent species evolve in an endless reciprocal cycle - in which changes in species A set the stage for the natural selection of changes in species B – and vice versa.”

Another important model is Kauffman’s (1993, 1995) NKC model. It is defined as a model of genetic interactions on a fitness landscape where there are N characteristics and each characteristic can take one of A states. According to Vidgen and Wang (2006)’s discussion on this model, the evolution results from an adaptive walk through the landscape where an agent seeks to improve its fitness by considering all the one-change neighboring locations and then making a change if a neighbor provides improved fitness. Levinthal and Warglien (1999) also suggest that robust design as one in which there is moderate interdependence among the elements of a system. A robust design is suitable when it is not clear what the best solution is, but it can also be found through an adaptive walk (search and selection). One characteristic is changed at a time and if none of the neighboring locations provides improvement, then the agent is not changed.
This concept of Kauffman (1993, 1995) suggests that eventually, all the agents in an ecosystem are striving for fitness and seeking to avoid extinction. The actions of each agent modify the overall landscapes of the other agents and thereafter the fitness landscapes are constantly changing.

Co-Evolution

Ehrlich and Raven (1964) and Vidgen and Wang (2006) all use co-evolution to illustrate the reciprocal evolution that results from the interactions of unrelated species. As a conclusion, they suggest that the co-evolutionary process has widely existed in the biological ecosystem. According to Merry (1999: 272)’s definition: “When the change in fitness of one system changes the fitness of another system, and vice versa, the interdependency is called co-evolution.”

Pagie and Mitchell (2004) make an assumption that co-evolution can happen with one or two populations. In the first scenario, co-evolution re-shapes the individual fitness of the members within the population. In the second situation, the fitness of the agents is formed by their behavior in the context of the individuals of the second population. The latter one can be also considered as “host-parasite” or “predator-prey” co-evolution.

One important point made by Peltoniemi and Vuori (2005) is that the previous definition of evolution and co-evolution is not only restricted to biology. In the business world, referring to Metcalfe (1998), there are three settings of co-evolution of business processes can be identified: competition, exploitation and mutualism. Metcalfe further explains that competition is where one agent seeks to disturb the fitness of other agents, but is in turn removed by that other. On the other hand, mutualism is where each agent stimulates the individual and collective fitness. Clearly, mutualism is what is desired for the processes within an organization, but one can expect situations in which a process can become competitive and seek fitness at the expense of the others, which widely exists in the business world.

Kauffman (1993, 1995) develops two further themes that relevant to the business process ecosystem: the mutation rate and “patching”. According to Kauffman (1995:
183)’s literature, the behavior of a population depends on factors, such as the size of the population, the structure of the landscape and the mutation rate. When mutation rates are low, then at long intervals a fitter variant emerges and quickly colonizes the population; when mutation rates are very high, many fitter and less-fit variants are found quickly and the population may diffuse away from the peak.

The second theme is called patching, which is suggested by Kauffman (1995) that it is a way of taking a complex system and dividing it into a quilt of patches in which each patch can be treated as a species that seeks to improve its own fitness while interacting with others. In general, it is suggested that the mutation rate has implications for process innovation and patching for selecting the size of processes and services.

To conclude, Kim et al. (2010)’s study has shed lights on what co-evolution means for ecosystem participants. In general, Kim et al. (2010) suggest that the healthiness of individual companies is their productivity in creating value, for example, operational efficiency, output efficiency and R&D efficiency. Javalgi et al. (2005) also suggest that ecosystems evolve towards efficiency, with survival of the species dependent upon the organism’s ability to adapt to changing environments. For the species to continue to flourish, it must make the most efficient use of resources.

According to Kim et al. (2010), when each ecosystem participant achieves high level of efficiency, they create the robustness of the ecosystem by continuously introducing advancement and innovation for the ecosystem as a whole. Such co-evolution contributes to the short to mid-term performance of the ecosystem and the well-being of each member within.

2.5 Emergence of the Cloud

In this section, the main focus is placed on the historical development of Cloud computing throughout its birth to present time as well as the key drivers behind its development.
2.5.1 Cloud’s Drivers and Benefits

Udhas et al. (2011) argue that in today's economic climate, while organizations are dealing with dynamic markets and constantly imposed regulations, business leaders are under constant pressure to implement cost-efficient strategies that enhance business performance, in other words, to “do more with less”. Because of that emerging need, the adoption of the Cloud is expected to open up new business opportunities.

The macro forces that lead to the emergence of Cloud are improvements in bandwidth, commodity server market, grid computing & database, and network storage systems. Therefore, these external forces forged new business propositions such as pay-as-you-go subscriptions, online storage, and the outsourcing of the management of IT infrastructure support flexible business models. What significant is that the Cloud technology is likely to become a computing services model that is not restricted to any given industry. Udhas et al. (2011).

2.5.2 Change of Cloud Industry

The name Cloud computing was inspired by the Cloud symbol that's often used to represent the internet in flow charts and diagrams. The underlying concept of Cloud computing dates back to 1960 when John McCarthy (an American computer scientist) suggested that, “computation may someday be organized as a public utility.” According to Petar (2011), the first academic definition was provided by Chellappa (1997) who called it a computing paradigm where the boundaries of computing will be determined by economic rationale rather than technical limits.

In 1999, Salesforce.com applied several technologies developed by companies such as Yahoo! to its own business applications. In the early 2000s, Microsoft extended the concept of SaaS through the development of web services. IBM further detailed these concepts in 2001.
Launch of Amazon Web Services (07. 2002)

According to Raghupathi (2011), like many internet companies in the period of the Dot-Com bubble, Amazon has accumulated large amounts of underutilized computing infrastructure. Therefore they started providing access to their systems through Amazon Web Services on a utility computing basis in 2002.

Amazon S3 Launches (03. 2006)

The real breakthrough of Cloud was the pricing model for S3 which defined the model of “pay-per-use”. The launch of S3 also defined the shift of Amazon from being just a retailer to a strong player in the technology space, as Raghupathi (2011) suggests.

Launch of Google App Engine (04. 2008)

Raghupathi (2011) also ranked Google’s launch of App Engine as a major event in Cloud evolution. According to him, the launch of Google App Engine in 2008 was the entry of the first pure play technology company into the Cloud computing market. As with all their other products, Google introduced radical pricing models with a free entry level plan and extremely low cost computing and storage services which are currently among the lowest in the market.

Windows Azure launches Beta (11.2009)

The entry of Microsoft into Cloud computing is a strong indication of the growth of the Cloud ecosystem as a whole. This is because Microsoft has been long not accepting the “internet” as a significant market. Now the launch of Azure is a key event in the history of Cloud with the largest software company making significant shift to the Cloud. Raghupathi (2011) suggests that Microsoft’s shift in Cloud symbolizes a clear shift from traditional IT approach to Cloud is taking place.
Figure 6. Historical Timeline of Cloud Development (adapted from Petar, 2011).

Until now, it can be seen that the Cloud industry as a whole ecosystem, is growing across time. This is similar to the literature and theoretical propositions of Moore (1996) and Iansiti and Levien (2004). On the other hand, it is worth to highlight that each major player of the IT and internet industry does not stand for only one company. In fact, all of these companies have long established strong ecosystems of their own, according to the interviews conducted for this research.

2.6 Emergence of Cloud Ecosystem

In this study, the main objective is to develop a more comprehensive understanding of why and how business ecosystem emerges through the force of evolution, in other words, the process of variation, selection (and retention).

Van de Ven and Poole (1995) present a foundation for theorizing the complex processes of organizational change and innovation. They identified four distinct process theories: life-cycle, teleology, dialectic, and evolution. All of these theories rely on different generative mechanisms, or motors, that drive the change process. Complex change processes are generated by the interaction of more than one of these process theories. Van de Ven and Poole (1995) also give some suggestions on how motors of different types might fit together in complex process theories. Moreover,
they extend the framework by specifying more thoroughly on how composite theories of change can be built by aggregating the interactions of change motors that may operate at different organizational levels, temporal intervals, and degrees of interdependence.

According to Peltoniemi and Vuori (2005), the birth and evolution of an ecosystem is a path-dependent, chaotic process, which means that a small difference in starting values can cause great differences to results. Kauffman (1995: 211) also states a question wondering how stable communities of species come together, and proclaims that it is not known yet. The formation of an ecosystem is affected by certain attractors, which are the non-living components of the area where the ecosystem takes place.

It must be stressed that a key ingredient of the evolutionary approach brought forward by Quatraro (2009) stands in the co-evolution of environmental factors, for example, institutions. The change in the industrial structure that has characterized the evolution of the ICT ecosystem in the US went along with a parallel adaptation of the financial structure, such as the birth of venture capitalism, the legal structure affecting the patterns of cooperation between industry and university, the regulation of the competitive environment and the standardization policy.

Based on the above discussion, this study considers that the emergence and evolution of Cloud ecosystem stay in the domain of ICT ecosystem’s emergence and evolution.

2.6.1 Emergence of Business Ecosystem (Macro Level)

According to various studies (Nohria and Eccles, 1992 and Granovetter and Swedberg, 2001), most efforts to understand networks and organizations strive to demonstrate how different network patterns support innovation, team productivity, and knowledge sharing. It is witnessed that, linear types of business forms like supply chain and value chain that were once celebrated as effective models, are now considered limited to fit the current business context. On the other hand, as an emerging concept, business ecosystem has been increasingly discussed and analyzed
because of its success in the real world, as can be seen from the literatures reviewed in previous sections.

In addition to the continuous evolution of the companies’ business forms, another interesting phenomenon is that the same company, usually a multinational business leader is often cited and studied for different business forms. For example, Wal-Mart is claimed to be a successful model of supply chain (Chopra et al., 2004: 53-61). Yet, it is also the real-life proof of value network and business ecosystem. The same situation applies to many industry leaders, such as Amazon, SAP, Microsoft, Cisco and Apple.

Thus, in this study, it is inferred that these organizations have been undertaking an evolutionary path to develop from less complex business forms such as linear model to more complex network form. Their operation models or forms change and evolve across time and focuses, for example, shifting from internal focused operation to external focused operation (e.g. value co-creation).

Therefore, the basic assumption of this study is that the recently emerged business form, business ecosystem is a complex system that evolves out of the linear structure. For example, Wal-Mart evolves from the linear model of supply chain to its current structure of business ecosystem.

The properties of business ecosystem as a business form are proposed in the Table 3 below. In the same table, business ecosystem is also compared across different business forms, which are value chain and value network. These two business forms are selected for comparison analysis, because both organization forms involve integration with external partners and are beyond individual organizations. This is comparable to business ecosystem. Another reason is that both value chain and value network are widely recognized as revolutionary model of their time by both academic researchers and business practitioners.

From the comparison, it can be seen that as a business form, business ecosystem not only inherits the key properties of the other two business forms, for example, “integration with external partners”, it also exhibits some new characteristics which
are unique in contrast to the other two. Therefore, as more literatures and researches suggest, business ecosystem is more advantageous business form for today’s economic environment (Moore, 2005; Hearn and Pace, 2006; Tian et al., 2008).

Table 3. Property Comparison of Value Chain, Value Network and Business Ecosystem

<table>
<thead>
<tr>
<th>Feature of Business Systems</th>
<th>Value Chain</th>
<th>Value Network</th>
<th>Business Ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Value</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Integration with External Partners</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Require more than one participant</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Shift from individual to collaborative thinking</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Interdependence of the participants</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Value co-creation</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Co-petition</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Open innovation</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Shared fate of success or failure</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

To further explain the emergence of business ecosystem as a new business form, the concepts of variation and selection which are essential to the process of evolution are used for further analysis.

**Variation**

According to Knudsen (2002), there are two sources of variation. The first source is uncertainty. The second one is innovation.
Uncertainty leads to variation

According to Alchian (1950: 218), “people’s judgments and opinions will differ”, therefore, “uncertainty fuels variation.” The consequence is a chance-dominated model with random survivor selection. It is emphasized that, in general, the luck and adoption by the market are sufficient conditions for an evolutionary explanation to work (Alchian, 1950). However, at least three additional assumptions are needed:

i. the relative stability of organisms and their environment are critical for evolution by natural selection;
ii. the viable behavior of agents must be constrained; and
iii. the emergence and evolution of selection rules must be explained.

Innovation leads to variation

In contrast to the conventional understanding of innovation, the term “innovation” here means that what leads to variation is explained as conscious but imperfect modifications that come through attempts to imitate others (Knudsen, 2002).

Companies are motivated to imitate the elements common to the observable success of other companies when relative results are important and the decision situation is complex and uncertain (Knudsen, 2002). Alchian (1950) argues that all of the companies live in the complex world, action is guided by rules embodying codified imitations of observed success, for example, “conventional” mark-up, price “following”, “attractive” advertising campaign, and et cetera. These rules are instrumental in conscious adaptive behavior. Companies adapt by forming rules that embody the elements common to observed success. All this leads to an explanation of innovation as a source of variation, as suggested by Alchian.

Selection

One important discovery that Shepherd and McKelvey (2009) address is that selection can only work on variation. Naturally, if there is insufficient variation, selection will be ineffective however the evolutionary process operates (Kauffman
1993). This claim is supported by Burgelman (2002)’s study of Intel. According to Burgelman, strategic initiatives in companies emerge in patterned ways. Variation occurs as individuals interpret these initiatives. However variation produced is subject to both internal and external selection pressures. There are times and contexts when variation needs to be encouraged and selected for and times when it should be avoided and selected (Burgelman 2002).

According to the proposed general selection process, economic evolution by natural selection may be defined as a two-step process. Step one involves direct replication of an encoded instruction set, while in step two, the entity of interest directly interacts with the environment in a way that causes differential replication (Hull, 1990). In the case of socio-economic selection, the market provides feedback in terms of profits, successful companies will tend to expand, and the less successful ones will tend to fade away from the scene, as Metcalfe and Gibbons (1986) suggested.

**Competitive Selection**

From an evolutionary perspective, Cassill and Watkins (2010) argue that cooperation is unlikely to evolve in an environment of chronic scarcity. Instead, a combination of stealing, hoarding and even killing transactions would dominate. From an ecological perspective, harsh face-to-face transactions would cause individuals to migrate from the territory in search of resources elsewhere. Or, many individuals would die, reducing population size to a territory’s carrying capacity.

**Skew Selection**

Being different from several models have attempted to explain the evolution of cooperation, including group selection (Sober and Wilson 1998), game theory (Maynard-Smith 1982) and reciprocal altruism (Axelrod 1984), Cassill and Watkins (2010) suggest that skew selection assumes that cooperation and self-interest are not antagonists. Cooperation provides benefits to the donor and the recipient alike, but in different currencies, as suggested by several other researchers, such as Landa (1986), Seger (1991), Landa (1999), and Cassill et al. (2007).
Cassill and Watkins (2010) also suggest that skew selection explains that cooperative hierarchies provide a greater probability of survival to a greater number of members than egalitarian cooperatives. Through this, it is can be seen that many aspects of the skew selection resemble the dynamics of the business ecosystem.

In general, at the macro level, the concept of business ecosystem emerges as a new business form to meet the requirements of today’s business climate. Thanks to the evolution process, business ecosystem inherits characteristics of the earlier and simpler business forms. At the same time, there are also newly emerged unique features acquired by business ecosystem through the evolution. These features are usually not observed in the business forms established earlier than business ecosystem. Therefore, this study suggests that business ecosystem can be taken as the result of business form evolution through numerous cycles of variation and selection process.

2.6.2 Emergence of Individual Ecosystem (Micro Level)

When reviewing the existing literatures, the most matching paper discussing the emergence of Cloud system is a case study on How Google brought the Cloud computing concept to Taiwan and initiated the emergence of Cloud ecosystem there (Yang and Hsu, 2011). Due to the lack of theoretical framework available for the emergence of Cloud business ecosystem, this part of the paper is primarily based on the case of Google in Taiwan to illustrate how individual ecosystem emerges at micro or individual level.

Yang and Hsu (2011)’s study illustrated that the term “Cloud computing” was first introduced to Taiwan from a number of international Cloud technology companies, among which Google is a forerunner. At the very beginning, Google repeatedly sent its employees to Taiwan to visit the Industrial Technology Research Institute (ITRI), Institute for Information Industry (III), and to meet and exchange ideas with the top management of Taiwan’s IT companies.

However, at that time, the organizing vision for Cloud computing was not yet widely known in Taiwan, and domestic IT professionals in this beginning stage saw Cloud
computing merely as “the latest hype of IT technology”. Yet, unlike Wang and Swanson’s (2007) suggestion that institutional entrepreneurs incorporate success stories in order to launch IT innovation, in Yang and Hsu (2011)’s case the driving force encouraging local IT practitioners to jump into the Cloud computing is the motivation to avoid losses, rather than motivations for profit and efficiency gains. Kennedy and Fiss (2009)’s study may give explanation to this scenario that early adoption is associated with opportunity farming and motivations to achieve gains, while late adoption is associated with threat framing as well as the motivations to avoid losses.

The key question here is that “How has Google been building its ecosystem?” According to Yang and Hsu (2011), Google first held a workshop, and strategically selected six universities in US and Asia, aiming at promoting the new concept to academic institutions. The vision for Cloud computing was stressed on the high efficiency and data processing capability that Cloud services could bring about. Through this process, Cloud computing became popular among a small group of IT professionals, who were first “educated” by the forerunners above. The company continuously sent its employees to Taiwan to visit several industrial organizations and groups to spread ideas with the top management of Taiwan’s ICT companies. Yang and Hsu suggest that these consistent actions and initiatives from Google help promote the idea of Cloud in Taiwan’s ICT industry. In Kim et al. (2010)’s terms, Google has great ability to spread the fragrance of Cloud.

From the example of Google, it can be seen that firstly Google has played a significant role in forming its Cloud ecosystem. Clearly, Google positions itself as a keystone in the Cloud ecosystem. It also exhibits its leadership and vision by continuously interacting with various organizations that may become contributors or members of the ecosystem. On the other hand, Google also plays a role of aggregator or moderator by getting relevant stakeholders together through seminars and company visit.

One important point to note is that, during the early stage of Cloud ecosystem emergence, Google has not only involved IT companies, but also the educational and research institutions. It can be inferred that these organizations may play an
important role in fostering the emergence of business ecosystem. In the aspect of mechanism, it is clear that Google mainly uses education approach to get stakeholders together, instead of leaving the organizing task of education events to other stakeholders. This is quite different from the Finnish Cloud ecosystem studied in this paper. For the healthiness of the ecosystem, Google has shown its focus on getting more variety and more parties involved in the ecosystem with certain types of organizations. However, for this case study, it is unclear that what type of Intellectual Property Rights (IPR) agreement and common technology platform Google provides to the ecosystem members in Taiwan.

In the case of Google, it shows that being different from the macro level evolution (or the evolutionary-process-oriented emergence), at micro level, the ecosystem can be created intentionally instead of following the process of natural evolution (variation and selection). Furthermore, it can be seen that Google initiated the Cloud computing in Taiwan with a certain set of strategic and consistent actions, as listed in the Table 4 below.

In general, the phenomenon observed from Google case suggests that Google created business ecosystem with clear intention. It does not follow the natural process of evolution and emergence, but rather, it has an aim of creating the ecosystem business form right at the beginning. Therefore, while the study recognizes that business ecosystem emerges from the process of business form evolution (at macro level), business and organizations can harness the result of evolution and engineer its own business ecosystem with strategic design and appropriate execution methodology.
Table 4. Google's Initiative Actions to Create Cloud Ecosystem in Taiwan.

<table>
<thead>
<tr>
<th>Google’s Actions to Create Cloud Ecosystem in Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forming a shared vision</td>
</tr>
<tr>
<td>Strategically selecting and prioritizing the initial organizations to approach. This may include educational organizations, research institutions, and industry associations</td>
</tr>
<tr>
<td>Promoting the key concept and technology to the list of well-selected organizations</td>
</tr>
<tr>
<td>Creating a common forum or platform to attract potential ecosystem participants</td>
</tr>
<tr>
<td>Taking the leadership and acting as the keystone member of the ecosystem</td>
</tr>
<tr>
<td>Persistent with formulating the interaction mechanism for potential ecosystem member to interact</td>
</tr>
<tr>
<td>Constantly attract new members to the ecosystem</td>
</tr>
</tbody>
</table>

2.6.3 Key Elements for the Emergence of Cloud Ecosystem

Through reviewing the case of Google and other related literatures, the following key elements are identified as the key conditions for a Cloud ecosystem to emerge:

*Prerequisite Conditions for Ecosystem to Emerge*

Regarding ecosystem emergence, it is worth to take a look at Huang et al. (2009)’s work, which is claimed that their research on enterprise software ecosystem yields implications for where ecosystems are least likely to arise. Huang et al. (2009) suggest that ecosystems will be less likely to arise among companies with little formal means of IPR protection and, in particular, will be less likely where the protection afforded by patents is weak. The companies will be relatively more open to ecosystem when they can more effectively secure their innovations through copyrights, patents, and downstream capabilities.
Environment and Resources

It is important to address that, in this study, business ecosystem is taken as one type of business forms, therefore, the environment and resources mentioned here are meant for the entire business ecosystem’s external environment, but not the internal environment which surrounds each individual ecosystem member.

According to Betton and Dess (1985), organizational theorists stress the importance of the role of the environment in determining the survival of organizations. Javalgi et al. (2005) argue that lack of response to environmental changes, organizational inertia, is a potential contributor to business’ inability to adapt and ultimately survive.

Knudsen (2002) demonstrates another factor, the market force which can be used to explain how the environment has significant influence over business ecosystem as well as the participants within. According to Knudsen’s explanation, the criteria for performance are established by the expectation of the market. While within the ecosystem, the selection pressure is exerted by market forces and mediated by keystone leader of the ecosystem.

Shared Vision

In this study, the shared vision is another elements identified as important to the emergence of business ecosystem. According Yang and Hsu (2011)’s research on the Cloud ecosystem development in Taiwan, it is suggested that the formation of organizing vision comes from a collection of social actors who recognize its existence.

Leadership of the Ecosystem

Iansiti and Levien (2004) and Kim et al. (2010) both suggest that the leader in a business ecosystem can increase ecosystem productivity by simplifying the complex task of connecting network participants to one another or by making the creation of new products by third parties more efficient. It enhances the robustness of an
ecosystem by consistently incorporating technological innovations and by providing a reliable point of reference that helps participants respond to new and uncertain conditions.

Moore (1998, 2006) and Isckia (2009) also stress the need for the leader to develop the vision to which the ecosystem’s members can adhere. Under this framework, the role of the leader is to encourage the convergence of all other community members’ visions and ensure that their efforts will enable the development of beneficial synergies for the customers.

Apart from Google’s case, numerous empirical cases support the dimension of leadership in ecosystem. Wal-Mart and Microsoft are two examples: Wal-Mart sees itself not only as a retailer but as an information management company, has created a system for managing inventory where supply chain information is packaged and distributed to its business partners as part of knowledge-sharing about inventory, logistics, and detailed financial information; the Microsoft Developer Network is a cornerstone to its business model, which places a premium on encouraging developers to write applications for the Windows platform (Iansiti and Levien, 2004).

**Ecosystem Platform**

According to Kim et al. (2010), a platform is the core of the business ecosystem in expanding and developing mutually beneficial cooperation between small-to medium-sized companies and large enterprises. Iansiti and Levien (2004) define that a platform is a set of solutions to problems that is made available to the members of the ecosystem through a set of access points and interfaces. The strength of a platform grows in the market with an increase in the number of business partners of the platform. This is the similar to the relationship between flowers and bees. If the number of bees, which help to provide moisture, decreases, and then the plants will not be able to bear fruit, Kim et al. (2010) argue.

Isckia (2009) further suggests that within an ecosystem, companies must strive to take advantage of all available expertise and resources. Platforms permit the
standardization of access to these resources and contribute to increasing the density of the partners’ network. As a result, the platforms encourage the ecosystem’s increased productivity and the creation of new services.

**Mechanisms of Platform**

Since the 1990s, much research has been done on how two organizations govern their joint activities. Governance typically involves the structure, power and process to organize collective actions (Von Tunzelmann, 2003). Hennart (1993) suggests that governance mechanisms to organize joint activities include formal contracts and authority. But more sociological mechanisms like trust, reputation and social values are relevant as well, as Powell (1991) suggests.

**Ecosystem Healthiness**

Referring to a quantitative study proposing indices of ecosystem healthiness constructed by Kim et al. (2010), there are three dimensions: productivity, robustness, and expansibility. Among ecosystem indices, productivity is a necessary condition. Robustness is a sufficient condition for the short-term, and expansibility is a long-term sufficient condition for the ecosystem healthiness:

i. Productivity represents the healthiness of each individual. Each company must continuously create satisfactory advancements in operational efficiency (ability to improve continuously and reduce costs), output efficiency (ability to transform inputs into outputs), and connection efficiency, for example joint R&D. Kim et al. (2010);

ii. Robustness is a sufficient condition because it is the ability to cope with environmental changes by continuously introducing innovative products. This robustness is a continuous improvement in the existing business domain. Kim et al. (2010); and

iii. Expansibility is a long-term sufficient condition for the ecosystem. An ecosystem has to be able to extend into new areas. Through innovation, ecosystem members create new areas and expand boundaries of ecosystem. Kim et al. (2010).
Kim et al. (2010) further suggest that in general, three indicators of ecosystem healthiness are equally important. However, the importance of each dimension will change dependent on the growth stage of the companies or levels of cooperation. According to Kim et al., at the birth stage of an ecosystem, productivity and robustness play important role in stabilizing business processes and innovation of the ecosystem, while expansibility become important in the long run.

*IT Infrastructure*

Quatraro (2009) suggests that innovation is the key driver of evolution of the ICT ecosystem. Innovation is defined as new products, new processes, new forms of organization, and new markets. According to Isckia (2009), web service technologies bring forward both a language-neutral and environment-neutral programming model that accelerates application integration inside and outside the company. The objective of web services is to facilitate access to applications between companies and simplify electronic data interchange. Over the last few years, web services have gradually become the core of business ecosystems by facilitating the connectivity, ease of access, and availability of e-services, as Barros and Dumas (2006) suggest.

Lyons (2005) also supports the dimension mentioned above, suggesting that the advance of ICT means that routines (business processes) are increasingly embedded in software and that evolution of the company means evolution of its software infrastructure.

### 2.7 Summary of the Literature Reviews

After undergoing the process of literature review, it is important to address this question: “what do we now know about business ecosystems?”

In general, it is considered in this study that the business ecosystem is a type of more advanced business form emerged recently. It is especially adopted by large multinational companies. It has the characteristics as follow: provision of value, integration with external partners, requiring multiple participants, shifting from
individual to collaborative thinking, interdependence of the participants, value co-creation, co-petition, open innovation and shared fate of success or failure.

From a macro level viewpoint, the emergence of the business ecosystem is the result of the continuous evolution of business forms, which arise from linear type towards a more complex networked type.

At a micro level, for an ecosystem to emerge in a given industry, it involves strategic design and appropriate execution. Taking the case of Google, it can be generalized that the following actions are necessary to create an intentionally designed ecosystem:

i. Forming a shared vision;
ii. Strategically selecting and prioritizing the initial organizations to approach;
iii. Promoting the key concept and technology to the list of well-selected organizations;
iv. Creating a common forum or platform to attract potential ecosystem participants;
v. Taking the leadership and acting as the keystone member of the ecosystem;
vi. Persistent with formulating the interaction mechanism for potential ecosystem member to interact; and
vii. Constantly attract new members to the ecosystem.

Furthermore, a set of critical elements need to be in the right place for a business ecosystem to emerge, which including:

i. Prerequisite conditions for ecosystem to emerge
ii. External environmental and resource
iii. Shared vision
iv. Leadership of the ecosystem
v. Common platform
vi. Mechanisms of the ecosystem
vii. Ecosystem healthiness
viii. IT infrastructure
3 RESEARCH METHODOLOGY

This study was divided into two stages: theory development and empirical research. In the theory development stage, a comprehensive framework regarding the emergence of business ecosystem is developed through an extensive review of the existing literatures, publications and theories discussing about business ecosystem and its emergence and evolution. The source of information is primarily secondary data.

In this stage, the focal subject of the study is approached by analyzing evolutionary theories as the foundation and lens of the study. At the same time, the literatures regarding ecosystems, especially the different viewpoints on business ecosystems are collected to serve as the purpose of outlining a more concrete framework for the second stage of empirical study.

The second stage is to evaluate the theoretical framework through empirical study. A qualitative search is conducted, in order to provide empirical findings. This is in line with Miles and Huberman (1984)’s suggestion on qualitative research methodology. For the study of business network concept, Salo et al. (2008) as well propose that due to the novel nature the complexity of business networks in particular, a case study is a method of choice. Moreover, since this study is dealing with a relatively new area of study in which the researcher has only little or no control over the events that are occurring in a real-life context, qualitative case study is a more appropriate method to approach the question. (Stake, 2000: 435-454).

For the qualitative study, the main data source is collected from semi-structured interviews as referred to other researchers, such as Kumar et al. (1993) and Arksey and Knight (1999). Interviews were taped with the interviewees’ permission, and then transcribed and analyzed accordingly.

In general, this study employs qualitative analysis in order to thermalize the material. Interviews are complemented with documents available on the internet as well as with the additional materials provided by the respondents. These documents are mainly used as sources of background information.
3.1 Background of Cloud Finland

Rooting from the foundation, Cloud Finland (this is a fabricated name due to the confidentiality requirement requested by the respondents) is to bring in new business opportunities and ideology to the Finnish software industry. The project is operated by Organizer (again, the name is fabricated for confidentiality purpose), an information and communication industry research company. Organizer launched Cloud Finland ecosystem along with other ICT companies, which is based on the CloudSoft Finland program for resultant technologies, knowledge and concepts. The duration of the first phase of the program is eighteen months.

Cloud Finland started in early 2012. Currently, it is at the initial stage of attracting ecosystem members and growing business opportunities. According to the ecosystem director of Organizer (2012), “we want to create a new Cloud technology-based business, as well as partner companies and cooperation between them. Program also aims to create a marketplace for Cloud resources, the companies, organizations and individuals can buy and sell computing power.” As Organizer suggests, “Cloud Finland” differentiates Finland as a safe, sustainable and open Cloud services provider. Nord Cloud (2012) also states that the recently launched Cloud Finland ecosystem has a main focus to create new business opportunities for Finnish companies involved in the software industry.

Based on the definition from the literature review, it is an ecosystem that fulfills the following characteristics as shown in Table 5:
Table 5. Properties of Cloud Finland.

<table>
<thead>
<tr>
<th>Ecosystem Characteristics</th>
<th>Cloud Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Value</td>
<td>Yes</td>
</tr>
<tr>
<td>Integration with External Partners</td>
<td>Yes</td>
</tr>
<tr>
<td>Require more than one participant</td>
<td>Yes</td>
</tr>
<tr>
<td>Shift from individual to collaborative thinking</td>
<td>Yes</td>
</tr>
<tr>
<td>Interdependence of the participants</td>
<td>Yes, but low</td>
</tr>
<tr>
<td>Value co-creation</td>
<td>Yes</td>
</tr>
<tr>
<td>Co-petition</td>
<td>No</td>
</tr>
<tr>
<td>Open innovation</td>
<td>Yes, but only partially</td>
</tr>
<tr>
<td>Shared fate of success or failure</td>
<td>No</td>
</tr>
</tbody>
</table>

At this stage, Cloud Finland can be defined as ecosystem Type 3: It is not dominated by a single player and it is open to those who meet specific criteria which is transparent to the public, according to Bailetti and Hudson (2009)’s model. However, at operational level, it also differentiates itself from other keystone-led ecosystem, for example, ecosystems of Apple and Google.

Referring to the ecosystem director of Organizer (2012), each of the company involved in the Cloud Finland develops projects based on the OpenStack, an open Cloud software-based technology infrastructure. Members in the ecosystem are also looking for opportunities to test commercial cooperation. One of the leading technology funds in Finland supports and finances the project. The participants are primarily comprised of a number of Finnish ICT companies.
In addition to the company-specific support and development of OpenStack and the Cloud-based software, Cloud Finland also constantly searches for the opportunities with promising commercial cooperation. The common infrastructure and development of this business aim at creating a dynamic and growing business of Cloud ecosystem in Finland.

According to the ecosystem director (2012), Cloud Finland ecosystem aims at addressing several benefits. First, it makes the Cloud technology better known in Finland and among Finnish companies. Second, participants in the project may apply for public funding, which reduces the barrier to get involved in learning about the architecture and application of the Cloud technology. In addition, the project generates a reference infrastructure for commercial exploitation. In practice, this means that if Cloud Finland is an advantageous model, it would help participating companies to build a commercially viable application through the research work on this platform.

One respondent from the leading software company in Cloud Finland (2012) states that, “our ecosystem objective of the project is to provide software companies a unique collaboration model, which allows them to join the international operators and our cooperation between the Cloud-based businesses. The new cooperation model offers consumers a safe and subsidized access to high-quality and customer-oriented Cloud services.”

Regarding the birth of Cloud Finland, it is originally initiated by a group of participants involved in another cloud software program. This cloud software program has a main focus on the technological development of Cloud. What motivated these participants to form Cloud Finland is the urging need to make business case with the technology developed from the cloud software program. Then these members with the common interest sat down together to search for the solutions. After the discussion, they decided that the best approach is to start an ecosystem-like consortium that addresses the need of each participant. The discussion then became the starting point of Cloud Finland.
3.2 Background of CloudSoft Finland

The interviewed Cloud solution specialist from the open source start-up (2012) suggests that there is a research network called, CloudSoft Finland (this is a fabricated alias for confidentiality purpose). The website of CloudSoft Finland stated that the four-year program was initiated in 2010 and now forms a partner network of Finnish enterprises and research organizations in Finland. The project aims to generate breakthroughs in the field of Cloud technologies, Lean enterprises and business models, integrating user experience and security as value-adding elements.

However, ecosystem director of Organizer (2012) claims that CloudSoft Finland is primarily focused on technology research and development. The missing piece of this program is that “in the process of developing new technology for Cloud, companies can often come up with business ideas. In most of the cases, these companies do not have the resource and capability to further explore these ideas”, according to ecosystem director. In other words, CloudSoft Finland provides limited support in terms of commercialization of the Cloud technology, and that becomes the main driver of forming Cloud Finland ecosystem. This real-life case echoes on the World Resources Institute (2001)’s claim that ecosystem “represents a solution to a particular challenge to life”. The need of finding ways to commercialize Cloud technology thus becomes the “attractor” described by Kauffman (1995: 22).

3.3 Background of Ecosystem Finland

Recently, based on the knowledge gained for the development of Cloud Finland, Organizer has also started building a leadership in digital services with the commencement of developing laboratory, Ecosystem Finland (the name is fabricated for confidentiality purpose). Ecosystem Finland is expected to use the first stage of OpenStack-based infrastructure (IaaS) developed from the previous research.

According to ecosystem director of Organizer (2012), the digitalization of services has profoundly changed working practices and opened up new opportunities in every industry. However, designing and implementing digital services is challenging since there is no existing set of tools and practices that could help guide the process.
Organizer’s Service Development Laboratory (Ecosystem Finland) is designed to fill that gap by creating an environment that facilitates digital service creation.
4 RESEARCH ANALYSIS

According to Peltoniemi and Vuori (2005), a business ecosystem is always more than the sum of its parts. The result of interactions between different units is something that no individual member of ecosystem could produce by oneself. The ecosystem director of Organizer (2012), who is also in charge of organizing the Cloud Finland, confirmed that the above statement in the case of Cloud Finland ecosystem. According to the ecosystem director, each member of the Cloud Finland could not handle all aspects of Cloud technology and business development. By having companies specialized in a diverse range of fields, each member can benefit from the contributions of other participants. Therefore, the entire ecosystem can help members capture more business opportunities which are otherwise not possible for individual company to pursue.

The Cloud solution specialist of the start-up software company in Cloud Finland (2012) also addressed that by joining Cloud Finland ecosystem, his start-up company gained knowledge and access to testing the Cloud software in the very early stage of product development. This is largely because that the hardware and infrastructure provider from the Cloud Finland ecosystem has assisted them from the beginning. Without Cloud Finland, traditionally, the start-ups are not able to carry out trials and experiments on the state-of-the-art Cloud infrastructure.

Simply put, the whole is greater than the sum of the parts. Surowiecki (2004) uses the application of emergence to explain a principle of collective wisdom, where all of the people together know more than any some of the population. Surowiecki’s work provides concrete support on how aggregating the knowledge of the collective can produce smarter, better ideas and solutions than by relying on one individual expert. Mitleton-Kelly (2003: 40) also expresses, “emergent properties, qualities, patterns, or structures, arise from the interaction of individual elements; they are greater than the sum of the parts”.

To further illustrate the power of co-creation, Peltoniemi and Vuori (2005) use the case of microprocessors and software, suggesting that while microprocessor producers develop more efficient processors, the software producers quickly make
use of the new opportunities and the software becomes heavier, which causes pressure to develop even more efficient processors. In the case of Cloud Finland, however, the above stated situation did not emerge. In general, there are two reasons behind this:

First of all, the Cloud Finland has just started for several months before this study has conducted. In this early stage of the ecosystem, each member organization has not undergone any major changes or organizational evolution process. Thus, there is no evidence of co-evolution at this early stage. The second reason is that one mechanism of the Cloud Finland is that each member makes specific contribution to the ecosystem, while keeping its core of business operation, in other words, their “business secrets” remain confidential from the other members in the alliance. Therefore, the change of each individual company has not brought significant impact to other companies.

However, several small-size participants of the Cloud Finland addressed one leading software participant as the influencer of the ecosystem, recognizing that as the largest member of the ecosystem, this influencing participant indeed has more influence over other members and it also brings more benefits to the ecosystem. It is evident that the ecosystem member mentioned here is a keystone member of the Cloud Finland, despite that the interviewed respondents from this company claimed that the members are equally important in the ecosystem.

According to the interviews conducted with various members of Cloud Finland (2012), it is confirmed that one of the characteristics of the Cloud Finland is that the program aims at maintaining and maximizing the flexibility of the organization. There are very few rules, regulations or mechanisms to constrain the development of the ecosystem and the cooperation of the participants. The existing mechanisms only include the following:

i. Incumbent members jointly review when new members submit their applications for participation in the alliance.

ii. There will be a monthly meeting for members to get together and review the current status of the projects and deliverables.
iii. The Organizer company periodically share news and information related to Cloud industry with ecosystem members.

4.1 Emergence of Cloud Finland and Beyond (Macro Level)

From the Table 6 below, it appears that when business form becomes more complex, from linear to network structure, an incremental development of business form features can be observed. For example, as a more complex form, business ecosystem inherits the key features of value network, while it also exhibits some emergent unique features of its own, like open innovation. It is important to note that the table below only lists a set of key features of the business forms that are frequently discussed in the literatures.

Table 6 also gives a clearer view that if Cloud Finland fits the concept of business ecosystem and to how much extent it can be taken as a business ecosystem. The first finding is that Cloud Finland possesses characteristics that beyond Value Network, for example, it is designed for open innovation. However, it does not fully resemble all aspects of business ecosystem. One example is co-petition. The explanation for this can be that the ecosystem has relative low number of participants. The current members are not directly competing in the same business areas.
Table 6. Property Comparison of Various Business Forms in Theory and Practice.

<table>
<thead>
<tr>
<th>Feature of Business Systems</th>
<th>Individual Company</th>
<th>Value Chain</th>
<th>Value Network</th>
<th>Business Ecosystem</th>
<th>CloudSoft Finland</th>
<th>Cloud Finland</th>
<th>Ecosystem Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Value</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Integration with External Partners</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Require more than one participants</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Shift from individual to collaborative thinking</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Interdependence of the participants</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, but low</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Value co-creation</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Co-petition</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Open innovation</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes, partially</td>
<td>Yes</td>
</tr>
<tr>
<td>Shared fate of success or failure</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

From CloudSoft Finland to Cloud Finland

Cloud Finland was originated by a group of participants of CloudSoft Finland. The information in Table 6 shows that Cloud Finland and CloudSoft Finland share a series of similarities when compared with the listed features. At the same time, Cloud Finland enables open innovation while the data on CloudSoft Finland is not very clear. From the interviews with various respondents, the key difference between the two is that CloudSoft Finland focuses on the technological development of Cloud on the one hand, while Cloud Finland focuses on the commercialization of Cloud technology on the other hand.
From Cloud Finland to Ecosystem Finland

Referring to the interview with the Cloud Finland participants, Ecosystem Finland is considered to be a further development or a broader extension of the Cloud Finland ecosystem. After summarizing the description on Ecosystem Finland from the interviews, it shows that if Ecosystem Finland could be organized in the way that it is claimed to be, then Ecosystem Finland can be taken as the real business ecosystem in Finland. It is also clear that, at the current stage, Cloud Finland is beyond value network. However, there is still distance for Cloud Finland to become a true business ecosystem.

In the following part, the use of variation and selection theories for Cloud Finland is discussed, in order to evaluate that if Cloud Finland as an empirical case, can fit the framework of evolution.

Use of Variation and Selection

Shepherd and McKelvey (2009) claim that a small number of people all with very similar backgrounds, who have worked together for a long time, meeting face to face, create less new knowledge than many more people meeting for the first time virtually.

Shepherd and McKelvey (2009)’s research also suggest that a long established management team appears unable to adapt their variation-creation patterns effectively to different tasks. No matter if they are being innovative (Internal) or exchanging knowledge to come to an agreement (Project) or having an Off Agenda conversation, they add similar amounts of variation in a very similar way.

For the case of Cloud Finland, since participants are from different organizations, it can help to generate variations and innovations more effectively than when it is from the same company. On the other hand, the fact that the participants have known each other for a period of time may sometimes limit the innovativeness. Despite that Cloud Finland shows its capabilities in variation generation, however, there is currently no any clear mechanism that optimizes the process of selection.
4.2 Emergence of Cloud Finland (Micro Level)

According to Moore (2005), a vision of a business ecosystem is not maintained in practice simply by being beautiful and compelling. Cooperation is difficult in practice, while competition can bring fragmentation to business ecosystem. Companies are distracted away from community concerns by the immediate, pressing work of running their own innovative businesses. Thus, the only way that co-evolution can be achieved is through events to keep a shared vision alive. These events are often led by large companies like keystones, but are sometimes the result of visionary politicking by small companies, groups, and charismatic individuals.

Part of the creativity of campaigns is identifying non-obvious but potentially important contributors and reaching out to them, and identifying non-obvious but potentially important contributions and incorporating them. From Google’s case, it can be inferred that industrial organizations and research institutions are identified by Google as the important contributors to the emergence of Cloud ecosystem.

The Table 7 below shows the comparison between how Google and Cloud Finland develop the Cloud ecosystem.
### Table 7. The Comparison between the Ecosystem of Google and Cloud Finland

<table>
<thead>
<tr>
<th>Ecosystem Characteristics</th>
<th>Google</th>
<th>Cloud Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forming a shared vision</td>
<td>Yes</td>
<td>Yes, but the vision is not clearly defined</td>
</tr>
<tr>
<td>Strategically selecting and prioritizing the initial organizations to approach. This may include educational organizations, research institutions, and industry associations</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Promoting the key concept and technology to the list of well-selected organizations</td>
<td>Yes</td>
<td>Yes, but relatively low</td>
</tr>
<tr>
<td>Create a common forum or platform to attract potential ecosystem participants</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Take the leadership and act as the keystone member of the ecosystem</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Persistent with formulating the interaction mechanism for potential ecosystem member to interact.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Constantly attract new members to the ecosystem</td>
<td>Yes, very proactive</td>
<td>Yes, less active and more discreet</td>
</tr>
</tbody>
</table>

It can be seen that Cloud Finland use a different approach when comparing with Google’s approach of developing an ecosystem. Google’s approach is quite similar to what literature describes that it voluntarily educates and reaches out to the key organization and institutions that can contribute to the ecosystem. On the other hand, Cloud Finland develops network by using the existing network of the members. Membership is on a voluntary basis, and is not heavily promoted as Google.

In addition, Google seems to have a clearer vision to pull companies specialized in different fields together, while Finnish Cloud does not promote a clearly defined vision and leadership. Therefore, it can be seen that Google is more like Bailetti and Hudson (2009)’s first type of ecosystem: It is dominated by a single supplier and it is open to those who meet specific criteria which is transparent to the public, while Finnish Cloud is more like the third type: It is not dominated by a single supplier and it is open to those who meet specific criteria which is transparent to the public.
To generalize, Google’s ecosystem building approach is rather proactive. It develops clear vision regarding Cloud technology, strategizing its execution on how to build the Cloud ecosystem effectively, carefully selecting the potential influencers or contributors who can have large impact on the emergence of Cloud ecosystem, and positioning itself as the leader or keystone throughout the promoting process. At last, Google are persistent when building the ecosystem which creates an impression that Google has strong commitment to the Cloud. It strengthens the confidence of the existing and potential ecosystem members.

In contrast to Google’s approach, Cloud Finland adopts a relatively discreet method, promoting a flexible and innovative environment for the ecosystem participants to interact and collaborate. Despite that there is already a leading software company who has the potential to lead the ecosystem as the keystone, in general, the ecosystem promotes equality among the members. On the one hand, Cloud Finland focuses on setting up the environment that fosters innovation among members. It seems to follow the setting of natural evolution process, allowing the variation generation and selection process to take place. Therefore, Cloud Finland is quite similar to what Peltoniemi and Vuori (2005) suggest, “The emergence of an ecosystem is a path-dependent, chaotic process.” On the other hand, it is difficult to measure the immediate and near-term benefits Cloud Finland can generate. At the time when interviews were conducted, there was not any significant commercial case developed by Cloud Finland. Therefore, it requires the patience and long-term commitment of the ecosystem moderators and funding providers to continue supporting the development of Cloud Finland, since it is not a direct and result-oriented process when building business ecosystem like Cloud Finland.

4.3 Key Elements for the Emergence of Ecosystem

In the following section, the elements that enable the emergence of a business ecosystem, especially for Cloud ecosystem are discussed in line with the empirical interview results.
Pre-requisite Conditions for Business Ecosystem to Emerge

As previously mentioned in the literature review, one of the important conditions for an ICT ecosystem to emerge is the issue of IPR. Cloud Finland ecosystem maintains a relatively loose and flexible interaction among members. The protective measure is the Non-Disclosure Agreement signed by members, which is relatively general. However, the upcoming Ecosystem Finland does offer secured legal environment for its members. According to the ecosystem director of Organizer (2012), Ecosystem Finland will set up a ready-made legal and contractual framework for collaboration. It can be estimated that, this new frame of Ecosystem Finland is emerged from the learning of Cloud Finland. Whether at large or small, it can be deemed as an evolution from the Cloud Finland model.

Environment and Resource

Regarding external environment, Adomavicius et al. (2007) extend the definition of the environments that business ecosystems are subjected to, suggesting three major types of external environmental forces: social and governmental forces, technological forces, and economic forces.

Social and governmental forces are pressures from societal and political sources that shape technological innovation. For instance, the social constructivism in technology perspective argues that all technology is socially constructed.

Technological forces represent pressures and needs for technological change formed by technical barriers and opportunities. In Nelson (1995)’s review of evolutionary economics, the theory of cumulative technology is introduced, which proposes that today’s technologies build from and improve upon the technology that previously existed, while tomorrow’s technologies build on today’s. Similarly, evolutionary economic theorists believe that technological innovations come from deliberately planned research (Adomavicius et al., 2007).

Economic forces are captured by market dynamics and the demand for new products and technologies. For example, Mokyr (2000)’s model of technology evolution
considers market pressures as a driver of new technology selection and adoption. This external force is complex and important in the shaping of ecosystem evolution, according to Mokyr (2000)’s model.

In general, each of the external forces may be acting at any given time, and discerning the specific effects of each will definitely be a difficult task (Adomavicius et al., 2007). Similar to Adomavicius et al. (2007) and Mokyr (2000)’s suggestions, one of the drivers behind Cloud Finland is to keep up with the emerging trend of Cloud technology. According to the respondents from different companies, following large multinational companies like Microsoft and Amazon, ICT companies have been paying attention to address the Cloud technology. On the one hand, Cloud as a new business area can help company to have more business opportunity; on the other hand, the move into Cloud field is also because of the market demand.

According to the leading software company in Cloud Finland (2012), they find the customers require more functionality and offerings that are only possible to realize through the Cloud system. To meet customers’ growing needs, this Software Leader also need an ecosystem to help them create better service offerings in order to out-run the competition.

**Shared Vision**

Yang and Hsu (2011) conclude in their study that, how different actors, such as Trend Micro, the Taiwanese government, global and local IT practitioners, research institutions and journalists, collaborate to create an organizing vision to interpret, legitimate and mobilize resources in shaping Cloud computing in the Taiwan IT industry. According to Yang and Hsu, this process of institutionalization manifests itself when various stakeholders make sense jointly of innovation, and therefore becomes a normative pressure within the community. The organizing vision serves as the core of these interpretive activities. These results are in line with Swanson and Ramiller’s argument (1997).

From the interviews, the shared vision has a different scenario in Finland than the case in Taiwan. Due to the relative loose cooperation mechanisms of the members,
Cloud Finland only has a vague vision of developing business opportunities for each member. At the same time, every member has its own strategic focus, therefore, apart from the general vision; members are acting independently towards their own vision.

*Leadership of Ecosystem*

Storbacka and Nenonen (2011) suggest that some market actors, for example, keystone leaders in ecosystem are more proficient in the reconfiguration activity because they have the ability to influence market configurations with value sensing and measuring market configurations.

Even if ecosystems are dynamic by nature, they remain regulated by one or several leader companies - the keystone organizations, as Iansiti and Levien (2004) suggest. The keystone plays a structuring role within its ecosystem in terms of value creation and value sharing, such as Isckia (2012)’s case of Amazon.

From the case of Cloud Finland, an interesting finding is that smaller companies in the Cloud Finland claim the Software Leader Company as a keystone player as well as the leader of the ecosystem. This is mainly because it is the largest company of this ecosystem. Companies rely on this Software Leader’s technology, market knowledge and customer reaches. However, Organizer and the Software Leader shared different points of views. The ecosystem director of Organizer (2012) as the facilitator of the Cloud Finland claims that it is not necessary to have a leader in the ecosystem, since right from the beginning, the ecosystem is built on an equal relationship. However, ecosystem director (2012) also expressed that it is not Organizer’s concern whether there should be any form of leader or leadership within the system, since Organizer’s role is only facilitating the cooperation among members.

The Software Leader Company (2012) interviewed in this study, however address that the members are treated equally in the ecosystem despite the different sizes of the companies. From this, it can be seen that the Software Leader does not position itself as a dominating keystone member in the ecosystem. However, inevitably, with
more tangible and intangible resources, other smaller members naturally take this Software Leader as the natural leader in Cloud Finland system.

As Kim et al. (2010) argue, in cooperative relationship between SMEs and large corporations, large companies must play as a platform leader. These keystone companies attract bees through a fragrant flower, while there are others that are not able to attract bees due to unavailability of fragrant flowers. Thus, fragrance plays an important role in attracting the bees and enhancing the interfaces of the ecosystem.

Ecosystem Platform

For a platform owner that focuses on fostering the rapid growth of its ecosystem to capture the indirect network effect and promoting the platform as industry standard, understanding the incentives and reservations of its complementary product providers is of significant importance, and building proper governance mechanisms that alleviates its partners’ expropriation concerns could be conducive to the shared success of the community (Gawer and Henderson 2007).

Platform serves as the foundation of the Cloud, that on the one site of the platform it attracts the heterogeneous customers, while on the other side, it helps value creators to be selected by users. In fact, platform model is a way to aggregate customers and ecosystem members together, so that it is easier to obtain feedback. In the case of Google, it is clear that Google develops its Cloud service ecosystem with the platform model. By utilizing its massive IT infrastructure, Google allows end customers and business ecosystem participants to interact on this platform. It is suggested in this study that the platform model enables a quite effective way to facilitate the selection process of evolution cycle. The variations generated by ecosystem can be brought to the end customers with less effort compared to the traditional delivery approach. In addition, the feedbacks, comments and end results of the mass customers’ selection are reflected on the platform nearly as fast as real time. Online mobile app marketplaces like Google Play and Apple’s app store are good examples.
Since Cloud Finland is a newly created ecosystem, the common platform for the ecosystem to move forward is also its facilitator, the Organizer company. Part of the work of Organizer is to keep members of the Cloud Finland connected, since the ecosystem is quite flexible in the terms of cooperation. Therefore, unlike Ballon and Hawkins (2008)’s concept, there is no any complex process to classify what type of structure Cloud Finland should work on as of the time when the interviews were conducted. However, further change of the practices may take place as the ecosystem continues evolving. It can be observed that, the missing piece is how to obtain and distribute the feedbacks from the customers to the ecosystem with less cost of effort, resource and time.

Mechanisms of Platform

Reuver (2011) introduces a quite relevant case study to bring insight for this research. It is on the transition of European Mobile industry, as until recently, operators controlled most of the activities of mobile service innovation. Since the emergence of the voice services, operators have been used to being in control of the network, service delivery and customer interaction (Sabat, 2002). When GPRS technology enabled the first generation of mobile internet services, operators generally acknowledged that they would need to obtain content from third parties. To manage relationships with these content providers, they copied the successful Japanese i-mode model (Natsuno, 2003). In general, this model is to launch mobile internet portals that provide access to content services from a range of third-party providers, which had to use the “i-mode” service platform in order to access the customer. Operators maintained control of the communication, the provider network, as well as controlling access to the customer, customer data and transactions.

However, Reuver (2011)’s findings reveal a trend towards less operator involvement and power in the mobile domain. As Reuver (2011) concludes, mobile device manufacturers and software platform providers increasingly control the relationship with customers as well as the relationship with application developers through the device and application store. While the role of operators has reduced, Apple and Google now dominate the mobile ecosystem with their software platforms.
The above example shows that leadership may take different approach towards the ecosystem, either dominant or cooperative. But it also proves the failure of the self-centric control mechanisms used by dominate keystones.

In the case of Cloud Finland, as it is described earlier, the ecosystem is built on the mutualism basis. Although, one of the members is already considered as the natural keystone leader in the ecosystem, equality and mutualism are promoted in the ecosystem of Cloud Finland. This shows a positive sign in terms of the mechanisms to engage ecosystem members.

In terms of the operational mechanisms, apart from monthly review meeting to track that if members bring what they promise to the Cloud Finland, there is no complex mechanism undergoing in this newly formed ecosystem. It can be inferred that this is largely because the ecosystem has only small number of companies. A more flexible operating mechanism is favored at the moment.

_Ecosystem Healthiness_

Kim et al. (2010) divide the developmental stages of a business ecosystem into three stages of “low”, “medium”, and “high”: in the first stage, the business ecosystem needs just productivity to survive. As the ecosystem progresses to the second stage, it will need robustness as well as productivity. In the third stage, all sub-dimensions of business ecosystem healthiness will be necessary.

According to Kim et al. (2010)’s research, the empirical findings suggest that for its healthiness, business ecosystem needs more than just productivity and profitability. If evaluating the healthiness of a business ecosystem just based on productivity and profitability, it is very likely that cooperation between businesses can be seen as conflicting relationship, which is a short-term perspective. To maintain long-term orientation, it is important to examine if robustness is increasing in the ecosystem. If a vertical business ecosystem is healthy, suppliers must have resistance to environmental conflicts. High robustness means that the company is armed with high level of entrepreneurial willingness and expertise. A business ecosystem must revitalize its entrepreneurship to recover its healthy condition. For this, niche
companies must become specialized experts. Moreover, if an ecosystem wants to maintain its healthiness, it must have convergence-based competitive power, which raises ecosystem expansibility.

In terms of ecosystem healthiness of Cloud Finland, many interviewed respondents claim that the ability to innovate is very important to the prosperity of the system as a whole. Referring to Kim et al. (2010)’s framework, productivity is the key to make ecosystem survive in the early stage. However, it is interesting to note that Cloud Finland ecosystem is addressed more on the robustness. One of the reasons here can be that the Cloud Finland is a government funded project. In this case, acquiring the financial resource is usually critical to the survival of an ordinary ecosystem is insignificant in Cloud Finland’s setting. The survival of ecosystem is more driven by the government funding instead of market pressure. As a result, the companies may have already moved to the next focus, which is the mid-term healthiness of the ecosystem, or bringing innovativeness into the system.

*IT Infrastructure*

At last, regarding the common IT infrastructure, the Cloud Finland ecosystem uses OpenStack as the common technology within the ecosystem. It provides a technological foundation for Cloud Finland.

The technological aspect of infrastructure is addressed as one of the key elements in the ecosystem by numerous interviewed companies. It shows that for the ICT ecosystem as well as Cloud ecosystem, the common IT infrastructure for technology development is an indispensible component of the ecosystem.
5 DISCUSSION AND CONCLUSION

In this final chapter, the paper presents research findings and the new proposition arising from both theoretical and empirical study. In addition, the limitations of the study are listed to help further study in the area of business ecosystem.

5.1 How Do Business Ecosystems Emerge?

The answer to the research question of this study is presented below with both macro and micro perspectives.

5.1.1 Business Ecosystems Emerge Out of Business Form Evolution (Macro Level)

Via the lens of evolutionary theory and its sub theories (variation and selection theories) to examine the existing business forms, this study suggests that the answer to research question “How do new ecosystems emerge?” At the macro level is as follow:

*The various existing business forms today are the results of evolution through the process of variation, selection in one or multiple evolution cycles. Business ecosystem is therefore emerged out of the business form evolution as a new and more adaptive business form to today’s socio-economic context.*

To explain the proposition, the special features that allow these business forms to survive and thrive in the socio-economic environment have a general purpose: to enable business forms or systems to better adapt to the external selection environment. Similar to the species in natural environment, the underlying reason of their existence is the environment adaptability that inherited through a long line of evolution history, although species manifest in different physical forms and may have different mechanisms to adapt to the environment. The inherited physical features of the species are the outcome of natural evolution, the universal purpose of variation-selection process is to enable species have a better fit to their living environment, and allow them to utilize the resource in the environment more efficiently.
Similarly, the features or characteristics that embody various existing business forms can also be taken as the manifestation and the result of business form evolution. The ultimate objective of the evolution is to adapt to the ever-changing market environment and to satisfy end-customers’ needs more effectively and efficiently. Referring to Vervest et al. (2004), business ecosystem develops not only because technology permits them to develop, but more remarkably because markets and modern business competitiveness require such networks in order to survive and thrive.

This macro level answer to the research question is largely supported by literature review and case study. From the result of empirical research, it can be seen that the Cloud Finland initiative has shifted from the business form of value network towards the thinking of business ecosystem. Referring to the summary of Table 6 in Chapter 4.1, it provides evidence that Cloud Finland is on the process of moving from value network towards business ecosystem. The case of Cloud Finland provides support for the theoretical point made by Peltoniemi and Vuori (2005) that the emergence of an ecosystem is a path-dependent, chaotic process.

Due to the length of such evolution is quite short, the current empirical level finding can only marginally support the proposition. As an emerging pattern, more research is needed to see a clearer picture.

5.1.2 Business Ecosystems Can be Built with Appropriate Design and Execution (Micro Level)

By studying Google’s approach in building its Cloud ecosystem in Taiwan, the study suggests that business ecosystem can be built intentionally with the appropriate methodology in terms of strategy design and operational execution.

At the micro level, for an ecosystem to emerge in a given industry, a set of guideline can be followed. It is interesting to note that with the different approach of ecosystem building, the guideline may vary. The guideline in Table 4 from Chapter 2 shows the process used by Google to build its Cloud ecosystem in Taiwan, which is also an international business case. However, it is later discovered through the empirical
study that this guideline is not fully followed by Cloud Finland. In general, there can be two explanations for this finding:

First, it is clear that Google pursues a proactive and result-oriented ecosystem building approach. It positions itself as the keystone and leader of the ecosystem. The dominating approach requires Google to prioritize it is execution by focusing on the most important or influential contributors to the ecosystem first, according to Google’s strategic preference. While Cloud Finland adopts the approach of mutualism and equality, therefore prioritization may not be key agenda in their ecosystem development approach.

Second, one may argue that some elements of Google’s approach are not in conflict with Cloud Finland’s. For example, approaching educational and research institutions. In this case, the study agrees that Could Finland indeed may already have paid great attention to this type of organization. But due to the discreet approach used by Cloud Finland, such information is not documented publicly.

5.1.3 Key Elements for the Emergence of Business Ecosystem

Through literature review and case study, a list of key elements critical to the emergence of business ecosystem is identified and discussed in the study. During the empirical interview, one observed situation is that nearly all the respondents take ecosystem platform and IT infrastructure as the same element before any further explanation was given.

One possible explanation can be that on the one hand, in the field of ICT and Cloud, IT infrastructure and IT platform are highly related terms. On the other hand, some of the leading ecosystems are actually integrating IT infrastructure with ecosystem platform. The IT infrastructure plays an important role in supporting the real-time interaction between ecosystem members and end customers on a public platform. For example, Amazon and Microsoft are such cases, as suggested by Iansiti and Levien (2005).
From the findings of this study, the emerging platform model used for ICT ecosystem improves the overall evolution process of variation generation and integrating feedbacks from end customer selection. The detailed explanation is presented in the next section.

5.1.4 New Proposition Emerged from the Study

The proposition: the core of sustainable business forms is the capability of constant self-evolution, not its temporary superior features. Such capability can be achieved via embedding the mechanisms that allow business forms to effectively and efficiently involve in the cycle of evolution, that is, variation and selection.

From the literature review and empirical interview, the study concludes that the fundamental logic to create any sustainable business forms is to design the capabilities that allow effective and efficient self-evolution. The assumption of the study is that the process of variation and selection is a universal principal that governs nature, social and economic systems. Every living species is subjected to the power of evolution process. It is beyond human’s control, just like no one can change the universal law of gravity.

By comprehending the universal laws, people can achieve more than physical capability. For instance, space walking on the Moon, or cloning living creatures. The findings of this study can provide a fundamental ground to help business practitioners in inventing or engineering effective business forms, or at its least, improving the existing business strategies, structures and operations. The conceptual framework developed in the study can help to explain what features or competences of an existing business form are the right components to its success, and how these features or competences can be utilized in new business forms.

The central ideology invented from this study is that if a business form can develop more effective and efficient mechanisms to improve how it evolves (specifically, via the process of variation, selection, and possibly retention), it will be able to achieve the sustainable success in the long run. The sustainable success means that the
business form is more capable at adapting to the environment with its resource at any point of time. In other words, only the “fittest” survive and thrive.

Another implication of the research is that due to the ever-changing nature of socio-economic and technological environments, there will constantly be plenty of business forms emerging. These forms are results or variances that come up under the given external circumstances through the force of evolution process. In nature environment, it is not that all the species try to develop and grow features like an ultimately strong life form to survive and thrive. But every species try to adapt to the external environment, and seek their ways of survival. The species can do so because they have inherited the capabilities in complying with the universal process of variation, selection and retention from diverse paths. The similar situation can be also applied to business forms and ecosystems that “live” in the socio-economic environment.

To explain further, for example, the emergence of value co-creation (a feature of business ecosystem) is not because that co-creation may sound better than competition. It is because that at some point of time, value co-creation naturally emerged as a variation of business routines just like competition. The external environment and market force started to favor and gradually “select” co-creation over competition for certain business scenarios. In this case, it can be assumed that the selection has taken place in ICT industry. And then the selection resulted integrated features of the business form, in this scenario, it eventually becomes the business ecosystem.

In regard to the main reason why business leaders such as Microsoft and Wal-Mart have been so successful to date is that they have “figured out how to create, manage and evolve an incredibly powerful business ecosystem.”, as Iansiti and Levien (2005) recognized. Both companies played central roles in the establishment of shared platforms, in the form of services, tools or technologies that could be leveraged by a large number of companies in the way to increase productivity, enhance stability and use as building blocks for innovation.
The Table 8 below does not only evaluate how Cloud Finland ecosystem is suited for evolution, it also shows that although ecosystem is a more advanced business form, some of the ecosystem characteristics such as “inter-dependence of the participants” and “shared fate of success or failure” show vague connection to the evolution process, or at least, the evidence of their impacts are not visible from the existing studies.

Table 8. Comparison between Theoretical Business Ecosystem and Cloud Finland.

<table>
<thead>
<tr>
<th>Feature of Business Form</th>
<th>Theoretical Business Ecosystem</th>
<th>Cloud Finland</th>
<th>Explanation using the case of Cloud Finland</th>
<th>Well-suited for evolution (Cloud Finland)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Require more than one participants</td>
<td>Yes</td>
<td>Yes</td>
<td>More participants help to create more variation that is otherwise not possible from one company</td>
<td>Yes</td>
</tr>
<tr>
<td>Integration with External Partners</td>
<td>Yes</td>
<td>Yes, but low</td>
<td>Integration with external partners helps variation creation and better feedback communication after selection. Members in Cloud Finland have a relatively loose integration.</td>
<td>No</td>
</tr>
<tr>
<td>Collaboration between firms and customers</td>
<td>Yes</td>
<td>No</td>
<td>Collaborating with customers make companies more agile in respond to external selection as well as generating market-oriented solutions (variation). Cloud Finland ecosystem is consisted of companies from IT field, and lack of integration with end-customers.</td>
<td>No</td>
</tr>
<tr>
<td>Shift from individual to platform performance</td>
<td>Yes</td>
<td>No</td>
<td>Platform model helps to integrate offers and customers, thus facilitating the variation-selection process more effectively. Cloud Finland collaborates on a common technology platform named OpenStack. However, it is important to point out that Cloud Finland has not developed commercial platform that integrating Cloud Finland with the market or end-customers. This is</td>
<td>No</td>
</tr>
</tbody>
</table>
one of the greatest differences between Cloud Finland and other well-known ecosystems, like Google, Microsoft and Amazon.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Yes, but low</th>
<th>No</th>
</tr>
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<tbody>
<tr>
<td>Value co-creation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value co-creation helps companies create market-driven values more effectively. However, in the case of Cloud Finland, there has not been any significant co-created offering. Each member is still primarily focused on their own offering. The only exception is the keystone member.</td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Interdependence of the participants</th>
<th>Yes</th>
<th>Yes, but low</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referring to the structure and operation mechanisms of Cloud Finland, members are relatively independent of each other. In the current stage, smaller members are more dependent on the keystone member rather than mutual dependence.</td>
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</table>

<table>
<thead>
<tr>
<th>Co-petition</th>
<th>Yes</th>
<th>No</th>
<th>Partially Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation helps to generate market focused variation instead of random variations. Then the fit variations survive from Competition. In general, co-petition supports the evolution. In the case of Cloud Finland, due to the low number of participants, members are more of cooperative relationship. Therefore, it only partially supports the creation of the fit solutions.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Open innovation</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>As the fundamental principle, Cloud Finland operates on an open innovation level. Therefore, it supports further evolution.</td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Shared fate of success or failure</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Because of the loose structure, members of Cloud Finland do not necessarily share the same fate.</td>
<td></td>
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</table>

Generally, the study tentatively answered the research question, “How do new business ecosystems emerge, in the context of Cloud computing?” as summarized in the sections above.
The evolution of business ecosystem will be constantly driven by the complex external environment forces, like government regulations, technology advancement, and social-economic changes.

The emergence of Cloud Finland ecosystem is to meet several challenges as suggested here:

i. Internally, it is the requirement of continuous economic innovation;
ii. Externally, it is the pressures from competition and market demand.

What common for the macro and micro level perspectives proposed in this study is that any evolution of business ecosystem or other business forms follows the underlying principles:

i. Generating variations effectively and efficiently (it is important to note that it is not equivalent to generating as many variations as possible); and
ii. Letting the created variations be selected by the external forces and embedding the selection feedbacks back into the organizations as effectively and efficiently as possible.

At last, a number of key elements for the emergence evolution of Cloud business ecosystem are presented, which include but not limited to IPR arrangement, Environment and Resource, Shared Vision, Leadership of the Ecosystem, Common Platform, Mechanisms of the Ecosystem, Ecosystem Healthiness, and IT Infrastructure.

The reality check of this study verified Moore (1993, 1996)’s theory of ecosystem, and roles of the ecosystem participants. On the other hand, similarities and differences between Google’s Cloud ecosystem in Taiwan (Yang and Hsu, 2011) and the empirical case of Cloud Finland are discussed and compared. Both cases show that in order to meet the growing competition from multinational companies and to catch up with the emerging demand of the customers, companies are forming alliances to tap into the source that they are not able to acquire alone previously. As a result, different businesses bring their unique sets of capabilities and resources to the
table, so as to support each other in terms of innovation and technology development as well as business opportunity discovery. In the end, their objective is to benefit from the overall well-being of the ecosystem.

In addition, market demand from the end customers appears to be another driver for companies (even keystones) to form ecosystem, and to develop the necessary capabilities by collaborating with the other smaller niche companies. One point to bear is that through different cases, the formation of the ecosystem is primarily driven by the external market or completion pressure, since the companies involved, although large, are generally not comparable to the global business giants, such as Google or Amazon.

Drilling from the surface, this study further developed a concept to explain the prevailing phenomenon of inventing new business forms from supply chain to business ecosystem. The author considers that the emergence of business ecosystem as a new business form is not out of luck or probability. It is a natural path that under the governance of the evolution forces existing in the social-economic contexts, just as the evolution of all the living creatures in the natural environment. For this broader perspective, the emergence of ecosystem is inevitable due to the social-economic and technological pressures.

In the above context, what unpredictable is that no one can confidently tell what the next evolution of business form would be after business ecosystem, assuming that business ecosystem is not yet the end form. On the other hand, what predictable is that, the evolution of the business ideology from linear to network is a path dependent process. The underlying criterion enables the new business forms to exhibit more effective characteristics when coping with the ever-changing and complex business environment. To narrow it down, if another new form emerges, it will potentially inherit and create new types of mechanisms that help the businesses better meet the fundamental requirements of the evolution processes, in other words, effectively and efficiently generating variations and being selected by the external environment.
5.2 Evaluation of the Study’s Reliability and Validity

Referring to Golafshani (2003), in order to understand the meaning of reliability and validity, it is necessary to present the various definitions of reliability and validity given by many qualitative researchers from different perspectives. Therefore, before conducting the reliability and validity test for this study, current theories regarding reliability and validity in qualitative research are discussed.

Quantitative Research versus Qualitative Research

To explain the definition of quantitative research, Bogdan and Biklen (1998: 4) suggest that charts and graphs illustrate the results of the research, and commentators employ words such as “variables”, “populations” and “result” as part of their daily vocabulary. According to Charles (1995), quantitative research has:

i. the emphasis is on facts and causes of behavior (Bogdan & Biklen, 1998);
ii. the information is in the form of numbers that can be quantified and summarized;
iii. the mathematical process is the norm for analyzing the numeric data; and
iv. the final result is expressed in statistical terminologies.

Qualitative research uses a naturalistic approach that aim at understanding phenomena in context-specific settings, according to Patton (2001: 39). It is defined by Strauss and Corbin (1990: 17) that as “any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification and instead, the kind of research that produces findings arrived from real-world settings where the phenomenon of interest unfold naturally.”

Reliability and Validity in Qualitative Research

Guba and Lincoln (1981) suggest that in qualitative research, each paradigm requires paradigm-specific criteria for addressing “rigor” or “trustworthiness”. These criteria were refined to credibility, transferability, dependability, and conformability by Lincoln and Guba (1985).
Golafshani (2003) argues that although the term “reliability” is a concept used for testing or evaluating quantitative research, the idea is quite often applied in all kinds of research. However, the difference in purposes of evaluating the quality of studies in quantitative and qualitative research is one of the reasons that the concept of reliability is irrelevant in qualitative research. According to Stenbacka (2001: 552) “the concept of reliability is even misleading in qualitative research. If a qualitative study is discussed with reliability as a criterion, the consequence is rather that the study is no good.”

As Campbell (1996) suggested, the consistency of data will be achieved when the steps of the research are verified through examination of such items as raw data, data reduction products, and process notes.

In terms of validity, Golafshani (2003) suggests that although some qualitative researchers have argued that the term validity is not applicable to qualitative research, however, these researchers have also realized the need for some kind of qualifying check or measure for their research.

**Test of Reliability and Validity of the Study**

Morse et al. (2002) suggest that verification is the process of checking, confirming, making sure, and being certain. In qualitative research, verification refers to the mechanisms used during the process of research to incrementally contribute to ensuring reliability and validity and, thus, the rigor of a study.

According to Morse et al. (2002), the first verification is methodological coherence that ensures congruence between the research question and the components of the method. The context of the current research is that the topic is not researched by previous researchers. Therefore, it can be inferred that the author taps into a relatively unknown and under-researched territory. The methodology adopted for this study are manifested in two stages, which including an exhaustive review of the existing theories and paradigms in both academic and real world. Only after that, the primary data collection is conducted with qualitative and in-depth interviews. It can
be seen that the research question of the study in fact requires such a step-by-step exploratory research methodology.

Morse et al. (2002) also suggest that the sample must be appropriate, consisting of participants who best represent or have knowledge of the research topic. For this study, during the empirical study phase, the selected respondents are confirmed to meet the following criteria:

i. Representing significantly different roles within the ecosystem;
ii. Highly involved in the organization and operation of the Cloud Finand ecosystem;
iii. Participating in Cloud Finland from the initial stage.

Overall, this study has used literature reviews as a secondary data research, as well as qualitative interviews with credible representatives of the Cloud Finland ecosystem. The representatives’ companies cover different roles in the ecosystem, from niche player to keystone leader.

Morse et al. (2002) also suggest the third test, which is collecting and analyzing data concurrently to form a mutual interaction between what is known and what one needs to know. To meet this requirement, the data collection of the study is conducted intensively within one month period. With this pacing, it is to ensure that the data and analysis attain and sustain reliability and validity as Morse et al. (2002) suggest.

5.3 Suggestion for Future Research

The study is conducted on qualitative basis and analyzed one newly formed ecosystem in Finland. However since the ecosystem is only at the birth stage, the information can be obtained is relatively basic, and is not able to show the full path of the emergence of ecosystem, especially for Kim et al. (2010)’s short to long-term perspectives.
For further study, it is necessary to bring the findings and propositions of the study to a quantitative scale, specifically for the key elements critical for an ecosystem to emerge and evolve. This is to avoid the bias that these elements are only applicable for certain scenarios or cases, and lack of the capability for generalization.

The second area that is worth further research is the new proposition regarding the constant evolution of the ecosystem that this research brings forward. For example, it is necessary to identify the best practices for a company or ecosystem to adopt in the process of variation creation and selection engagement. It is important to note that the proposition suggested in this study is not only based on pure assumption and literature research, but also can be examined through empirical data, so that the new proposition can practically benefit the business practitioners to cope with the constantly changing business environment.

The third area that needs further clarification is the evolution cycle. The current study addressed more on variation and selection, while conventional wisdom and theories often considers retention as one key element of evolution cycle, such as Van de Ven and Poole (1995)’s Evolutionary Process Theory. However, due to the limited evidence on the significance of retention in evolution process, the findings and propositions of this study are based mainly on the variation and selection. Further exploration of retention’s role in the evolution of ecosystem is indispensable to identify whether the variation and selection processes are sufficient to complete the evolution of business ecosystem.
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