Value appropriation in business ecosystems
a case study of High Tech Campus Eindhoven

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Value Appropriation in Business Ecosystems: A case study of High Tech Campus Eindhoven

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Abstract

Nowadays, many R&D-driven companies are increasingly located in business ecosystems. It is commonly believed that firms can innovate faster, better, and cheaper by joining a business ecosystem. Previous studies have shown the value creation process in a business ecosystem; yet, little research focuses on the value appropriation/capture aspect of business ecosystems. This master thesis investigates the value appropriation process from the perspective of the residents of a business ecosystem and the ecosystem managers. The aim of this master thesis is to develop a well-grounded understanding of value appropriation processes in the High Tech Campus Eindhoven. In particular, we investigate, which mechanisms are employed by the campus residents to appropriate value, which factors affect the value appropriation process of the campus residents, and how the campus site management facilitate value appropriation by its residents. The resulting insights are drawn from multiple case studies, and literature on business ecosystems and value appropriation. The findings extend the existing literature on business ecosystems, and serve as a starting point for further development and improvement of strategic management of science parks and business ecosystems.
Executive Summary

Due to the high uncertainty surrounding leading edge technology and the considerable costs of most R&D projects, companies can no longer afford to follow an independent strategy for all their innovation projects (Chesbrough, 2003; Hagedoorn, 2002). As a result, R&D-driven companies are increasingly joining forces in so-called business ecosystems. A business ecosystem involves a large number of loosely interconnected participants that collaborate to create value for the customers and they are typically located close to each other (Camarinha-Matos & Afsarmanesh, 2006). In this study, a business ecosystem is defined as a complex set of economic communities sharing similar interest to generate new innovations or technologies that can help to solve social problems and challenges. This community consists of interdependent and diverse members who are mostly co-located in a geographical hotspot characterized by a close connection between customers, research institutes, and other stakeholders. These members interact, collaborate, as well as compete with each other in order to produce and share values together.

Previous studies have shown that, by joining a business ecosystem, a firm will be able to improve its value creation process and accelerate its innovation process (e.g. Adner & Kapoor, 2010; Ben Letaifa, 2014; Ritala, Agouridas, Assimakopoulos, & Gies, 2013; Van der Borgh, Cloodt, & Romme, 2012). Nevertheless, it remains unclear how exactly the residents of a business ecosystem benefit from their presence in the ecosystem and how the residents of such ecosystem appropriate/capture the value created within the ecosystem. Quite often it is implicitly assumed that value appropriation in business ecosystems is an automatic consequence of value creation. In fact, value creation and value appropriation do not have to be related to each other since firms can create value without capturing any of it (Lepak, Smith, & Taylor, 2007). Although previous studies have shown the importance of a balance between value creation and value appropriation for the survival of the business ecosystems, little research has been conducted on the topic of value appropriation in business ecosystems. This study is one of the first research projects that focuses on the value appropriation process from the perspectives of the residents of a business ecosystem and the ecosystem managers.

Aim of the study

This study is the result of my master thesis project, which aims to understand the value appropriation process in a business ecosystem. This study was conducted in High Tech Campus Eindhoven (HTCE). The HTCE is renowned as one of the business ecosystems that has deliberately adopted and further developed the open innovation approach (Chesbrough, 2003). The campus is renowned for its success in developing open innovation ecosystem in which the residents are fostered to share knowledge, expertise, and R&D facilities to accelerate technological and product development. Furthermore, the HTCE has been recognized as the "smartest square kilometer in Europe" by Fortune magazine. At the time of data collection, the campus of 103 ha has hosted over 135 companies and over 10.000 highly-skilled people from more than 85 nations. With the motto of ‘Turning Technology into Business’, the campus promotes the growing trend to keep evolving to be a major technology center with global reputation. To realize this, it is very important for the Campus Site Management to ensure that the residents are not only creating value together but also capturing a fair proportion
of it. As such, a comprehensive study in the value appropriation process in HTCE will provide insights for the campus management to further facilitate the value appropriation of the residents.

The main objective of this study is to understand how the residents of a business ecosystem (cf. HTCE) can appropriate/capture the value that is created in the business ecosystem. The main research question was addressed by answering three sub-research questions:

(i) Which factors affect the value appropriation process of the HTCE residents?
(ii) Which mechanisms do the residents employ to realize value appropriation in HTCE?
(iii) How do the ecosystem managers (cf. Campus management team) facilitate the value appropriation process at HTCE?

Due to the complex nature of the business ecosystems and the limited knowledge available on the topic of value appropriation in business ecosystems, an exploratory research approach was chosen to address the research questions. Furthermore, an empirical analysis was conducted based on multiple case study analysis. This research is focused on technology-based Startups or SMEs with employees < 50 and that has been situated in the HTCE at least for a year. As a result, four startup companies were chosen as the objects of the case studies. Prior to that, an extensive literature review was conducted. The literature review provided preliminary insights of the topic and the direction of the research and served as a theoretical guidance. Also, based on the literature review, a conceptual model was developed. The model was an aggregation of the pool of theoretical factors that influence value appropriation processes in the business ecosystems. Furthermore, the data and evidence were collected from multiple sources, namely: semi-structured interviews, observations, and archival data.

Results & Findings

As the first finding, the data analysis revealed that the HTCE’s reputation, the campus’ network of partners, and the campus’ open culture are the three most important sources for the residents’ value appropriation. First, the good reputation of the campus has leveraged the credibility of the residents of the case studies; thereby, it helps them to attract investors, potential customers, and skilled personnels (overcome the liability of newness). Moreover, it was found that a positive reputation helps the firms to build a new or maintain existing customer relationships; hence, it supports the technology commercialization. Second, the HTCE’s network of partners was found to effectively support the residents to gain the complementary assets required for commercialization. The huge network of the HTCE’s partners, which consists of investors, suppliers, manufacturers, and customers, provides an ample opportunity for the residents to source for partners who can complement their innovation efforts globally. Third, the case studies showed that the open innovation culture of the campus was beneficial in establishing partnerships and developing a high level of trust among members. Furthermore, the networking aspects offered by the Campus Site Management (CSM), including networking events and Campus Business Club, supports companies to develop informal networks and a strong sense of community.

Interestingly, the case studies showed that the innovation stage of the companies might influence the perceived importance of value appropriation sources. For example, firms that are in the development phase might not reward the ecosystem reputation and the campus networks as high as other firms
which are already in the commercialization phase. In the development phase, the value creation becomes the top priority of the firm. As such, technical facilities might be valued higher than other (social) facilities. In contrast, when firms move forward to the commercialization phase, the complementarities including the ecosystem’s reputation and network become highly valued. The Figure below illustrates this phenomenon.

In addition, this study proposed four factors that might directly influence the value appropriation process of the HTCE residents. As predicted, the firm’s technological capabilities, access to complementary assets, and appropriation mechanisms were the main factors that may have a direct influence on the firms’ ability to appropriate value of the business ecosystem. Furthermore, it was found that firm’s business model has an important role in determining the firm’s ability to appropriate value from its innovations. Unexpectedly, the firm’s bargaining power did not play a role in the firm’s value appropriation. The respondents of the case studies did not experience bargaining power asymmetry, even with the bigger partners. Hence, it is rather unclear what the role of bargaining power was in influencing the ability of the firm’s to secure a fair amount of value from the collaborations. Additionally, the firms’ engagement in the community was found to indirectly influence the firm’s appropriation capability. Firms which are highly involved in the campus community and participated in the networking events held by the campus management, gain a relatively higher chance to find complementary partners that will support the commercialization process. Also, by actively involved in the campus community firms might be able to establish a high level of trust among members; thus opportunistic behaviors could be prevented.

As the next findings, it was found that the residents employed both tangible and intangible mechanisms together. In general, there was no a single mechanism that can fully prevent imitation and partners’ opportunistic behaviors. Most of the companies used contractual agreements and patents as the tangible mechanisms and trust-based relationship as the intangible one. Contractual agreements were used to state explicitly the goals and objectives of each party and to prevent disputes in case of disagreements. On the other hand, trust was essential to build a good relationship
with the partners during collaborations and to reduce the possibility of opportunistic behaviors. Furthermore, the relationship between tangible mechanisms and intangible mechanisms was complementary rather than substituting. The relation of contract and trust might reinforce each other. A sufficient level of trust is required before signing a contract. On the other hand, the presence of a contract might also increase the trust and confidence of the partners. In addition, most of the companies preferred to patent their technologies. However, patents might not be effective for every technology and industry. When IPR was considered less effective, firms might shift to intangible mechanisms such as secrecy and lead time advantage. In general, our findings indicate that firms need to have an appropriate mix of tangible & intangible mechanisms to effectively capture value in the business ecosystem, since neither of them alone is sufficient.

Lastly, this study has shown the essential role of the campus site management in supporting value appropriation of the startups residents in the HTCE. We argued that the ecosystem managers enable value appropriation through two mechanisms. First, at the firm level, the ecosystem managers support the firms’ value appropriation by facilitating the later stage innovation process of individual companies. These supports including (1) Offer of a flexible, yet representative, workplace; (2) provide mentorship and consultancy; and (3) give access to multinationals and research institutes. Second, the ecosystem managers enable the firms’ value appropriation by developing a supportive climate based on an open innovation culture. This was achieved by (1) maintaining a positive reputation of the campus, (2) establishing networks of partners, which covers the complete R&D value chain, (3) nurturing an open innovation culture through various networking aspects. The Figure below illustrate the two patterns of value appropriation.
Insights & Implications for the HTCE Campus Site Management

The most important requirements for the CSM that were uncovered during the analysis are presented as follows. First, in order to be the best place to “turn technology into business” in Europe, the CSM needs to keep attracting high-tech startups and SMEs, while maintaining the health of the current residents by ensuring that they can profit from the ecosystem. In the future, ensuring the balance between value creation and value appropriation in the campus might be a challenge for the campus site management. This study provides insights for the campus site management, especially to support the value appropriation of the residents.

Second, the CSM should maintain the current level of the campus’ reputation. The study showed that the reputation of the campus is essential for the startups because it improves their credibility in attracting customers and partners, due to the positive association. However, our data suggest that the HTCE is well known for local businesses in the Netherlands but less known globally. Therefore, the CSM should increase the global image of the campus by promoting itself via international media and publishing (e.g. startup magazines, technology blogs, etc.); and participating in international conferences and exhibitions. Also, it is good for the CSM to engage with organizations which publish entrepreneurship or innovation indexes, such as Intelligent Community Forum (ICF), Bloomberg Innovation Index, etc. By being listed in one of the entrepreneurship or innovation indexes, the campus will get international exposures which might increase the global reputation of the campus.

Next to that, the CSM needs to retain its focus on attracting startups and SMEs. As the first step, the CSM could encourage the alumni of Startupbootcamp to reside at the campus after they graduated from the program. To date, most of the startups choose other places to grow such as Strijp-S or TU/e Science Park. Therefore, the campus should create more dedicated infrastructures (permanent or flexible offices) for startups with competitive rents.

Third, the CSM should foster more collaborations between multinational companies and startups in the campus and strengthen the interdependent links amongst residents. The case studies indicated that most of the respondents appreciate networking events and other network initiatives such as Campus Business Club, held by the CSM. However, our data suggest that these initiatives rarely result in real collaborations. One approach that can be done by the CSM to increase joint projects between residents is to develop an online platform where the residents, especially multinationals, can share their projects and invite others to participate in. For example, the CSM can utilize the existing online community (MyTechCampus.nl) owned by the campus as a place where the residents can share collaborative projects or other partnership opportunities. Finally, the CSM should be aware of the problems that may arise with the splitting of Philips. The splitting of Philips might increase the coordination complexity since the CSM should align two (or even more) different companies with different focuses and concerns. Moreover, our finding indicated that the re-organization of Philips might influence the shared facilities provided by the HTCE. To anticipate this, the CSM should encourage other multinationals and research institutes in the campus to open their research facilities for other residents. As such, the CSM can ensure that a sufficient number of shared facilities are available in the campus.
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List of Abbreviation

BOM : Brabantse Ontwikkelings Maatschappij
CBC : Campus Business Club
CEO : Chief Executive Officer
CSM : Campus Site Management
EMC : Electromagnetic Compatibility
EWD : Electrowetting Display
HCL : Human Centric Lighting
HTCE : High Tech Campus Eindhoven
IPR : Intellectual Property Right
NDA : Non-Disclosure Agreement
NRE : Non Recurring Engineering
PINS : Phillips Innovation Service
R&D : Research and Development
SME(s) : Small and Medium-sized Enterprise(s)
TU/e : Eindhoven University of Technology
Chapter 1: Introduction

Chapter 2: Project Environment
1. Introduction

This chapter provides an overview of the rationale of this study. The chapter begins with the background of the research. The next part explains the definition of the project and the research questions that will be addressed in this research. The end of the chapter gives an overview of the structure of the report.

1.1 Research Background

In a complex and uncertain high tech-environment, firms cannot successfully pursue research and development (R&D) and innovation activities solely in-house, due to the increasing cost of R&D combined with a shortening of products and technologies life cycle, and the dispersed nature of innovation itself (Chesbrough, 2003). As a result, firms are increasingly becoming more interdependent and shifting their focus from a standing alone strategy into ecosystem (Iansiti & Levien, 2004b; Adner, 2006). A growing number of technology-based firms therefore organizing themselves in a business ecosystem (Clarysse, Wright, Bruneel, & Mahajan, 2014; Van der Borgh et al., 2012). A business ecosystem involves a large number of loosely interconnected participants that collaborate to create value for customers and typically located close to each other (Camarinha-Matos & Afsarmanesh, 2006). In other words, a business ecosystem can be considered as a group of companies that simultaneously create value by uniting their skills and assets (Clarysse et al., 2014). Previous research have acknowledged the role of business ecosystems in supporting value creation of its residents (e.g. Adner & Kapoor, 2010; Ben Letaifa, 2014; Van der Borgh et al., 2012; Ritala, Agouridas, Assimakopoulos, & Gies, 2013). In business ecosystems, firms’ value creation increases through the enhanced opportunities to get access to the shared resources and shared facilities provided by the ecosystem management. Also, the firms’ value creation increases by the improved possibility to collaborate with other fellow residents with similar and complementary innovation process. In addition, the collaboration among residents also brings synergistic value creation effects at the ecosystem level (Van der Borgh et al., 2012). In essence, business ecosystems allow firms to create value that a single firm could not have created alone (Adner, 2006).

However, to date, it remains unclear whether firms residing in business ecosystems can also appropriate value that created in the ecosystem. Quite often it is implicitly assumed that value appropriation in business ecosystems is the automatic consequence of value creation. In fact, value creation and value appropriation do not have to be related since firms can create value without capturing any of it (Lepak, Smith, & Taylor, 2007). Value appropriation is essential for firms’ survival since firms that are able to attain a greater proportion of the value captured by the ecosystem are able to continually invest in advanced technologies and resources (Ellegaard, Geersbro, & Medlin, 2009). Moreover, previous studies (e.g. Ben Letaifa, 2014; Pitelis, 2012; Ritala et al., 2014) have shown that a balance between value creation and value appropriation is essential for business ecosystems survival. Therefore, the ecosystem managers should not only encourage members to collaborate and increase the total value created, but also they need to orchestrate the ecosystem to make sure that the members also capture a significant proportion of the aggregate value created within the ecosystem (Vanhaverbeke & Cloodt, 2006).
Little research has been conducted in the context of value appropriation in business ecosystems. Furthermore, most of the current literature investigate value appropriation in business ecosystems from the leading actor (focal firm) perspective. In fact, niche players such as SME and Startup companies make up the largest mass of business ecosystems (Iansiti & Levien, 2004b). Nevertheless, hardly any previous research has investigated value appropriation from their perspective. Therefore, how startup companies capture the value of the ecosystem to support technology commercialization and firms’ growth remained questionable. As such, it is worthwhile to investigate value appropriation from the residents (startups & SMEs) and the ecosystem managers’ perspectives.

1.2 Project Definition
This master thesis project is the first phase of my PhD research about value creation and value appropriation processes in business ecosystems. The study was conducted in High Tech Campus Eindhoven (HTCE), one of the fast growing business ecosystems in the Netherlands. To date, there is no direct problem related to the commercial activities in HTCE. However, the campus is in the growing trend to keep evolving to become a major technology center with a global reputation. The HTCE’s management planned to grow the campus by increasing the number of high-tech companies, especially in the field of Health, Energy, and Smart Environments. One of the most important target groups are the techno-starters (e.g. Spin-offs, startups) and growing companies (SMEs). The marketing & communication director of campus site management pointed out that attracting more startups and SMEs is part of the HTCE’s growth strategy. HTCE strives to build an attractive climate for the starters by introducing a ‘plug & play’ environment. For example, HTCE offers flexible offices that provide state of the art test research & testing facilities for startups with flexible rental contract. Furthermore, with a tagline “Standing on the Shoulders of Giants”, HTCE facilitates the startups and SMEs to collaborate with multinationals (e.g. Philips, NXP, ASML, etc.) as well as leading research institutes (e.g. Holst Center, Solliance, TU/e, etc.) to accelerate collaboration and innovation. In fact, according to the HTCE residents’ survey 2014, over 85% of the companies collaborated and worked together with their fellow residents to generate new technologies and innovations.

To accomplish HTCE’s premise of ‘Turning Technology into Business’ it is very important to ensure that the residents are not only creating value together but also capturing a fair proportion of it. As mentioned before, it is essential for a firm to appropriate value from its innovation to keep surviving. In the case of HTCE’s residents, a previous study indicated that the office space and other facilities at the HTCE were too expensive for some residents (Van der Borgh et al., 2012). Every year, startups and SMEs perform a cost/benefit analysis to determine whether to continue staying at HTCE or not. Furthermore, the profitability of startups or SMEs may suffer when they collaborate with partners of larger size (multinationals) since they cannot capture a fair proportion of the value created due to bargaining power asymmetry (Lu & Beamish, 2006). As such, Startups/SMEs have to make sure that their presence in the HTCE and their collaborations with other residents will bring benefit and profit in the short and long term. On the other hand, the CSM should ensure that the ecosystem can facilitate and support value appropriation process in the ecosystem. Therefore, it is very important for the residents and the campus site management to understand the value appropriation process in HTCE and the role of campus management in facilitating value appropriation of the residents.
This graduation study was conducted to gain more understanding concerning value appropriation in business ecosystems (e.g. HTCE). The goal of this study is twofold. At academic level, the study aims at contribute to the scientific literature on business ecosystems, particularly in the value appropriation process of the residents of business ecosystems. The practical goal of the project is to develop recommendations for the CSM to manage value appropriation of the residents.

1.3 Research Questions
According to the project definition, the main focus of this research is to understand the value appropriation process of the residents in a business ecosystem. Therefore, the following general research question can be formulated:

How do the residents of a business ecosystem appropriate/capture value created in this ecosystem?

In order to answer the main research question and explore more insights on value appropriation in a business ecosystem, several sub-questions were developed. The sub-questions were based on the literature on business ecosystems and inter-organizational value appropriation. The literature suggests several factors that might influence the firm’s value appropriation (e.g. bargaining power and appropriation mechanisms). However, from the current literature, it is still not clear which factors are the most influential to value appropriation, and neither is it clear which mechanisms do the residents employ to realize value appropriation in the business ecosystem. Furthermore, it is not clear how the ecosystem managers can influence and facilitate the value appropriation process of its residents. Based on that, three sub-research questions were addressed in this research:

i. Which factors affect the value appropriation process of the HTCE residents? (e.g. Firm’s bargaining power, appropriation strategies)

ii. Which mechanisms do the residents (Startups or SMEs) employ to realize value appropriation in HTCE? (e.g. Tangible or Intangible)

iii. How do the ecosystem managers (cf. Campus management team) facilitate the value appropriation process at HTCE?

1.4 Research Model
A research model was developed as a guide of this research. As depicted in Figure 1, the research model provides a global overview of the different steps that must be executed to fulfill the research’s goals. The fourth elements on the left hand side of the research model represent the various sources of information which were drawn from literature (top two fields) and from the case study (bottom two fields). Based on the literature on business ecosystems and value appropriation, a conceptual framework was developed. Prior to that, more than sixty scientific publications, reports, articles, and working papers were reviewed. From the literature review, preliminary insights about the concept of business ecosystems and value appropriation process were obtained, in which became the basis for the formulation of the conceptual framework. The conceptual framework acted as a boundary object and served as a guidance of the research. Furthermore, the empirical analysis was conducted to reveal the value appropriation process of the HTCE’s residents. The empirical analysis was based on multiple case studies approach which was qualitative and exploratory. Specifically, the organizational data and the data gathered from the interview were the main source of the information for the empirical analysis. As the next step, the findings from the empirical analysis were
compared and analyzed with the existing knowledge of the literature review. Then, a comprehensive analysis was conducted to develop the theoretical propositions as well as the managerial implications which drawn from both theoretical and empirical evidence. Finally, the study were concluded with possible theoretical insights on business ecosystem literature as well as managerial implications for both HTCE’s residents and site management.

Figure 1: Research Model

1.5 Report Structure
The report consists of five sections which are consistent with the phase conducted during the research: orientation, theoretical background, conceptual framework & methodology, empirical analysis, and conclusion (see Figure 2).

Figure 2: Report Structure
The first two chapters discuss the research orientation. The first chapter provides descriptions of the project and the second chapter describes the environment of the study. Accordingly, the theoretical background consists of two chapters. Chapter three discusses the concept of business ecosystems, including the definition, firms’ roles & strategies in business ecosystems, and its challenges. In addition, chapter four discusses the theories about value creation and appropriation in the business ecosystem. Moreover, the conceptual model & methodology section provides explanations of the conceptual model (chapter five) and research methodology (chapter six). Then, the empirical analysis section presents an analysis of strategy and policies regarding how HTCE supports its residents’ growth as well as the empirical results of the case studies, which is written down in chapter seven and eight. Finally, chapter nine presents the conclusions and recommendations of the study. Theoretical propositions, managerial implications, answers to research questions, limitations, and future research directions are discussed in this chapter.
2. Project Environment

This chapter describes the project environment and the research setting. The first part describes High Tech Campus Eindhoven (HTCE), a business ecosystem that becomes the object of this study. The second part focuses on the HTCE management team that is responsible in managing day-to-day operations and the overall development of the campus.

2.1 High Tech Campus Eindhoven (HTCE)

High Tech Campus Eindhoven (HTCE) is a business ecosystem that serves as the object of this study. HTCE is a campus with a unique mix of multinational companies, leading research institutes, fast growth enterprises, high-tech startups, and service companies. The campus is situated at the heart of the Brainport region Eindhoven which it is renowned for its high concentration of high-tech and knowledge-intensive industries. Nearly 50% of the total Dutch expenses on research and developments are spent in this region. The region also hosts global technology players (e.g., Philips, ABB, ASML, NXP) and a reputable technical university (TU Eindhoven). Moreover, according to the International Association of Science Parks, the HTCE belongs to the 17% of largest science parks worldwide based on the number of occupants. The campus is renowned for its success in developing an open innovation ecosystem in which the residents are fostered to share knowledge, expertise, and R&D facilities to accelerate technological and product development. The HTCE has been recognized as the “smartest square kilometer in Europe” by Fortune magazine and has been given the titled of “campus of national significance” by the Dutch ministry of economic affairs. At the time of the data collection, the campus of 103 ha hosted over 135 companies, which 60 of them are startups, and over 10,000 highly-skilled people from more than 85 nations. Approximately, four patent applications are created every day by the campus residents, which contribute to over 40% of Dutch patent applications. The main goals of the campus are to help companies to accelerate their innovation by offering easy access to high tech facilities, expertise, and international networks.

The development of the campus began in 1998 when Royal Philips decided to co-locate their R&D facilities into a single location for all its national R&D activities. The concentration of high-end knowledge and facilities has attracted non-Philips companies to establish their R&D activities on the campus site. Following this trend, in 2006 Philips decided to open the campus entirely to other technological companies and institutes with the goal to create a perfect open innovation ecosystem. Since then, governments, knowledge institutes, and businesses have been working together at the campus to generate innovations. Later in 2012, the HTCE was acquired by Chalet Group, a Dutch consortium of private investors, which makes the campus independently owned and operated. Philips resignation as the owner of HTCE and as a site manager creates space for further growth that makes HTCE become an independent hot spot for the global high-tech market.

Currently, the HTCE provides technical facilities and supports for its residents. Collaborating with Philips Innovation Services (PIS), the campus offers a wide range of technological facilities and services such as EMC test center, Reliability test center, Material analysis lab, and Instrumental Rental. In total, there are 45,000 m² R&D facilities, lab, and clean rooms, plus a 35,000m² of pilot factories that are shared amongst the residents. Moreover, the campus residents can get access to a

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The overview of HTCE mainly drew from HTCE’s brochures and website: [http://www.hightechcampus.com/](http://www.hightechcampus.com/)
large number of technical specialists and collaborate with them through open research programs conducted by several technology institutes, including Holst Center, Solland, EIT ICT Labs, and many more.

In addition to state-of-the-art technical facilities, the campus also offers social facilities such as sports facilities, child care facilities, restaurants, and shops. One of the beating-heart buildings of the campus is The Strip. The strip is a 400-meter-long building that houses restaurants, shops, wellness center, and conference center. The strip has been designed to be a central meeting point for all campus residents and visitors with the objective to stimulate communications and connections. Moreover, The Strip hosts around 200 events per year including technical conferences, business events, and network meetings.

The campus offers 185,000 m² office space for SME’s, institutes, and multinationals. In addition, there are two dedicated buildings (Béta & Mu) with a total area of 10,000 m² reserved for startups. The Béta building is dedicated for later stage hardware technology startups and company spin-offs, while the Mu building is intended for startups in the fields of life-tech and new energy. Furthermore, the campus hosts Startupbootcamp HightechXL, a consortium of global accelerator networks for high-tech startups. The HTCE has an attractive climate for startups in which they are supported by the ecosystem and its reputation that enable them to attract partners and investors. As a result, the campus has become the birthplace of several innovative startups and spin-offs companies. By 2020, the HTCE’s management team has planned to grow the campus to host about 140 companies with 12,000 employees, in which half of them are startups.

2.2 **HTCE Campus Site Management (CSM)**

Campus Site Management (CSM) is a management team of High Tech Campus Eindhoven² (see Figure 3 for the CSM organization structure) who responsible in managing day-to-day operations of the campus and maintaining the wealth of campus’ residents by promoting open innovation ecosystem. Bert-Jan Woertman, the Manager marketing & communication, analogizes High Tech Campus Eindhoven as a Hot Pot with the best ingredients in it and ready to be cooked into a special dish, while the CSM can be analogized as a chef who has to choose and put the best mix of ingredients in the hot-pot and stir the whole ingredients and spices until it is perfectly cooked. From this analogy, it can be concluded that the CSM always strives to create the best mix of the firms in the campus (e.g. Multinationals, Techno-starters, SME, knowledge institute, service companies) and establishing a collaborative and open culture in order to foster innovation in the ecosystem.

According to the CSM Marketing Plan 2014, the CSM has a straightforward mission: “HTCE as the best location to turn technology into a successful business”. Its particular objectives are to grow the business by further developing the open innovation ecosystem, the state of the art technical facilities, and business services, and increasing the number of high tech companies in the areas of health, energy, and smart environments. Furthermore, the HTCE offers five value propositions to attract companies/residents: (1) open innovation culture; (2) high proximity of companies & facilities; (3)

² The overview of CSM mainly drew from HTCE CSM Marketing & Communication Plan 2014 and HTCE’s brochure
international and highly educated community of technical professionals; (4) dynamic and sustainable work environment; and (5) Cost efficient R&D through facilities sharing.

The campus has positioned itself as a technology-based ecosystem with the focus on idea conversion and innovation adoption. To realize this, the campus management encourages the residents to leverage the power of collaboration by connecting them with suppliers and companies in complementary businesses and stimulate faster adoption rate of innovation. The CSM has an essential role in promoting collaboration and networking among residents. The CSM offers networks to grow by organizing a large number of technical, business, and social activities. Formal events such as Campus Technology Seminars as well as informal events (e.g. Second Friday Drinks & Campus Business Club) are organized to promote networking. Furthermore, all these events attract speakers and visitors around the world; thus, the residents can develop both personal and professional networks with experts around the world. These collaborations and networks transform the campus into a ‘networked community’. Moreover, the CSM also promotes the residents’ engagement with the community using both offline & online channels, for instance by organizing sports and social events, introducing a loyalty program for campus employees, and active use of online platform (mytechcampus.nl) and social media (Twitter & LinkedIn). In conclusion, the CSM can be seen as a ‘conductor’ who orchestrate the business ecosystem (HTCE) by promoting collaboration and an open innovation culture to generate innovation and turning technology into business.
Theoretical Background

Chapter 3: The concept of Business Ecosystems
Chapter 4: Value Creation and Value Appropriation in Business Ecosystems
3. The Concept of Business Ecosystems

In this chapter, a literature background of the business ecosystem is discussed. Specifically, the important concept of business ecosystems, its definition, the firms’ role & strategies in business ecosystems, and the firms’ motivation to join a business ecosystem are discussed.

3.1 An Introduction to the Concept of Innovation & Ecosystem

Nowadays, with the ever-growing rivalry in the market, firms need to innovate in order to stay ahead of competitors. Firms strive to continuously improve their research and development (R&D) capabilities to be able to generate innovations. Innovations are often described as new ideas, methods, solutions, and improvements that are implemented into a meaningful and useful outcome. In other words, innovation is a combination of invention and market introduction. As such, not all inventions and creative ideas can be considered as innovations, only if they produce economic value in the marketplace (Byers, 2011). Innovations are seen as a main engine of firms and nations to create value and enhance competitive advantages (Porter, 1985). As mentioned earlier, firms perform R&D activities in order to generate innovative products or services that may allow them to establish a high market position. R&D activities become the backbone of the companies’ successful innovations; thus, companies develop their own R&D capabilities in order to excel in the market. Until the late 20th century, companies tend to develop innovation and technology in isolation on a stand-alone basis (Chesbrough, 2003). However, due to the increasing cost of R&D combined with a shortening of products and technology’s life cycle, and the dispersed nature of innovation itself, it is almost impossible to successfully pursue R&D and innovation activities solely in-house (Chesbrough, Vanhaverbeke, & West, 2008). Furthermore, companies can no longer afford to follow an independent strategy for all their innovation projects due to the high uncertainty and complexity of the high-tech environment and the substantial costs of R&D projects (Chesbrough, 2003; Cloodt, Hagedoorn, & Roijakkers, 2006; Hagedoorn, 2002). As a result, companies are increasingly becoming more interdependent and shifting their focus from standing alone strategy into an ecosystem strategy (Iansiti, 2005).

The term of ‘ecosystem’ in the context of innovations and the inter-organizational relationship was inspired by the concept of ecosystem in nature (Iansiti & Levien, 2004a; Jackson, 2011). In a biological sense, an ecosystem describes as a complex system consists of all living organisms and its physical environments that functioning together to maintain an equilibrium sustaining state (Jackson, 2011). The equilibrium state is a stable set of conditions that can be described by nutrient exchanges that enable both living organisms and its environments to benefit from the relations (Jackson, 2011). Analogous with individual species in a biological ecosystem, in the context of inter-organizational relation, each member (organization) shares the fate of the network as a whole, irrespective of that member’s apparent strength (Iansiti, 2005; Iansiti & Levien, 2004a). In this context, each member is a fully participating agent that influences and also influenced by the social ecosystem which consists of all related business, such as material resources (e.g. Equipment, facilities, funds), human capital (e.g. Faculty, researchers, managers), institutions (e.g. Universities, venture capital, research institutions), customer, suppliers, as well as economic, cultural, and legal institutions (Jackson, 2011; Moore, 1993). Moreover, Iansiti and Levien (2004b) distinguished business ecosystems with the
biological ecosystems by pointing out three important characteristics that business ecosystems have while the biological ecosystems do not, namely: innovation, competition for members, and intelligent actors. Unlike business ecosystems, biological ecosystems are less concerned with innovation since they are not under pressure to grow and to satisfy new demands. Moreover, in business ecosystems firms are in a continuous competition for a member as they need to attract new customers and partners to grow. Furthermore, compared to the members of biological ecosystems, business ecosystems’ members consist of intelligent actors that capable of some degree of “forethought and planning” (Iansiti & Levien, 2004b). In addition, unlike biological ecosystems in which competition is always harmful for all involved species, in business ecosystems competition can be either beneficial or harmful to the organizations (Mars, Bronstein, & Lusch, 2012). Business ecosystems are characterized by a simultaneous cooperation and competition (coopetition), and interdependence among firms; thus, competition is regulated in ways such that it may take place in the interest of the greater good (Adner & Kapoor, 2010; Mars et al., 2012).

3.2 Defining Business Ecosystem

The concept of business ecosystems was first coined by James F. Moore in 1993. Moore (1993) defined business ecosystem as a condition where companies co-evolve their capabilities around a new innovation and technology in which they work cooperatively and competitively to support new products or services, in order to satisfy customer needs. Moore (1993) used the analogy of the business ecosystem to understand the dynamic of interconnected organizations by adopting the analogy of ‘predators and prey’. Furthermore, business researchers have been adopting the “business ecosystem” concept to study business relationship and strategic decision making in interconnected organizations (e.g. Adner, 2006; Iansiti & Levien, 2004a, 2004b).

However, despite the abundant literature on business/innovation ecosystem and inter-organizational relationship studies, there is no universal and adequate definition on what a business ecosystem actually is (Anggraeni, Hartigh, & Zegveld, 2007). To date, the concept of the business ecosystem does not seem has an inclusive definition yet. Some researchers have defined a business ecosystem as a constellation of organizations that create and appropriate value around a specific product or technology (e.g. Adner, 2006; Adner & Kapoor, 2010; Gawer & Cusumano, 2014). In contrast, others have defined an ecosystem as a community that bound by the geographic or thematic similarities in which the ecosystem’s members do not necessarily share a value offering (C. Pitelis, 2012; Van der Borgh et al., 2012). In this sense, a business ecosystem is characterized by a high level of physical proximity, as well as a high level of cognitive and social proximity (Frenken, 2010). The members of business ecosystems are co-located in a close physical proximity of each other. Furthermore, the residents have a high extent in sharing a code of communication, tacit knowledge, and experience among members (high cognitive proximity). Moreover, business ecosystems are considered to have a high extent of social proximity in which members in business ecosystems know and familiar with each other. Appendix A shows an overview of the business ecosystems definitions from various studies.

Despite the widely varying definition, in this research business ecosystem is considered: A complex set of economic communities sharing similar interest to generate new innovations or technologies that can help to solve social problems and challenges. This community consists of interdependent
and diverse members who are mostly co-located in a geographical hotspot characterized by a close connection between customers, research institutes, and other stakeholders. These members interact, collaborate, as well as compete with each other in order to produce and share values together.

### 3.3 Firm’s Motivations to Join a Business ecosystem

As mentioned in the previous section, the increase of complexity in high tech-environment and the rise of R&D cost force companies to open-up their innovation activities and collaborate with others (Chesbrough, 2003). Proximity is one of the characteristics of business ecosystem that considered as the key aspect that allow companies to collaborate and exchange tacit knowledge easily (Frenken, 2010). A high geographical proximity allows tacit knowledge easier to share since the actors of the innovation process are in relatively close to each other (Gust-Bardon, 2012). Furthermore, according to Frenken (2010), a geographical proximity facilitates frequent interactions that lead to the strengthening of trust between members. As a result, a growing number of companies organize themselves around the centers of knowledge in a geographical hot spot which result in the emerge of business ecosystems (Clarysse et al., 2014; Van der Borgh et al., 2012).

Van der Borgh et al. (2012) analyzed the motivation of companies to join a knowledge-based ecosystem. One of the most important reasons is to gain cross-industrial technical complementarities. Typically, an ecosystem has shared resources and facilities that relatively unique to other ecosystems. Thus, by joining to the ecosystem, companies can gain access to the resources and facilities that may do not exist elsewhere (Van der Borgh et al., 2012). Moreover, Companies can tap directly into the knowledge of other companies in the ecosystem with diverse products and services and create synergies. Synergies also enhance when the ecosystem successfully aligns the goals and the objectives of the participating companies and create a sense of being part of a “community” (Van der Borgh et al., 2012). When companies build synergies, basically they create value that exceed the value that created by a single company alone (Adner, 2006).

Another important motive arises from the economic perspectives. According to Van der Borgh et al. (2012), one of the key motivation to join an ecosystem is to increase efficiency and achieve economies of scale. By joining a business ecosystem, firms can reduce the transaction costs and coordinating cost (Van der Borgh et al., 2012). Moreover, by getting access to the shared facilities provided by business ecosystems, companies are able to exploit economies of scale. In addition, alliances among participants will accelerate the development of innovation in which they do not only share development, but also market uncertainty and technological risks (Adner & Kapoor, 2010). For example, by utilizing shared facilities and resources provided, companies can postpone out-of-pocket investment until the project is launched which result in the reduction of upfront costs (Traitler, Watzke, & Saguy, 2011). In addition, Pitelis (2012) argued that firms will only interest to join a cluster/ecosystem if the co-created value that they can capture by being part of a cluster is higher than the value they could have appropriated by standing alone.

The next incentive for entering a business ecosystem, according to Van der Borgh et al. (2012) is the perceive reputation of the business ecosystems. Reputation is strongly associated with the perceive advantages or disadvantages of the resources, facilities, and innovation process on a business ecosystem (Van der Borgh et al., 2012). As such, the reputation of the business ecosystem becomes
the main reference for potential entrants to join a business ecosystem. Companies tend to get a leverage on their brand reputation by joining a reputable ecosystem. Also, the ecosystem’s reputation will raise switching costs for the residents that encourage them to stay in the ecosystem (Van der Borgh et al., 2012).

To sum up, there are heterogeneous motives of an individual company to join a business ecosystem. First, to obtain cross-industrial technical complementarities. Second, to get access to the unique shared facilities and resources of the ecosystem. Third, to increase efficiency and economies of scale; and lastly, to get leverage from the ecosystem’s reputation.

3.4 Firm’s Roles and Strategies in Business Ecosystem

According to my definition of business ecosystems, business ecosystems consist of diverse members with certain roles. Companies can have different roles in a business ecosystem, as the different roles of organisms in the nature. Iansiti and Levien (2004a), adopted the concept of different roles of species in the nature in the context of business ecosystem. They identified three roles of the organizations in a business ecosystem: Keystone, Dominator, and Niche organizations. Companies can choose their role in an ecosystem, according to their objectives and capabilities (Iansiti & Levien, 2004a).

Keystone organizations in a business ecosystem play a critical role in ensuring the health of the ecosystem in general. They do not strive to proliferate and dominate the ecosystem, but content themselves by keeping the ecosystem in balance (Göthlich & Wenzek, 2004). Keystone firms have abundant core resources of an ecosystem, hence, they have a large effect on other members of the ecosystem as well as on the ecosystem as a whole. The keystone companies able to increase the ecosystem’s productivity by simplifying the complex task and making the creation of new products more efficient (Iansiti & Levien, 2004b). Moreover, they can contribute in developing network robustness by incorporating technological innovations and providing a point of reference that ensure participants to accurately respond to new and uncertain conditions. Also, they offer innovative technologies to diverse third-party organizations and invest in new fundamental infrastructure in order to encourage niche creation (Iansiti & Levien, 2004b). The role of keystone organization in the ecosystem is similar to the concept of hub firms in the innovation network. Similar with the keystone organizations, the hub firms occupy a central position in an innovation network and have a prominence and power to perform a leadership role in combining dispersed resources and capabilities of network members together (Dhanasai & Parkhe, 2006). According to Dhanasi & Parke (2006), hub firms are also responsible to perform a ‘network orchestration’, a set of deliberate and purposeful actions in order to create value and extract value in their marketplace. In conclusion, it can be said that both keystone organizations and hub firms are responsible for creating value within the ecosystem and sharing the value with other members in the ecosystem.

Contrary to the keystone organizations, dominators use their power and resources to exploit central position within an ecosystem to take over the ecosystem and drain value from it (Iansiti & Levien, 2004a). Dominators also contribute to shape the behavior of the ecosystem hubs; however, unlike, keystones, dominators progressively take over their ecosystem and damage the ecosystem health by reducing diversity, eliminating competition, limiting consumer choices, and stifling innovation.
In addition, Iansiti and Levien (2004a) classified dominator firms into two categories: physical dominator and value dominator. The aim of the physical dominator is to integrate, either vertically or horizontally, and to own and control a large proportion of ecosystem, although they are responsible for creating the value that they capture. On the other hand, value dominators create little value for the ecosystem, instead they extract value as much as they can until it leaves too little value to sustain the ecosystem (Iansiti & Levien, 2004a).

The last category, niche organizations, aims to develop specialized capabilities that distinguish them from other members in the ecosystem (Iansiti & Levien, 2004a). Generally, niche organizations occupied the largest proportion of the total population in business ecosystems. Niche organizations seem to have the least contribution and impact to the ecosystem; however, it does not always the case. A niche organization tends to focus on its narrow domain of expertise by leveraging complementary resources from other niches or keystones, which often result in breakthrough innovations (Iansiti & Levien, 2004a). When they are allowed to thrive, niche organizations will become responsible for most of the value creation and innovation in the ecosystem; therefore, niche organizations are essential for the health of an ecosystem (Iansiti & Levien, 2004b).

In the context of the HTCE as a business ecosystem, the analogy from Iansiti & Leiven (2004a) may be used to explain the roles of HTCE’s residents in the ecosystem. However, the dominator role is not relevant to the context of HTCE since there are no companies that only drain value from the ecosystem without creating any of it. As such, the roles of the residents of HTCE can be classified into three categories: Keystone, Niche, and Service-oriented companies. Multinationals such as Philips and NXP as well as leading research institutes, including Holst Center and Solliance can be considered keystone organizations. The multinationals and the research institutes contribute to the ecosystem by providing resources such as technical facilities and technological expertise. In addition, startups and SMEs can be categorized as niche organizations. The startups and SMEs in the HTCE focus on a specific domain of expertise and leverage the complementary resources provided by the keystone organizations and/or the ecosystem managers to create breakthrough innovations. Finally, a service-oriented company such as patent office, HRM agencies, and IT supports do not directly create value for the ecosystem; instead, they provide complementary supports to other companies in the ecosystem to create and capture value.

3.5 The Challenges in Business Ecosystems

From the previous section, it is safe to assume that participate in a business ecosystem is a good strategy for companies to access and exchange value, knowledge, resources, and benefits of others. However, along with the new opportunities, business ecosystems also present a new set of risks and challenges (Adner, 2006). According to Moore (1993), companies may face a dilemma from both cooperative and competitive challenges which related to the four evolutionary stages of a business ecosystem (birth, expansion, leadership, and self-renewal). These challenges including (Moore, 1993): (1) Working with customers and suppliers, or protect the ideas from others, and tie up critical lead customers, suppliers at the birth phase; (2) Bringing new offers to market by working collaboratively, or defeating similar ideas to make sure domination on the marketplace during expansion phase; (3) Providing a compelling vision to encourage collaborations for the future
improvements, or maintaining status quo and domination during the leadership phase; (4) Working with innovators, or maintaining high barriers to entry during the self-renewal phase.

In addition, Smith (2013) classified four risks that emerge when companies decided to participate in a business ecosystem. The first risk is general risks which related to the relationship among other actors in a business ecosystem. The horizontal relationships among companies, which relate to the co-existence, cooperation, co-opetition, and competition, might create a new challenge, especially if the relationship is weak and uncoordinated (Bengtsson & Kock, 1999). In addition, Adner (2006) argued that the relationships among participants in a business ecosystem may create new dependencies that can brutally derail a firm’s best efforts. He pointed out that dependencies can generate delay risks which will result in delay in time to market. Another risk might arises if the innovation plan of the ecosystem is absent. The absence of an innovation plan creates an uncoordinated partnership that may lead to the overall confusion in terms of what innovations that will be carried out together, who has control, and how can members profit from the collaboration, and what happens to intellectual property rights? (Corkill, 2007).

The second risk, according to Smith (2013) is keystone risks. Keystone risks are related to the decisions and actions of a keystone or core organization. For example, the keystone organization might change their products along the process; as a result, niche players who are not suit with the current products are forced to exit the ecosystem (Pierce, 2009). According to Pierce (2009), a market turbulence generated by the keystone firm’s decision can generate a huge financial loss for the niche companies in the business ecosystem. Furthermore, there is also a risk when a keystone attracts new actor that might present a threat to the existing companies. The third risk is a risk associated with the location of companies in the value chain. Adner and Kapoor (2010) revealed that the challenges are often situated not only within the focal firm itself but also in the focal firm’s ecosystem, especially in the upstream suppliers and downstream customers. The challenges from upstream suppliers arise when it constrains the focal firm’s ability to produce its product, while the challenges from downstream occur when customers constrain to derive full benefit from consuming the focal firm’s products (Adner & Kapoor, 2010). The last risks are related to the standard risks. These kinds or risks might occur when companies competing in a technology-standard. As a technology-standard emerges, companies need to build the best alliance with the competitors and all of the key actors; thus, companies might get exposure with free-rider risks and opportunistic behaviors (Calcei & M’Chirgui, 2012).

To sum up, although business ecosystems offer a lot of advantages to the participants, companies should be aware with the challenges and risks that present in business ecosystems. Companies might face dilemmas in the different evolutionary phase of business ecosystems. Furthermore, risks might arise from the horizontal relationships between participants in the ecosystem; the actions of keystone organizations; the companies location in the value chain; and the coalition with competitors as a result of the emerging of technology-standard.
4. Value Creation and Value Appropriation in Business Ecosystems

This chapter discusses related theories of value creation and value appropriation. First, the concept of value creation in business ecosystem is explained. Thereafter, the basic concept of value appropriation and the existing theories about the value appropriation and the dynamic of value creation & appropriation in business ecosystems are described.

4.1 Value Creation in Business Ecosystem

Value creation is the aim of every firm (Porter, 1985). According to Porter (1985), firms strive to create new values for the users/customers through the new or better ways of doing things, new products, new services, and new technologies. As such, innovations play a central role in the value creation of the firms (Porter, 1985). Innovations help firms to create products/services that are ‘valuable’ in the perspectives of customers/users (Lepak, Smith, & Taylor, 2007). However, the value itself is very subjective that depends on the perceived worthiness of customers which emerge because of the rarity, aesthetic appeal, and a perceived monetary satisfaction (Pitelis, 2009). A perceived worthiness itself can be realized through value added/value creation in terms of the improvement of efficiency, effectiveness, innovativeness that can lead to higher quality and lower price (Pitelis, 2009).

Due to the subjective and the context-specific nature of the value and value creation itself, Lepak et al. (2007) proposed that the process of value creation should be studied in three different levels of analysis: Individual, Organization, and Society. In the Individual context, value is created by developing novel and appropriate services, products, process, or other contributions that perceived to be valuable by the target users (Lepak et al., 2007). Furthermore, they argued that individual characteristics such as creativity, ability, intelligence, and motivation are the main sources of value creation in the individual level. In organizational level, the focal process of the value creation is on the issues related to the innovation, knowledge creation, invention, and organizational management (Lepak et al., 2007). As mentioned earlier, companies create value by introducing superior new products or services from their innovation process (Porter, 1985). Moreover, considering the dynamic capabilities of the companies, Teece et al. (1997) posited that companies “integrate, build, and reconfigure” their internal and external competencies to build advantages and create value. Additionally, Pitelis (2009) pointed out four determinants of value creation of the companies, namely: innovations, firm-infrastructures and strategies, economies of scales, and human resources.

On the other hand, value creation at the societal level is highly influenced by the level of entrepreneurship and macroeconomic conditions such as laws and regulations (Lepak et al., 2007). At this level, the value creation process refers to the programs and incentives which intended to encourage entrepreneurship and innovations into a society (Lepak et al., 2007). Therefore, it can be said that the government plays a critical role in inspiring innovation and entrepreneurship in a society to ensure the value creation at the societal level. Value creation in the societal and individual level are outside the scope of this research. In this research, we only focused on value appropriation in the firm and the ecosystem level (elaborates in the next section).
Compared with other levels of analysis (e.g. Individual companies, inter-organizational), the empirical studies of value creation are still not much explored at the ecosystem level. One of the few studies that investigated the value creation in business ecosystem is a research by Van der Borgh et al (2012). The authors argued that value creation at the ecosystem derives from the dynamics of single firms and from the ecosystem at large. Specifically, they proposed two distinct patterns of value creation (1) facilitation of innovation process, and (2) creation of innovation community. The first pattern focuses on the value for individual firms. In this respect, the focus of inter-organizational collaboration do not rests on the product offering, instead on the facilitation and support of the innovation process. On the other hand, the second pattern focuses on the leverage value of the ecosystem. In this case, the focus is on the value that brought forward by the synergistic effects at the ecosystem level (Van der Borgh et al., 2012).

Additionally, Van der Borgh et al. (2012) adopted a framework by Amit & Zott (2001) to describe value sources that enable value creation processes in business ecosystems. According to them, there are four value creation drivers of the ecosystem, namely: efficiency, complementarities, lock-in, and novelty (Van der Borgh et al., 2012). The detail explanation of each driver is discussed below.

Efficiency. Efficiency refers to the reduction of unit costs via the economies of scale/scope and the decrease of transaction costs (Amit & Zott, 2001). In the context of business ecosystems, economies of scale can be achieved by utilizing shared facilities. Moreover, reduction of the transaction costs accomplished by providing comprehensive and transparent information that reduces information asymmetry, coordinating costs, searching costs, and the risk of opportunistic behavior (Van der Borgh et al., 2012). Additionally, the proximity of a large pool of resources and skills provides an efficient environment for its residents (Van der Borgh et al., 2012).

Complementarities. Complementarities presents when a bundle of goods equally provides more value than the total value of each of the goods separately (Amit & Zott, 2001). In business ecosystems, a high physical proximity provided by the ecosystem allows companies to interact with other residents with complementary resources (Van der Borgh et al, 2012). Furthermore, the ecosystem managers can develop vertical and horizontal linkages between residents and provide a bundle of service to residents to encourage synergies (Van der Borgh et al., 2012). Additionally, the ecosystem’s reputation contribute to attracting new knowledge and resources from elsewhere; thereby, improved the opportunity to obtain complementary assets.

Lock-in. In the business ecosystem context, lock-in emerges when the members of an ecosystem are demotivated to leave and engaged in utilizing services provided by the ecosystem's management. Several lock-in mechanisms that operate within an ecosystem, including network externalities and switching cost. Moreover, by locking-in members in the ecosystems, it may improve the willingness to facilitate other members which may increase transaction volume (Van der Borgh et al, 2012).

Novelty. Novelty in the ecosystem can arise from the introduction of shared facilities, the stimulation of new ways of interaction and doing business, and the creation of new partnerships (Van der Borgh et al., 2012). Also, the ecosystem managers promotes innovation cultures, provide incubation facilities, and manage intellectual properties that may enhance the novelty of the ecosystem. In
addition, the ecosystem managers may act as a broker to support shared development of innovations by linking residents and non-residents (Van der Borgh et al., 2012).

In conclusion, value creation is a central concept in management to understand the organizational sustainable advantages (Pitelis, 2009). At the ecosystem level, a study by Van der Borgh et al. (2012) revealed two patterns of the value creation in business ecosystems: facilitation of innovation process and leveraging the value of the ecosystem. Furthermore, four drivers of value creation in business ecosystems are identified, namely: efficiency, complementary, lock-in, and novelty.

4.2 The Basic Concept of Value Appropriation

Besides creating value, another important aspect of the organization to achieve sustainable advantages is to capture/appropriate the value created. From a conceptual perspective, while value creation refers to the total net value created in collaborative activities, value appropriation refers to the total net value that an individual firm successfully claims from the collaboration (Lepak et al., 2007; Wagner, Eggert, & Lindemann, 2010). In addition, the firm’s value creation and value appropriation can be explained from the innovation process. Cooper (2008) described the innovation process from ideas to commercial products as “ideation, investigation, development, testing & validation, full production & market launch”. Moreover, over the period of translating an idea to a commercial product, there are four milestones that experienced by every successful product introduction, namely: (1) success in R&D (technology transfer); (2) success in the product launch; (3) success as a new product; and (4) success as a business (Osawa & Miyazaki, 2006). Figure 4 illustrates the typical innovation process of a firm. As can be seen in the Figure, the innovation process can be classified into two periods: (1) from R&D to technology transfer, to product launch, and (2) commercialization after product launch, through the success as a new product and success as a business. These two distinct periods reflect the different phase of value creation and value appropriation of a firm (Nobeoka, 2010). In this context, value creation refers to the phase where the aim of the firms is to develop and produce products/service with the excellent functionality or quality at the lowest possible costs. On the other hand, value appropriation refers to the commercialization phase in which the aim of the firms is to create economic value from the products/services created in order to get returns on their R&D investment (Nobeoka, 2010). In other words, value appropriation is the stage where a firm start profiting from its innovation, gain returns on their R&D investments, and surpass the “valley of death”.

In the inter-organizational setting, value appropriation is essential for firms’ survival since firms that are able to attain greater proportion of the innovations are able to continually invest in advanced technologies and resources (Ellegaard, Geersbro, & Medlin, 2009). However, firms have to compete to capture the value created since it can be divided by the involved parties (Lepak et al., 2007; Pitelis, 2009). Sometimes firms fail to get profit from its innovation. One of the famous examples is the case of EMI Ltd. EMI Ltd. Invented the first commercial CT scanner, but the companies did profit from such invention due to the lack business visions and fierce competition from its rival (General Electric).

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3 While the term value appropriation is used throughout this study, it is also labeled by other authors as value capture.
Also, the inventor of polio vaccine did not patent the vaccine in which he did not claim the profit from the invention (Mizik & Jacobson, 2003).

![Diagram of Value Creation & Value Appropriation]

*Figure 4: Value creation & value appropriation based on innovation process perspective (Adapted from Osawa & Miyazaki (2006))*

Several researchers have attempted to explain the determinants of value appropriation in the inter-organizational setting (e.g. Di Gregorio, 2013; Gulati & Wang, 2003; Lepak et al., 2007). Most of the research has centered on the bargaining power of the firms and the isolating mechanisms that firms employed to defend or guarantee their appropriation streams. In this research, isolating mechanisms are considered as appropriation strategy/mechanisms.

**Bargaining Power.** Researchers argue that firms' bargaining power determine how much value each party can capture in an inter-organizational relationship (e.g. Brandenburger & Stuart, 1996; Coff, 1999; Lepak et al., 2007). Firms with higher bargaining power have the ability to influence the 'bargaining set' and the outcomes of the negotiations (Lavie, 2007; Yan & Gray, 1994). Firm's bargaining power arises from many sources. In this research, we focused on two aspects that relevant to the context of this research. First, firms tend to increase their bargaining power if they have unique resource advantages such as scarce natural resources, technical abilities, and business infrastructures since they will make the other partners more dependent on them, thereby increase switching costs (Brandenburger & Stuart, 1996; Lepak et al., 2007; Yan & Gray, 1994). Second, firms may gain high bargaining power when they get better access to information, especially market/customer-related information (Coff, 1999; Di Gregorio, 2013). A better-informed firms can manage and control information flows and exploit entrepreneurial opportunities to achieve and maintain bargaining power (Burt, 1995).
Appropriation Mechanisms. In order to get profit from innovations, firms have to prevent others to imitate their R&D outcomes by employing appropriation mechanisms. Appropriation mechanisms creates a ‘barrier’ to prevent others to imitate. Isolating mechanisms, refer to any knowledge, physical, or legal barrier that are intended to prevent replication of the new innovations, products, or service by competitors (Lepak et al., 2007). An effective isolating mechanism will incentivize innovation by increasing the expectation that firms will be able to capture the value that they create (Teece, 1986). Appropriation mechanisms can be classified into two categories: tangible and intangible (Ritala et al., 2013). The tangible mechanisms refer to the formal means or contractual relationship in which the terms and conditions are explicitly stated and legal sanctions may be applied when violations occur. The examples of tangible mechanisms are Intellectual Property Right (IPR), contractual agreement, and common rules and guidelines. Intangible mechanisms refer to any non-contractual governance that affect the exchange value mechanism between partners (Lawson, Samson, & Roden, 2012a). Intangible mechanisms involve building trust and reputation among members and sharing common visions. In a collaborative setting, relational trust plays a key role to ensure the value to be effectively shared among partners (Wagner et al., 2010). Other intangible mechanisms that also considered effective for value appropriation are secrecy and lead time strategy. Secrecy involves protecting innovation by concealing technical information and technical know-how, while lead time is a type of informal mechanism that applied by entering the market before competitors (HanGyeol, Yanghon, Dongphil, & Chungwon, 2015). Furthermore, in this research a strategic alliance in the form of equity alliance (e.g. minority participation, joint ventures) is classified as a tangible mechanism. Equity alliances are classified as a non-contractual agreement that typically involve a financial investment in either the new firm or in the partner firm (Van de Vrande, Lemmens, & Vanhaverbeke, 2006). According to Hagedoorn and Narula (1996), firms involved in equity alliances aim at both commercial and technological aspects. The equity arrangements in such alliances are not merely driven by the motivation to share technologies but also to explore market opportunities and profiting together (Hagedoorn & Narula, 1996). Firms that use equity alliances typically shows a high commitment as well as a high level of control of the partners (Van de Vrande et al., 2006). On the other hand, Van der Vrande et al., proposed that firms which choose an equity alliance more likely has a low level of inter-firm trust. In this sense, a high level of trust among firms might have not yet been formed due to a limited prior cooperations. As such, firms tend to choose more hierarchical governance modes, such as equity alliance that involve a higher level of control to prevent opportunistic behaviors among partner firms (Van de Vrande et al., 2006). Thus, considering the nature of equity alliances in terms of trust and control, an equity alliance is best to be classified as a tangible mechanism.

To conclude, value appropriation is not an automatic consequence of value creation since firms might not always succeed in profiting from their innovations. Nevertheless, value appropriation is essential for firms’ survival and growth. The success of value appropriation can be influenced by firm’s bargaining power over partners and the appropriation mechanisms.
4.3 Value Appropriation in Business Ecosystems

In the context of value appropriation in ecosystems, little research has been conducted in this area. To the best of the author’s knowledge, there are only two studies that investigate the value appropriation process in business ecosystems. The first study is conducted by Ben Letaifa (2014). This study investigated the dynamic of value creation and value appropriation in the different phases of ecosystem’s life cycle. She argued that the extent of value creation and value appropriation in the ecosystem shifts over time according to the ecosystem’s life cycle. During the first phase, when the ecosystem has emerged, the members agreed to co-create the ecosystem by establishing technological infrastructures and resources, and identifying promising projects. In this phase, the high level of value co-creation is needed in order to institute the required resources and facilities for the ecosystem. On the other hand, value capture is low since in this phase the objective is to leverage every members’ assets and create an ecosystem shared vision (Ben Letaifa, 2014). Then, as the infrastructure is built and the ecosystem is developed, members of the ecosystem start to work on common projects with the value capture objectives in their mind. In this second phase, the collaboration among members is high as well as the competition, in which they not only try to closely cooperate to co-create value together but also compete to capture the created value (Ben Letaifa, 2014). In the third phase, the ecosystem is mature and has lacks capability to create more value; thus, the focus is shifts from value co-creation to value capture. The ecosystem’s member race for leadership to recoup the value as much as possible (Ben Letaifa, 2014). Finally, in the last phase, the ecosystem start to struggle to survive as value creation absent and value capture lacking. At this point, the ecosystem might dissolve and be replaced by the new one; otherwise, the ecosystem decides to innovate and renew itself (Ben Letaifa, 2014). One important remark from this study is in the context of business ecosystems, value appropriation should not only be assessed from an economic value perspective; instead, it should incorporate multidimensional value such as social, economic, and cultural (socioeconomic) value (Ben Letaifa, 2014). Socioeconomic value encompasses, for example, the perceived business performance and company’s reputation by residing in an ecosystem. In this research, the value appropriation process is considered as a process in which members of the ecosystem benefit & profit from the value created in the ecosystem for the overall business performance and the firm’s growth. Another important finding from the study reveals that a balance between value creation and value appropriation is a mandatory for business ecosystems’ survival (Ben Letaifa, 2014).

The second study by Ritala et al. (2014) concerning the value creation and value appropriation mechanisms in different phases of innovation ecosystems: ecosystem building phase and ecosystem management phase. They argued that at both building and management phase there are several types of mechanisms (tangible and intangible) that employed by the leading actor (focal firm) to coordinate how value is created and captured. In the building phase, the focus is on facilitating and defining the premises of value creation and value capture. In this phase, the framework regarding what kind of value that can be created and how the members can appropriate a portion of it is established. Furthermore, in order to facilitate the premises of value creation, both tangible and intangible mechanisms are employed. The tangible mechanisms involve a formal structure that connects and attracts participant to sit-together, including forums, associations, and gathering. The intangible mechanisms involve a clear communication of common visions and building trust among members
Moreover, during the ecosystem building phase, the premises of value capture are also defined by the tangible and intangible mechanisms. The tangible mechanisms including setting up a contractual framework that specifies plans for innovation appropriability and establishing intellectual property policy. Additionally, the intangible mechanisms in this phase involve considering motivations of each member in the ecosystem and creating a vision for the initial business goals (Ritala et al., 2013). Furthermore, in the ecosystem management phase, the main objectives shifted into maintaining value creation and realizing value capture. To maintain the value creation, tangible mechanisms such as contracts, platforms, and forums are employed. On the other hand, intangible mechanisms, such as maintaining trusts, open communications, and common vision become more pronounced in this phase. Moreover, to realize the value capture during the management phase, tangible mechanisms such as common guidelines, contracts, and IPRs concerning profits and appropriability; and intangible mechanisms relate to ensuring the communication of different actors’ business needs are employed. To conclude, the different phases of the ecosystem’s life cycle present different challenges. As a result, the focus of value creation and value appropriation shifts over time. Hence, in order to sustain, business ecosystems should maintain a balance between value creation and value appropriation. As such, the ecosystem members will be able to keep innovating and survive.

4.4 Research Gap
From the literature review, it is clear that little research has been conducted in the area of value appropriation at the ecosystem level. Furthermore, despite several attempts in understanding value appropriation process in business ecosystems, current literature still unable to provide a comprehensive insights regarding the role of the business ecosystems in supporting value appropriation processes of its resident. Moreover, previous research mainly examines value creation and value appropriation process from the leading actor (focal firm) perspectives. Therefore, it is still unclear how the residents or participants within the whole ecosystem appropriate value. In addition, from the point of view of the ecosystem managers (cf. CSM) it is also important to understand the value appropriation process and mechanisms to facilitate value appropriation of its residents. Thus, it is worthwhile to analyze the value appropriation process and mechanisms of the residents in a business ecosystem.
CONCEPTUAL FRAMEWORK & METHODOLOGY

Chapter 5: Conceptual Framework
Chapter 6: Methodology
5. Conceptual Framework

This chapter explains the conceptual framework of the research which derived from a literature review. In the first section, the structure of the model is described; then, the explanation of the factors and its relationship are given in the second section. The model is an aggregation of the pool of theoretical factors that influence value appropriation process in business ecosystems. It also shows the proposed relationship between the factors and value appropriation. The model provides a structure and direction for the empirical analysis of this study. However, due to the exploratory nature of this research (elaborates in the next chapter), the conceptual model provides only a preliminary insight of the value appropriation process in the business ecosystem. As such, the conceptual model will be compared with the empirical findings which will show whether the conceptual model has to be revised or not. Moreover, by comparing the conceptual model with the empirical findings we can also analyze in what extend the theoretical background differs from reality.

5.1 Structure of the Model

The illustration of the conceptual model depicts in Figure 5. The model consists of three basic parts in accordance with the research questions. The first part (the green box in the figure) displays the factors that might directly influence the value appropriation process of the residents in a business ecosystem. This part consists of two factors, namely: bargaining power and value appropriation mechanisms. For the first factor, we identified two aspects that might influence bargaining power: technical/knowledge advantages and access to the market-related information. The second part (the yellow box in the figure) related to the second research question regarding value appropriation mechanisms. As mentioned in the previous section, the appropriation mechanisms in this research are distinguished into tangible mechanisms and intangible mechanisms. Finally, the third part (the red box in the figure) was designed to answer the third research question about the role of the business ecosystem and its management in managing and facilitating value appropriation process of the residents. To examine this, I adopted two patterns of value creation in a knowledge-based ecosystem by Van der Borgh et al., (2012), namely: facilitation of innovation process and a creation of innovation community.

5.2 The Relationship of the Factors

As illustrated in the conceptual model, the firm’s bargaining power and value appropriation mechanisms are predicted to have a positive direct effect on value appropriation. As mentioned in the literature study, most of the studies considered the central roles of firms’ bargaining power in determining the amount of the value that they can capture in the collaborations (Brandenburger & Stuart, 1996; Yan & Gray, 1994). Firms with higher bargaining power tend to have the ability to influence the ‘bargaining set’ and the outcomes of the negotiations; hence, firms can secure the value created in the collaboration. Firms’ bargaining power is developed by establishing a unilateral dependence (Di Gregorio, 2013). Unilateral dependence means that a firm is less dependent on the other than the other is on the firm. The unilateral dependence arises from several sources (Coff, 1999; Lepak et al., 2007). In this research, we only focused on the two sources.
First, the unilateral dependence arises when firms have unique resources that are difficult to imitate. In our context, the resources are considered as technical and/or knowledge advantages. Firms with technical and/or knowledge advantages might enforce a high switching cost or replacement cost to partners due to the uniqueness and the superiority of their technologies. Second, unilateral dependence can be created by exploiting information asymmetries, especially regarding market-related information (Di Gregorio, 2013). A better-informed firm may actively manage information flows and seeking a sustain structural holes to maintain its bargaining power (Burt, 1995).

Furthermore, in the conceptual model, value appropriation mechanisms also predicted to have a positive direct effect on value appropriation. Several researchers have examined the effectiveness of different appropriation mechanisms (i.e. contractual or relational mechanisms) in protecting firm’s innovation outcome and securing profits from competitors (e.g. Cohen, Nelson, & Walsh, 2000; HanGyeol et al., 2015; Teece, 1986). It is argued that there are no single appropriation mechanisms that fully effective to capture value from innovations (Arora, 1997; Cohen et al., 2000). For example, a study by Cohen et al., (2000) revealed that the effectiveness of IPRs such as patent varies across different industries. As a result, firms have to strategically utilize a combination of various kinds of appropriation mechanisms. By employing a right appropriation strategy, firms are able to protect their innovations; thus, allows them to exploit and profit from the innovation.

Regarding the roles of the business ecosystem managers in facilitating value appropriation of the residents, to date, literature does not provide a sufficient insight regarding how exactly business
ecosystem managers influence value appropriation in the ecosystem. Therefore, as a starting point I argue that value appropriation in business ecosystems might also have the same pattern as value creation proposed by Van der Borgh et al., (2012): Facilitation of innovation process and Creation of innovation community. However, how such pattern influences the value appropriation process and how its relationship with firm’s bargaining power and appropriation mechanisms is not clear. For example, facilitation of innovation process by providing technical complementarities for residents might support firms for capturing value. According to Van der Borgh et al., (2012) when firms joining a business ecosystem they can get access to the unique and difficult-to-imitate value sources. In this context, the value sources can be considered as vertical and horizontal complementarities provided in the ecosystem and the reputation of the ecosystem. Technological complementarities might reduce firm’s dependency to another supplier or partner that in the future might ask for a big proportion of the ‘pie’. Therefore, technological complementarities provided by the ecosystem might be beneficial for capturing value, especially when firms lack resources and complementary assets.

In addition, the creation of innovation community might increase the ability of the firms to capture value through the improvement of the appropriation mechanisms effectiveness especially intangible mechanisms. Trust is essential for value appropriation, especially when firms decided to use intangible mechanisms. For example, when firms employ a secrecy strategy, a high trust among partners may prevent opportunistic behaviors since trust may enhance shared norms through mutual interest of continuous cooperation. Moreover, trust can be seen as a social control mechanism that complementing, or even substituting legal governance mechanism in a collaborative setting (Blomqvist, Hurmelinna, & Seppänen, 2005). Additionally, a study by Morgan et al. (2013) revealed that a firm’s participation in a network enables value capture by allowing firms to take advantage from the ideas, knowledge, and expertise of the other participants that may be lower their development and maintenance costs and increase their visibility (Morgan et al., 2013). In addition, according to Di Gregorio, (2013) value appropriation does not strictly an economic process; instead, socially-driven factors, such as group affiliation, credibility, and status may also play a role in influencing appropriation process. In addition, being associated with an ecosystem with strong reputation may increase the credibility of the firm in the eye of customers and partners; hence it allows firms to capture more value. To sum up, the business ecosystem managers might influence the value appropriation process of the residents. Nevertheless, the pattern influences the value appropriation process and how its relationship with the firm’s bargaining power and appropriation mechanisms is not clear. Hence, the relationships of these factors are investigated in the empirical analysis.
6. Methodology

This chapter explains the general methodology of the research. The first part of this chapter describes and justifies the approach that used in this research. The second part discusses a step-by-step research method based on the theory-building approach by Eisenhardt (1989). In the last part, a strategy to ensure the quality of the research is described.

6.1 Research Approach

Due to the limited knowledge available on the topic of value appropriation and the complex nature of the business ecosystems, a qualitative and exploratory research approach is more suitable to this study. An exploratory study is “best to use to tackle new problems on which little or no previous research has been done” (Brown, 2006, p. 45). In addition, we applied a retroductive approach in which a combination of theoretical framework and empirical research were employed in order to create a better understanding of the situation (Poole, Ven, Dooley, & Holmes, 2000). Such approach will support the theory-building aspect in this study since data is collected and analyzed in accordance with the relevance of a pre-determined conceptual framework. Moreover, a qualitative methodology provides rich data that can facilitate the generation of theoretical insights.

In addition, the empirical analysis of this research was conducted based on the case study approach. The case study is a research strategy which focuses on “understanding the dynamics present within single settings” (Eisenhardt, 1989, p. 534). The case study approach was selected due to its advantages in supporting exploratory research. According to Yin (2003) the case study approach is preferable when: (a) the research questions are in the form of “how” and “why”; (b) the researcher has little control over events (no experimental setup possible); (c) the contextual condition is important for the acceptance in the wider organizations; or (d) the boundaries between the phenomenon and context are not clearly evident. Furthermore, the results of the case study can be generalized to some broader theories. As such, the case study approach is appropriate for this study since the main goal of this research is to explore the value appropriation process in a business ecosystem. Also, it well suits with the context of business ecosystems since controlled manipulations in an ecosystem or organizations are impossible. Yin (2003) made a threefold distinction of case study types. He emphasized that the number and type of case studies depend upon the purpose of the inquiry. In this study, we employed a multiple case study type of research due to its advantages in supporting an exploratory research. Yin (2003) posited that a multiple case study enables the researcher to explore differences within and between cases with the goal to replicate finding across cases so that the researcher can predict similar results across cases, or predict contrasting result based on theory. The multiple case studies approach is often considered more convincing and compelling; therefore the overall study can be regarded as being more robust (Yin, 2003).

In a case study research, a selection of an appropriate unit of analysis is fundamental for the quality of the research (Yin, 2003). According to Yin (2003) the unit of analysis is typically a system of action rather than an individual or group of individuals and should focus on one or two issues that are fundamental to understand the system being examined (Yin, 2003). In accordance with the aim of this research, the first unit analysis of this research is value appropriation process of the residents of HTCE. This unit analysis was investigated at the firm level, especially regarding the value
appropriation sources, mechanisms, and firms’ perceived value of the business ecosystem in supporting value appropriation. In addition, this study also aims to analyze the role of the business ecosystem in facilitating value appropriation process. Therefore, an analysis at the ecosystem level is required. As such, the second unit analysis of this research is the policies and/or the governance of the HTCE.

6.2 Research Methods
This study followed a step-by-step research method for a multiple-case study by Eisenhardt (1989). This method synthesizes previous studies on qualitative methods, case study research, and theory building and extends that with within-case analysis and replication logic. Additionally, this method provides a roadmap for building theories from a case study research. The step-by-step method that applied in this study is explained as follows.

6.2.1 Getting Started
Defining the research questions, at least in broad terms, is essential in building theory from case studies (Eisenhardt, 1989). Therefore, the first step to do is to determine the research question and the scope of the research. In this study, the research questions were mainly developed based on the research gap in the literature. As a starting point, the literature in the business ecosystem was analyzed to understand the basic knowledge related to the subject and to find interesting directions for the future research. Then, the research questions were discussed with the research supervisors who are expert in this area. As the final step, to gain the practical relevance of the research, the research questions were confirmed to the practitioners, which, in this case, is the CSM's managers. The detail explanation of the research questions and the research gaps are already taken care in the foregoing chapter.

In addition, even though this study is an exploratory research, it is also important to specify some potential important variables based on the relevant literature. As the first step, I started from studies by Van der Borgh et al., (2012), Ritala et al., (2013) and Lepak et al., (2007). These studies provide a relevant information about value creation & value appropriation in business ecosystems. Other starting points were the previous master thesis of Van der Borgh (2007) and Daniël Timmermans (2014) on the governance of HTCE and the implementation of open innovation in the HTCE.

Furthermore, a scholarly database (ABI/inform) was used to find some relevant articles. I used search terms (keywords) such as business ecosystem and value appropriation in combination with other terms such as value capture, Science Park, bargaining power, appropriability mechanisms, etc. Furthermore, the validity and the reliability of the articles were guaranteed by only selecting a peer reviewed articles from a journal with a high impact factor. Based on the extensive analysis of the literature, a preliminary theoretical model and variables were selected (as depicts in chapter 5).

However, as suggested by Eisenhardt (1989), along the process, the author attempted to avoid thinking about the specific relationship between variables and theories as much as possible to avoid bias and limit the findings that may arise from the empirical analysis.

6.2.2 Selecting Cases
The next important step in a case studies research is to select a possible set of cases that may represent the whole population. In this study, I relied on a theoretical sampling approach in selecting the case studies (Eisenhardt, 1989; van Aken, van der Bij, & Berends, 2012). As such, the cases were
chosen based on a theoretical reason instead of statistical reason. Moreover, in multiple case studies, the selected cases should be based on replication logic (Yin, 2003). In essence, the cases must be carefully selected so that it either predicts similar result (literal replication) or predicts contrasting results, but for anticiptable reasons (theoretical replication). Therefore, selection criteria were developed based on the relevance to the context of the study and the conceptual framework. In this study, these following criteria were used for case selections: (1) A technology-based Startup or SME with employees < 50, that (2) Has been situated in HTCE at least for a year, and (3) Get an extensive exposure to processes, facilities, and services of the HTCE (and its partners).

Based on the criteria, 20 companies were selected. Then, based on the consultation with one of the directors of the CSM 12 companies were chosen to be contacted, a list of the companies contacted is provided in the Appendix B. However, the willingness of the companies to participate in the study was relatively low. In total, only 4 of 12 the potential respondents have agreed to participate (33% response rate). Most of the firms that did not willing to participate were not interested or were too busy with their schedule. The detailed profile of the companies that become the case studies of this study explains in Chapter 7.

6.2.3 Crafting Instruments and Protocols
As suggested by Eisenhardt (1989) and Yin (2003), multiple data collection methods were employed in this study. In this study, the data and evidence were collected from multiple sources (triangulation). Specifically, three main sources were used in this research: interviews, observation, and archival data.

*Interviews.* A set of semi-structured interviews was served as the main sources of this study. In total, eight in-depth interviews were conducted with respondents from five different companies and from the CSM. All respondents were chosen based on their decision making power in their organization. These respondents included the CEO of the companies, and the directors of the CSM. Appendix C presents the full list of interviews. Before the interviews, an interview protocol was developed based on the research questions and the conceptual model. Then, the protocol was confirmed to the mentors regarding the content and the appropriateness of the questions with the conceptual model. Next to that, a pilot interview was executed to make sure that the interview protocol will work in the real situation accordingly. The pilot interview was conducted with an SME in the HTCE. Then, based on the feedback from the mentors and insights from the pilot interview, the interview protocol was revised, as shown in the Appendix D. Before the interview, each respondent informed about the purpose and the scope of the interview via email. The interviews were recorded to prevent loss of information. Then, the transcripts of the interviews were made within 24 hours after the recordings. Afterward, the transcripts were sent to the interviewee to be cross-checked to prevent invalid information. The recorded interviews with the companies had an average duration of 48 minutes and a total duration of 191 minutes; while the interviews with the CSM had an average duration of 31 minutes with a total duration of 94 minutes.

*Observations.* Direct participant observations also served to collect data on the daily conduct of the CSM activities. In this case, the author was physically located at the HTCE for a period of 18 weeks, from March 2015 to July 2015. During this period, the author joined a number of meetings of the CSM
marketing & communication team and informally talked with a number of employees and guest. Moreover, the author had an opportunity to present the current research in the business ecosystem field to the marketing & communication team and discussed the current situation in HTCE and its challenges. The author also participated in several seminars and conferences held in the HTCE. In addition, on a weekly basis, informal discussions with the marketing and communications manager of the CSM were carried out. All in all, direct participant observations provide insights and knowledge that will enrich the data for this study.

Archival Data. A variety of documents and other archival data were also collected. In particular, brochures, presentations, websites (blog & social media), and newsletters provide a good overview of the HTCE activities and policies. In addition, the residents’ surveys for the past four years were studied to understand the general perceptions of the residents towards HTCE and the campus site management.

6.2.4 Analyzing Data
In this research, the analysis involved in three stages: (1) developing case summaries of each company; (2) coding these texts with regard to perceived value appropriation and other related concept according to the conceptual model; and (3) analyzing the pattern of relationships among the conceptual categories.

In the first stage, the case summaries of each investigated company were developed (within case analysis). These summaries were based on all the data collected about each company (i.e., interviews and archival data). From this data, an extensive description of each company in the case studies was carried out. The descriptions provide an overview of the firms’ characteristics, its strategy for profits from an innovation, its perception of the importance value appropriation sources of the HTCE, and its strategy to capture value from the ecosystem. Then, in the second stage, the summaries were coded with respect to the defined conceptual model. In order to systemize the coding process, NVivo 7 was used to record and cross-reference the codes. This process was an iterative process that involved moving between summaries, existing theory, and the raw data. In the final stage, a cross-case comparative analysis was conducted to understand the similarities and the pattern of the case studies. Specifically, I was interested in finding the value appropriation sources, the input factors that determine the firm’s ability to appropriate value in the business ecosystem, and the appropriation mechanisms in which the companies of the case studies employed.

6.2.5 Shaping Research Propositions
In this step, the evidence that arose from the cross case analysis were compared to the theories. This was a highly iterative process which the emergent frame/constructs were systematically compared with the evidence from each case to assess how well it fits with the data case (Eisenhardt, 1989). The constant comparison between data and constructs aimed to accumulate the evidence in order to establish a single, well-defined construct. This process results in a revised conceptual model that contain a series of constructs arose from the case studies.
6.3 Ensuring Quality of the Research

In order to assure the quality of the research, the validity and reliability of the research should be managed. In this research, I adopted case study tactics proposed by Yin (2003). According to him, there are three tests of validity that have been commonly used to establish the quality of case studies, namely: construct validity, internal validity, external validity. Construct validity refers to the use of correct operational measures for the phenomena being studied (Yin, 2003). To ascertain the construct validity, in this research, multiple sources of evidence were used (e.g. documents, observations, interviews) and a chain of evidence was established by using a coding scheme in Nvivo during the data collection. Moreover, the key informants were asked to crosscheck the interview transcript to avoid misinterpretation. Also, the key protocol was reviewed by the supervisors and tested with a pilot interview. The second validity test, internal validity, refers to the appropriateness of the causal inferences that are made during the data analysis. To eliminate spurious relationship during the analysis, I performed pattern matching and explanation building during the data analysis. To do so, an empirically based pattern will be compared with a predicted one from the conceptual framework.

Table 1: Summary of Case study Tactics

<table>
<thead>
<tr>
<th>Tests</th>
<th>Action taken In this research</th>
<th>Research Phase in which tactic Occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construct Validity</strong></td>
<td>Used of multiple sources (observations, Interviews, and archival material)</td>
<td>Data Collection</td>
</tr>
<tr>
<td></td>
<td>Established a chain of evidence by recording the interview and written out the interview within 24 hours. Employed a coding scheme in Nvivo</td>
<td>Data Collection</td>
</tr>
<tr>
<td></td>
<td>The interview protocol has been reviewed by the supervisors. Also, the interview transcript has been crosscheck with the interviewee</td>
<td>Composition &amp; Data Collection</td>
</tr>
<tr>
<td><strong>Internal Validity</strong></td>
<td>Performed pattern matching by comparing an empirically based pattern with a conceptual model</td>
<td>Data analysis</td>
</tr>
<tr>
<td></td>
<td>Performed an explanation building by identifying the &quot;how&quot; and &quot;why&quot; of the proposed cause and effect relationships</td>
<td>Data analysis</td>
</tr>
<tr>
<td><strong>External Validity</strong></td>
<td>Incorporated rival explanations by designing an interview protocol, which allows respondents to mention other factors outside the conceptual model</td>
<td>Research Design</td>
</tr>
<tr>
<td></td>
<td>Applied a replication logic by developing a case selection criteria.</td>
<td>Research Design</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>Used a case study protocol and applied a consistent data collection procedure and a same set of questions in each interview</td>
<td>Data Collection</td>
</tr>
<tr>
<td></td>
<td>Developed a case study database. All of the research data, interview data, additional notes have been stored into a database</td>
<td>Data Collection</td>
</tr>
</tbody>
</table>
The last validity test, external validity, refers to the generalizability of the study beyond the present domain of the case being studied. In other words, the results from a case study should be generalized to a specific broader theory (Yin, 2003). This type of validity was addressed by incorporating rival explanations and implementing replication logic during the case selection. Another important quality criterion that should be addressed is reliability. Reliability means that an exact replication of the study would generate the same results. The errors and bias might be impossible to avoid completely; however by working in a structured way (using the interview protocol) and maintaining the chain of evidence (documenting the results in a database) the reliability of this research can be assured. The summary of case study tactics that employed in this research are presented in Table 1.
EMPIRICAL ANALYSIS

Chapter 7: Collective Case Studies Analysis
Chapter 8: Facilitation of Value Appropriation in HTCE
7. Collective Case Studies Analysis

In this chapter, the empirical data of the case studies were analyzed. Firstly, the four cases are described in detail to get a complete overview of the companies’ background and a better understanding of their business strategies. In every case study, several aspects that might influence value appropriation of the company according to the theories are presented. Next to that, the explanation on how the companies appropriate value of the ecosystem is given. As described in the theoretical background, the explanation of value appropriation follows the two patterns of value creation by Van der Borgh et al., (2012). Then, the collaboration & value appropriation mechanisms of the company are explained. Next to that, the empirical findings of the case studies are analyzed and compared with the existing theories to come up with general results and new insights. Finally, the chapter concludes with the discussion and answers to the first and second sub-questions.

To begin with, the overview of the companies in the case studies is provided in Table 2.

<table>
<thead>
<tr>
<th>Company</th>
<th>Business</th>
<th>Number of Employees</th>
<th>Type</th>
<th>Innovation Stage</th>
<th>Founded</th>
<th>Year Situated at HTCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etulipa</td>
<td>Electrowetting display,</td>
<td>6</td>
<td>Startup</td>
<td>Development/ Pilot Production</td>
<td>2013</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>Digital Billboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proxible</td>
<td>Location based platform</td>
<td>7</td>
<td>Startup</td>
<td>Commercialization</td>
<td>2013</td>
<td>2013</td>
</tr>
<tr>
<td>Vitaallicht</td>
<td>Light-standing biodynamic LED-light</td>
<td>1</td>
<td>Startup</td>
<td>Commercialization</td>
<td>2011</td>
<td>2013</td>
</tr>
<tr>
<td>ZS (Not the real name)</td>
<td>Wireless charging solutions</td>
<td>8</td>
<td>Startup</td>
<td>Commercialization</td>
<td>2011</td>
<td>2014</td>
</tr>
</tbody>
</table>

7.1 Etulipa

Etulipa is an innovative startup that focuses on developing digital billboard based on electrowetting display technology. Etulipa offers a revolutionary display technology for cost-efficient and eco-friendly billboards that can be read like paper, but still offer all the advantages of a LED-based digital billboard with 100 times less energy.

7.1.1 Firm’s Characteristics

Etulipa is a subsidiary of Miortech, a Dutch company originating from Philips that developed applications for electrowetting display technology (EWD). Initially, Miortech focused on the application of EWD on auto-dimming rearview mirrors. During the development, the company was approached by a number of parties, including companies from China, that asked whether the electrowetting technology can be applied in signage/billboard (Oostra, 2013). The Miortech’s executives thought that the digital billboard market would be more commercially attractive compared to the conservative automotive sector. According to Doeke Oostra (2013), VP Business Development at Etulipa, “The advertising sector is less cautious and can generate revenue faster; therefore, for a young company is even more convenient than automotive”. As a result, in 2013 Etulipa was established as a subsidiary to bring its electrowetting technology in the digital signage market.
Since the beginning of its establishment, Etulipa has been situated at the HTCE. If we consider Etulipa as a continuation of Miortech, the company has been situated at the HTCE since 2006. Dr. Hans Feil, the CEO of Etulipa, even has been situated in the area since 1988 when the campus still part of the Philips Research site. “I know the place very well, I see the development, everything” as Dr. Hans Feil explained. Currently, Etulipa occupies an office space and a laboratory space in Mµ building.

Technology and Knowledge Advantages

Today’s digital billboards are mostly made of LEDs that emit an intense light which have to be extremely bright to be seen in daylight. Moreover, this unnatural lead to light pollution that may affect human health (Etulipa, 2015). Also, the light bright that produced by LED billboards may distract drivers’ attention; therefore, it might compromise safety on the road (Etulipa, 2015). Consequently, the local governments have restricted or totally banned digital billboards (Feil, 2015). This policy might create a problem for advertisers and billboard owners because for them digital billboards are preferable due to the higher yield and the flexibility to update the ad-campaign in a real time. Furthermore, LED-based digital billboards are far from environmentally friendly since they consume much energy. An LED-based digital billboard typically consumes more energy than thirty average households (Etulipa, 2015).

To overcome these problems and seize the market opportunity of digital billboard markets, Etulipa has developed color displays that reflect sunlight based on its revolutionary display technique, called electrowetting. The heart of Etulipa’s solution is on Electrowetting Display Technology, a revolutionary display technique that makes use of the surface tension of the liquids. In other words, the ‘pixels’ are not powered by light, but with colored oil. This technology is applied to digital billboards which result in billboards that more pleasant to read, just like paper. Moreover, the Etulipa’s display can lift the ban on digital billboards since it does not cause light pollution and influence traffic. Furthermore, the display uses 100 times less energy than an LED screen, which will lead to the significant cost savings for digital billboards’ owners (Etulipa, 2015). To summarize, with all the benefits of digital displays, Etulipa’s displays are far more energy-efficient, more environmentally friendly (no light pollution), and more pleasant to read.

The superiority in electrowetting technology is the source of Etulipa’s strong value propositions. Etulipa has a patented their technology and has in-depth knowledge of electrowetting technology that made the Etulipa displays extremely difficult to imitate (Feil, 2015). For instance, the CEO of Etulipa is the inventor of the second generation electrowetting display technology and also an expert in electrowetting display technology. Furthermore, the CEO emphasized that “The top value of this company is in the know-how of the display’s technology. We have a lot of know-how which makes us different from others”. Based on these facts, it is clear that Etulipa has technological advantages that are unique and difficult to copy.

Business Model & Commercialization Strategy

As mentioned earlier, Etulipa is a subsidiary of a company called Miortech which initially developed electronic dimmable mirrors for automotive applications. The decision to implement the electrowetting technology in digital signage and to enter the digital billboard market was due to its huge business opportunities and market potentials. As Dr. Hans Feil (2013) explained in an interview
with display-central.com “We found that advertisers and billboard owners are extremely keen to enable a technology that allows for instantaneous creative updates and the ability to respond in real-time to current events and market conditions”. Through its unique value propositions, Etulipa expects a large share of the USD 16 Billion markets of digital billboards (Etulipa, 2015). Currently, Etulipa already has developed a pilot screen of the one-square meter full-color version that is ready to demonstrate to the billboard owners and licensing authorities (Feil, 2015). To bring the technology into the market, Etulipa will develop and manufacture the displays by their own, collaborate with an overseas partner. Then, Etulipa will provide lease plans of the billboard for the billboard owners. The smart lease/share plans are expected to be the main revenue stream of the company (Etulipa, 2015).

Access to the market-related information
Getting access to the potential market is essential for a young company like Etulipa. One of the strategies employed by the Etulipa’s management is to attract one of large billboard manufacturer to invest in the company. Etulipa has successfully attracted a large American LED display manufacturer to invest in and cooperates with Etulipa to bring digital paper billboards to the market (Feil, 2015). With the main potential customer investing in the company, Etulipa is able to secure their first customer. Furthermore, together with its strategic investor, Etulipa explores another potential application of the display for a different market. For instance, Etulipa will co-develop an electronic version of copy boards with one of its strategic investors. Furthermore, another strategy employed by the Etulipa’s management to get access to the market-related information was to go directly to the potential customers via meetings and conferences (Feil, 2015).

7.1.2 Appropriating Value from the Ecosystem
In general, the HTCE ecosystem did not directly affect the overall business performance and the commercialization process of Etulipa. The company mostly benefited from the availability of shared facilities, especially in the early development of the technology. However, the campus’s ecosystem & reputation was perceived less valuable by the company. The following section describes the perceived value of the campus in relation with the firm’s value appropriation process based on the two patterns of value creation by Van der Borgh et al., (2012): (1) facilitation of innovation process through shared facilities, and (2) the creation of innovation community.

Facilitation of Innovation process. The availability of shared facilities and technology support was the main motivation of Etulipa to be situated at HTCE in the first place. As the CEO noted, “The reason we here because during the development phase, we need to use the clean room facilities, the shared facilities, the equipment, and work with the experts from Philips to develop the technology and made the prototype. That was the reason we started here”. Furthermore, the shared facilities proved to be cost-effective for a startup company like Etulipa, during the early development of the company. The company was able to optimize the investments in product development since some of the R&D activities can be outsourced to scientists from other residents of the campus, while the research facilities can also be rented from the campus (Feil, 2013). However, in early 2015, the shared clean rooms provided by Philips were restricted for the medical purpose only so that it was not possible for other companies like Etulipa to use the clean facilities (Feil, 2015). “Luckily for us, we decided to create our own pilot and clean room at the same time we heard that it was not possible to use the clean facilities anymore, otherwise we were in trouble” explained the CEO. Currently, Etulipa has built their
own lab facilities in Mµ building, a dedicated building for small and medium enterprises in the field of Lifetech & New Energy. The company has benefited from the laboratory facilities in the building mainly because its allow them to do the experiments using chemical legally. As noted by Hans Feil (2015) "It is easier to get a permit for using chemical when you are under the umbrella of the campus". Based on that facts, it is shown that the availability of shared facilities and technological supports were clearly contributed to the early development and value creation of the company as it was reduced the transaction costs and R&D costs in general. However, it is not clear how the shared facilities influence the value appropriation of the company. It might be due to the fact that the company is still in the development phase; as such, the value creation process is more dominant for the company instead of value appropriation.

**Innovation community.** The company did not reward the innovation community and the ecosystem reputation as high as the shared facilities. The company considered HTCE as a “pleasant place to be” mostly because of the service facilities provided (restaurants at the Strip, conference center, etc.). Also, the company considered the opportunity to work with other companies in the campus as less important. The company believed that the suppliers or partners can be found everywhere, not necessarily in the campus. Furthermore, the CEO considered there was no difference between partner from inside or outside the campus, in terms of trustworthiness. Moreover, the company appreciated the CSM’s initiative in creating a sense of community and fostering collaborations among residents by arranging various networking events and social activities. However, the company did not realize many benefits from the networking events, as noted by the CEO “If I have to spend my time on networking with people that are very interesting and smart, but I have no business with, it costs time. The chance to meet people that can really do business with you when you are going to a business meeting or networking meeting is small”. Additionally, the CEO agreed that at some point a high physical proximity might increase the possibility of collaborations; however this case seems did not occur in Etulipa. “Even in there (Mµ building), we meet people from other companies on the same floor; but those are medical people, life sciences, etc. You chat with them at the coffee machine, what are you doing, and that’s it. The chance that you work with somebody in the same building is almost zero because they do something else” as explained by the CEO. In addition, the company considered the concept of the community is still missed in the campus, as noted by the CEO “With the startupbootcamp, the impression is made that this is a place that a lot of startups and collaborations are flourishing. But the reality is different. The reality is about 10.000 people are working here and there is about 1 billion Euro are spent here yearly for R&D, but less than 1% of the business here is funded by venture capital. So the idea with the startups and community is missing”. Nevertheless, the CEO suggested the campus to attract more companies in order to maintain the region’s growth. To conclude, Etulipa was not actively participate in the campus’s networks and perceived less benefit of the innovation community and the ecosystem reputation.

### 7.1.3 Collaboration & Value Appropriation Mechanisms

As a company which originated from Philips cradle, Etulipa has a historical relationship with Philips research. Philips research was the initiator of the research and development of the first generation electrowetting technology before the technology was spun out into a different company. Furthermore, The CEO of Etulipa is a former researcher of Philips Research that had been involved...
since the beginning of the development of 2nd generation electrowetting display technology. In the early phase of the development, Etulipa’s engineers worked closely with experts from Philips Research and Philips Innovation Services (previously called Philips Apptech). As mentioned in the previous section, Etulipa used Philips’s shared facilities, especially the advanced cleanrooms, to develop the technology and make the prototype. However, the partnership with Philips become weaker over time, especially when Philips decided to restrict the use of the cleanrooms (shared facilities) from outside parties (Feil, 2015). At the same time, Etulipa built their own pilot line and cleanroom facilities so that they hardly need cleanroom facilities from Philips anymore. Currently, Etulipa only used a service from Philips Innovation Service (reliability center) as a needed basis. Nevertheless, Etulipa acknowledges that the easy access to the shared facilities and the experts helped them to accelerate the pace of innovation during the early development phase of the technology. As Dr. Hans Feil stated “We benefited from the quick trial & error possibilities and found ways to create our displays from the collaboration with Philips”.

Besides Philips, Etulipa does not have any collaboration or partnership with other residents of the HTCE. Therefore, the value appropriation mechanisms in the context of the business ecosystem can only be identified based on the collaboration with Philips. However, we can analyze the dynamic of the appropriation mechanisms in the context of inter-organizational relationship from other collaborations that Etulipa has with other parties outside the campus. Etulipa has partnerships with the American and Taiwanese LED manufacturer. The Taiwanese LED manufacturer provides its manufacturing capability to produce sub-components and the display tiles for Etulipa, while the American partner invests in the company and help Etulipa to get access to the market (Feil, 2015).

**Value Appropriation Mechanisms**

Based on the interview with the CEO, it was found that Etulipa employed both tangible and intangible mechanisms in the partnership with Philips as well as with both American and Taiwanese partners. In general, Etulipa tends to rely on intangible mechanisms, especially trust, to ensure the value appropriation. The intangible and tangible mechanisms are described in detail in the following section.

**Tangible Mechanism.** Etulipa utilized intellectual property protection such as patent to protect its core technology: 2nd generation electrowetting display. The patents not only provide protection from imitation, but also provide a freedom to operate in different market applications such as auto-dimming car mirror, digital signage, digital billboard, and electronic copy board. Furthermore, in order to maintain the growth of the company, Etulipa has established an equity alliance in the form of minority participant with a large billboard manufacturer. The aims of the alliance were not only to secure funding for the development of the technology but also to get access to the global market. The alliance was manifested in the form of contract. A contractual agreement was developed at the beginning of the alliance. The contract was described by Dr. Hans Feil as a “small & thin” contract which only covers some basic term or agreements (Feil, 2015). The company did not create a detailed contract because they believe the reality was not always described in the contract. As such, a mutual trust was considered as a basis of the partnership (Feil, 2015). The role of trust in the collaboration explains in the next section.
**Intangible Mechanisms.** In the collaboration, Etulipa relied on the informal mechanisms such as trust, technological complexity, and shared goals to capture value from the collaboration and to prevent opportunistic behaviors of the partners. For instance, in the early development of the technology, the Etulipa’s engineers have benefited from informal contacts and expertise from external experts, which were their former colleagues in Philips. The interactions were only based on the trust which developed from interpersonal interaction and past experiences.

Generally, the company heavily relied on mutual trust to maintain the partnerships. Both Taiwanese and American partners were considered trustworthy by the CEO of Etulipa since they were technologically competent and a goodwill had developed in the interpersonal interaction. For example, the Taiwanese partner was introduced by a business partner which has been doing business together for 15 years with the CEO of Etulipa. Moreover, the commitment of the American partner was showed by the fact that the partner also invest in the company (minority participation); thereby, it shows a high faith in the company. Furthermore, trust was built through regular meetings and informal occasions (e.g. dinner). During the meeting, the progress and the strategy were discussed. Additionally, the common vision was clearly communicated and the differences in the goals of partners were taken into account. Interestingly, although the trust between partners were relatively high, the company did not give away the technology and the know-how at the same time. For example, with the Taiwanese Partner, the company transferred the technology and know-how, step by step according to the different levels of partnership (e.g. affiliate partner, strategic partner). Moreover, Etulipa kept some chemicals that needed in order to make the display remain proprietary. Thus, the technologies were not easily copied and the company will be able to ensure the value appropriation. Table 3 presents the summary of both tangible & intangible mechanisms in the case.

![Table 3: Value Appropriation Mechanisms (Etulipa)](image)

<table>
<thead>
<tr>
<th>Tangible</th>
<th>Intangible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual Property Rights</td>
<td>Trust-Based Relationship</td>
</tr>
<tr>
<td>Contractual Agreements</td>
<td>Establishing Common Goals &amp; a Shared Vision</td>
</tr>
<tr>
<td>Equity Alliance (Minority Participation)</td>
<td>Keeping complementary technologies proprietary (Selective Revealing)</td>
</tr>
</tbody>
</table>

### 7.2 Vitaallicht

Vitaallicht is a startup that develops the first light standing bio-dynamic LED lights in the worlds. The Vitaallicht’s lamp matches the light requirements of a human being that received through the day which make users more alert during the day and sleep better at night. The Vitaallicht innovative lamp has won the “LED application of the year” 2013.

#### 7.2.1 Firm’s Characteristics

*History of the company and Establishment at HTCE*

The idea to develop a bio-dynamic LED light came when Maarten Voorhuis, the founder of Vitaallicht, worked at Philips Lighting. At that time, he acknowledged how light can influence human mind and body. Since then, he started to appreciate that lighting does not only affect human visual and emotional aspects but also the human health aspect. He realized that the idea of a ‘special light’ that
is able to improve human health also caught the attention of medical people. However, the implementation of the lighting was very limited because the users have to change the entire light system of the building with the new lighting. From that point, Maarten saw the opportunity to overcome the problem by creating a freestanding lamp. “What would happen if we get the technology and take it from the building and making it like a freestanding product? It will get out of the game when make it freestanding, it is easy to implement, does not have to involve with the building’s owner, and you can experience the lighting before you make a decision to purchase” as he (2015) explained. From that idea, the founder started to design and develop the lamp until the products released to the market.

Vitaallicht has been situated at the HTCE since the opening of the Mµ building at 23rd of September 2013. Vitaallicht is one of the first tenants of the Mµ building. Currently, Vitaallicht occupies a flexible workspace in the Mµ building.

*Technology and Knowledge Advantages*

Inside the building, the light level often at 100 times lower than outside. Although the level is sufficient to see, there are other receptors in human eyes which are not triggered that makes it perceive a biological darkness (Voorhuis, 2015). Vitaallicht brings an outdoor experience to indoor by bringing more sunlight into human body. With its energy-efficient LED technology, Vitaallicht imitates the natural rhythm of daylight, which starts in the morning, gradually increases to become brightest in the afternoon, and fades away in the evening (Vitaallicht, 2015). As such, the light will trigger the receptors in the eyes; hence, supports the natural rhythm of the body. Moreover, it has scientifically proven that the biodynamic light has a favorable influence to increase concentration and motivation, decelerate dementia, lessen depression, and improve the quality of sleep (Voorhuis, 2015). In addition, Vitaallicht has a graceful and simple design which will add to the style of the living rooms or offices (Vitaallicht, 2015)

As mentioned before, Vitaallicht is the first integrated free standing human-centric lighting lamp in the world. One of the core technology of the lamp lies on the LED technology. Vitaallicht developed a state of the art energy-efficient LED technology. With the proprietary know-how in combination with the patented technology, the CEO was confident the lamp will be difficult to copy. Furthermore, this technology has been scientifically proven by a reputable university that it has a positive effect on human health. Another core technology that would be difficult to imitate is the software. The software, which allows the lamp to automatically follow the natural rhythm of daylight, is unique and proprietary (Voorhuis, 2015). Another key advantage of the company lies on the knowledge of the human-centric lighting (HCL) market. The founder has a background in the strategic marketing and has an extensive experience in the HCL market. In addition, the CEO was believed that the customers’ feedback is one of the main value of the company, as he pointed out: “The main value that I have now are feedbacks from the customers in terms of what they like and what they appreciate most, so if there is somebody who going to copy, I would know already and can think for the next step”.

*Business Model & Commercialization Strategy*

As a startup, it is very important for the company to validate the market value of the product. Before deciding to set up a company, the founder needs to ensure if the market is ready and if the market is willing to pay for it. Therefore, the founder used the lean and mean approach by going to the market
quickly and asking directly to the people: “do you know that light can be healthy? And are you willing to pay for it?” (Voorhuis, 2015). In addition, to further validate as well as to promote the product, the founder participated in several trade fairs which allow the (future) customers to experience the products and provide feedback to the company. The company allows customers to have a trial and experience the product before makes a decision to purchase. The strategy seems to be effective for the company, as the founders stated “Lighting is something that you can talk about a lot, but it is an experience. The argument that I make to get the value across at the moment, is much based on “don’t believe office me, don’t believe the strong research that is out there, but believe in yourself”. That’s working for me very well at this moment”.

However, due to the high price of the lamp (at the moment, the lamp is sold at € 2999), the founder realized that only early adopters who have a big wallet that might be interested in the product; hence, the company started to shift the target market from the customer to the business to business market (Vitaallicht, 2015). Currently, the company targeted customers in the office, hospital, and care facility segments. Furthermore, the company also has a leasing deal with a technical university. In the future, the CEO also considered to add another revenue stream through leasing deals.

**Access to the market related information**

In general, the CEO was well informed with the market potential of the product. The founder was believed that the HCL is the next important step in the lighting industry due to the increase need for the healthier environment (Voorhuis, 2014). In addition, the company was relatively well-informed with the market’s preference of the product due to the extensive feedback that the company received from the customers. Moreover, to get access to the potential market, the company used a ‘door-to-door’ approach by going to the potential customers directly (e.g. care facilities, offices, hospitals). As mentioned before, the company also actively participated in trade fairs and networking events to approach potential customers.

### 7.2.2 Appropriating Value from the Ecosystem

In general, the company perceived a lot of benefits by being part of the HTCE ecosystem. First, the company benefits from the building facilities and the infrastructure. More importantly, the company benefits from the campus’ networks and the reputation of the ecosystem. The following section describes the perceived value of the company to the campus facilities and the innovation community.

**Facilitation of innovation process.** The company did not utilize any technical facilities provided by the campus. However, the company captured the value of the campus’ internal infrastructure (the office building) as well as the external infrastructure (university). The CEO thought that the professional appearance of the building, as well as the reputation of the campus, increase the credibility of the company in the customers’ eye, as indicated by the following statement: “The main thing is being located in this building. It is very important for me, so I can have a good venue and I am able to invite people to high tech campus which has a great name. Also, I have the light in the office so I can show it to people, so for me it’s a way to have a potential customer by allowing them to experience the lamp. For the moment, it’s perfect because the cost is relatively low, the appearance of the building is professional. So that’s helping me”. Furthermore, the company has benefited from the close proximity to the University. The company had a collaboration with Eindhoven Technical University in which
the university performed several measurements and tests to the lamp. In the end, the output of the research increased the credibility of the product since the result supported the claim of the health benefits of the lamp. Moreover, the company also benefits from being close with the Philips lighting, the biggest player in the Human Centric Lighting Market. As such, the company was able to scout and anticipate the competitors maneuver in the market. “I also visited Philips’ new lighting experience to also know what they are doing. One of my worst nightmares is if Philips would overtake me with the same product”, as explained by the CEO.

Innovation Community. In general, the company has leveraged from the ecosystem reputation. As mentioned earlier, being associated with the campus has a good marketing effect for the company. The CEO indicated that the brand of HTCE has a lot of respect at the heart and mind of people, he elaborated: “People are always impressed when they see my card and see high tech campus standing on it. It’s like: wow you must be doing something right”. Furthermore, the company also benefits from the networking aspects of the company. By being actively participated in the campus business club and other networking events, the CEO can found networks and contacts that were valuable for the company, as noted by the CEO “Another aspect which is nice about the campus is the business club. I already had a few chances to give a presentation at health meeting. I got an interesting, network, people, and contacts from that”. Moreover, the company benefits from the tight connection of the CSM with people from brainport development and brainport industries. Through their networks, the CEO was connected to the network of suppliers who can develop and assembly the products. Additionally, the company received consultancy and advice from the people of brainport development. Furthermore, the company was introduced and endorsed to the several parties who can accelerate the development and production of the product. As noted by the CEO, “The advisor from brainport introduced me to the director, and the director was opened to have a discussion with me because I said: This person is sending me, he indicates that you are the right party to talk to. So that opened doors”. In general, the CEO perceived the ecosystem of the campus has enabled a platform of networks which the residents can tap into and develop further. To sum up, the companies captured value from the HTCE’s reputation and the campus’ networks.

7.2.3 Collaboration & Value Appropriation Mechanisms
The company involved several parties when developing the products. In the early development of the product, the founder utilized his personal connection to produce their first prototype, as explained by the CEO “What I did was used the ecosystem of Eindhoven to find the right parties. For example, I found somebody in design academy who is good with metal, I found someone who more or less like hobbyist that can develop the brain of the lamp and I found someone who can put the LED together and do the assembly”. Then, the company started to collaborate with the professionals parties to further develop the lamp (The 2.0 version). To design the new version of the lamp, Vitaallicht worked together with a professional design company in Eindhoven. Furthermore, the company also worked together with a product development service provider in Eindhoven. To do the production and assembly, the company worked with the suppliers and companies in the Eindhoven area. In general, the CEO was proud that the products were designed, developed, and assembled in Eindhoven.
However, Vitaallicht did not have any collaboration with other residents of the HTCE. Nevertheless, the CEO claimed that he had a ‘triple helix’ collaboration which involved businesses as well as government and university (Voorhuis, 2015). The company was supported by the brainport development and brainport industries to find the right partner for product development and production. Moreover, the company worked together with the Technical University of Eindhoven to perform some measurements and tests to investigate the effectiveness of the lamp in improving health and well-being of patients with dementia. In the end, the company received a lot of benefits from the results of the research since it supported the company’s claimed of the health benefit of the lamp. In conclusion, even though the company did not have any direct partnership with other residents of the HTCE, the company collaborated with other parties within the ecosystem of Eindhoven which also link with the HTCE’s ecosystem.

Value Appropriation Mechanisms

Vitaallicht employed both intangible and tangible mechanisms to ensure the value appropriation from the collaboration in the ecosystem. In general, the company tends to rely on the tangible mechanisms such as contract and other written agreements. Nevertheless, the CEO also considered trust as an important aspect to capture the value. The detail explanation of both mechanisms explains in the following section:

Tangible Mechanisms. Vitaallicht employed an intellectual property right (patents) mainly to prevent imitation and to defend against the existing Intellectual Property (Voorhuis, 2015). Moreover, the CEO thought patents were good for marketing purposes since patents gave a signal of innovativeness of the product to the partners and customers. Furthermore, the company heavily relied on the contract to appropriate value from the collaboration with other parties. The CEO believed that it was important to really know about the terms and conditions as well as the legal conditions in every partnerships/collaborations. For example, in the collaboration with the designer, the software engineer, and the manufacturer, the CEO felt that the other parties only worked on a part of the project, while the total project was owned and managed by the company. Therefore, the company needs to ensure that in the end the partners delivered the propositions which have been agreed upon. As such, contracts were considered important to ensure the deliverables of the project.

In addition, the CEO was very careful in sharing the know-how of the product to other parties, as noted by him “What I’m discovering during the process is that, developing this product takes a lot of more energy than I expected. Knowing this, I feel more reluctant to give some ideas away to other people because I think really developing what I have done is such an effort”. Moreover, to anticipate the proprietary knowledge being leaked to the partners, the company preferred to use a less detail contract. The CEO perceived less risks in a less detail contract because the company did not need to put much confidential information in the contract. In addition, contracts were important to minimize the effect of conflicts and disputes on the business activities, especially when the trust between parties is gone “The contract was very valuable because, for example, I got into conflict with one of software developers and we need to end the relationship and just having that clause in the contract really prevented us from going to court, so that was really a value” as explained by the CEO.
Nevertheless, the CEO felt that creating contracts and other legal instruments were time consuming. As such, the company planned to be more open which more based on trust. The role of trust in value appropriation is discussed in the next section.

**Intangible mechanisms.** In the early development of the product, the collaborations that the company had were initiated from the personal and informal networks. Those collaborations were heavily based on trust in which the company asked favors to the partners without a substantial monetary compensations. In general, trust was considered important when the company decided to partner with other parties, as indicated by the CEO “Trust is still important, I think it’s even more important than the contract because you act from the trust and only if the trust gets damaged along the way you need a contract, so the contract is step one, and you need to think how big is the risk if the trust is damaged, then you want to rely on a good contract”. Furthermore, in partnering with bigger parties, the company perceived to has less bargaining power to influence the outcome of the negotiation. One way to achieve a better deal, the company needs to be considered as a trusted partner by the bigger company, as noted by the company “The challenge as a startup company is you are small and you don’t have a lot of bargaining power in the contract. So, I really need to be a nice and trusted guy”. Another mechanism which employed to ensure the value appropriation from the collaboration was by monitoring the performance and stay interested with the progress. By monitoring the progress and the performance, the company not only can ensure the output of the collaboration, but also can manage and build trust as well as a good relationship with the partners. In addition, the company believed that the key success of the collaboration was choosing the right partner in the beginning. The company had experienced several collaborations that did not go well in the end. Based on such experiences, the CEO stressed out that the key success to benefit from the collaboration was choosing the right parties that are credible and trustworthy in the beginning. Table 4 presents the summary of both tangible & intangible mechanisms in the case.

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<thead>
<tr>
<th>Tangible</th>
<th>Intangible</th>
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<tr>
<td>Intellectual Property Rights</td>
<td>Trust-Based Relationship</td>
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<tr>
<td>Contractual Agreements</td>
<td>Partner selection</td>
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<td>Performance Monitoring</td>
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### 7.3 Proxible

Proxible is a startup company which introduces a sensor which enabled hyper-localized interactive service platforms that trigger the right content at the right time via mobile apps. Proxible bridges the gap between online and physical world and enhance the user experience. Proxible has developed dedicated end-to-end solutions, including hardware, app, and a cloud service, for diverse segments such as retail, city exploration, and leisure.

### 7.3.1 Firm’s Characteristics

*History of the company and Establishment at HTCE*

Proxible is one of the alumni of Startupbootcamp HightechXL, a business accelerator program for high-tech hardware startups which hosted by the HTCE. Initially, the company developed a Bluetooth-based sensor that could make connection between the client and the application of a
company, so that the company could provide more contextual information to the clients. However, since the introduction of iBeacon (an active-tag technology) by Apple, Proxible adjusted its sensor with the standard of Apple’s iBeacon. Along the process, the focus of the company was shifted from a hardware-oriented into a software-oriented company. At that time, the company perceived that the hardware model was not very scalable in the future, as indicated by the CEO (2015) “The hardware is very scalable if you have a large infrastructure team or deployment team, as a startup if you have to deploy hardware in multiple locations is very time consuming; therefore, we focused more on the software side of it, it does more practical for a startup”. Currently, the company provides a service that enables businesses to link the online interactive contents (e.g. digital advertising, campaign) with physical objects which enables on the spot messaging (Proxible, 2015).

It can be said that Proxible was born in HTCE. The company was formed when Shinjan Dasgupta, the CEO and the founder of Proxible, participated in an event called startup weekend that held at the HTCE. Then, the company joined with a business accelerator in HTCE which help them to started the business operations. To date, Proxible has been situated in HTCE for about two years. The company occupied a flexible office in HTCE 31 that provided by EIT ICT Labs, a European entrepreneurship initiative.

Technology and Knowledge Advantages
The key advantages of the company derive from its sensor technology and its interactive service platform. Proxible developed a proximity sensor based on beacon technology. The technology enables handheld devices to perform certain actions when they are in close proximity to the beacon. In other words, the technology allows any object to communicate with people in close proximity of the object (Proxible, 2015). The Proxible’s sensor uses Bluetooth low energy technology, which makes it very energy-efficient. Furthermore, the beacon sensors are fully compatible with Apple’s iBeacon industry standard. The Proxible innovative sensor technology is perfect for proximity marketing purposes; for example, as soon as a person shows interest in an object, it is picked up by the sensor and a highly contextual and personalized message is sent to that person (Dasgupta, 2013).

Another Proxible’s key advantage lies on its smart engagement platform. Proxible offers a flexibility for the clients to build their own brand/information campaigns by using the platform. Furthermore, in combination with the sensors, the engagement platform is able to accurately pinpoint user’s location and can understand the user’s information based on the incoming data. Then, the Proxible’s software can analyze the data to create suggestions for the user. In essence, the key advantages of the company lie in its integrated solutions which combine the Proxible beacon sensors, the engagement platform, mobile app framework, and cloud service for analysis (Heuvel, 2015).

Business Model & Commercialization Strategy
Initially, the company business model was more focused on the subscription based model. Proxible charges a monthly subscription fee for the sensors. However, after the company shifted its focus from a hardware-based company to a software-based company, the company started to focus on providing an integrated solution for a location based analytics (Dasgupta, 2015). The company focuses on three revenue streams (1) by building the sensor infrastructure and licensing its use on monthly recurring revenue, (2) by assisting clients to build their own brand/information campaigns on the Proxible
smart engagement platform, and (3) by offering data consultancy to interpret the collected data and rapidly make modifications when necessary (Proxible, 2015). In general, the business model of the company is project-based model, in which the company provides a module as a license for the customer’s project and perform all the custom development at the customer cost (Dasgupta, 2015).

At the moment, the company focuses on three market segments: Theme Parks & Zoo, Smart City, and Retail. However, the company believes in the tremendous business potential of the proximity sensor technology and its platform for various applications. Hence, the company developed a generic solution called “smart space” which can be customized in various industries. As indicated by the CEO, “Basically, because we do a location based analytic it can be made into various applications, location analytic is interesting for movement of people in cities, for instances. It is also can be used for movement of people in the museum or retail stores. So, it’s quite a broad topic what we are doing, so we build a generic solution which we called the smart spaces core of Proxible around that solution, we built various vertical solutions, specifically for certain industry”. By developing a generic solution, the company aims to wider its market in various industries such as health application, hospitality, transportation, etc.

Access to the Market
In general, the CEO perceived that is quite challenging for a small company to introduce a new technology to the market. Hence, to get introduced to the potential customers the company utilized the network that they got during the mentorship program at Startupbootcamp. At first, the company preferred to do a project with company/organizations who were familiar with the company because it was easier to explain the technology and develop trust. As noted by the CEO “We don’t do a project with companies who don’t know our brand, it’s very hard. It’s almost impossible to do a project with a company does not already know us because this is a new technology”. In addition, the company also actively participated in networking events and conferences to increase their brand awareness.

Another strategy to get access to a wider market was by collaborating with a big player in the market. For example, the company had projects with Eindhoven City Marketing, Dutch Railways, and KLM. By having a project with a big organization/company, the company got positive referral effects from the clients. “For instance, City marketing Eindhoven is linked to the city marketing of other cities in the Netherlands as well, they do talk to each other about what is happening in the market, what the new technology that’s available in this city. So after something done in Eindhoven, I am very sure other cities will listen and adapt to it because Eindhoven is considered as the leader in the area of smart city” as noted by the CEO.

7.3.2 Appropriating Value from the Ecosystem
Proxible has benefited from the campus ecosystem since its early establishment. As mentioned before, the company was formed during an entrepreneurship event held by the campus management. Since then, the company has received a lot of benefits from the ecosystem of the campus. First of all, the company benefits from the flexible offices. Furthermore, the company benefits from the mentorship and consultancy from the campus’s members. Also, the company advantages from the campus’ networks and the reputation of the ecosystem. The following section describes the perceived value of the company on the campus facilities and the innovation community.
Facilitation of Innovation Process. Proxible did not utilize any technical facilities or services provided by the campus. Nevertheless, as mentioned in the previous section, the company used the environment of the campus to do a pilot project in the early development of the technology. The support from the CSM indeed helped the company to accelerate the product development process (Dasgupta, 2015). Additionally, the CSM helped the company to connect with the future customers, as noted by the CEO “Bert-Jan [one of the campus site manager] supported me a lot, he connected me to a lot of people who again connected me to my future customers, so the ecosystem work because few individuals took me and promoted me in their ecosystem”. Moreover, the company benefited from the mentorship and advice from the Startupbootcamp mentors. In fact, the CEO mentioned that the transition of the company from hardware to software-based “has a lot to do with HTCE” since the transition has occurred based on the advice and feedback that the company got from the mentors. Additionally, the company benefited from the close proximity and the tight connection between the campus ecosystem and the city of Eindhoven. As such, the company was able to initiate a partnership with the city of Eindhoven and made the city as their first and primary customer.

Innovation Community. In general, the company has benefited from the ecosystem reputation and the “open culture” of the ecosystem. The CEO perceived that the HTCE has a good reputation which help the company to build credibility, especially for local businesses. Moreover, the reputation of HTCE sometimes helped the company to open the door of the partners/customers, although it did not really help the company to close the deals. In addition, the company has advantaged from the ‘open culture’ of the campus ecosystem where people can freely get advice and ask for support. The CEO elaborated with this following statement “I would say the benefit that I got from HTCE is access to a good network of mentors and companies who I could go and approach. That’s a lot of experience from the entrepreneurs and also big companies available in the HTCE who are willing to advice, if you find the time to going to speak to them”. Furthermore, the CEO highly appreciated the networking activities initiated by the campus management, such as campus business club. The CEO perceived that by being actively participated in the network it will open more business opportunity, as noted by the CEO “I also like another initiative that the HTCE does like business meeting club. I like those as well it’s good to find who those people are at the HTCE, what they do, and how can we work together on it”. However, although the company has benefited from the open culture, the CEO pointed out that in some extent, the level of openness between multinational such as Philips or NXP still relatively low. As pointed out by the CEO “The ecosystem not yet make sure that the startups interact that freely with large companies. For example, I don’t know what project that Philips is working on and where I could participate in. So, how would I know if my team and I or my product can help with the project, I don’t know what project they are working on”. In the future, the company hopes that campus site management can foster collaboration between startups and multinationals by developing a platform where people can share their internal project and ask for participation of other campus residents. In sum, the company captures the value from the HTCE’s reputation, mentorship and consultancy, and the open culture of the ecosystem.

7.3.3 Collaboration and Value Appropriation Mechanisms
To date, Proxible does not have any collaboration with companies in the HTCE. However, Proxible had a collaboration with the CSM and the city of Eindhoven. The CSM helped the company during the
early development of the technology by allowing the company to do a pilot project in the campus during the Dutch Technology Week 2013 event. The collaboration with HTCE was considered as a big first step for the company to start, as indicated by the CEO “We did pilot project here [at the campus], so we initiated to see how the system works and the site management did not have any objections to us to install our hardware and software here to check and evaluate data. That’s very beneficial for us because there is a larger set of company in the ecosystem and there are a lot of people at the HTCE, close to 8000 people, you can collect the data locally here to see if the technology work before expanding anywhere else.”

The city of Eindhoven is one of the first partner as well as the first customer of Proxible. The main goal of the collaboration was to make the city more interactive with the citizen. The company was involved in the smart city initiative of Eindhoven and collaborated with the Eindhoven’s city marketing in developing marketing solutions for the city of Eindhoven. Furthermore, Proxible provided the technology for several city’s events such as GLOW festival, Dutch technology week (Dasgupta, 2015). In addition, Proxible collaborated with the city marketing to develop a digital city guide which based on iBeacon technology. In general, the collaboration has created a mutual benefit between both parties. The CEO perceived that the city government was very open with the company and also did a lot of promotion which has a positive impact on the brand awareness of the company (Dasgupta, 2015).

**Value Appropriation Mechanisms**

Proxible employed both intangible and tangible mechanisms to ensure the value capturing from the collaboration. In general, the company tends to rely on intangible mechanisms such as secrecy and trust-based relationship. Nevertheless, the CEO also considered tangible mechanism such as contract as an important instrument in capturing the value. The detail explanation of both mechanisms explains in the following section:

**Tangible mechanisms.** Proxible used contract and co-investment agreement to ensure value appropriation from its business activities. The contracts were typically covered basic things such as deliverables and timelines. Furthermore, the contracts still have a room for a flexibility to change certain terms and agreement during the collaboration. The CEO considered contracts were important because “It shows that they believe in the idea and willing to pay for the idea” (Dasgupta, 2015). Moreover, the contracts, especially that combine with a Non-Disclosure Agreement (NDA), were also useful to prevent confidential information being leaked to other parties. More importantly, in every project, the CEO perceived that it is very important to have a co-investment agreement beforehand. Aside for the risk sharing purposes, the co-investment agreement shows the commitment of the party with the project as mentioned by the CEO “They have to make an initial investment. If they don’t make an initial investment, then they don’t really believe in the idea is more like nice to have”. In the co-investment agreement, the partners/customers were expected to pay for the entire development up front as an investment for the Non-recurring engineering cost (NRE). Also, if the pilot project success, they must commit to a minimum one-year contract to use the solution provided by the Proxible. As such, the company can minimize the risk of technology failure and profiting from the project.
Intangible Mechanisms. For a young company like Proxible, trust is very essential, especially to initiate a project. The CEO perceived that in every project, it was always based on trust since as a startup the company did not have much background performances or a proven record. Furthermore, the CEO felt it was impossible to start a project without being trusted by the partner since the company was selling a future technology that may not exist yet in the market. As indicated by the CEO, “Unless there is trust and they see business value in this thing, then they will be interested and do the co-investment for the project. Since we are selling a future technology right now, it’s not really there right now. So, unless there is trust and they see a business value within a period of times, they wouldn’t do a business with you”. In addition, it is also important to establish a long-term partnership with partners to secure the business opportunity. To do that, the company always tries to establish a common goal with the partner. The CEO of the company then sits with the partner and explain a roadmap of the technology so that both parties know what will be coming and what to expect in the next couple years (Dasgupta, 2015). Furthermore, to protect their technology from imitation, the company does not utilize patents due to the nature of the technology. The CEO thought that it will be much challenging to get a patent for software technology in Europe. As such, the company preferred to keep the know-how and the logic of the technology remain secret/proprietary. The summary of both tangible and intangible mechanisms employed by the company presents in Table 5.

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<th>Tangible</th>
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<tr>
<td>Contractual Agreement</td>
<td>Trust-Based Relationship</td>
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<tr>
<td>Co-Investment Agreement</td>
<td>Establishing Shared &amp; Common goals</td>
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<td></td>
<td>Secrecy</td>
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7.4 ZS

ZS (Not its real name) is a startup company that develops solutions for smartphones, tablets, and smartwatches to allow them to be charged wirelessly. ZS is the first company in Europe that introduces a series of wireless charging solutions based on the Qi standard (an industry-standard interface for wireless charging). The ZS solutions including wireless charging for mobile devices, integrated wireless charging for furniture (tables, lockers, etc.), and in-car wireless charging solution. Currently, ZS is the second largest wireless charging in Europe after Samsung.

7.4.1 Firm’s Characteristics

ZS was founded by brothers from a small region in Noord Brabant. The company started when the founder saw the opportunity of wireless charging. At that time, He was working at the Philips headquarters in Amsterdam and one of the initiators of the Wireless Power Consortium which developed the Qi standard. The technology was initially developed by Philips; however, Philips decided to ‘pull the plug’ and not introduced the wireless charging to the market since there were no chargers and appliances that supported Qi standard, as noted by the founder (2015) “There was already a technical specification on paper, but there were no chargers and appliances Qi supported”. Nevertheless, the founder saw the market opportunity and the trend of wireless charging in the coming years. Then, he pulled over his brother, who is a graduate business administrator, and introduced wireless charging to the market by their own company, ZS. At first, the company was
progressing slowly as not many smartphones adopted the Qi standard, but along the way the predictions of the founders come true, as noted by one of them “In the past three years, a lot of brands have adopted the Qi standard for their products; currently, over 500 products are Qi-certified”.

Initially, the company was situated in Hapert, a small town in the Nord Brabant Province. As the company grows, in 2014, the company moved to the Mµ building in HTCE. The motivation to be located at HTCE illustrates in this statement “We choose this place because we are living in this area. We want to find a place where we can grow, we wanted a place where it is nice to people to be around and we wanted a place with more technical people working in the same area” (CEO of ZS, 2015). At this time, the company centralizes its business activities in Mµ building and make it as their new headquarters.

*Technology and Knowledge Advantages*

The technology of wireless charging is not new since it is based on the induction and electromagnetic principles. For example, this technology has been applied to recharge electric toothbrushes since a long time. However, the application on mobile devices was applied only in recent years. One of the founders (2015) argued that it was only booming in the past five years due to the fact that mobile devices become more power consuming and there was no industry standard for wireless charging before. ZS is not the only producer of wireless charging, there are about thirty companies that produce wireless charging. However, most of the big brands only put the wireless charging as a side product while ZS solely focus on the wireless charging solution.

Product wise, the ZS chargers are equipped with seven inductor coils that are seven times more than typical chargers. A large number of embedded coils allows the charger to be placed freely on the, does not have to be placed exactly in a certain position (ZS, 2015). As such, the ZS chargers offer the largest positioning area compare with the other wireless charging available on the market. In addition, the company claimed the charger is one of the most efficient Qi chargers in the markets. Furthermore, unlike typical charger which made from plastics, the ZS charger is made of aluminum, which made it withstand with the water. With these advantages, ZS can apply its charger to various applications. For example, the company introduced ZS PuK, a charger that can be integrated with furniture such as desk, bedside table, lockers, etc. Furthermore, the company always put user-friendly and customizable designs in every product. Another key advantage of the company is the knowledge of the wireless charging market. As one of the contributors on the Wireless Power Consortium, the founder has access to the latest trend of wireless charging technology. As such, the company can develop products that anticipate the next trend of the technology. In sum, it can be said the key advantages in all of ZS’ products are in its innovative multi-coil technology and its design.

*Business Model & Commercialization Strategy*

As their business model, the company targeted both retail and business to business market. For the retail market, the company sold the products via offline and online stores. The company approached retailer including Dixons, Mediamarkt, and mobile operator phones (e.g. T-Mobile, KPN). Furthermore, the company aimed the online stores market by selling the products via e-commerce website including Amazon, bol.com, Coolblue, and the company’s website. When the company first introduced its wireless charging in 2011 to the retail market, there was none of smartphone that
could be charged on the wireless charging. As a consequence, the company developed a customized sleeve/case that act as a receiver for the wireless charging. Back then, the sales were not as good as expected due to the fact that the customers have to buy an additional receiver to be able to use the charger. Eventually, the big brand such as Nokia, LG, Samsung and Google have started to integrate the Qi receiver to their devices. In the next couple years, the CEO expects that the covers or other form of external receivers will no longer be necessary since all manufacturers of mobile phones and gadgets will incorporate the Qi standard (ZS, 2015). The founders predict there will be 100 million wireless rechargeable phones on the market by the end of 2015. In addition, to promote and to introduce the charger to the wider audience the companies approached online journalists and provided testing devices to them to be reviewed in their online media.

In business to business market, the company targeted the furniture manufacturers, bed manufacturers, kitchen manufacturers, and product designers. The company vision is to integrate their wireless charging to home and office appliances. Therefore, the company strategy is to approach the twenty biggest manufacturers of table & furniture in Europe and partnering with them to develop an integrated product together (CEO of ZS, 2015). Furthermore, ZS partnered with the building owners such as offices, restaurants, and hotels to install the wireless charging in their desks and tables. Lastly, the company plan to explore the automotive market by collaborating with car manufacturers such as Lexus and Toyota to provide in-car wireless charging.

Access to the Market
In general, the successful of the company in selling the product partly depends on the level of adoption of the mobile manufactures on the Qi standard. In other words, the company will benefits when more and more mobile manufactures integrated the Qi receiver to their devices. As such, the company strives to stay update with the incoming gadgets so that they can be the first company that offers wireless chargers that suitable with the phones. Furthermore, the company also attempts to keep up with the current trend of wireless power technology by, for example, attending exhibitions, conferences, or market fairs. In this case, the company is the member of the Wireless Power Consortium. By becoming the member of the consortium, the company will keep update when new industries/companies adopt the Qi standard. While waiting for the network effect (externalities) of the technology, the company strives to initiate partnerships with their target markets (furniture manufacturer) to establish its supremacy as a provider of wireless charging solutions.

7.4.2 Appropriating Value from the Ecosystem
In general, the CEO perceived the HTCE is the right place for ZS to grow. The company received a lot of benefits by being part of the campus. Firstly, the company benefits from the technical facilities and the infrastructure of the campus. Secondly, the reputation of this campus leverage the credibility of the company to the partners and suppliers. The following section describes the perceived value of the company with the campus facilities and the innovation community.

Facilitation of Innovation Process. First of all, the company benefits from the infrastructure (offices) and the pleasant working environment of the HTCE site. The green environment and the modern infrastructure give a good impression to the potential customers or partners that visit ZS office. As indicated by the CEO, "In Hapert (the previous office), we were in the old building, old furniture, but
here everything is up to date. The ecosystem, the grass is green, the trees are nice, and the buildings are very modern so it is good to invite people over here and walk with them to the strip and they are already impressed. When you have a sales meeting in the campus, you want to give the impression before everything started”. From the statement, it can be said that the infrastructure, the landscape of the campus site as well as the professional appearance of the building have positive influences in increasing the credibility of the company in the eye of the potential customers. In addition, the company also benefits from the technical service provided by Philips Innovation Service (PINS). The company used the PINS services to test and further validate the reliability of their products. By being tested with a reputable company like Philips, the credibility of the products has increased. As noted in this following statement “I think when we invited them or we are telling them we are in the HTCE, and we are working together with Philips Innovation Services for testing our product. That’s convinced them to work together with us not with somebody in Rotterdam”. Furthermore, the company benefits from being close with multinationals, as noted by the CEO “I’m very happy that I have a chance to listen to somebody from Intel telling about new chips, they are developing and I’m very happy that I can learn from Philips Lighting what their strategy would be with light. When I wasn’t here in the area, probably I wasn’t invited to listen to those stories”. The benefit of being close with multinationals might not directly relate to the value appropriation; instead, it allows the company to learn about technology and market trend and spot new business opportunities.

In addition, the company got benefit from the personal help provide by the CSM. The CSM introduced the company to other residents and promote them in the campus's networks. Additionally, the CSM helped the company to increase their reputation by connecting them to a national newspaper, as stated by the CEO “I think a lot (benefit of being part of the campus), because a few weeks ago we were in one of the most important newspaper in the Netherlands, when we work at Hapert, a small village nearby, they never come by and do a great interview, while in this case, Bert-Jan (The CSM manager) called me and connected me with them. That was very important for our company in this stage”.

Innovation Community. The ecosystem reputation was considered as an important source of value appropriation for the company. The good reputation of the ecosystem really helps the company to attract potential customers to consider the product and other companies to collaborate, as pointed out by the CEO “When we talk to our potential customer and we say that we are located at the HTCE, they say ‘Okay, the quality will be good because they are in the HTCE’. So, that’s really important”. Furthermore, the company perceived a lot of benefits from the networking events held by the campus since they can find a potential supplier and potential customer in the events. In addition, the company benefits from the campus network in finding partners to solve their business problems, as illustrated by the CEO, “Several weeks ago we had a problem and nobody in our network could help us. Then, I went to Bert-Jan, and ask do you know somebody who can help us with this, and he said I think I know three people, maybe four. So, I asked for one, but he said I know four. Then, I called these guys and they are helping us now”. From the statement, it can be said that the companies exploited the campus network to accelerate their business activity.

Additionally, the company perceived that the open culture of the campus and the high level of trust, support the company to reap the benefits from the collaboration with other campus residents. For
example, the CEO felt a different treatment from the PINS after the company located at the campus. As noted by the CEO “When we were working outside the campus you have to pay, when we are in the building the time was counted and we always have to pay. Now, it’s more I met them in the canteen or in the strip, and said do you have time for coffee, should I come back to you or you came to visit. It’s very informal and we are helping each other. We can do that without always need to pay. I think that’s the great advantage when you are here in this area. It’s also easier for them to try to get contact with us”. Based on the statement it is clear that the company has benefited from the openness and the informal culture of the ecosystem. Moreover, the company perceived that the residents of the HTCE are more trustworthy and less likely to do opportunistic behaviors due to the fact that they belong to the same community (the HTCE Community). As such, the company might be able to save a fair proportion of value from the collaboration with other residents, especially when the company employs intangible mechanisms.

7.4.3 Collaboration and Value Appropriation Mechanisms

As mentioned earlier, the company has established many partnerships with partners including furniture manufacturers and automotive manufacturers. For example, ZS collaborated with Lexus to develop a car wireless charging. However, this will only focus on the partnership that the company has with the residents of HTCE. According to the CEO, the company has collaborations with three HTCE residents. The first one is a collaboration with Philips Innovation Services (PINS). The company used PINS testing services and facilities to test the reliability of the products. The CEO perceived that the collaboration with Philips went well since, there was a clear communication between each other (CEO of ZS, 2015). Additionally, the CEO perceived that the collaboration also increases the product’s credibility since it was tested by a reputable company like Philips. For the other two, the aims of the collaborations were to developed products together. The collaboration was involved combining ZS wireless charging with other technologies. The CEO did not provide more information about these collaborations as it was confidential from a firm. Nevertheless, the CEO felt so far the collaborations with partners went well and a prototype was resulted from the collaboration.

Value Appropriation Mechanisms

In order to appropriate a fair proportion of the value that created from the collaborations, ZS employed tangible mechanisms such as contractual agreements as well as intangible mechanisms including trust-based relationship and first-mover advantages. However, in general, the company tends to rely on the intangible mechanisms in capturing value from collaboration. The detail explanation of both mechanisms is provided in the following section:

Tangible Mechanisms. The CEO perceived contractual agreement was one of the effective instruments to ensure the value appropriation from collaborations. The company often created a contract at the beginning of a collaboration. In the contract, both parties specified the deliverables of the project, the costs, the estimated profits, and the share that each party can claim. Moreover, the contract described the allocation of the ownership of any intellectual property (and knowledge) generated from the collaboration. However, the CEO perceived contracts did not always need in every collaboration. The contract can be effective when the output of the collaboration was relatively clear. Moreover, when the collaboration involves radical innovations in which the output of the collaboration was hard to
predict, a contract was less important (CEO of ZS, 2015). Furthermore, the CEO preferred not to employ a contract when working with SMEs or startups. As indicated by the CEO, “When we are working with the small company, we don’t have time, we do negotiations, we write down some points, but not using a legal contract because we are small. But when we do negotiations with the customer [or bigger company], they always want to have contracts, so liabilities, warranties, paying conditions, etc. Mostly, we are not the party who offering the contract, mostly they ask for signing the contract.”

At the time of the interview conducted, the company did not have any patent for the technology yet. The CEO felt less necessary to apply for a patent due to the fact that the wireless charging technology is an opened standard. Nevertheless, the main reason not to apply patent from the beginning was the lack of monetary resource. The founders had experienced a dilemma when deciding not to patent the technology, as indicated by this statement: “At the beginning, we didn’t apply because we didn’t have money. When we went to several legal advisors they all asked us for 300 or 400 hundred Euro per hour and we think it’s a lot of money. Then, we think what we are going to do. Are we going to spend 40,000 euro’s in the new mold to really build the product or are we going to spend it to have a legal patent and maybe in the end there’s no need in the market for. Then, you have a patent for nothing” (CEO of ZS, 2015). In addition, the CEO thought that applying for a patent might be time consuming which might prevent the company to be the first in the market. However, as the company grows, the company planned to have a patent to defend against infringements.

**Intangible Mechanisms.** In general, trust was considered to be essential when starting a collaboration. The CEO will not initiate a collaboration unless he felt a good connection with the partner and had a sufficient level of trust. As noted by him “I think trust is the beginning on working together in the collaboration. The feeling must be good and you have to feel that you can achieve something; then, you (start to) negotiate”. In fact, the CEO was preferred to be based on trust than a contract because sometimes developing a contract is time consuming and in the end may not cover all conditions of the collaboration. To maintain the high level of trust among partners, the CEO thought it was important to maintain the communication by speaking to each other clearly, having regular meeting, and have a nice evening (informal meeting) (CEO of ZS, 2015). Another strategy that employed by the company to ensure value appropriation is by always being first in the market. The CEO believed the company will enjoy lead time advantages if they are faster to bring the product to the market. As noted by the CEO “We believe in going very fast and I think when we are still up front and the fastest in the market, then there always be a share for us”. Furthermore, in the collaborations, the company always strives to be in the lead and always try to be the first guy who in touch with the customer. As such, the company was better informed with the customer feedback and market trends. As noted by the CEO, “We are always trying to be in the lead and we always try to make sure that our company (is the one who) will go to the customer. So, we will know what’s happening, and we control over the situation. As a result, we know what we can earn; therefore, we try to be the front guy”. To conclude, the company valued the trust-based relationship and first-mover advantages as the effective mechanisms in capturing value from the collaboration. The summary of both tangible and intangible mechanisms employed by the company presents in Table 6.
7.5 Cross-Case Analysis
In this section, a comparative analysis of the four different case studies is presented. In the analysis, the similarities, patterns, and interpretations are only considered if based on data from at least two of the case studies. In addition, the empirical findings arise from the case studies are discussed and compared with the existing theories.

7.5.1 Firm’s characteristics
All companies in the case studies are startups with less than 10 employees. Most of the companies are in the commercialization phase with the products/services that have been already introduced in the market. Only Etulipa that is still in the final stage of the product development phase; nevertheless, the company has started to introduce its pilot screen to the market. Therefore, it can be said that most of the companies have experienced the value creation phase and they have started to appropriate the value of their innovations. Furthermore, two companies, Etulipa & Proxible, were developing their products or services in the Campus. As such, the HTCE ecosystems also contributed to the value creation of the firms as all the companies used campus facilities and supports in order to develop their products. These companies have a historical relationship with the HTCE. For example, Etulipa is the subsidiary of Miortech which was a spin-off of Philips, while Proxible is the alumni of Startupbootcamp HightechXL. On the other hand, the other two companies (ZS & Vitaallicht) have already developed their products prior to join the HTCE. Hence, it can be said that the campus ecosystem was not involve in the value creation of these companies.

In addition, only two companies (Etulipa & ZS) utilized the technical services provided by the campus. Moreover, not all companies have a direct partnership or collaboration with other residents of the campus. Nevertheless, most of the companies have collaborations with parties within the Eindhoven area (the brainport ecosystem). Three companies of the case studies reside in the Mµ building, while one company (Proxible) reside in a flexible office provided by one of HTCE residents. The companies that are located at the Mµ building have access to the technical and financial advisors of the Brainport development network. On the other hand, Proxible has access to the EIT ITC Labs’ (A European innovation network consortium) network and the Startupbootcamp network of mentors. Additionally, all of the companies have access to the campus’ events and the network of campus’ partners (e.g. Brainport Development, BOM, etc.). Furthermore, most of the companies are actively participating in the Campus Business Club. To conclude, all companies in the case studies are active residents that receive an extensive exposure with the HTCE facilities, services, and networks.

7.5.2 Appropriating Value from the Ecosystems
The case studies show that most of the companies were benefited by being part of the campus. In general, most of the companies were satisfied with the support & facilities offered, which was indicated by their intentions to stay at the campus for at least the next five years. Moreover, most of

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Table 6: Value Appropriation Mechanisms (ZS)

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<thead>
<tr>
<th>Tangible</th>
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<tr>
<td>Contractual Agreement</td>
<td>Trust-Based Relationship</td>
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<tr>
<td>Patent (in the future)</td>
<td>First-mover Advantages</td>
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the respondents perceived that the HTCE ecosystem supports company’s growth. To be more specific, the residents leverage the value of the HTCE’s reputation and the campus’ networks. This subchapter describes in detail how the residents of the HTCE benefit from the ecosystem, especially in terms of supporting firms’ commercialization process.

From the case studies, it is clear that ecosystem reputation is considered as the most important value for the companies since most of the companies are benefited from the positive association with the campus. A positive association with the HTCE increases firms’ reputation which in turn makes it easier for the firms to attract potential customers and/or suppliers. In addition, as pointed out by Stinchcombe (2000), a newly founded startup might suffer from the “liability of newness” in which the startups are unable to provide clear evidence of its ability that prevent stakeholders to objectively evaluate the full capabilities of the firm. As consequence, startups tend to lack institutional legitimacy that make them difficult to attract investors, potential customers and skilled personnel, and to compete effectively against more established firms (Dollinger, Golden, & Saxton, 1997). With respect to value appropriation, Teece (1986) considered firm’s reputation as one of the most important resources needed to commercialize inventions. The presence of high firm’s reputation and brand recognition offer additional benefits to the customer; as such, it influences the value that firms can capture (Teece, 1986). Moreover, a positive reputation can help the firm to build a new or maintain an existing customer relationship; hence, it supports technology commercialization. In this context, our case studies proved that being associated with the good reputation of HTCE improves firm’s reputation and credibility, while at the same time supports the firm’s value appropriation.

Secondly, the companies in the case studies appropriate value from the campus’ networks which cover a full chain of R&D networks, including investors, suppliers, manufacturer, and customers. As such, the residents of HTCE are able to source for partners who can complement their innovation efforts globally via the campus’s (and partner) networks. For example, some companies in the case studies have found suppliers, manufacturers, and potential customers via the campus’s networks. The access to the complementary assets, such as production facilities, sales channels, and marketing capabilities, are considered as essential aspects that enables firm’s value appropriation (Fischer, 2011; Teece, 1986). Complementary assets play an essential role in transforming knowledge into products and bringing products into the market by effectively meeting the customer needs and building brand reputations (Agarwal & Helfat, 2009). Hence, firms that have a superior access to complementary assets tend to capture more value since they can reduce the possibility of free-riders. In addition, a superior access to relevant complementary assets enhances the company’s value appropriation capabilities by increasing customers’ use value or decreasing costs (Teece, 1986). A study by HanGyeol et al. (2015) reveals that for SMEs, the investment in complementary assets may increase the firms’ R&D productivity, especially in the commercialization stage. However, small companies have relatively lower access to complementary assets than large enterprises since acquiring complementary assets involves high costs and managerial burden (HanGyeol et al., 2015). Nevertheless, the case studies show that startups could relatively easily gain access to the necessary complementary assets, including production capabilities and sales channels, via the campus’s networks without heavily investing their own money. For example, ZS found supply chain partners to solve its production & supply chain problem and Proxible found new customers via the campus’s networks.
partner networks. Hence, it can be said that the campus networks support the startups by providing access to complementary assets; thereby, supporting the value appropriation.

Thirdly, the open innovation atmosphere of the campus was considered as an important aspect that supports value appropriation in the ecosystem. The case studies show that the HTCE has a supportive climate for startups to grow and to initiate collaborations with partners from either inside or outside the campus. Furthermore, the networking aspects provided by the CSM, includes networking events and Campus Business Club, support the companies to develop informal networks and establish a strong sense of community. As a result, the high-level of trust among members is built. For example, some companies in the case studies believed that the residents of the campus are more trustworthy and less likely to do opportunistic behaviors than companies outside the campus. With regard to the value appropriation, several researchers argue that trust is one of the most effective mechanisms to secure value appropriation in alliances (Kang, 2013; Wagner et al., 2010). Trust safeguards partners from opportunistic behaviors; thus, the firms tend to share created value symmetrically (Kang, 2013). Furthermore, trust can compensate costly control mechanisms and diminish transaction costs (Wagner et al., 2010). In addition, the campus community, such as CBC, creates a dense and cohesive network that may discourage members to do opportunistic behaviors since bad actions will be quickly spread within the whole network and be heavily sanctioned within the community (Coleman, 1988). Thus, it is safe to assume that the ecosystem culture supports the firm’s value appropriation.

Additionally, the case studies showed that the residents also benefit from the facilitation and supports provided by the CSM. First, several companies in the case studies captured the value of the appearance of the building as well as the landscape and the green environment surrounding the campus. As indicated in the case studies, the modern appearance of the building and the campus facilities (The Strips) create a positive impression to the customers of the company. The positive impressions indirectly help the companies to persuade future customers. As pointed by Gourville (2006), customers hesitate to try a new innovative product and technologies due to the physiological bias. Customers tend to overweight the existing product’s benefit by a factor of three; hence, they undervalue the new products or services offered (Gourville, 2006). Therefore, companies have to make extra efforts to convince customers to try or use a new product. The case studies show that the good impressions which are created from the internal infrastructure of the campus and the reputation of the HTCE help them to sell their products. Secondly, a close proximity with multinationals (e.g. Philips, NXP, and Intel) and the university (TU/e) are considered as an important source of value appropriation at HTCE. By being close with the multinationals and university increase the chance of interaction for startups which can initiate partnerships. A partnership with more established partners may result in name recognition and reputation spillover which is beneficial for the startups (Teece, 1986). Moreover, forming alliances with more established organizations might counter firms’ liability of newness (Hauge, Strodomskyte, & Dai, 2012). First, alliances can help to address a new venture’s shortfall of complementary assets by providing access to valuable complementary resources. Additionally, alliances can indirectly help the startup to overcome the liability of newness through a reputation spillover that will increase the credibility and legitimacy of the startup in the eyes of potential investors and partner (Hauge et al., 2012). Furthermore, the startups can also learn from the multinationals through the knowledge sharing events that held by
the CSM. From these events, the startups can learn about technology and market trends from the biggest player in the field. As such, firms may get a better insight of the new business opportunities. Lastly, the residents benefit from the mentorship and consultancy provided by the CSM and its partners. As explained in the case studies, some companies received external advice and mentorship from the CSM partners which helped the companies to overcome bottlenecks and/or provide them with a strategic view of the market or organizational potential for future development. For example, Proxible got advice from the Startupbootcamp mentors which led them to shift their business model; while, Vitaallicht received advice from the Brainport development which helped the company to find the right partners for their production. From these examples, it is clear that the mentorship & consultancy provided by the campus support the companies to bring their technology into the market. Moreover, an empirical study by Ramsden & Bennet (2005) confirms that external advice might improve the SME’s ability to cope with problems, which in turn leads to the reduction in business costs. Therefore, it is clear that the mentorship & consultancy provided by the campus, assist the startups to successfully commercialize their products and support them to grow.

From the cross-case analysis above, we can tell that if we adopted the four value creation sources in business ecosystems proposed by Van der Borgh et al., (2007), it will indicate that only complementarities and lock-in are relevant in the context of value appropriation. The analysis clearly shows that access to the complementary assets is one important driver of the residents’ value appropriation process. In this sense, the access to the complementarities is facilitated by the ecosystem managers through linkages between residents of the campus as well as between non-residents via the campus’s networks. The residents’ access to complementary asset is also enhanced by the ecosystem’s reputation which in turn improves residents’ credibility to acquire complementary resources from other parties. Moreover, lock-in, in this case refers to the strong sense of community and cohesion that discourage members to get out of the community because the networks of residents are considered to be valuable assets; thereby, it will raise the switching costs. A dense and strong network of the campus residents promotes a high level of trust and prevent opportunistic behaviors. In the end, the high level of trust among members increases the effectiveness of intangible value appropriation mechanisms employed by the residents (e.g. trust-based relationship). In addition, the case studies show that efficiency is less relevant in supporting the value appropriation process of residents. Most of the companies in the case studies did not consider economies of scale and scope that can be achieved from the shared facilities as essential for product commercialization. Moreover, novelty is also considered less relevant since the focuses of the companies were no longer in the creation of new products or services, instead to commercialization of their product. Therefore, it can be said that efficiency and novelty are not relevant in the value appropriation process of the residents that are in the commercialization phase.
Based on those facts, it can be assumed the innovation stage of the companies might influence the perceived importance of value appropriation sources (Complementarities & Lock-in). The case study of Etulipa serve as a perfect example for this proposition. As mentioned in the previous section, Etulipa is the only company in the case studies who is still in the development phase. Compared to other residents, this company perceives less benefit from the ecosystem reputations and the campus networks. Also, the company’s engagement in the community was relatively low. As a result, the CEO of this company considered that the HTCE ecosystem provided fewer added values for his firm’s growth and the overall business performance. However, the company valued highly the technical facilities provided by the campus either via PINS or the lab facilities in the Mµ building. This statement is very reasonable considering the focus of the firm was on the product development at the moment.

Figure 6: Value Creation & Value Appropriation Sources in different stage of innovation process

Figure 6 illustrates this phenomenon. In the development phase, a firm might value the economies of scale & scope provided by the shared facilities higher than other value appropriation sources such as the ecosystem reputation and the campus’s networks. During this phase, the main concern of the firm is focused on producing products/services that are perceived to be innovative (Novelty). Also, the focus of the complementarities is more related to the technical complementarities provided by the campus or other residents of the campus. Moreover, the lock-in mechanisms related to the creation of a strong innovation community might be less valuable for firms in this stage, instead another lock-in mechanisms such as customized facilities and services provided by the ecosystem managers (e.g. customized office space, clean rooms, and technical supports) might be rewarded as more valuable. Then, when the firm moves to the commercialization stage, the value appropriation sources discussed earlier (Complementarities & Lock-in) will become increasingly more important for the firm while efficiency and novelty will become less essential. Based on that, it can be concluded that
the different phases of the innovation process might influence the importance of value creation and appropriation sources.

7.5.3 Factors Influencing Firm’s Value Appropriation
In this section, several aspects that influence the firm’s ability to appropriate value in the business ecosystem according to the insights from the case studies are discussed. First, the data gathered from the case studies shows that the bargaining power of the firms was less relevant in determining firm’s ability to capture value. Most of the respondents did not perceive any differences in bargaining power while working with partners. Even with the larger partners, most of the respondents felt there were no differences in firms’ ability to influence the ‘bargaining set’ and the outcomes of the negotiations. However, there was one company that perceived a bargaining power asymmetry; nevertheless, it was because the relationship with the partner was a buyer-supplier relationship. In a strategic alliance setting, most respondents did not feel a bargaining power asymmetry with larger partners, as has been previously assumed in the conceptual model since the basis of the collaborations are trust and mutual benefit. Furthermore, some companies believed that the larger companies were open with the startups and even they prefer to work with startups due to the flexibility possessed by startup companies. As such, the respondents perceived an equal footing with the partner in the negotiations. This phenomenon in line with research by Chesbrough (2003) and Vanhaverbeke et al., (2012) that posited large firms more open to collaborate with startups as they engage in open innovation practices. More and more large companies rely on external knowledge sources to create new business by cooperating with a multitude of external innovations, including startups (Chesbrough, 2003). Large firms can stay competitive by sourcing the disruptive technologies owned by startups. Furthermore, large firms can commercialize new technologies by leveraging their manufacturing capabilities, brands, and logistic channels without investing a large amount of capital upfront (Vanhaverbeke, Vermeersch, & De Zutter, 2012). On the other hand, SMEs can leverage complementary assets that large companies own to commercialize their technologies. Since both parties need one another, each party tends to have a symmetry bargaining power. Considering these facts and the nature of collaboration possessed by the firms in the case study, it can be concluded that bargaining power does not have influence on the firm’s ability to capture value at the business ecosystem.

Based on the insights from the case studies, there are five factors that might influence the firm’s value appropriation in the business ecosystem, namely: technological capabilities, business model, access to complementary assets, value appropriation mechanisms, and engagement at the community. The detailed explanations of these factors provide below.

Technological Capabilities. One of the key elements that determine whether a firm can profit from an innovation is on the difficulty of a product to be imitated (Teece, 1986). Legal instruments such as patents, copyrights, and trade secrets may make it harder for competitors to imitate; however, the efficacy of legal mechanisms at protecting innovations might vary across industries. Another important aspect that may create a self-protection from imitation lies in the firms’ technological capabilities (Lawson, Samson, & Roden, 2012b; Teece, 1986). Firm’s technological capabilities, in terms of product complexity and technical know-how, might act as an effective barrier against imitation (Lawson et al., 2012b). The increasing complexity of the product and processes reduce the
feasibility to reverse-engineer the invention; hence, it creates a natural barrier from imitation (Lawson et al., 2012b). For example, Proxible highlights the complexity of their software that can automatically provide people with relevant information based on their location and perform analytics of the behavior of the people at a certain location. The complex nature of the logic of the software made it difficult for competitors to replicate the technology. Furthermore, technological capabilities also relate to the firm-specific tacit knowledge and complex routine which neither articulate nor embodied in a single product (Lawson et al., 2012b). The technical know-how which is tacit, complex, and context-specific, may slow the rate of competitive imitation. This case study confirms that the technical know-how can be a potential source of inimitability. For example, a case study of Etulipa shows that technical know-how that developed by the CEO’s cumulative experience and deep knowledge on electrowetting technology made the technology difficult to imitate, although some essential information on the technology has been disclosed to the public through patents. Thus, from these facts, it can be said that the technical capabilities possessed by a firm positively influence the firm’s value appropriation in the business ecosystem.

**Business Model Innovation.** Another factor that arises from the case studies which might influence the firm’s ability to appropriate value is the effectiveness of the firm’s business model. According to Chesbrough (2003), the economic value of a technology remains latent until it is commercialized. It is the business model that defines the economic value of a new technology by indicating how the value of customer will be created and how the company can appropriate the value from that technology (Vanhaverbeke et al., 2012). The business model is a useful framework that mediates the technical domain of inputs to the economic domain of outputs (Chesbrough, 2003). A business model performs two important functions: value creation and value capture. Means, a business model defines a series of activities that will yield a new product or service (value creation) and describes how the firm captures value from a portion of those activities in order to gain a competitive advantage (Chesbrough, 2007). Furthermore, managers have to find an appropriate business model to capture the value from the technology because according to Chesbrough (2003, p. 64) “A mediocre technology pursued within a great business model may be more valuable than a great technology in a mediocre business model”. Therefore, it can be said that the firm’s ability to realize the economic value from its technology, highly depends on the choice of business model. The importance of the business model to capture value from an innovation also illustrates in the case studies. For instance, Etulipa drastically changed the application of its electrowetting technology from auto-dimming car mirrors to digital billboards. As such, the company targeted a completely different market segment. Other companies such as Vitaallicht and Proxible also recorded having changed their business model. Vitaallicht shifted its market segment from customer to business, while Proxible switched from a hardware-based company to a software company. These businesses model transformations were done in order to adapt to the market challenges and/or to pursue new business opportunities; thereby, these shifts allow firms to capture more profits from their technology. The phenomenon of business models transformation in SMEs is also acknowledged by Vanhaverbeke et al., (2012). They argued that successful SMEs do not remain with a single business model forever; instead they change their business model in a stepwise way. A successful SME is continuously probing new business models by discovering new applications of their technologies to improve its value proposition and profitability (Vanhaverbeke et al., 2012). From the facts mentioned above, it is very clear that an
appropriate business model will increase the firm's ability to appropriate the value created in the business ecosystem.

**Access to Complementary Assets.** Previous research have acknowledged the importance of complementary assets in capturing value and maximizing the profit from innovations for small companies (Cohen et al., 2000; Fischer, 2011; HanGyeol et al., 2015; Teece, 1986). As mentioned in the previous section, to successfully commercialize an innovation, firms need to utilize other capabilities or assets, such as marketing, production capabilities, supply chains, and after-sales support (Teece, 1986). Furthermore, a dominant position of value appropriation between leading firms and following firms, in most cases, is determined by complementary assets (HanGyeol et al., 2015). As such, firms, especially startups are suggested to invest in complementary assets in a profitable manner when commercializing an invention (HanGyeol et al., 2015; Teece, 1986). However, due to the high cost of investing in complementary assets, startups prefer to create strategic alliances with business partners or multinationals, to get access to complementarities (Åstebro & Serrano, 2015). Startups may overcome the barriers of complementary assets by obtaining business partners who can provide the necessary complementary assets in the form of skills, contacts, and funding (Åstebro & Serrano, 2015). For example, the case study of Etulipa shows by partnering with a big LED manufacturer, the company can gain access to the partner’s marketing channels, funding, and production facilities. Another example is Proxible, this case shows that partnering with the city of Eindhoven provides access to other cities that in the future can become prospective consumers. Based on these facts, it is clear that the access to complementary assets is essential to commercialize a product/service; thereby profiting from the invention. Hence, it is safe to assume that a firm’s access to complementary assets has a positive effect on the ability to capture the value created in the business ecosystem.

**Appropriation Mechanisms.** As mentioned in the previous section, the key element to success in technology commercialization is rooted on the ability to prevent others to imitate the innovation. Companies need to carefully formulate value appropriation strategies to prevent the imitation of their innovations so that they can protect the firm’s profits from competitors, suppliers, and customers (Fischer, 2011; HanGyeol et al., 2015). The value appropriation strategies/mechanisms include tangible mechanisms (patents) and intangible mechanisms (secrecy, lead time, selective revealing). Furthermore, in a collaborative setting, companies also need to ensure that they can capture a fair proportion of the value created from the collaborations. As such, firms might employ a contractual agreement (tangible mechanism) that clearly specifies the firm’s share on the output of the collaboration or relies on trust-based relationships (intangible mechanism) which may prevent the partners to behave opportunistically. Some researchers have argued that there is no a single appropriation mechanism that can fully maximize the return of innovation (Cohen et al., 2000; HanGyeol et al., 2015). Thus, the combination of value appropriation mechanisms is preferred in most industries (Cohen et al., 2000). A skillfully combined use of tangible and intangible mechanisms allow a firm to preserve the market position and limit imitation (Arora, 1997). In addition, a study by HanGyeol et al., (2015) revealed that for SMEs the mixed use of formal (tangible) and informal (intangible) mechanisms results in higher productivity in the commercialization stage. Therefore, a firm cannot rely on one type of appropriation mechanisms (tangible or intangible alone). The case...
studies confirms this view. For instance, the case study of Etulipa demonstrates the mix of patent strategy (tangible) with selective revealing (intangible). The Proxible case also shows that the effectiveness of a secrecy strategy (intangible) can be amplified by employing contractual agreements concerning non-disclosure clauses. Thus, the case studies confirm that the right strategy of utilizing both tangible and intangible mechanisms will positively influence the firm’s ability to capture value in the business ecosystem.

Engagement in the community. Being actively involved in the ecosystem community might not directly increase the firm’s ability to appropriate value in the ecosystem; instead, it will increase the possibility of the firm to initiate partnership with partners who can provide complementary assets. The case studies analysis show that companies which actively participate in the networking events held by the campus management can relatively easily find partners that may support their business. In fact, compare to larger companies, SMEs collaborate in a completely different way: through personal relationships, informal, and based on trust (Vanhaverbeke et al., 2012). Participating in the networking events will increase the frequency to get in touch with other firms in the ecosystem and build informal networks; thereby it will increase the chances to initiate collaborations. As mentioned earlier, SMEs will greatly benefit from a strategic alliance as it will improve their access to complementary assets (Åstebro & Serrano, 2015). Additionally, firms that actively participate in the community will establish a strong sense of belonging amongst the members of the ecosystems. As stated in the previous section, a strong community creates a ‘lock-in’ in which the members are highly attached to each other. As such, a high level of trust will be established and opportunistic behaviors will be hindered. Trust is an essential aspect that determines the effectiveness of value appropriation mechanisms, especially intangible mechanisms. A high level of trust will encourage partners to share the profits equitably; thus, it guarantees the firm to capture a fair proportion of the value created on the collaborations (Vanhaverbeke et al., 2012). Based on these findings, it can be said that the firm’s engagement in the community will indirectly increase the firms’ ability to appropriate value in the ecosystem which will be achieved by improving it accesses to complementary assets (via partnership) and by increasing the effectiveness of value appropriation mechanisms.

To conclude, from the case studies we identified several factors that directly affect the firm’s ability to appropriate value from the business ecosystem. The first factor is the technological capabilities which determine how easy the technology can be imitate by the competitors. The second factor relates to the effectiveness of the firm’s business model to profit from innovations while the third factor, access to complementary assets, refers to the firm’s ability to acquire complementary capabilities to commercialize their inventions. The fourth factor, value appropriation mechanisms, relates to the firms’ strategies to prevent imitation. Lastly, the firm’s engagement in the community is predicted to have an indirect effect with firm’s value appropriation by increasing the probability to get access to partners with complementary assets and improving the effectiveness of value appropriation mechanisms.

7.5.4 Value Appropriation Mechanisms
In this section, the general pattern of value appropriation mechanisms employed by the companies in the case studies will bed discussed. Overall, all the companies in the case studies did not only rely on a single type of appropriation mechanism. They employed both tangible and intangible
mechanisms to capture the value created from the collaborations. For the tangible mechanisms, most of the companies used contractual agreements and intellectual property rights (patents); while for intangible mechanisms they used trust-based relationships. The summary of value appropriation mechanisms employed by the companies in the case studies is shown in Table 7.

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<tr>
<th>Tangible</th>
<th>Intangible</th>
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<tr>
<td>Intellectual Property Rights (Patents)</td>
<td>Trust-Based Relationship</td>
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<tr>
<td>Contractual Agreements</td>
<td>Establishing Common Goals &amp; a Shared Vision</td>
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<tr>
<td>Equity Alliance (Minority Participation)</td>
<td>Keeping complementary technologies proprietary (Selective Revealing)</td>
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<tr>
<td>Co-Investment Agreement</td>
<td>Partner selection</td>
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<td>Performance Monitoring</td>
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<td>First-mover Advantages</td>
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<td>Secrecy</td>
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</table>

Most of the time, the contractual agreements used to safeguard the value created in the collaboration. In the contract, the companies specify the deliverables of the project, the costs, the estimated profits, and the share that each party can claim. By doing so, the parties are able to understand their individual goals as well as the mutual objectives of the collaboration. In addition, some companies perceived that by signing a contract, the partners show commitments and goodwill. Furthermore, a contractual agreement is used to safeguard transactions and to prevent disputes in case that disagreements may arise during the collaboration. The case study from Vitaallicht shows how contracts provide the company with the ability to secure the value from collaboration despite the conflicts with the partners. Moreover, by signing an NDA with the partners, the companies were able to protect their technology know-how. These findings are in line with previous study of the role of contracts in managing R&D collaboration. For example, a study by Blomqvist et al., (2005) shows that a carefully designed and flexible contract prevents disagreements and strengthens confidence in continuity, especially in asymmetric R&D collaborations. Furthermore, contractual agreements help in distributing outputs and allocating IPR or new knowledge created during the collaboration (Blomqvist et al., 2005; Olander, Hurmelinna-Laukkanen, Blomqvist, & Ritala, 2010).

Besides contracts, most companies in the case studies relied on trust while managing collaborations and ensuring value appropriation. The companies perceived sometimes contracts did not cover all of the desired conditions in the collaboration, especially at new product development alliances. The companies were not able to draw up a detailed contract that covers all of the terms, conditions, and predicted outputs of the collaboration due to the high risk and uncertainty involved in R&D collaborations (von Hippel, 1987). As such, a high level of trust is essential in every collaboration. Moreover, if trust is built since the beginning of the collaboration, firms can save time and effort in the negotiations, agreements, and drawing contracts (Blomqvist et al., 2005). In addition, although most of the time contractual agreements were made in the beginning of the collaboration, a sufficient amount of trust must be exist prior contracting and starting a collaboration. As suggested by the testimonies of the CEO of ZS and Proxible, it is very unlikely for a company to establish a partnership and sign a contract unless there is a sufficient amount of trust over the partners. This finding is also
confirmed by a study from Blomqvist et al., (2005, p. 500) that proposed “some cooperative threshold amount of trust is needed for a contract to be signed and R&D collaboration to start and develop”.

In addition, from the case studies, it can also be seen that the relation between contractual agreements and trust is complementary rather than substituting. To some extents, the level of trust might influence the extent of contractual agreements used in a collaboration. However, our case studies show that contractual agreements are still employed, although the level of trust among partner was considerably high. This finding might contradict previous research that argued that trust and formal control mechanisms are inversely related (Ouchi, 1979). This argument indicates that the high level of trust reduces the need for formal control mechanisms; conversely, an extensive use of formal control suggests a lack of relational trust between parties (Ouchi, 1979). In fact, our case studies show that the existence of contracts might enhance trust and confidence in the partner. For example, the case study of Proxible shows that a contract was considered as a signal of commitment of the partners. Another example is Vitaallicht, the CEO of Vitaallicht tends to be more open with the partner if there is contract beforehand. In this case, a contract may create a trust by stating future expectations explicitly (Blomqvist et al., 2005). This fact is consistent with the studies of Das & Teng (1998) and Dekker (2004) that argued that trust and formal control reinforced each other. Therefore, it can be said both trust and contracts have an essential role in ensuring value appropriation in collaborations; hence, neither of them alone is enough.

Another tangible mechanism that was employed by several companies in the case studies is patent. Patents were perceived to be an effective instrument to prevent others from imitating; thereby, it can act as isolating mechanism. As discussed in the literature, patent are considered as an effective mechanism for a firm to profit from their technology (Fischer, 2011; Teece, 1986). Patents provide an isolating mechanism which inhibits others to imitate a product or technologies without authorization from the patent owner; therefore, patents allow firms to appropriate the returns from the innovation investments (Jaffe & Lerner, 2004). Indeed, the case study of Etulipa confirms that patents not only provide protection from imitation, but also provide freedom to operate in different market applications. Furthermore, Vitaallicht perceived that patents increase the credibility of the product and the company; thereby patents are beneficial for marketing purposes. This insight is in line with the study by Holgersson (2013) which pointed out that patent markings on products are beneficial because they signal inventiveness to the customers and to show proprietary characteristics on the competitors eyes. However, it appears that patent may be less effective for certain technologies in specific industries. For example, Proxible chose not to patent their software because it is difficult to get a patent on software technology. Moreover, ZS also did not apply for a patent since the technology that they used was an open standard.

From these facts, it can be said that patents may be not as effective for certain technologies in a particular industry. A study by Cohen et al., (2000) confirms that the effectiveness of patent varies in different industries. When patents are considered less effective, companies tend to use other (intangible) appropriation mechanisms such as secrecy, lead time, complementary sales/service, or other legal mechanisms (Cohen et al., 2000). In the case studies some companies chose to use secrecy and lead time as their strategy. For instance, Proxible decided not to disclose its software technology
to partner and keep it proprietary. Also, ZS prefer the lead time strategy than patents as their commercialization strategy. In fact, for some SMEs, intangible mechanisms such as secrecy & lead time advantages can be more effective than patents since the innovator does not need to disclose its inventions, pay for all the fees related to the patent application & maintenance, and invest much time on the application process of the patents (Cohen et al., 2000).

To sum up, all companies in the case studies employed both tangible and intangible mechanisms to appropriate value from collaborations. The contractual agreement was the most frequently used tangible mechanisms while trust-based was the most widely used intangible mechanisms by the companies in the case studies. Furthermore, the relationship between contract and trust was found to be complementary and reinforce each other. Moreover, patent was another form of tangible mechanism used by some companies in the case studies. When the patent was considered ineffective, several companies preferred to use intangible mechanisms, including secrecy and lead time advantage. Overall, the case studies show that appropriate mix of tangible mechanisms & intangible mechanisms were required to maximize value appropriation in a collaboration.

### 7.6 Conclusion and Answers to the Sub-Research Questions

This chapter discussed the value appropriation process of four residents of the HTCE with the aimed to test the propositions of the conceptual model and to get additional insights from the field. In the first part, the case studies explained how the companies benefit and appropriate value from the ecosystem and which mechanisms did they employ to capture the value at the ecosystem. Then, the second part of this chapter provides a cross case analysis of the case studies. The analysis is intended to gain insights about the value appropriation process of the HTCE residents based on the similarities and patterns that arise from the case studies. The analysis revealed that the HTCE’s reputation and network were the most important sources to support the resident’s value appropriation. The HTCE’s reputation & the networks support the residents to gain complementary assets for commercializing their inventions. Additionally, the residents are leveraged from the good reputation of the HTCE’s brand which help them to overcome the liability of newness. Furthermore, the HTCE’s open culture is perceived to be effective in developing a high level of trust; thereby, it increases the effectiveness of the value appropriation mechanisms which employed by the firm in a collaboration. Moreover, it is found that the perceived importance of the value appropriation sources depends on the innovation stage of the firm. Firms that are in the commercialization phase might perceive the value appropriation sources (complementarities & Lock-In) more important than firms which are still in the development phase. In addition, the analysis explained the factors that affect firm’s value appropriation, thus it provides answers to the first sub-question of the study.

i. Which factors affect the value appropriation process of the HTCE residents?

Based on the data analysis, there are four factors that might directly influence the value appropriation process of the HTCE residents. First, technological capabilities. This aspect refers to the technology/product complexity and the know-how of the firm. A Firm’s technical capabilities creates an effective barrier from imitations; thereby, it allows the firm to gain returns from their investment on the innovation. This finding confirms the conceptual model regarding the positive influence of technical/knowledge advantage on the firm’s value appropriation ability. Second,
need to have an appropriate business model in order to appropriate value from their innovation. The business model translates the economic value of a technology. Therefore, the choice of business model will influence the firms’ ability to appropriate value from their technology. The business model as an important factor of firm’s value appropriation is a new insight which did not cover by the conceptual model; therefore, should be added to the conceptual model.

Third, access to complementary assets. In order to successfully commercialize their innovations and capture a big portion of the value from it, firms need to utilize complementary assets, including marketing, production, supply chain, and after-sales supports. As startups, the companies may not always have the complementary assets that required. As such, access to the partners who can provide the complementary assets determine the firm’s value appropriation ability. In the conceptual model, this factor was partly covered by the “access to market related information”; nevertheless, the conceptual model will be revised based on the findings. The last factor, appropriation mechanisms. This factor relates to the firm’s strategies to prevent imitation and to avoid opportunistic behaviors of the partners. A right mix between tangible & intangible value appropriation mechanisms was proved to be positively influence the firms’ ability to capture value in the business ecosystem. This finding is in line with the conceptual model. Lastly, the firm’s engagement in the ecosystem is found to indirectly influence firm’s value and appropriation process. The higher engagement of the firm in the business ecosystem, the higher level of trust among members which result in the increase probability to get access to partners with complementary assets. This aspect will be added to the conceptual model since it did not cover in the previous version.

In contrast with the prior expectation, bargaining power seems less relevant in the context of value appropriation of the HTCE residents. The respondents perceived equal bargaining power since the basic of the collaboration was trust and mutual benefit. Therefore, the bargaining power should not be considered as an input factor of the firm’s value appropriation; thus, it should be eliminated in the conceptual model. In conclusion, all factors that related to the firm’s value appropriation will improve the conceptual model created at the beginning of the study.

The analysis of the case studies also provides insights regarding firm’s value appropriation mechanisms in the business ecosystem; thus, it answers the second sub-research question:

**ii. Which mechanisms do the residents (Startups) employ to realize value appropriation in HTCE?** According to the case studies, the residents employed both tangible and intangible mechanisms simultaneously. Most of the companies used contractual agreements and patents as the tangible mechanisms, and trust-based relationship as the intangible one. Contractual agreements were used to state explicitly the goals and objectives of each party and to prevent disputes when disagreements occurs. On the other hand, trust was essential to build a good relationship with partners during collaborations and to reduce the possibility of opportunistic behaviors. Furthermore, the relation between tangible mechanisms and intangible mechanisms was complementary rather than substituting. The relation of contract and trust might reinforce each other. A sufficient level of trust was required before signing a contract. On the other hand, the presence of a contract might also increase the trust and confidence of the partners. In addition, most of the companies preferred to apply for patent for their technology. However, patents might not be effective for every technologies
and industries. When patents was considered less effective, firms shifted to intangible mechanisms such as secrecy and lead time advantage. In general, our data suggest that firms need to have an appropriate mix of tangible & intangible mechanisms to be able to effectively capture the value in the business ecosystem since neither of them alone is sufficient.
8. Facilitation of Value Appropriation in HTCE

This chapter shows the empirical analysis of the High Tech Campus Site Management’s (CSM) roles in facilitating value appropriation of the HTCE residents. Based on the data analysis, it is shown that in the context of business ecosystems, the ecosystem managers have different mechanisms in supporting value appropriation of its members compared to a focal firm in an ecosystem. For example, a focal firm can facilitate value appropriation of its member by setting up contractual frameworks concerning firm-specific innovation appropriability (Ritala et al., 2013). In other words, a focal firm can influence how much share that a company can appropriate in the ecosystem. On the other hand, the ecosystem manager cannot directly influence the amount of value that can be appropriated by the residents in the ecosystem. Instead, the ecosystem managers (cf. Campus Site Management) can enable value appropriation by (1) offering supports and facilities to individual residents, and (2) building a supportive environment where the residents can reap the benefit of the value created in the ecosystem (see Figure 7).

![Figure 7: Two mechanisms of value appropriation facilitation by the CSM](image)

The first two sections of this chapter explain how the CSM creates a supportive environment that enables its residents (startups) to benefit and profit from the value created in the ecosystem, and how the supports and facilities provided by the campus can influence the resident’s value appropriation process. According to the data analysis, I argue that the CSM supports value appropriation through two patterns: (1) Facilitation of (the later stage) innovation process of individual companies; (2) Creation of an innovation community and R&D networks. The first pattern refers to the supports or facilities provided by the CSM to the individual startups, while the second pattern focuses on the synergistic effects at the ecosystem level (HTCE as a single entity) in
supporting the residents’ value appropriation. Figure 7 provides an overview of the two patterns and the building blocks of the patterns. As can be seen, each pattern is characterized by the value-appropriation elements. The value appropriation elements in both firm and ecosystem level influence one another. For example, the internal infrastructures and the access to multinational companies, might indirectly influence the ecosystem reputation. On the other hand, the ecosystem culture might influences the extent of the collaborations among residents, especially between multinationals and small companies. However, in this study, our focus is on the direct effect of the value appropriation elements in supporting the residents’ value appropriation. Therefore, the interaction between each value appropriation elements will not discussed. In addition, the third part of this chapter describes the evolution of the HTCE that shows the dynamic of the ecosystem in managing value creation and value appropriation. Finally, the conclusion and the answer of the third sub-research question is presented in the last section.

8.1 Facilitation of (Later Stage) Innovation Process
The CSM managers perceived that one of the ways to support value appropriation of the residents is by facilitating the innovation process of the residents (startups), especially in the latter stage of product development and commercialization (Admiraal, 2015b; Woertman, 2015). Most of the startup companies in the HTCE are at the latter stage of development in which most of them already have clear value propositions and products/services to offer. The main focus of these startups are to look for a clear market validation of their products/services and to exploit the opportunity to grow. Hence, in accordance with the HTCE proposition Turning Technology into Business, the CSM believes that ensuring value appropriation involves promoting the startups to introduce their new products/technologies to the market successfully (Admiraal, 2015b). Therefore, the CSM initiates several programs and policies to support the startups growth.

First of all, the CSM offers free workplaces and an initiates an introduction program for small companies, especially startups. In this program, startups can use a free temporary branch office during a trial period of two months (Internal infrastructure). Furthermore, during that period the CSM will arrange an intensive introduction program to connect them with relevant parties such as companies, research institutes, network organizations, governmental organizations, etc. The startups will also be given the opportunities to introduce themselves during the campus events and can become a member of campus business club that will help them to successfully integrate with the ecosystem. Moreover, the two-month trial period provides the participants an experience of being part of the campus. As such, the startups can make a better estimation of cost and benefit analysis before deciding to be located at the campus; hence, they will be able to make sure that they can generate profits once located at the campus. In addition, the CSM plans to build a dedicated building, called the blue accelerators, for the startups. The building will offer affordable offices, and lab services so that startups can focus their funds on growing their business (Admiraal, 2015b). At the time of the data collection, there were two dedicated buildings for startups which have relatively lower rental cost, yet still have a professional and modern design. The appearance of the building somehow increases the credibility of the companies in the eyes of the customers. As illustrated by this statement: “For the moment, the office is perfect because the cost is relatively low, the appearance of the building is professional. So that’s helping me (to convince the customers)” (Voorhuis, 2015).
In addition, the CSM provides mentorship and consultancy for the startups to help them solve their business/technical problems. The CSM actively connects the startups with other residents of the campus as well as with the partners outside the campus. For example, the later stage startups and corporate spin-offs that located either in βèta Building and the Mμ Building can get access to the Brainport’s (regional development agency) network of technical and financial advisors. Additionally, the CSM managers claimed that they are very reachable and open with the startups that need help to find the right partners, especially related to the funding, supply chain, and product commercialization partners. As noted by one of the CSM managers “In case startups need contacts of investors, suppliers, or manufacturer, they can always contact either Bert-Jan or me and we will bring them into the network. Either to the specialist from the brainport or other specialist from the company we know since we know a lot of companies. For instance, EY (a reputable consultancy company) has a lot of people who can advise successful startup companies to expand their business in other markets. We also have the BOM, the brainport development agencies, etc. So that’s a complete well experience of people that can focus on the business aspect of the second phase startup” (Admiraal, 2015b). The mentor and the consultancy supports that are provided by the CSM were indeed considered very beneficial for some residents, especially in providing strategic views of the company, as illustrated in the case studies in the previous section.

The presence of multinationals and research institutes on the campus is one key advantages of the HTCE ecosystem which can be utilized by the startups (access to the ecosystem-wide value sources). The CSM plays an important role in encouraging startups to ‘standing on the shoulders of giants’ by collaborating with the multinationals or research institutes on the campus. By having collaborations with the reputable partners, the startups can gain more credibility and legitimacy to further attract potential partners and customers. In addition, the CSM also helps the startups to increase their brand awareness by promoting them in online media such as newsletter and social media, as well as offline media such as local magazine and newspaper. To conclude, the initiatives of the CSM to foster collaboration and to connect the startups with the multinationals and other partners within the campus network, help the startups to capture the value of in the HTCE.

8.2 Creation of Innovation Community and R&D Network

In addition to the supports to the individual companies, the CSM supports value appropriation by developing a supportive climate for startups, based on an open innovation culture (Woertman, 2015). Firstly, the CSM managers recognized that many companies have been benefiting from the good reputation of the HTCE (as an open innovation ecosystem). Therefore, to maintain the current level of reputation, the CSM management tries to create a balance mix of global companies, research institutes, SME, service companies, and startups with the key focuses on three application areas: health, energy, and smart environments. By focusing on certain target groups and application areas, the CSM wants to ensure that the ecosystem can keep attractive and the residents can reinforce each other and create a ‘snowball effect’(Admiraal, 2015a). As such, the residents can leverage from the ecosystem reputation. The importance of the ecosystem reputation for the company is illustrated by one of the respondents: “I believe with the strength of the brand of HTCE itself. It has a lot of respect at the heart and the mind of people, and that’s work” (Voorhuis, 2015).
Secondly, the CSM has been continuously developing a huge network of various partners from both inside and outside campus that can provide access to the full chain of R&D networks, including access to the funding, supply chain, and production. Inside the campus, HTCE has developed a network of 10,000 highly-qualified people and a network of over 90 CEOs (or representatives) of the campus companies. Outside the campus, via the Startupbootcamp networks, the HTCE is connected with 450 investors worldwide and with more than 150 mentors in a various area of expertise. Furthermore, the campus is partnering with the brainport industries which has networks of suppliers and OEMs in the Netherlands. The extensive network that HTCE has is illustrated from this statement: “We have created an ecosystem with partners on the spot here and also with the partners that are connected via networks to this campus. You can find the whole innovation chain either partners from here or other networks based on HTCE partners elsewhere in the world that can support you and being more successful in transferring technology to market” (Woertman, 2015). According to these facts, it can be said that the networks of partners are the key resources that distinguish the HTCE with other business ecosystems. Moreover, from the case studies, it is shown that startups get a lot of benefits from the campus networks. For example, the networks helped the startups to find partners and future customers, as mentioned by one of the CEO of the campus companies: “I already get the benefit, if I’m not here it will take me longer (to build networks). I mean I don’t know how to build networks to connect with companies which might be a customer or partner for me if I’m not here” (Gau, 2015). Eventually, startups can easily tap into and capture the value from the R&D networks to establish new business opportunities.

Lastly, the CSM deliberately nurtures and maintains the open innovation culture where everyone willing to share their ideas and cooperate with others. The CSM contributes shaping the macro-culture of the ecosystem and align the shared beliefs and assumptions of the residents by facilitating various networking aspects (Woertman, 2015). To reap the benefits of the campus network, the CSM perceived that it is important for the residents to informally make contact with each other. Informal contacts are considered to be important to start a relationship or cooperation and create a synergy among members (Admiraal, 2015b). Therefore, the CSM initiated a lot of social events such as sports events and networking drinks, and develop free communication channels, including LinkedIn group and campus community forum, to make sure that the residents can informally get in touch with each other. Furthermore, the CSM established a Campus Business Club (CBC), a community of CEOs (or representatives) of all campus companies, with the aim to facilitate information sharing on the managerial level. Through the CBC, startups can get easily meet with the CEO of multinationals which may help them to initiate a partnership with the multinationals. As shown in the case studies, some startups perceived the initiative may not have a direct effect on their business, but it allows them to learn from the market leader and to understand what is going on in the market. Nevertheless, such initiatives may support the establishment of a sense of community and a high level of trust among residents, which are the essentials aspects of value appropriation in inter-organizational settings. As indicated by one of the CEO of campus companies “There are many advantages (collaborate with fellow residents) because we are sitting in the same location, we meet very often, we share the same vision, and of course being here we feel like in one ecosystem, a family which can share experience. There are the advantages cooperating with companies in HTCE” (Gau, 2015).
8.3 The HTCE’s Evolution

In this section, a comparative analysis of the HTCE strategies & policies between the two data collection point of time (2007 & 2015) is presented. The analysis compared the conditions and the policies of the HTCE upon the study conducted by Van der Borgh, (2007) and Van der Borgh et al., (2012) with the conditions of the HTCE during my study (in 2015). A lot of changes have been taking place during the period of eight years. This study focuses on the aspects that might influence value creation and value appropriation of the HTCE’s ecosystem. Specifically, the comparative study will focuses on the change of ownership of the campus, the re-organizations of Philips, and the shifted focus from high-end market to small companies and startups.

The most noticeable evolution of the campus can be seen from its key figures (e.g. number of companies, number of people). In 2007, the campus had 100,000 m² office spaced and housed 52 companies with around 6,000 people from 50 nations (Van der Borgh et al., 2012; Van der Borgh, 2007); whereas at the time of the data collection the figures has doubled. In 2015, the campus had 185,000 m² and housed over 135 companies and 60 startups with more than 10,000 people from over 85 nations. Furthermore, the HTCE has undergone a change of ownership since 2012. Royal Philips Electronics has sold the HTCE to a Dutch consortium of private investors, which became the largest real estate property deal in the Netherlands at that time. The acquisition means Philips status on the campus changed from the owner and manager to the tenant. Furthermore, the CSM was acquired by the Chalet Group as the responsible party to run the daily operations and the asset management of the campus.\(^4\) When the CSM was part of the Philips Real Estate, Van der Borgh (2007) argued the CSM had a lack of ability to fully exploit their business opportunity, especially in terms of attracting lower market segments (startups or SMEs). At that time, the CSM had only focused on the high-end market due to the high rental cost and the technical facilities cost (Van der Borgh et al., 2012). Furthermore, the CSM also had limited access over the resources to allocate them into certain needs because they had to negotiate and coordinate with Philips stakeholders (e.g. Philips Research, Philips Real Estate, and the Philips CTO Office) (Van der Borgh, 2007). After the acquisition, the CSM became more independent to manage the campus’s assets and shaping the vision of the ecosystem. This situation was indicated by the statement of the HTCE managing director\(^5\) “With Philips stepping down as site manager, we can really be considered open and ‘neutral’ ground. This means we can create room for growth with new interesting R&D parties”.

The change of the ownership seems to have a positive effect on the development of the campus. The CSM started to consider small companies and startups as their growth strategy. The CSM acknowledged the importance of attracting startups and building an entrepreneurship ecosystem to maintain the innovativeness level of the ecosystem. With the ambition to be the place where the innovation and entrepreneurship flourish, the CSM strives to attract a large number of startups by partnering with Startupbootcamp, a global network of startup accelerators. The partnership is not only resulting in the creation of new startups but also in the establishment of networks of mentors and investors that beneficial for value creation and value appropriation of the campus residents. Additionally, the CSM invests in the development of infrastructures (offices) to support the early

stage startups to grow. The CSM’s concerns on the startups’ development illustrates in following statement “We realize that [startups are important]. That’s why we invested heavily in startupbootcamp. With the partners, we really put a lot of effort in building startupbootcamp HightechXL. We are also re-developing HTC 12, that’s the old building, to accommodate even more startups and also try to build network around that building to accommodate startups on the crossroad between high-tech & design” (Woertman, 2015). Overall, the CSM polices are intended to accommodate more startups in the ecosystem and to create a balanced mix of multinationals, knowledge institutes, SMEs, and startups.

Nevertheless, the detachment with Philips might bring new challenges in the future. Even though Philips is not the owner & manager of the campus, Philips still the main contributor of the campus. Philips accounts for more than 60% personnel and 75% of the rent revenue at the HTCE. Furthermore, Philips, with their Philips Innovation Service, is the main contributor of the shared facilities provided in the campus. As an illustration, PINS owned 25,000 m² of multi-purpose labs and clean rooms, over 15,000 electronic instruments for hire, plus a 35,000 m² pilot factory that can be used by other residents. By considering those facts, it can be said that Philips still has a big role in orchestrating the ecosystem of HTCE. As such, any strategic decisions about the re-organization of Philips and its subsidiary may affect the HTCE, especially regarding the shared facilities. For example, one of the respondents said that since the splitting of Philips, some clean rooms, and other shared facilities were restricted to other residents (startups). In this case, the CSM could not do anything since they did not have any authority in managing shared facilities. In fact, the CSM even was not informed about such policy change. Furthermore, due to the change of ownership, the CSM cannot formally influence the Philips’s decision about the use of technical facilities. In the future, the challenge of the CSM will be to align the goals and objectives of the two big companies (Philips Healthcare and Philips Lighting) with the HTCE’s mission. Moreover, considering the importance of the technical facilities to the value creation, the CSM should also encourage other multinationals such as Holst Center, Solliance, and NXP to open their technical facilities to other residents especially startups; thus, the reliance on the Philips shared facilities can be reduced. All in all, the CSM should maintain the synergy among the big players to uphold the ecosystem prosperity since they have (technical) resources that support value creation and value appropriation of the campus residents.

8.4 Conclusion and Answers to the Sub-Research Questions

This section discusses the role of the Campus Site Management in facilitating value appropriation of the HTCE residents. It was found that the ecosystem managers have a different role than a focal firm of the business ecosystem in managing the residents’ value appropriation. Unlike a focal firm, a campus management cannot directly influence how much share that a company can appropriate from the ecosystem. Two different mechanisms of the CSM facilitation of the residents’ value appropriation process arose from the analysis; thus, it provides answers to the third sub-research question.

iii. How do the ecosystem managers (cf. Campus management team) can facilitate the value appropriation process in HTCE?

Based on the data analysis, the CSM supports the resident’s value appropriation process by (1) facilitating the later stage innovation process of individual companies, and (2) creating an innovation
community and a R&D network. The first pattern focuses on the CSM’s supports and facilitation to the residents’ value appropriation process. This pattern includes the provision of dedicated offices for startups (e.g. free temporary branch office, flexible office, and business accelerator); mentorship & consultancy; and access to the multinationals company and other relevant stakeholder (e.g. government, university). The second pattern refers to the ecosystem in general, including ecosystem reputation, ecosystem network, and ecosystem culture. In this pattern, the focus is on the synergistic effects at the ecosystem level. The support and facilitation provided by the CSM might not directly improve the firm’s ability to capture value from the ecosystem. Nevertheless, it improves the firm’s access to complementary assets and increases the effectiveness of value appropriation mechanisms.

Finally, all of the findings about the factors that affect firm’s value appropriation; the appropriation mechanisms that the residents employed; and the business ecosystem and its management supports to facilitate the residents’ value appropriation, can be summarized in the revised version of the conceptual model. Figure 8 depicts the new conceptual model. From the conceptual model, it can be seen that the technical capabilities, access to complementary assets, business model, and value appropriation mechanisms have positive influence on the firm’s ability to appropriate value of the business ecosystem. Furthermore, supports by the CSM to the individual companies, such as internal infrastructure, mentorship & consultancy, and access to unique ecosystem-wide value sources increase firms’ ability to capture the value of the ecosystem. Moreover, the ecosystem reputation and the ecosystem network have a positive influence to the access to complementary assets. Lastly, the ecosystem macro culture was found to positively influence the effectiveness of value appropriation mechanisms; thereby, increase the firm’s ability to appropriate value of the ecosystem.

*Figure 8: Revised Conceptual Model*
CONCLUSION

Chapter 9: Conclusion & Future Research
9. Conclusion & Future Research

This concluding chapter consists of four sections. The first section intends to answer the research questions postulated in section 1.3. Then, in the next section the theoretical implications of this research are discussed. The implications of this study for the Campus Site Management are presented in the third section. Finally, this chapter and study conclude with some reflections on the limitation of this study and suggestions for future research.

9.1 Answer to the Research Questions

This study has investigated how the residents of a business ecosystem (HTCE) appropriate value from the ecosystem and how the ecosystem managers (CSM) support value appropriation of its residents. From the discussion, it can be proposed that the HTCE’s reputation, the campus’ network of partners, and the campus’ open culture are the most important sources of the residents’ value appropriation. The good reputation of the campus has leveraged the credibility of the residents in the case studies. As such, it helps them to attract investors, potential customers, and skilled personnel (overcome the liability of newness). Furthermore, the HTCE’s network of partners supports the residents to gain complementary assets required for commercialization. In addition, the case studies showed that the open innovation culture of the campus was beneficial in establishing partnerships and developing a high level of trust among members. Interestingly, this study showed that the perceived importance of the value appropriation sources was varied along the different stage of the innovation process. For instance, firms that are in the development phase might not reward the ecosystem reputation and the campus networks and community as high as other firms which already in the commercialization phase. In the development phase, the value creation becomes the top priority of the firm. As such, technical facilities might be highly reward than other (social) facilities.

In addition, this study proposed four factors that might directly influence the value appropriation process of the HTCE residents. As predicted, firm’s technological capabilities, access to complementary assets, and appropriation mechanisms were the main factors that have a direct influence on the firms’ ability to appropriate value of the business ecosystem. Moreover, it was found that firm’s business model has an important role in determining the firm’s ability to appropriate value from its innovation. Unexpectedly, firm’s bargaining power did not play a role in the firm’s value appropriation. The respondents of the case studies did not experience bargaining power asymmetry, even with bigger partners. Hence, it is rather unclear what the role of bargaining power has in influencing the ability of the firms in the case studies to secure a fair amount of value from the collaborations. Additionally, the firms’ engagement in the community was found to indirectly influence the firm’s appropriation capability. A firm which is highly involved in the campus community and that participates in the networking events held by the campus management relatively gained a higher chance to find complementary partners that will support the commercialization process. Also, by actively involving in the campus community firms will be able to establish a high level of trust among members; thereby, preventing opportunistic behaviors. By identifying the essential factors that affect firms’ value appropriation ability, the first sub-research question of: “Which factors affect the value appropriation process and mechanisms of the campus residents?” is answered.
The second sub-research question of: "Which mechanisms do the residents (Startups or SMEs) employ to realize value appropriation in HTCE?" was addressed by the data obtained from the case studies. In general, there was no a single mechanism that is able to fully prevent a firm's innovation from imitation and partners' opportunistic behaviors. It was shown by the fact that there is no a single firm in the case studies, which only employed one type of appropriation mechanisms (tangible or intangible alone). Instead, they tend to use a combination of both tangible and intangible mechanisms. Contractual agreements and patents were the tangible mechanisms that were most commonly used by the firms. Furthermore, it was found that a sufficient level of trust was needed when a firm wanted to initiate a partnership and sign a contract. Both trust and contractual mechanisms appeared to be complementary and re-enforce each other. A contract cannot be established without an adequate level of trust while the establishment of the contract will increase the trust and confidence to the partners.

Moreover, this study has shown the essential role of the ecosystem managers (cf. Campus site management) in supporting value appropriation of the startups residents. We argued the ecosystem managers enable value appropriation through two mechanisms. First, at the firm level, the ecosystem managers supports the firms' value appropriation by facilitating the later stage innovation process of individual companies. The supports, include an offer of a flexible, yet representative, workplace; mentorship and consultancy; and access to the multinationals and research institutes. Secondly, the ecosystem managers enable the firms' value appropriation by developing a supportive climate based on an open innovation culture. This was achieved by (1) maintaining a positive reputation of the campus, (2) establishing networks of partners, which covers the complete R&D value chain, (3) nurturing an open innovation culture through various networking aspects. These findings support the third sub-research question: "How do the ecosystem managers (cf. Campus management team) facilitate the value appropriation process in HTCE?"

To conclude, by answering these sub-research question, this study provides answers to the general research question: "How do the residents of a business ecosystem appropriate/capture values created in this ecosystem?" 

9.2 Theoretical Implications
Several scholars have argued the importance of a balance between value creation and value appropriation in a business ecosystem, and the need of a comprehensive theoretical foundation towards a better understanding of the benefits that business ecosystems provide in supporting value creation and value appropriation of the members (Anggraeni et al., 2007; Ben Letaifa, 2014; Van der Borgh et al., 2012). This study provides a general understanding of value appropriation mechanisms in the perspectives of the business ecosystem residents and the ecosystem managers.

Our study contributes to the existing literature in two ways. First, this study reveals the mechanisms of value appropriation in a business ecosystem from the perspective of the ecosystem’s members (the residents). Prior research on this topic (Ritala et al., 2013) primarily examined value creation and value appropriation mechanisms from the leading firms’ perspective. This study showed that the residents employed a mix of tangible and intangible mechanisms to secure the value created with partners in the ecosystem. Also, the findings demonstrated the appropriate mix both tangible and
intangible mechanisms was required to successfully appropriate value from collaborations. Furthermore, our findings challenged the existing research which posits the central role of firms’ bargaining power in inter-organizational value appropriation. In contrast with the previous studies (Brandenburger & Stuart, 1996; Coff, 1999; Lepak et al., 2007), our data suggest the firms’ bargaining power has little influenced in value appropriation since the basis of the collaborations were trust and mutual benefit. This insight provides a new perspective on the role of firms’ bargaining power in value appropriation.

Secondly, this study extends the business ecosystem and science park literature by providing insights for understanding of how the ecosystem managers facilitate value appropriation and how its residents, especially startups, appropriate value. Specifically, our findings confirm the study of Van der Borgh et al., (2012) by showing the importance of the campus reputation in counteract the 'liability of newness' of the startups residents by increasing their image and credibility. As such, the firms can attract potential partners outside the campus. Furthermore, this study demonstrated the essential role of the campus’ network of partners to support the residents’ value appropriation, which was hardly discussed in the previous research. Additionally, this study introduced two patterns on how the ecosystem managers facilitates value appropriation of its residents. This result enhances the two patterns of value creation explained by Van der Borgh et al., (2012). One remarkable finding of this study is that the perceived importance of the firms on the value creation/appropriation sources (e.g. complementarities, lock-in, efficiency, and novelty) depends on the innovation stage of the firms. This result suggests the need of the dynamic view in understanding the effect of value sources offered by a business ecosystem to support the value creation and value appropriation of its residents.

9.3 Implications for the Campus Site Management

For the coming years, HTCE will strive to be the best location to “turn technology into successful business”. To do that the CSM need to keep attracting high-tech startups and SMEs while maintaining the health of the current residents by ensuring that they can benefit from the ecosystem. In the future, ensuring the balance between value creation and value appropriation in the campus might be a challenge for the campus site management. This study provides insights for the campus site management, especially to support value appropriation of the residents.

First, the CSM should maintain the current level of the campus’ reputation. The study showed that the reputation of the campus is essential for the startups because it improves their credibility in attracting customers and partners, due to a positive association. However, our data suggest that the HTCE is very well known for local businesses in the Netherlands, but less known globally. Therefore, the CSM should increase the global image of the campus by promoting itself via international media and publishing (e.g. startup magazines, technology blogs, etc.); and participating in international conferences and exhibitions. Also, it is good for the CSM to engage with organizations which publish an entrepreneurship or innovation index, such as Intelligent Community Forum (ICF), Bloomberg Innovation Index, etc. By being listed in one of the entrepreneurship or innovation indexes, the campus will get international exposures which might increase the global reputation of the campus.

Secondly, the CSM needs to retain its focus on attracting startups and SMEs. As a first step, the CSM could encourage the alumni of Startupbootcamp to reside at the campus after they graduate from the
program. To date, most of the startups choose other places to grow such as Strijp-S or TU/e Science Park. Therefore, the campus should create more dedicated infrastructure (permanent or flexible offices) for startups with competitive rents.

Thirdly, the CSM should foster more collaborations between multinational companies and startups in the campus and strengthen the interdependent links amongst residents. The case studies indicated that most respondents appreciate networking events and other network initiatives such as Campus Business Club, held by the CSM. However, our data suggest these initiatives rarely result in a real collaboration. One approach that can be done by the CSM to increase joint projects between residents is to develop an online platform where the residents, especially multinationals, can share their projects and invite others to participate in. For example, the CSM can utilize the existing online community (MyTechCampus.nl) owned by the campus as a place where the residents can share collaborative projects or partnership opportunities. Finally, the CSM should be aware of the problems that may arise with the splitting of Philips. The splitting of Philips might increase the coordination complexity since the CSM should align two (or even more) different companies with different focuses and concerns (which was originally a single company). Moreover, our finding indicated that the re-organization of Philips might influence the shared facilities provided by the HTCE. To anticipate this, the CSM should encourage other multinationals and research institutes to open their research facilities for other residents. As such, the CSM can ensure a sufficient number of shared facilities always available at the campus.

9.4 Limitations and Future Research
Interesting as they are, it has to be noted that this study is subject to several limitations, especially regarding the methodology and the conceptual method used. Some shortcomings are dealt to the best of the author’s effort. However, some problems could not have been prevented. Nevertheless, these limitations provide opportunities for future research. The detail explanation is described below.

First of all, the initial conceptual framework of this study was useful for providing preliminary insights of the value appropriation process in business ecosystems. However, due to the limited study in the area of value appropriation in the business ecosystem, not all factors/variables were covered in the conceptual framework. Although the interviews were exploratory and some additional factors (business model & access to complementary assets) were found in the case studies, it somehow has limited the empirical findings since the interview protocol was designed based on the variables/factors described in the conceptual framework. Nevertheless, this limitation was partially overcome by including open questions to which allow the respondents to talk freely without being driven by the pre-defined model.

The second limitation arises from the limited number of startups that are analyzed as case studies in this study, which raises the questions to what extent the findings also applicable to other (type of) residents. Also, this study only took a case from a single business ecosystem (HTCE) which might decrease the generalizability of the findings to other business ecosystems. Future work might analyze value appropriation in other business ecosystems as well as include a larger sample size and different types of residents (e.g. service companies, multinationals, SMEs) next to the startups residents. The interview protocol, shown in Appendix D, makes it possible to repeat the same research in the
different contexts and research settings. Another limitation related to the fact that this study is typically static in nature and only focus on the characteristics of the ecosystem at a single point of time. The different life cycle of business ecosystems might present different focuses and challenges on value creation and value appropriation (Ben Letaifa, 2014). Since this study was conducted at the HTCE, which was already a mature and established ecosystem, it might raise the question if the results of this study are also applicable to other business ecosystems in different life cycles (e.g. emerging ecosystems). Therefore, a longitudinal study might be interesting for future research.

Third, the complex environment of the HTCE requires for an exploratory research approach. Therefore, the choice for the multiple case studies approach was basically a good choice. However, this study only used qualitative measures instead of quantitative measures since the aim of the research was to achieve a deep understanding and generate new insights of value appropriation issues in the business ecosystem. One of the problems that might arise from a qualitative study is subjectivity and bias of the researcher due to the fact that the findings were not based on the exact facts, but solely based on the researcher’s interpretation of the interviews and documents. Nevertheless, the triangulation used in this study did increase the validity of the findings in some extent, still the bias could not be completely eliminated. Future work might combine both qualitative and quantitative measures to enhance the validity of the research. For instance, a follow-up study can be done based on the construction of the revised conceptual framework (Figure 8), in which the factors that considered essential for firms’ value appropriation can be tested with questionnaires and statistical analysis. As such, the study will become more explanatory and the focus of the study will be focused on the relationship between the factors.

Finally, other future work can also be executed based on the findings of this study. For example, our results questioned the role of bargaining power in affecting the firms’ value appropriation ability in the inter-organizational setting; yet, previous studies have indicated the importance of this aspect on value appropriation. Future work may examine in which context or situation the firms’ bargaining power is relevant for value appropriation. Furthermore, one of our remarkable findings indicates that the innovation stage of the firm might influence the perceived importance of the valuable sources provided by the ecosystem. Since this study only focused on the startup companies in the latter stage of the innovation process (commercialization phase), future research might go one step further and performs a longitudinal study to specifically analyze the dynamic of perceived importance of value creation and appropriation sources of a firm from ideas to the commercialization phase.


Hauge, S., Strødomskylte, I., & Dai, X. (2012). All you need is trust-to overcome the liability of newness by forming alliances. Retrieved from https://www.duo.uio.no/handle/10852/12893


# Appendix A: List of Business Ecosystem Studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Definition</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moore</td>
<td>1993</td>
<td>Company should not be viewed as a member of a single industry; instead as a part of a business ecosystem that crosses a variety of industries. Companies within them co-evolve capabilities around the innovation and cooperatively and competitively support new products, fulfil customer needs, and develop the next of innovation.</td>
<td>Used an analogy from biological ecosystem to understand how companies not only compete but also collaborate to out-innovating competition and how such ecosystem emerge.</td>
</tr>
<tr>
<td>Gossain and Kadiah</td>
<td>1998</td>
<td>Business ecosystem as a paradigm of doing business in which the core organizations interact with customer and partner in a certain channel in order to create new value for the customer.</td>
<td>Explained the shift on traditional business to a new business ecosystem in the e-commerce.</td>
</tr>
<tr>
<td>Muegge</td>
<td>2011</td>
<td>Business ecosystem is a field of economic actor whose individual business activities, anchored around a platform and share in some large measure the outcome of the whole ecosystem.</td>
<td>Examined the phenomena of platforms, communities, and business ecosystems from the perspective of technology entrepreneurship.</td>
</tr>
<tr>
<td>Iansiti and Levien</td>
<td>2004a</td>
<td>Business ecosystem as a complex business network that formed by large, loosely connected networks of entities, that interact with each other and the health and performance of every members is dependent on the health and performance of the whole ecosystem.</td>
<td>Developed a framework for assessing the health of company in an ecosystem and suggestions for develop a strategy that match with its role and position in ecosystem.</td>
</tr>
<tr>
<td>Peltoniemi and Vuori</td>
<td>2004</td>
<td>A business ecosystem is a dynamic structure which consists of an interconnected populations of organizations such as small enterprises, large corporations, universities, and public sectors which influence the system.</td>
<td>Provided definition of business ecosystem and compare the different analogies of biological ecosystems including industrial ecosystem, social ecosystem and digital business ecosystem.</td>
</tr>
<tr>
<td>Adner</td>
<td>2006</td>
<td>Innovations ecosystems as collaborative arrangements through which firms combine their individual offerings into coherent, and customer-facing solution. Ecosystems allow firms to generate value that no single firm could have created alone.</td>
<td>Pointed out three fundamental types of risks in innovation ecosystems. Provided framework for formulating ecosystem strategies.</td>
</tr>
<tr>
<td>Van der Borgh et al.</td>
<td>2012</td>
<td>Describe a knowledge-based ecosystem as a heterogeneous set of knowledge-intensive companies and other participant that depend on each other and organize themselves around centers of knowledge in a geographical hotspot</td>
<td>Explained that the main driver of the companies to locate in a particular business ecosystems comes from the need to develop and exchange tacit knowledge. Also, described the business ecosystem management.</td>
</tr>
<tr>
<td>Clarysse et al.</td>
<td>2014</td>
<td>Business ecosystem characterized as a loosely interconnected organizations that focus on creating value for customers, represented by value networks which can globally dispersed, and have a large companies which act as leaders of business ecosystem.</td>
<td>Distinguished between business ecosystem and knowledge ecosystem. Business ecosystem more focused on creating value for customers and also concern with customer (demand) side.</td>
</tr>
<tr>
<td>Kelly</td>
<td>2015</td>
<td>Business ecosystems are dynamic and co-evolving communities of diverse actors who create and capture new价值通过 both collaboration and competition.</td>
<td>Provided an analysis of business ecosystem trends. Pointed out the transitions that has considerable implications for society, the economy, and business due to the continued rise of business ecosystems.</td>
</tr>
</tbody>
</table>
Appendix B: List of Contacted Companies

<table>
<thead>
<tr>
<th>No</th>
<th>Potential Respondents</th>
<th>SME/Startup</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rheavita</td>
<td>Startup</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Incatec</td>
<td>Startup</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Intrinsic-ID</td>
<td>SME</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Miortech/Etulipa</td>
<td>SME</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Montes Jura</td>
<td>Startup</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Nikinc Dental</td>
<td>SME</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Vitaallicht</td>
<td>Startup</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Cordian</td>
<td>SME</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>Care IQ</td>
<td>SME</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>Proxible</td>
<td>Startup</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>ZS</td>
<td>SME</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>TuliPPs</td>
<td>SME</td>
<td>No</td>
</tr>
</tbody>
</table>

Appendix C: List of Interviews

<table>
<thead>
<tr>
<th>Companies</th>
<th>Interviewee</th>
<th>Function</th>
<th>Date</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abyor Europe</td>
<td>Latif Gau</td>
<td>CEO</td>
<td>29/4/2015</td>
<td>42 min.</td>
</tr>
<tr>
<td>Etulipa</td>
<td>Dr. Hans Feil</td>
<td>CEO</td>
<td>14/5/2015</td>
<td>45 min.</td>
</tr>
<tr>
<td>Vitaallicht</td>
<td>Maarten Voorhuis</td>
<td>CEO</td>
<td>5/6/2015</td>
<td>58 min.</td>
</tr>
<tr>
<td>Proxible</td>
<td>Shinjan Dasgupta</td>
<td>CEO</td>
<td>8/6/2015</td>
<td>42 min.</td>
</tr>
<tr>
<td>HTCE CSM</td>
<td>Bert-Jan Woertman</td>
<td>Director of Marketing &amp; Communication</td>
<td>16/6/2015</td>
<td>29 Min.</td>
</tr>
<tr>
<td>HTCE CSM</td>
<td>Cees Admiral</td>
<td>Director of Business Development</td>
<td>17/6/2015</td>
<td>40 Min.</td>
</tr>
<tr>
<td>ZS</td>
<td>Erik PS</td>
<td>CEO</td>
<td>19/6/2015</td>
<td>46 Min.</td>
</tr>
</tbody>
</table>
Appendix D: Interview Protocol

**Introduction**
First of all, I would like to thank you for taking the time to talk with me to support my research in business ecosystem. My name is Fathiro and I am a master student at TU/e and currently, I’m doing a master thesis project at High Tech Campus Site Management. The objectives of this research are to understand how residents in HTCE benefit from being part of the campus, how they capture the value created in the campus, and how the campus management can support its residents.

I want to start this interview by asking you about your experience as a resident of HTCE. Particularly, the collaborations with other residents. Do you mind if I record the interview? If you prefer, this interview can be reported as anonymous, if you think certain answers are contained sensitive information. Furthermore, I will send you the transcript of this interview afterwards so you can check everything and decide whether to agree with the content or not.

1. **Interviewee Background**
   1. Can you shortly tell something about yourself, your background, your company, and your position in the company?

2. **Company Background**
   1. Can you explain the background/history of the company and your motivation building this company?
   2. In your opinion, what is your company main competitive advantages over competitors?
   3. Can you describe your business model? How do you commercialize your product/service?

3. **General questions about business ecosystem (open question)**
   1. For how long have you been located at HTCE?
   2. What is your main motivation when decided to be located at HTCE?
   3. What values do the campus bring to your companies and how do the values benefit your company?
   4. Does by being located at HTCE improved your overall business performance?
   5. Does by being located at HTCE improved your company's growth? If yes, How?
      i. Accelerate time to market?
      ii. Reduce development costs?
   6. Do you think being located at HTCE increase your ‘image’ and ‘credibility’ in the eye of customers and partners?
   7. The rental cost here at HTCE is quite premium compare to similar places in the region, If you compare the values than you get by being part of the campus with the rental cost, Do you think it is still worth it (value for money)? If yes, why?
   8. Do you think it is important for the HTCE to build a sense of community in HTCE? Why?
   9. How often do you participate in networking event or activities held by the campus site management?
4. **Collaboration & Bargaining Power**
   1. Do you have a collaboration project or partnership with other residents of HTCE?
   2. Can you describe the background and the goal(s) of such collaboration?
   3. Are you familiar with the partners (information asymmetry), in terms of their core business and competence, before the collaboration begin?
   4. What role was your company performs in these collaborations? And what kind of resources or expertise were your company brings into the table?
   5. Do you think the resource(s) that your company bring in the collaboration are unique and difficult to imitate?
   6. In general, does your company well informed with the business/profit potential from the collaboration?
   7. Do you think your partner(s) is (are) transparent regarding the future application or the future business opportunities that may arise from the collaboration?
   8. How do you think your bargaining position in the collaboration, do you think your company has the ability/power to, for example, change the terms of agreements and to influence the outcomes of negotiations?
   9. If the answer is positive, can you elaborate how your company achieve these situations? Or if the answer is negative, why do you think your company has a low bargaining power in these collaborations?
   10. Do you think the services provided by the HTCE reduces your dependency to? *(Only, asked if the company uses shared facilities at HTCE)*

*First, explain about value appropriation of value that was co-created together with partners.*

5. **Appropriation Mechanisms (Tangible)**
   1. How do you ensure your company's can capture a fair proportion of the value created from the collaboration?
   2. Do you employ any type of contractual agreement concerning the result/output of collaboration? If so, why were these contracts used?
   3. What was the contract like (e.g. the rules, and agreement)?
   4. In general, do these contracts are tight or flexible?
   5. Do you think that the contract was important during the whole collaboration or was it more important at some specific time (at the beginning or at the end)? (If so, why do you think it was more important then?)
   6. Was intellectual property (foreground knowledge) created in the collaboration, if so, how were the intellectual property rights allocated?
   7. How do you prevent confidential information of your company being leaked?
   8. What were the biggest challenges in managing and sharing the IP/knowledge?

6. **Appropriation Mechanisms (Intangible)**
   1. What was the role of trust and in the collaboration in your perspective?
   2. How does trusted built between the parties and what were the critical factors in developing trust?
3. How do you manage trust and good relationship with the partner?
4. In your opinion, during the collaboration did the common vision and goals of each party are well communicated?
5. How do you prevent opportunistic behavior?
6. In your perspective, which one is the most effective in ensuring value capturing and preventing opportunistic behavior, through the means of legal contract or other governance which utilize non-legal sanctions (relational)? And which one do you use most frequently?

7. The role of ecosystem in value appropriation
   1. Do you think the familiarity and the credibility of the partners have an effect on the level of trust? And how much value that you capture from the collaboration?
   2. Are there any differences in collaborating with fellow HTCE residents compared to partners from outside? (If yes, please specify)
   3. Given the fact, that you’re in the same community, do you think the fellow residents are more trustworthy and less likely to do opportunistic behaviors?
   4. Do you think the current mix of companies in HTCE already sufficient to offer complementary services/products to your company (or startup in general)?
   5. Do you use patent office, business consultants, branding agency service in HTCE?

8. Campus Site Management
   1. The motto of HTCE is: Turning Technology into Business. Do you think the campus policies and activities have supported technology commercialization, especially in the sense of turning technology into business?
   2. In the next couple years, as your company grows, do you plan to stay at the campus?
   3. Do you think the campus management policies and activities facilitates the residents' growth, especially for SMEs and startups?
   4. What kind of activities and resources does the Campus Site Management should employ to facilitate residents' growth?

With this we conclude the interview session. Do you have any remarks or suggestions for campus site management? These were all the questions I wanted to ask you.

Again, Thanks a lot for your participation in my study. I will send you my final thesis report as soon as I have finished it, in case you are interested.