Mirva Peltoniemi and Joonas Järvinen (eds.) Industry Evolution Aalto University

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Empirical studies on industry emergence

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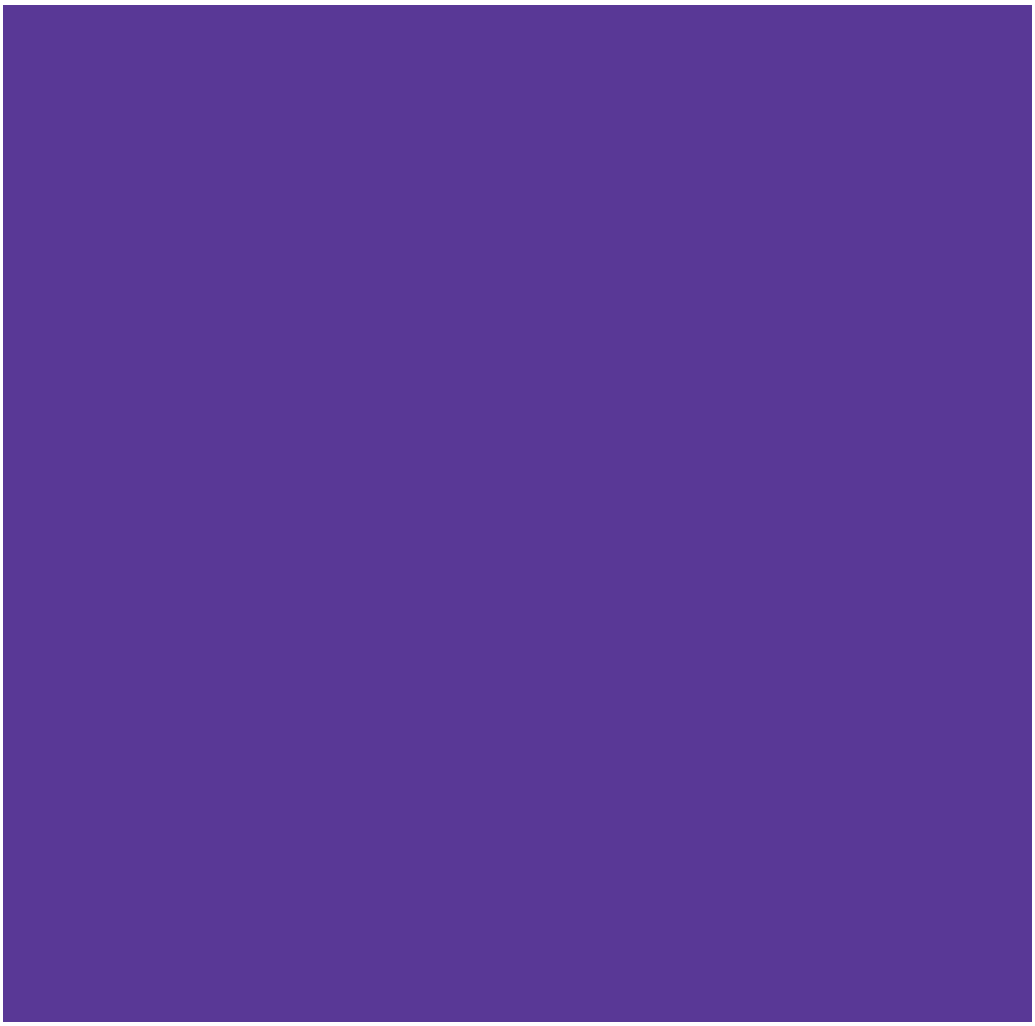

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Foreword

Industry evolution research focuses on answering the key dilemma of the field of strategic management, that is, what makes certain firms successful and others to fail, from an evolutionary perspective. The course Industry Evolution has been in the syllabus of the Department of Industrial Engineering and Management at Aalto University / Helsinki University of Technology since 2005. The present publication comprises a selection of graduate student course assignments from the Spring term of 2012 when the course was lectured jointly by the editors of the publication, Joonas Järvinen and Mirva Peltoniemi. The course was originally established and lectured until 2010 by Prof. Juha-Antti Lamberg (currently at University of Jyväskylä).

Due to increasing popularity of evolutionary perspective in strategic management and organizational research, the main message of the course has been that an evolutionary view on industries and firms may offer important and complementary insights when it comes to understanding the above mentioned key dilemma in strategic management. Thus, the general aim of the course has been to offer insights and frameworks to analyze and understand such issues as survival, industry evolution, dethronement processes, the role of top management and business dynamics in general. The course has offered introduction to the most important streams of research in industry evolution (i.e., evolutionary economics, industry life cycle, and organizational ecology), practical insights from the evolution of several industries (such as pulp and paper, biotechnology, video games, retailing, and electricity), and a hands-on experience on how to analyze evolution of a particular industry or group of firms.

An important part of the course has always been a demanding group assignment in which students have been expected to analyze the evolution of a particular industry, organizational form or a firm by applying a theoretical perspective introduced during the course. With the aim of producing a publishable quality short empirical paper with practical managerial implications, students have first chosen an empirical setting to analyze and then gathered empirical data, studied earlier research on the area of interest, conducted empirical analysis, presented their findings in a seminar, and constructively evaluated the findings produced by other groups. As a result of this process, this publication now includes a selection of the final short research papers from the spring 2012 course. Since all the studies are focused on industries with a high level of importance for future economic growth, we hope that publishing these interesting findings achieved through a considerable amount of work may offer important insights for the future success of the studied industries and firms.

The general theme for the course assignments this year was emergence, growth, and resurgence of industries and organizational forms. Potential research questions in the area were related to how

new industries emerge, what are the drivers behind the emergence and growth of a particular industry, and why it is often seen that within old already concentrated industries new firms start to emerge at some point of time. Considering that earlier research has offered limited answers to these highly important questions (e.g. Aldrich and Ruef, 2006), the theme offered highly interesting and challenging opportunities for students. Related to the theme, the following chapters present analyses of the emergence and evolution of hybrid cars, laser eye surgery, and payday loan industries with differing interesting theoretical and practical insights.

First, the study by Heiskanen et al. (2012) focuses on hybrid electric cars industry within the US with an aim to identify the stage of the HEV industry life cycle and provide insights of the firm success factors in the industry. By applying industry life-cycle (ILC) theory, their findings imply that the development of entry rates, firm density, sales volumes, prices, and innovativeness behave as the ILC theory predicts. In contrast, the results also suggest that exit rates do not behave as expected. In the light of the ILC theory, they suggest that the HEV industry is in its emergent phase. The study also identifies that early entrance and innovativeness are key factors for firm survival.

Second, Nieminen et al. (2012) study the refractive laser eye surgery equipment industry in the United States. They test the propositions of firm survival central to the industry life-cycle literature, i.e. the effects of entry timing, preentry experience and innovativeness on firm survival. Moreover, they analyze the shift from product to process R&D predicted by the theory. They find that preentry experience and innovativeness improve the probability of firm survival, while early entry does not bring about such an advantage. Moreover, they find that instead of a clear shift from product to process R&D there are cyclical trends.

Third, Hiirsalmi et al. (2012) present a study with a focus on legitimacy of a payday loan industry in Finland. On the basis of earlier research, they first suggest that the legitimacy of an industry consists of 1) density-based; 2) regulative legitimacy; and 3) social legitimacy. By applying this framework in the research context, they then find out that the most important legitimacy factor for the payday loan industry is regulative legitimacy, which can be comprehended as a perquisite for the other two legitimacies. Further, they suggest that with regulative legitimacy, an industry can grow and flourish, even if social legitimacy is not that high.

As a conclusion, we believe that the assignments offer interesting insights for both firms operating in the studied industries but also firms in industries experiencing similar kinds of dynamics and particularly management researchers interested in evolutionary research.

In Helsinki, Finland, and Vienna, Austria, May 2012,

Mirva Peltoniemi and Joonas Järvinen

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Contents

Evolution of the Emerging US Hybrid Electric Vehicle Industry

Teemu Heiskanen, Anni Pekkala, Taina Pere and Sebastian Sillanpää

ABSTRACT

This study focuses on the Hybrid Electric Vehicle (HEV) industry within the US automotive industry. The research aims to identify the stage of the HEV industry life-cycle and provide insight to the firm success factors in the industry. Industry life-cycle (ILC) theory is used to explain industry development and firm success factors. The main findings of the research are that the development of entry rates, firm density, sales volumes, prices, and innovativeness behave as the ILC theory predicts. However, exit rates do not behave as expected. In the light of the ILC theory, the HEV industry is in its emergent phase. We also identify that early entrance and innovativeness are key factors for firm survival.

Keywords: hybrid electric vehicle, automotive industry, industry evolution, industry life-cycle

1. Introduction

In the recent years, the limitedness of fuel-based energy and greenhouse gas emissions have become a serious global issue that is receiving increased attention (Bayindir & Gözükücük 2011, Amjad et al. 2010). The transportation sector is rapidly growing as a consumer of energy and consumes about half of the world's oil resources (Ehsani et al. 2004). According to some estimates, if the current trends in oil discovery and consumption continue, we will run out of oil by 2038 (Ehsani et al. 2004). Furthermore, transportation causes a considerable share of emissions: In 2007, 39% of total emissions in the US were caused by transportation (EPA 2009).

These concerns have driven automotive researchers to develop alternative methods to generate energy for vehicles (Bayindir & Gözükücük 2011, Amjad et al. 2010). Most car manufacturers are conducting research on alternative powertrains and alternative fuels (Pohl & Elmquist 2010).

One of the most promising technologies currently being researched and developed is the hybrid electric vehicle (HEV). It is defined as a vehicle that derives its propulsion power partly from an internal combustion engine (ICE) and partly from an electric motor (Cleveland & Morris 2009). HEVs differ from each other by how the different parts of the engine are organized and what share of the power is generated by the ICE and what by the electric motor (Jaeger 2011).

HEV technology offers a wide range of benefits over conventional ICE vehicles including improved fuel economy, lower emissions (Amjad et al. 2010) and multifaceted performance improvements (Bitsche & Gutman 2004). Hybridization might represent a future paradigm shift and can therefore be considered a discontinuity or a radical innovation of the future (Pohl & Elmquist 2010).

To the best of our knowledge, no previous scientific studies have been conducted on the HEV industry evolution. Searching two extensive databases (ISI Web of Knowledge and Scopus) for topic words "hybrid" and "industry" in relevant research fields did not seem to bring up any articles related to the evolution of the HEV industry.

With this descriptive study we intend to fill some of the void in industry life-cycle (ILC) literature. ILC was chosen as a theory framework, because it explains industry development through changes in technology development and thus suits a technology-intensive industry like the HEV industry. We use the theories of ILC to analyze the evolution of the HEV industry to identify what life-cycle stage it is currently in and to get some insight into the industry success factors.

1.1 Industry definition

According to an expert interview with Professor Matti Juhala from the Mechanical Engineering Department of Aalto University, HEVs do not actually constitute an industry of their own, but instead are a sub-industry of the automotive industry. HEVs use basically the same production lines and processes as traditional ICE vehicles and they are transported, sold and serviced using the same networks. The motor techno-

logy is basically the only thing setting HEVs apart from traditional cars. (Juhala 2012)

According to Jaeger (2011) there are five distinct roles among actors in the HEV industry: original equipment manufacturers (OEMs), system providers, component providers, technology providers, and consultancy service providers. A single actor can have many roles.

Acknowledging that HEVs are only a sub-industry of the automotive industry and that the industry consists of several types of actors, in this study, we use the term "HEV industry" to refer to those OEMs in the automotive industry that have a HEV in their product portfolio. Although the HEV industry is a sub-industry of the automotive industry, we will treat it as an independent industry in our study.

1.2 Industry history

Although the concept of hybrid electric vehicles might seem relatively new to the automotive industry, it is actually over a hundred years old (Wouk 1997). According to Hybrid-vehicle.org (2005), the first hybrid car was built already in 1899 by Dr. Ferdinand Porsche.

Despite of its early introduction, the idea of HEVs was long ignored. This was primarily due to high development costs and the uncertainty related to the acceptance of electric vehicles. (Illumin 2002)

Toyota was the first auto manufacturer to release a widely adapted commercial HEV (Juhala 2012). Toyota Prius was released in 1997 in Japan (Pohl & Elmquist 2010). In 2000, Toyota began to sell a revised version of Prius also outside of Japan (Pohl & Elmquist 2010). By the end of 2008, Toyota had sold about 80% of all HEVs globally (Pohl & Elmquist 2010).

In the US, Honda was the first brand in the HEV market. Its Honda Insight was introduced in 1999. Toyota entered the US HEV market with Prius in 2000 and exceeded the sales of Honda Insight already in the same year. (U.S. Department of Energy 2012)

Since the introduction of Prius, all major automotive manufacturers have become involved in hybrid research and development (Bruggers 2000) and many of them have introduced their own HEV models (Jaeger 2011). Hybrid technology is clearly seen as an essential component of future vehicles (Illumin 2002).

1.3 Industry description

Through introducing the first HEV technologies, Toyota has become a highly central firm in the HEV value network (Jaeger 2011). The industry players are highly centralized (Pohl & Elmquist 2010). Of all the HEV dollar sales between 1997 and 2008, Toyota has a share of 80%, Honda 14%, and Ford 4% – meaning that these three companies together have had a 98% share of the global HEV sales during 1997 – 2008. (Pohl & Elmquist 2010)

Entrants to the industry have been almost exclusively de alio entrants, who have operated in the automotive industry before entering the HEV markets. (Juhala 2012)

Although patenting is becoming increasingly popular in the HEV industry, competitive advantage is mainly seeked from possession of production technology, access to markets, and power stemming from economies of scale rather than protection provided by patents

(Jaeger 2011). According to Professor Juhala, however, some manufacturers treat HEVs mainly as a promotional tool to signal that the manufacturer has the capability to provide cutting edge technology (Juhala 2012).

There are horizontal technology-related relationships among industry players that span from very collaborative to very restricted. These relationships reflect those of the automotive industry at large. In many cases manufacturers license their systems and platforms to other manufacturers or work jointly with other actors to develop new technologies. (Jaeger 2011) Toyota, who possesses many central HEV patents, has been especially active in licensing their technologies to other manufacturers (Juhala 2012) in order to create economies of scale (Nonaka & Peltokorpi 2006). Its technologies are thus very widely used in the industry (Juhala 2012).

Due to the limited sales volumes of HEVs compared to traditional cars and the lack of HEV standards, the manufacturing of motors and other HEV components are done mainly in-house. Increasing HEV sales and declining prices are expected to lead to increased outsourcing of HEV components. (IMAP 2010)

1.4 Research objective and questions

The objectives of this study are (1) to identify what life-cycle stage the HEV industry is currently in and (2) to get insight into the industry success factors.

To identify the life-cycle stage of the HEV industry, we first study the evolution of the HEV industry by answering the following four research questions:

- *1A. How has the number of HEV manufacturers evolved between 1999–2010?*
- *1B. What has been the development of HEV manufacturer entries to the industry and exits from the industry between 1999–2010?*
- *1C. How has the number of new HEV patents evolved until 2010?*
- *1D. How have the sales volumes and prices of HEVs evolved through 1999–2010?*

We then analyze some of the possible industry success factors by answering the following two research questions:

- *2A. Do early entrants have an advantage against late entrants?*
- *2B. Does a high number of patents correlate with firm success?*

1.5 Research scope

In this study, we decided to focus on the US, the car market of which is well-defined and large. Time-wise we decided to focus on the HEV industry evolution in the years 1999–2010 or 1999–2008 depending on data availability. Although the HEV industry has not evolved identically in different regions (Juhala 2012), studying the industry in the US probably also gives some indication about the HEV industry evolution globally.

1.6 Structure of the report

The report consists of six sections. In the next section, we describe ILC theory, on which we base our study, and bring together some relevant theory to identify the stage of the HEV industry life-cycle

and discover relevant success factors for firm survival in the industry. In the third section, we detail the data and methods used to answer the research questions. The fourth section presents the results of our analyses and answers the research questions. The fifth section of the report discusses the results and their implications. Finally, the sixth section concludes our study by bringing together what has been learned.

2. Theory development

Industry life-cycle (ILC) theory focuses on searching for patterns to describe the development of industries (Peltoniemi 2011). The theory explains changes in technology development and in industry structures as time passes. ILC concentrates on business firms, which are observed at the macro-level. Changes in firm numbers are explained through changes in technology development, which consists of decreasing product variety and emerging scale economies. The life-cycle of an industry can be divided into the phase of emergence and into the phase of maturity. Since the HEV industry is a young industry, we will mainly concentrate on the emergent phase of industry development. We make the assumption that the industry is in its emergent phase. In this theory section, we will go through the relevant ILC theories that can help to explain the development of the HEV industry from the viewpoint of our research questions.

According to the ILC theory, an industry emerges when a new technological opportunity is being discovered, and multiple firms are attracted to exploit the opportunity by providing new product innovations (Klepper 1996). The opportunity is a discontinuity that is born out of new competences, products, production processes or by the introduction of a considerable increase in the level of performance relative to the price (Ehrnberg 1995). The latter case can be applied to the HEV industry, because increases in the fuel price have lowered the price of HEVs relative to other automotive alternatives, increasing the performance per price ratio relative to other automotive alternatives.

Innovations can be categorized into competence-enhancing or competence-destroying, the former usually introduced by incumbents of the industry using their existing knowledge and creating barriers for entry (Tushman & Anderson 1986). In the automotive industry, the HEV has been the former kind, since all HEVs are produced by incumbents that apply their existing knowledge of the automotive industry.

The ILC theory assumes that firms have different kinds of expertise and backgrounds, which produces diverse R&D activities resulting in various kinds of innovations (Klepper 1996). During this entrepreneurial regime (Audretsch 1991), information external to the industry is relevant as new entrants compete in the marketplace (Gort & Klepper 1982). In the HEV industry, the firms have similar backgrounds and expertise, and most of the information comes from the external source of the automotive industry in general, and in this respect, the theory is not perfectly suited for the HEV industry context.

Innovations can be categorized into incremental, modular, architectural,

and radical (Henderson & Clark 1990). Clearly the invention of HEV over a hundred years ago was radical in its nature. However, in the case of the HEV industry in the 1990s, the integrated energy storage system can be seen as a modular innovation, since it added a new complex component to the vehicle, but did not change the core architecture or the vehicle itself.

According to the ILC theory, in the emergent phase of an industry, the entry rates should increase, and entry and exit rates should be highly positively correlated, resulting in a small net entry (Geroski 1995). The amount of firms in the industry forms an inverted U-shaped curve as a function of market age, and in the emergent phase of the industry, a sales takeoff is expected as a result of improved quality and reduced prices (Peltoniemi 2011). In our research, we expect the entry rates of firms to grow as a function of time. We also expect the exit rates to correlate positively with the entry rates. We will also expect the firm numbers to form the beginning of an inverted U-shaped curve as a function of market age. We will also take a look at the sales volumes of HEVs as a function of time, and expect the sales volume to increase. We will also investigate the price development of HEVs. We are interested to see whether the price will decrease as the sales volumes increase. This information will provide us with a rich picture of the early evolution of the industry, and allow us to see whether the HEV industry follows the same kind of development path as projected in the ILC theory. In addition, we will see whether our initial assumption of placing the HEV industry in its emergent phase holds true.

The industry moves from the emergent phase to the mature phase when the focus of firms shifts from product innovation to process innovation, which is explained by the size advantages in R&D (Cohen & Klepper 1996, Klepper 1996). Entries to the industry become rare, but exits are common (Klepper 1996). In contrast to the emergent phase, internal industry knowledge is valuable, existing firms need to keep up with the technological developments, and entrants have a disadvantage against incumbents (Gort & Klepper 1982). The innovation space in the mature phase is defined as the routinized regime (Audretsch 1991). During the transition from emergent phase to the mature phase, a shakeout during a lengthy period of time occurs, in which the increase in firm numbers is broken, and is continued by a fall in the firm numbers at the same time as industry output keeps increasing (Klepper & Miller 1995).

ILC theory also studies success factors of firms that survive the shakeout, and the most common factors studied are entry-timing, pre-entry experience, and innovativeness (Peltoniemi 2011). Since all entrants in the HEV industry have similar kind of pre-entry experience in the automotive industry, we will focus on entry-timing and innovativeness.

The ILC studies mostly focus on studying firm success factors by examining the survival rates of firms in an industry, in which success is determined by firm survival. As the HEV industry is young and no shakeout is expected to be witnessed, it is not useful to select firm survival as a measure for firm success. In our study, we have selected the measure of market share as a measure for firm success. Previously, Lee and Lim (2000) have used market share as a measure for firm success in their study. In addition, Mata et al. (1995) have found firm size

to be an important determinant for the likelihood of firm survival. As firm size and market share are strongly linked, it can be to some level argued that market share can be used also as a measure for firm survival. In addition, Utterback and Suarez (1991) state that firm survival should be related to measures of performance such as market share and profitability. We have selected the measure firm market share instead of firm profitability due to the lack of availability of profitability data of the HEV manufacturers that would capture only HEV related data. We use market share as a measure of success, and also assume that the higher the market share, the higher is the likelihood of firm survival. In this respect, we define success as having a high market share and a high probability for survival.

When it comes to entry timing, the ILC research has found evidence both in the support of early entrants and late entrants, but the majority of the research supports the fact that early entrants have an advantage against late entrants (Peltoniemi 2011). We expect early entrants therefore to have higher market shares than late entrants.

The ILC theory assumes that innovative firms have a better likelihood to survive (Peltoniemi 2011), technological activity increases the likelihood of survival (Agarwal 1996), and that patents increase firm survival (Wagner & Cockburn 2010). We will measure innovativeness as the number of released patents by different firms. In the ILC theory, patents have been used as a measure for innovative activity (Gort & Klepper 1982, Agarwal 1998). Hall et al. (1986) have showed that patents are strongly and positively correlated with R&D activity. In addition, Acs and Audretsch (1989) have found support for the fact that patents provide a fairly reliable measure of innovative activity. Here we also define market share as a measure of firm survival and firm success. We expect that firms with a high number of patents have a higher market share than firms with a lower number of patents.

Research has shown that patenting rates do not differ in emerging and mature industries (McGahan & Silverman 2001). However, there is a shift from product innovation to process innovation during the industry life-cycle (Abernathy 1978, cited in Peltoniemi 2011; Gort and Klepper 1982; Utterback and Abernathy 1975). We expect to see a growing number of product-related patents in the HEV industry, because we assume that it is in the emergent phase.

The ILC theory also addresses the theme of dominant design, which emerges as customer preferences have been tested (Suárez & Utterback 1995), the needs of a broad class of users have been satisfied (Abernathy 1978, cited in Peltoniemi 2011), and sales grow significantly as the dominant design emerges (Anderson & Tushman 1990). Licensing is one signal of the emergence of the dominant design (Murmann & Frenken 2006), which is also present in the HEV industry. Another important theme in the ILC research is inter-industry relationships. The phenomenon of having a mature industry give birth to a new technologically related industry has been studied in the ILC research (Peltoniemi 2011). Using these kinds of studies would be interesting and they could provide more insight to our research, since the mature automotive industry has given birth to the emergent HEV industry. However, we exclude the themes of the dominant design and the inter-industry relationships from our research. This is

because this kind of a research would require a deep dive into the development of the HEV technology and into the development of the automotive industry, for which we do not have enough resources for. Additionally, we want to ensure a focused and a high-quality approach to the other important themes of ILC theory.

The concepts of the ILC theory and our measures of them are presented in the Appendix VIII.

3. Data and methods

3.1 Brands, sales volumes and prices

Data

In order to analyse the development of the HEV industry, we had to gather historical HEV market data. We used data of annual sales volumes in the US from 1999 to 2010 as the basis for our analysis. The data is provided by the U.S. Department of Energy (2012). As units of research, we selected brands of HEV manufacturers. Naturally, one HEV manufacturer can have many brands, which can be manufactured in different models. The data included the number of different brands operating, entering and exiting the market. However, given that some of the brands are part of the same company (for instance, Lexus and Toyota), one could argue that the research should focus on the parent companies. Our decision to focus on brands is based on Professor Juhala's recommendation (Juhala 2012). Despite some of the brands sharing a parent company, they are independent, separate units and their market positions differ. Although the brands under one parent company are likely to engage in cooperation, the cooperation is close also across companies. Therefore, the brands are only a little less distinctive but significantly more clearly defined basis unit for this study than their parent companies. In this research, thus, when we refer to *HEV manufacturers* we mean *brands of HEV manufacturers* unless otherwise mentioned.

In order to study the volume and price development of HEVs in the 2000s, we combined the brand level annual sales volumes data with respective price data. We used manufacturer's suggested retail price (MSRP) data for a new HEV of the respective year's model. For instance, the MSRP for Toyota Prius year 2008 model was used as the Toyota Prius' price in 2008, and 2010 model for the price in 2010. The data was obtained from Consumer Guide Automotive (2012) and Aol Autos (2012) web pages. The price data needed to be made comparable between years. In general, adjusting the data for inflation would do this. However, as we have discussed, the industry can be seen as a sub-industry of the automotive industry. Therefore, we decided to adjust it for the development of new vehicles' prices in the US. New vehicles index, a sub index of the Consumer Price Index (CPI), was used for this. The data was gathered from Federal Reserve Economic Data (FRED 2012). In order to interpret more reliable results from the volume data, we also examined the development of the US automotive market sales volumes in general. The data was gathered from National Automobile Dealers Associations (NADA 2012) data reports.

Methods

We used the annual sales volume data by HEV model to construct a table presenting which car manufacturers were present in the market in each year. From this information, we could develop graphs presenting the annual density of HEV manufacturers and annual entry and exit rates.

In order to address the question 1D about the volume and price development of HEVs, we examined the development of prices and volumes of HEVs between three reference years: 2006, 2008 and 2010. The reason to focus on relatively recent years is that in the early 2000s there were too few manufacturers on the market and thus they would have received a disproportionately large weight in the sample. However, we acknowledge that Toyota Prius has quite a heavy weight even in the late 2000s figures.

In question 1D, we were interested to find out whether the HEV industry has been developing towards less expensive mass market products from niche markets. We studied this by dividing the market into five price categories and examining which share of the sales volumes in the US market each of these price categories represented in 2006 and how it had developed by 2008 and 2010.

In our analysis, we adjusted the prices for the development of new vehicles index of CPI instead of the whole CPI. This was because the HEV industry is a sub-industry of the whole automotive industry and is thus driven by the same trends. By adjusting the prices for the new vehicle index, we could study how the HEV industry has developed with respect to the general HEV industry and how HEVs' position with respect to other cars has changed. Similarly, we examined also the volume data of the US automotive industry and calculated a volume index showing the development of HEV volumes with respect to the development of the automotive industry volumes using the year 2006 as the base year. The reason for this was mainly the financial turmoil of late 2000s which strained the US automotive industry greatly and which we therefore wanted to take into account.

To answer the question whether early entrants have an advantage against late entrants, we built a graph showing market share development for all manufacturers on the y-axis, and then the development of the number of years these manufacturers have been in the industry on the x-axis. The number of years a manufacturer has been in the industry was calculated as a simple count of years since their first HEV model was introduced to the market.

3.2 Patents

Data

The patent data was retrieved from United States Patent and Trademark Office (USPTO), which is the Federal agency for granting patents and registering trademarks in the U.S. (USPTO 2012a). USPTO cooperates with European Patent Office (EPO) and Japan Patent Office (JPO) as one of the Trilateral Patent Offices. Since most of the automotive industry in the world operates in these geographical regions, a patent database consisting of all the patents in these regions is sufficient for us.

There is a separate patent class for HEVs in U.S. patent classification, 180/65.21. The number 180 in the

code denotes Motor Vehicles and the number 65.21 then specifically denotes Hybrid Vehicles. The Hybrid Vehicles class 65.21 operates under class 65.1 which denotes Electric Vehicles (vehicles wherein an electric motor in the body or on the body-frame drives the vehicle). The patents in this class are all so-called product patents meaning that they all relate to power transmission in HEVs instead of their manufacturing process. There are altogether 291 different patents in the patent class of Hybrid Vehicles. The first patent in this patent class has been filed by Wallace H. Moore in April 1977 and the last one by BNSF in February 2010.

It is always HEV manufacturers who file patents, not any specific brands. This is the reason why, for instance, one does not see any patents filed by Lexus: they are all filed by Toyota. Therefore, in the sections where we investigate patents, we treat OEMs as HEV manufacturers instead of the brands.

To conduct our analyses with the HEV patent data, we needed a table showing all the patents, the company or individual that has filed them, and the date the patent was filed. Unfortunately, the USPTO (2012a) database only allows studying one patent at a time and generating a combined table of the required patents with the web browser software is not possible. Therefore, we had to generate the desired table by hand by going through all the 291 patents individually and collecting the needed information. In the end we had a table showing patent assignee, patent number and date filed.

Methods

Based on the Hybrid Vehicle patent (HEV patent) tables we had constructed, we developed different kinds of graphs to answer our research questions. To prove our initial assumption that the HEV industry is still in the emerging phase, we were keen to know if the generation of product patents has already started to decrease. As already mentioned, our dataset consisted only of product patents. To answer this question, we generated a graph showing number of patents filed by each year. Looking at the data, we noticed that data was reliable only until 2008. Because actually obtaining a patent currently lasts a little bit over two years, it is obvious that there are not so many patents filed in the last two years in the data as they can still be in the patent observation process (USPTO 2012b). We decided to tackle this problem by not using data from years 2009 and 2010. To use also company-level patent data, we generated another graph where we were able to use the same table we had gathered from USPTO (2012a) database. To keep the company-level graph readable, we included companies that had more than nine HEV patents.

Second, we were interested to know whether firm success is correlated with how many patents the firm has been able to generate in the HEV patent class. Based on the data described above, we choose to build a graph comparing market shares of different firms versus the amount of patents they have had yearly.

4. Results

4.1 Industry development

1A: How has the number of HEV manufacturers evolved between 1999–2010?

The density of HEV manufacturers present in the US industry can be seen in Appendix I. It can be seen that the number of manufacturers has been following quite nicely the exponential trend line the whole period 1999–2010. Especially 2008 was a strong year of entrants in the US HEV market with the density increasing by 57%. This was due to entry of Chevrolet, GMC, Cadillac and Chrysler in the HEV industry. It is worth noting that all these manufacturers are from the US and all except Chrysler are part of General Motors.

1B: What has been the development of HEV manufacturer entries to the industry and exits from the industry between 1999–2010?

Appendix II presents annual entry and exit rates in the HEV industry. The entry rate has been increasing with two notable spikes of which the other was just discussed. The other spike occurred in 2010 when the entry rate hit a historical high of five new manufacturers entering the US HEV industry. An interesting point is that these five companies include e.g. BMW, Mercedes-Benz and Porsche, all premium car manufacturers. This would indicate that HEVs have started to penetrate into the luxury car segment as well. Before 2010 there were only two real premium car manufacturers in the US HEV market: Cadillac (entry in 2008) and Lexus (entry in 2005, Lexus is part of Toyota).

The exit rate of the US HEV industry is quite interesting: there are no exits before 2010 when Chrysler and Dodge (owned by Chrysler) exited. The low exit rates support the statement by Professor Juhala that HEVs are used also as marketing tool: if the HEVs are used for marketing, then it is clear that the company is not going to exit the market even if its HEVs was not competitive. On the other hand, our observation period – and the US HEV market in general – is relatively short with respect to the life-cycle of a car model. It may be that the manufacturers are not expecting the business to be profitable until some years in the future and the first model series are used to gain experience and develop the product.

1C: How has the number of patents evolved until 2010?

The evolution of Hybrid Vehicle patents filed by each year can be seen in Appendix III. It seems that the number of patents filed yearly has increased almost exponentially year by year from the first patent filed in 1977 until 2007. Especially years 2006 and 2007 have been strong as during both those years the number of patents filed has almost doubled. In 2008, the number of patents filed turned to decrease. Looking at the data, we found out that the main explanatory factor is Nissan whose patenting rate decreased from seven in 2007 to zero in 2008. One cannot find any particular reason for this slump. Actually, Nissan presents in its Annual Report in 2009 various different R&D projects it is currently executing (Nissan 2009). One has to remember that the decrease in patents filed in 2008 can also be caused by some

patents that are still in the observation process. If there are these kinds of patents still in the observation process and if they get accepted, they will be listed as patents filed in year 2008.

The evolution of Hybrid Vehicle patents filed yearly by different manufacturers can be seen in Appendix IV. One sees here the same kind of exponential growth development as with general patent development graph. One also notices how the number of patents filed by Nissan suddenly slumps in 2008. What is important to notice from the graph is that the two strongest players, Toyota and GM, continued to increase the number of patents filed with a growing pace even in 2008. At the same time all the other players, not just Nissan, have declined. This indicates that the innovativeness in HEV business might be consolidating to the hands of big players.

Based on the two graphs (Appendix III and Appendix IV) mentioned above it is a bit hard to estimate if the number of patents filed yearly really has turned into decline since we don't know about patents that are filed in year 2008 but are still in the observation process. However, there is not likely to be many of these patents if any since it is already more than three years from the end of 2008 and during that time there have been many Hybrid Vehicle patents that have been granted. Graph in Appendix IV indicates that the patent creation among the two biggest players is still growing.

Therefore, we conclude that even though the exponential growth in Hybrid Vehicle patents by all manufacturers seems to have slowed down, the big players, namely Toyota and GM, have continued to file product patents with a growing pace. Therefore, one cannot say that the HEV industry would already have moved to mature stage where the main innovations are process innovations. Toyota and GM continue to develop new kind of technological solutions for HEVs. The Appendix IV indicates also that in the future licensing technology from the two biggest players might increase as the others are not able to keep up with the rapid technology development.

1D: How have the sales volumes and prices of HEVs evolved through 1999–2010?

Appendix V presents the development of the HEV sales volumes, market shares of the price categories and the volume index. As can be seen, there has been a shift towards lower price categories in the last years. HEVs with MSRP of less than $20,000 (in 2006 car prices) represented ca. 55% of the market in 2006 but 64% in 2010. 10% of the HEVs sold in the US in 2010 cost less than $20,000 in terms of 2006 car prices. This price category was non-existent two years earlier. On the other hand, the market share of the highest price category has remained quite flat during the observation period. This might imply that although the general trend seems to be that HEV prices are declining and an HEV is becoming more and more widely affordable, there is also demand for the HEVs in the premium cars class. This argument is supported by the fact that in 2010 majority of the new entrants in the business were premium brands.

The total HEV sale volume was only a little higher in 2010 than it was in 2006 despite of the strong growth in 2007. The significant decline in years 2008 and 2009 was due to the struggle of the automotive industry in the financial crisis. As can be seen, the volume index actually grew in 2008 and 2009, which means that the HEV industry kept growing rela-

tive to the whole automotive industry, i.e. the share of HEVs of all cars sold in the US increased. In other words, the decline in the volumes in years 2008 and 2009 was caused by the financial crisis, but HEV industry suffered from it less than the general automotive industry. However, an interesting finding is that the decline in HEV volumes continued also in 2010 while the automotive industry volumes in general went up by ca. 11%.

4.2 Industry success factors

2A: Do early entrants have an advantage against late entrants?

The market share development of different HEV manufacturers compared to the time they have been in the industry can be seen in Appendix VI. It seems that in general, time in the industry is correlated with market share: all the brands that have a decent market share have been in the industry for more than five years. All the other big players seem to have a somewhat increasing trend in their market share compared to years in the industry except for Honda that seems to have a decreasing trend in the graph. What is interesting is that even though Honda was the first one to introduce a HEV in the US, it has definitely lost the main share of the market to Toyota. Based on a market study conducted in the US, people buying Toyota Prius felt it less expensive compared to other options and in many cases as the only option available in the market (Hallbright & Dunn 2010). This is also something that Professor Juhala (2012) pointed out in the interview several times: even today Toyota Prius is the only HEV that is highly available in the market.

All in all, we conclude that yes, early entrants have had a clear advantage compared to late entrants in the HEV industry. All the players that currently have a decent market share in the HEV industry, namely Toyota, Ford and Honda, have also been the first ones to introduce a HEV model to the market.

2B: Does a high number of patents correlate with firm success?

The market share development of different manufacturers compared to their amount of patents they have had yearly can be seen in Appendix VII. It seems that in general the market share is correlated with the number of patents the firm has quite well. One notices immediately from the graph that the current market leader, Toyota, has also the most patents. Also two other big players, Ford and Honda, have good amount of patents. This is something that prof. Matti Juhala pointed out in the interview (Juhala 2012). He thought that the companies that have invested a lot in HEV technology development are more likely to have workable HEV models broadly in market even today. What is interesting about the graph in Appendix VII is that while GM has the second most patents, it is only fourth in terms of market share. Thus, one could conclude that even though GM has invested a lot in developing HEV technology, it has not been able to capitalize on those innovations.

It is also interesting not to think only the current situation based on the graph in Appendix VII, but also the development of market shares compared to the number of patents. It seems that Toyota was able to take the controlling stake in the industry with eight patents and this happened in 2000. Thus, one sees how

already in 2000 Toyota mastered the innovativeness of HEV industry. From the rapid development of the number of patents, it looks like it was Toyota who was the first manufacturer that started to believe in hybrid vehicle technology and thus started to invest their innovative efforts in it. This was also something that prof. Matti Juhala noted in the interview (Juhala 2012). Also other two big players, Honda and Ford, had already more than five patents in 2003. Interesting fact about the graph is that even though GM has 33 patents at the moment, it has only managed to generate a market share of 2.46 % in 2010. The reason might be that GM awake to invest in HEV technology development quite late.

All in all, we conclude that high number of Hybrid Vehicle patents seems to be correlated with firm success. Good examples of this are the three HEV manufacturers that actually have a decent market share in the HEV industry: Toyota, Ford and Honda. They all have a good amount of patents. What seems interesting is the importance of investing in HEV R&D already in the beginning of the industry. All these three players were able to produce patents already in the 1990s. GM filed their first Hybrid Vehicle patent already in 1992, but then something happened and the next patent was filed only in 2003.

5. Discussion

We found that the ILC theory can be applied well in the context of HEV industry. By using the ILC theory, we were able to determine the life-cycle stage of the HEV industry and also get some insight into the industry success factors.

The development of the number of HEV manufacturers, which was studied in the research question 1A, resonates very well with ILC theory, denoting that the HEV industry really is still in its emergent phase. What is important to notice is that the density of HEV manufacturers seems to follow exponential growth pattern very well, just as the ILC literature predicts.

The prices of HEVs related to their sales volumes have developed exactly as the ILC theory assumes. As the sales volumes of HEVs have increased, also their prices have decreased.

One interesting finding was that the number of exits in HEV industry, which was studied in the research question 1B, has not developed as the ILC theory predicts: exit rates have not correlated positively with entry rates as the first exits were experienced in 2010. There can be various reasons for this. One thing that was already mentioned is that the entrants to the HEV industry are big car manufacturers who are, to at least some extent, introducing HEVs as a marketing tool and an option for future. They aren't in danger of death even if the product doesn't succeed because the basic business can cover the losses. Actually, the exits that have taken place in the HEV industry have been caused by restructuring the brand portfolio, rather than the bad financial returns. Another thing worth mentioning is that probably the ILC theory about entry and exit rates does not apply very well in this kind of a sub-industry that HEV industry in the end is. Sub-industries often arise from some specific industry meaning that the early entrants to this specific industry are not necessarily completely new firms

as the ILC theory assumes.

The development of product HEV patents, which was studied in the research question 1C, resonates well with ILC theory denoting the emergent phase of the HEV industry. The strongest creators of HEV patents are filing new product HEV patents with a growing pace. However, one has to remember that our dataset does not cover patents related to process innovations in HEV technology. Therefore, the process patents in HEV technology can have developed even faster than the product patents. Thus, we can only conclude that according to the patent data the HEV product technology has not reached its peak point, which still according to ILC theory denotes an emergent industry.

In research question 2A, we investigated whether early entrants have an advantage against late entrants. Similarly to most of the ILC research, we also found that early entrants do have an advantage against late entrants. However, all the studied brands do not show a linear correlation as the HEV manufacturer with the longest time in market, Honda, has not performed as well as Toyota.

The effect of patents to firm success was studied in the question 2B. Also here we found that the data resonates very well with the ILC theory denoting that firms with higher number of patents have a higher market share than the firms with a lower number of patents. Especially the number of patents very early in the development in the industry seems to be significant in explaining the success of a HEV manufacturer.

6. Conclusions

In this research, we were able to identify the life-cycle stage of the HEV industry and also get some insights into the industry success factors. HEV industry is at the moment in emergent phase based on the development of the number of companies in the industry and the number of product patents filed. Entering early and having many HEV patents have proven to be important for the success in HEV industry.

7. Limitations and ideas for future research

Although we were able to answer our research question and thereby achieve the research objectives, there are some limitations in our methods. First, we were not able to be consistent in our decision to study the brands of HEV manufacturers rather than their parent companies as the patent data was available only on the company level. Another limitation due to the available patent data was that the time period varies between analyses: the patent data was reliable only till 2008 while the time period in other analyses continues till 2010.

We propose several topics for future research. If the consolidation of HEV innovativeness to the hands of the biggest patent creators is to continue, it would be interesting to find out whether other

players decrease their innovation activity and license the technology from the bigger players. Is it possible to succeed in the HEV industry without having own HEV technology? How does the licensing affect the industry structure? Or is the consolidation only a sign that the easily attainable profits have now been made and therefore less competitive players will cease to exist?

Another interesting topic would be to dive deeply into the technology of HEVs and investigate if a dominant design has already been introduced. One could see Toyota Prius as some sort of dominant design because of its dominant position in the market, but still Toyota is continuing to make new product innovations with a growing pace.

This research has only covered the U.S. market. Professor Juhala stated in the interview that the U.S. market does not fully describe the world market (Juhala 2012). Therefore it would be interesting to find whether the results of Japan or European HEV markets are similar to the results of this research.

Another interesting topic would be to investigate the inter-relationship between the mature automotive industry and the emergent HEV industry. We have touched lightly several important themes such as marketing efforts, R&D investments, and financing base in our research, but it would be interesting to investigate these factors affecting the HEV industry further. It would also be interesting to find out which ones of the traditional carmakers have entered the HEV industry. Is it the big, the profitable or the technologically advanced?

Furthermore, our results related to the patenting activity of the HEV industry players in the most recent years raise questions for future research. It seems that patenting activity has turned into a decrease. Could it be that all of the HEV-related technologies that are easiest to develop have already been patented? Why have only a few firms filed patents recently while the others have been inactive in their development efforts?

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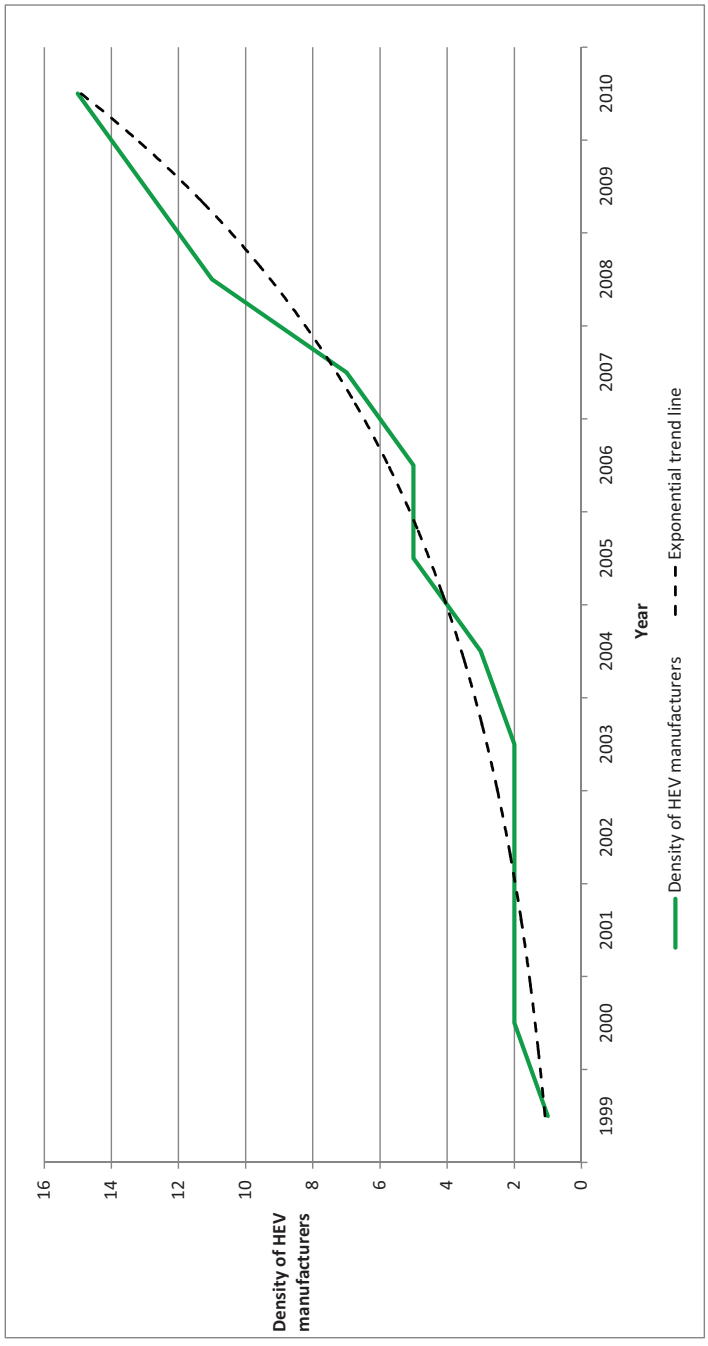
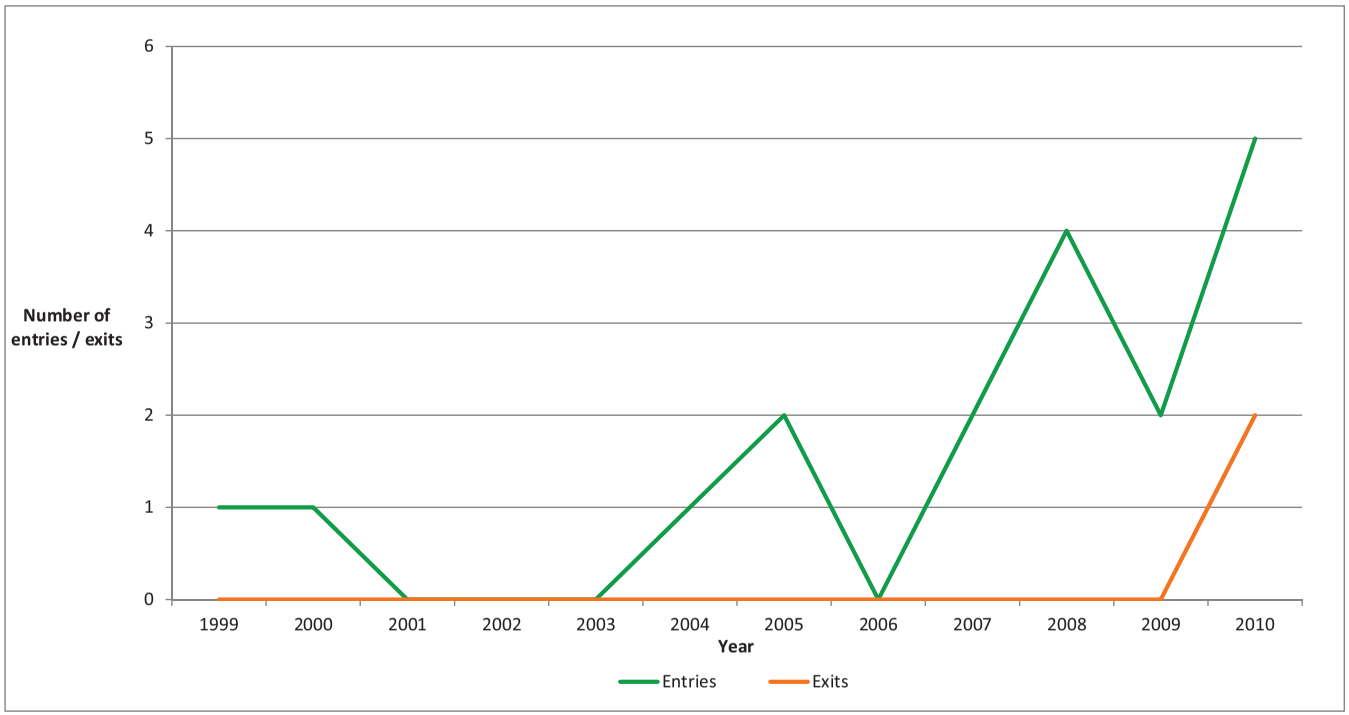
8. Appendices

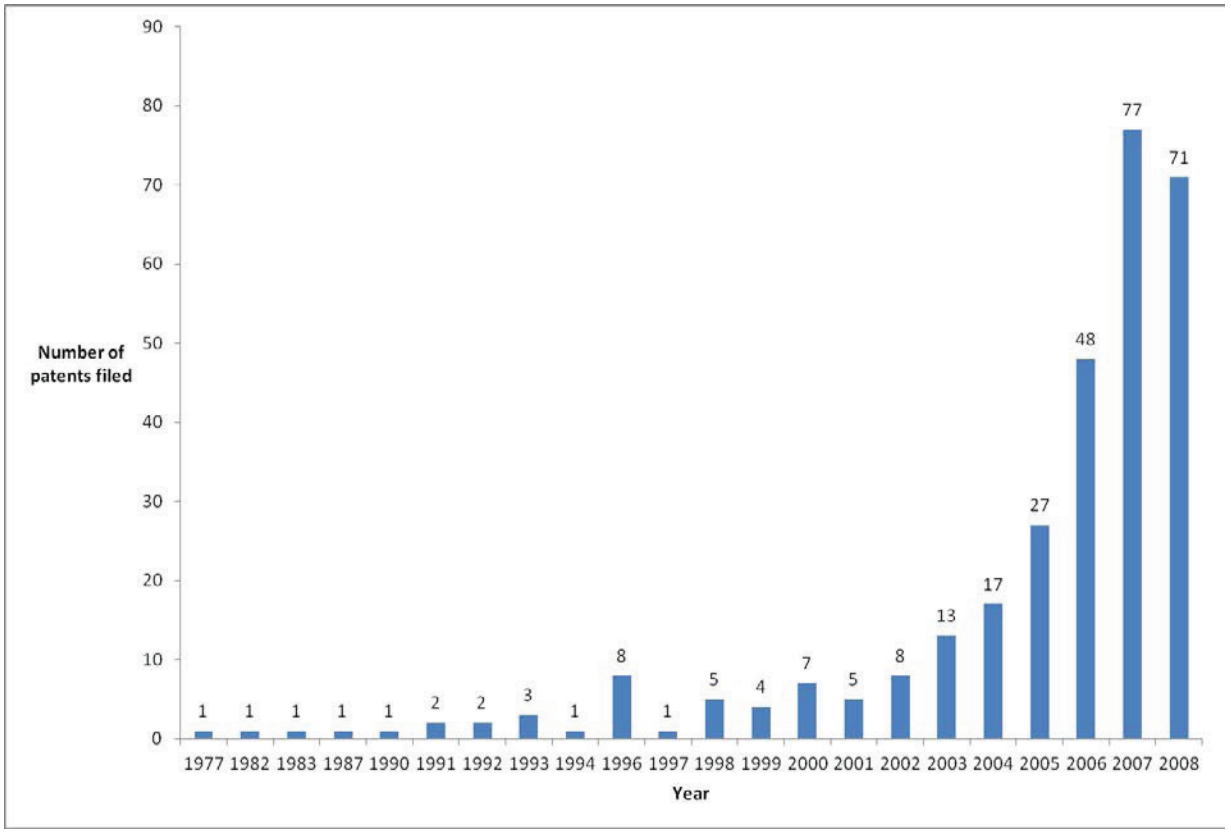
Appendix I. **Density of HEV manufacturers 1999–2010**



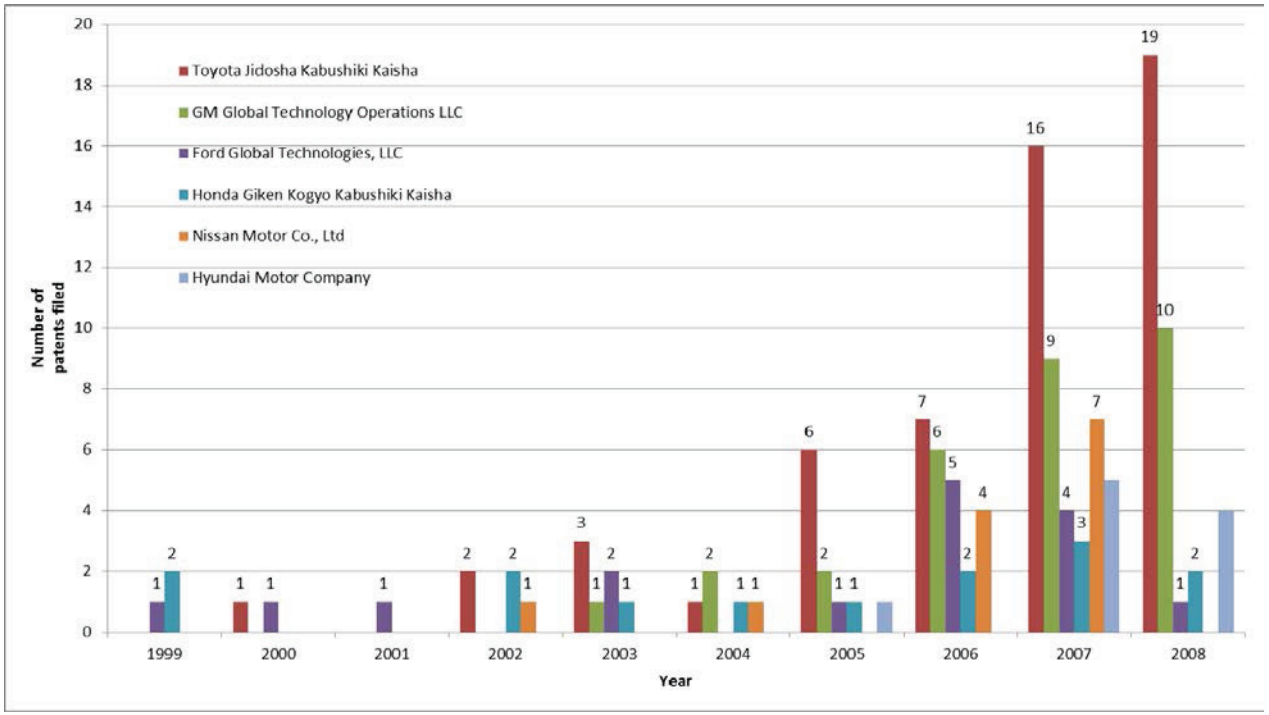
Appendix II. HEV manufacturer entry and exit rates 1999–2010



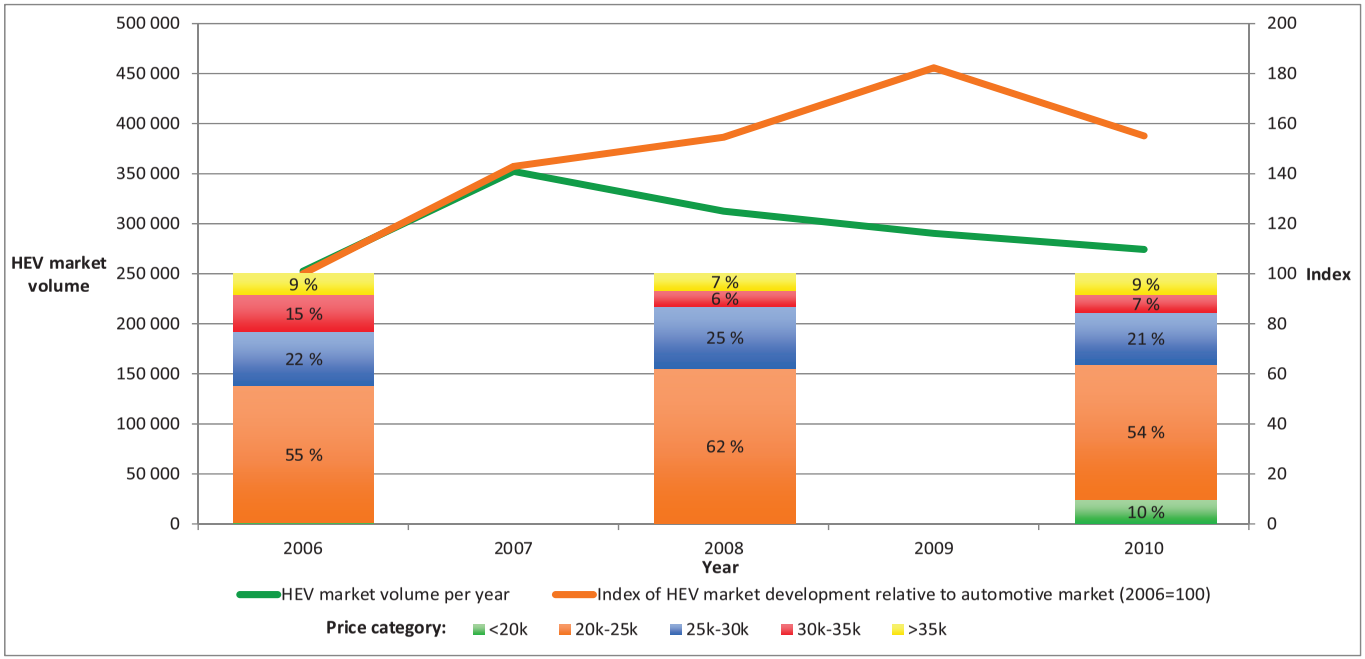
Appendix III. Total number of HEV patents filed yearly 1977–2008



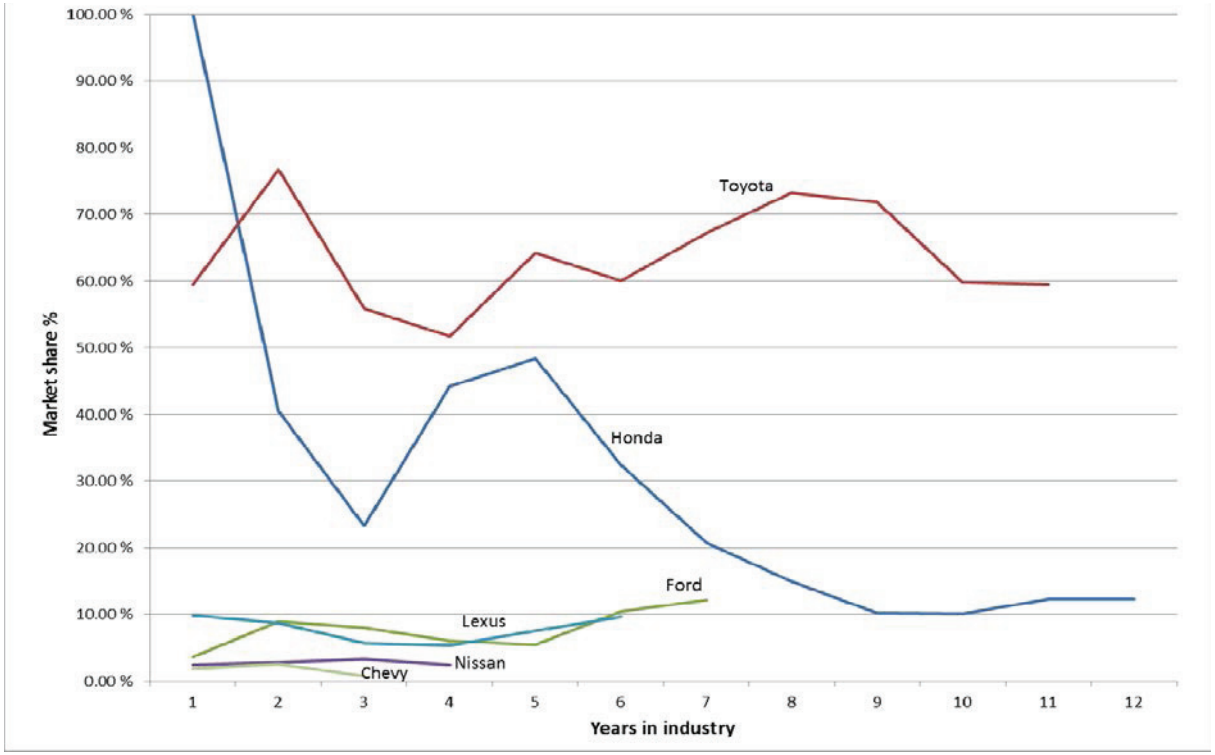
Appendix IV. **HEV patents filed yearly by manufacturer 1999–2008**



Appendix V. The development of HEV sales volumes and prices

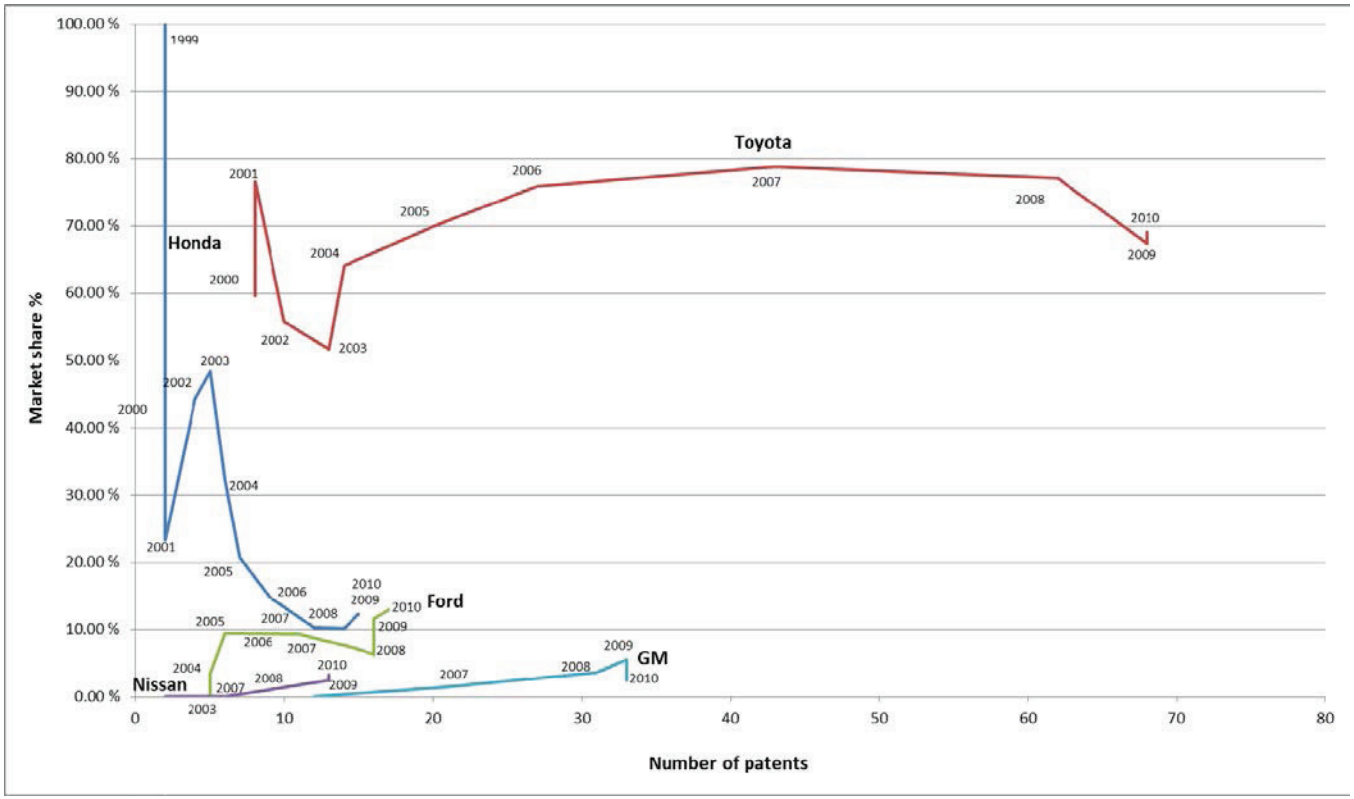


Appendix VI. **The market shares of HEV manufacturers (brands) vs. years in the industry**



Note: The brands shown in the graph have been in the industry for more than one year and managed to catch 2% market share a least one year

Appendix VII. The market shares of HEV manufacturers (firms) vs. number of patents



Note: The manufacturers shown in the graph have all been able to catch at least 1% market share one year

Appendix VIII. The concepts used in the study

Concept	Measure	Time period	Data sources
Entry rate	The number of firms entering the industry each year	1999-2010	U.S. Department of Energy (2012)
Exit rate	The number of firms exiting the industry each year	1999-2010	U.S. Department of Energy (2012)
Density	The amount of firms in the industry in each year	1999-2010	Calculated based on the cumulative entry and exit rates
Sales volumes	The amount of cars sold for each HEV brand in each year	1999-2010	U.S. Department of Energy (2012)
Price	The price of a car for each HEV brand	2006, 2008, 2010	For prices: Consumer Guide Automotive (2012), Aol Autos (2012) For adjustment: Federal Reserve Economic Data (FRED 2012)
Entry timing	Timely period of the HEV firm in the industry	1999-2010	Calculated based on the entry and exit timing
Innovativeness	Number of patents of the HEV firm for each year	1977-2010	United States Patent and Trademark Office (USPTO) (2012a)
Success	Market share in terms of volume of the HEV brand or firm for each year	1999-2010	Calculated based on the sales volumes

The refractive laser eye surgery equipment industry evolution in the United States

Karla Nieminen, Macarena Pallares, Jenni Silvennoinen and Elina Virtanen

ABSTRACT

This study focuses on the refractive laser eye surgery equipment industry in the United States between 1995 and 2012. Motivation to study this industry can be derived from the future potential of the global refractive laser surgery market of 700 million dollars in revenue with 30 percent estimated yearly growth. The four following industry life-cycle (ILC) theory propositions are examined in relation to this industry: early entrant advantage, related industry experience advantage, innovative firm advantage and the presence of change from product to process innovation. Companies researched are those who have obtained Food and Drug Administration (FDA) approval(s) for their machine(s) or are in the process of applying. The amount of US patents related to the industry is used as a measure for innovativeness. The main findings are that for this industry the early entrant advantage seems not to hold, the related industry experience advantage seems to hold, the innovative firm advantage seems to hold and the presence of change from product to process innovation can neither be confirmed nor denied. Generations of eye surgery technologies are also presented. The observation is made that the legitimization of the industry has happened but the industry is still not in the mature state of its life cycle.

Keywords: refractive laser eye surgery, laser eye surgery equipment, industry evolution, industry life-cycle

1. Introduction

In this study we research the refractive laser eye surgery equipment industry in the United States. We include in our study the equipment that has been approved by the FDA (Food and Drug Administration) and focus on the development of the industry in 1995–2012. First approval was issued in 1995, thus we are studying the whole lifetime of the industry in focus.

The excimer laser, a device that uses a mixture of argon and fluorine gases, was developed in the mid-1970s for the need of electronics industry. In 1983 Dr Stephen Trokel filed a patent for the use of excimer laser in refractive surgery and created VISX Company, which was the First Laser Vision Correction Company (Calloud, O. et. al., 2001). Reflective laser eye surgery is performed so, that the outer layer of the cornea is either removed (PRK) or moved aside (LASIK) and then the deeper layers of cornea are modified with laser to correct vision of the patient. Cataract eye surgeries are outside of the focus of this research.

The global refractive surgery market of over 700 million dollars, mainly driven by the excimer laser technology, is expected to grow 30% in a period of 5 years. United States has the largest market at the moment, and it is expected to keep growing and remain the largest market in the upcoming years. Hence, the US market was selected as a focus of this study. The global refractive surgery market revenues in 2011 and the forecast market revenues in 2016 are summarized in Figure 1.

The market growth is driven by an increasing standard of living especially in USA, Europe, Japan and China. People have more money to spend and especially taking care of individual health has become of increasing importance for people. People are ready to pay for their health and some may even have insurance that covers refractive surgery. As the quality of surgeries improves, more people will be interested in operating their eyes. If surgery for presbyopia becomes possible, this opens up further growth potential for the industry.

The industry is strongly regulated in the United States and FDA approves all equipment that can be used widely for doing surgeries. In addition, surgery clinics are careful in choosing equipment for their clinic, as patients are interested in having a high quality surgery. In refractive laser eye surgery equipment industry, selection is mainly based on the quality of operations or especially how good results the operations show in clinical examinations. If there are no clear results of medical tests, selection may also be based on customers' perceptions. Customers may perceive new and more expensive technology to be better.

2. Literature/Theory development

In this section we will discuss the theoretical implications based on which we will explore the industry more thoroughly.

For the purposes of this research, the industry subject to our research can be defined as the reflective eye surgery laser equipment producers approved by FDA

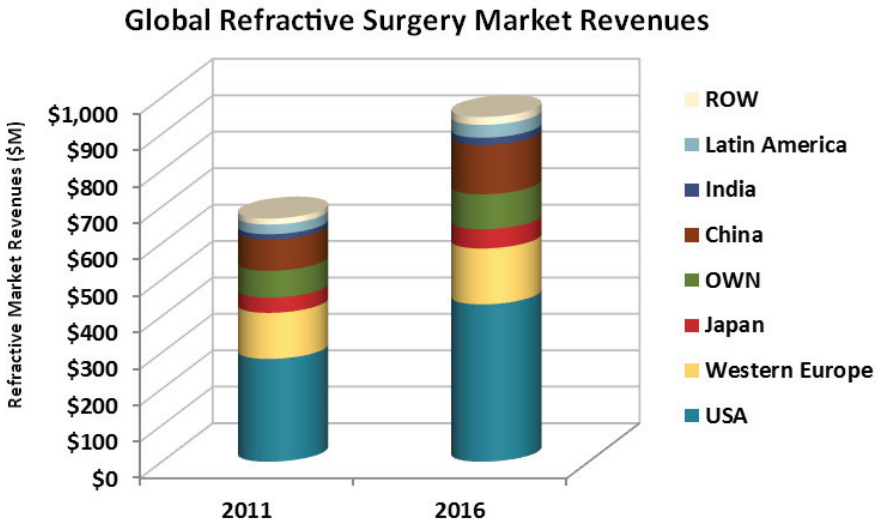


Figure 1- Global Refractive Surgery Market Revenues (Market Scope, 2012).

in the USA who provide the actual laser itself. We also discuss in our study companies that have applied for FDA approval but have yet not received it. We have chosen to study the given industry mainly in the light of the Industry Life Cycle (ILC) theory. However, some elements from other industry evolution theories such as Ecology and Evolutionary Economics will be included.

The ILC theory presents a view that as industries age, they follow a set of stages from industry emergence to a more mature stage. Depending on the stage the industry is at, there are factors that affect the industry dynamics and the survival of the companies in it. According to ILC, industry emergence takes place when a technological opportunity is introduced and followed by a set of companies that begin to produce products with this technology. The theory also suggests that company numbers form an inverted U-curve as a function of market age. In the initial phase, where the entry and exit rates are high and net entry small, discontinuity characterizes the industry dynamics. As the emerging industry seems ever more lucrative, legitimation takes place and as for example investors see new investing opportunities in it, increasing rates of entry are recorded. As competition of the demand and raw materials intensifies, a shakeout with very high exit rates takes place. The last phase of the inverted U-curve is the stagnation phase. In this phase a smaller number of companies dominate the industry (Peltoniemi M., 2011). Next, we will take a closer look on what happens in the industry life cycle stages relevant to our study.

Young industries are characterized by turbulence resulting from the high entry and exit rates with net entries only accounting for a small fraction of all entry. Though competition is fierce, companies embark on population-level learning from their competitors and jointly develop a standard for fitness in the

given industry. This prepares the population for taking collective action when needed, for example to persuade government legislation to more suit the needs of the community. As higher acceptance of the specific nature of the technology is developed throughout the population, complementors, government and finally consumers, the industry standards become legitimate; i.e. widely accepted (Peltoniemi, M., 2011).

After the industry emergence, competition gradually intensifies. When it reaches extremely high levels, a shakeout and a transition from product development to process research and development takes place. Though product development never fully halts, process R&D is able to bring the benefits of cost spreading effect to the companies. In addition to the common learning environment in the young industries, the economies of scale is another reason why the incumbent companies and early entrants are more likely to survive until the maturity stage of the industry. Following the legitimation process, industries may develop a dominant design of their technology (Peltoniemi M., 2011).

Even though dominant designs are too ambiguous concepts to study empirically in detail, a characteristic of such a design is that it fulfills the needs of a broad class of users and the frequency of variations is decreased. A dominant design need not be a radical innovation that shifts the industry focus fully but they can be incremental and only perhaps introduce a quicker way to reach the same results. Dominant designs can be for example the shape or minimum capacity requirements of a given product (Peltoniemi M., 2011).

Emergence of dominant design and the proneness to invest in higher unit production facilities by the incumbents decrease product variation and result in less amount of choice for consumers. On the other hand it introduces a level of acceptance for a reasonable quality product and protects the consumers, manufacturers and other stakeholders alike. Dominant designs can emerge in a cyclical order, where older designs are replaced by newer ones, which quickly become the industry standard. Setting a dominant design increases the incentive for companies to grow their capacities (Murmann JP. & Frenken K., 2006).

As the markets reach a saturation stage, a sharp increase in exit rates take place. This shakeout can either take place after excessive entries into a new and fascinating industry or after technological developments, where the companies unable to conform to produce the dominant design must exit (Bhaskarabhatla A., and Klepper S., 2008). In the case of a niche, such as that of the refractive laser eye surgery equipment industry, the benefits of having relatively lower level of competitor density can be offset by the more fierce competition over resources and cause a shakeout (Dobrev S.D., Kim T. and Hannan M.T., 2001). However, some research results indicate that a shakeout might not take place due to technological developments or any other particular events but they are a part of the competitive process of the industry, whereby active innovative moves of the early entrants allow them to achieve dominant market positions (Klepper S. and Simons K., 2005).

The final stage of any industry life cycle is the mature stage. Here, product development takes relatively little place but process R&D could, as in the case of the Finnish pulp and paper industry, continue to produce even multiple times

better numbers of output units for many decades. Mature industries have high barriers of entry for new beginners but feed the other emerging industries with competence, entrepreneurs, employees and new business or technology ideas. Mature industries might even create or enable new industries to emerge by creating a need for a new related technology for the market (Peltoniemi M., 2011).

As the theory suggests, industries emerge in a cyclical order. Mature industries breed new industries and companies develop products and new companies such as spinoffs that outrun their predecessors in an unbeatable way that causes them to fade into oblivion. In case another superior product emerges, the capable and fit companies then compete who masters the art of production the best. Industry life cycles, therefore, produce new generations of companies, products, trends, waves of consumption and production as time goes by. These generations either replace one another or at times can even coexist before the better product or process finally takes control over the industry (Klepper S., and Sleeper S., 2005).

The industrial ecology theory mainly researches the demography of organizations. The most important numbers of companies' life cycles such as the year of founding, disbanding, transformation and growth rate are studied to demonstrate the connections between them and the change in their environment, such as industry dynamics. Contrary to ILC theory, companies are seen as subject to high inertia forces, what makes it very difficult if not impossible for them to change. Inertia follows from internal reasons such as not wanting to withdraw from current investments, company politics, information flow constraints and the burden of history and tradition. Especially challenging factors to change are marketing strategy, core technology, forms of authority and stated goals. External inertia forces include legal and fiscal barriers both to entry and exit, contracts that tie a company to an existing state, difficulties of legitimizing change and constrained flow of external information (Baum J.A.C., & Shipilov A.V., 2006).

However, the higher the inertia of a company, the more likely it is to survive in selection processes, since companies with highly reliable past performance and accountability have proved to flourish. This infers that inertia is also a consequence of the selection process of the fittest companies to survive, not only the precondition. In this kind of environment, legitimation plays a key role in defining the industry standards, both internally and externally. However, legitimation raises the overall industry standards and therefore enhances the quality of the business, products and outputs, which makes a company in the given industry a more viable investment target (Baum J.A.C., & Shipilov A.V., 2006).

We have previously discussed the main propositions of the ILC theory. In this research paper, we will further focus on discussing, testing and analyzing some of the main propositions based on the ILC theory as follows:

- Product innovation comes first, and the focus subsequently shifts towards process innovation.

- Early entrants have higher survival rates than later entrants.

- Entrants with experience from relating industries (i.e. de alio entrants)

and spin-off entrants have higher survival rates than entrepreneurial firms (i.e. de novo entrants).

- Innovative firms are more likely to survive than non-innovative firms.

(Peltoniemi M., 2011)

3. Hypothesis and Research Questions

Based on the ILC literature propositions, the following null hypothesis are presented:

Hypothesis 1- Companies that have gotten the first FDA approvals, meaning the early entrants, survive longer than others as independent companies.

Hypothesis 2- Companies that have earlier experience from relating industries survive longer than others as independent companies.

Hypothesis 3- Companies that have more patents, and so are more innovative, survive longer than others as independent companies.

Hypothesis 4- The amount of FDA approvals per year, and so product innovation, decreases as the time passes.

In the next section of this research we shall cover the methods of data gathering and how the selection of relevant variables reflecting our research findings has been conducted.

4. Data and Methodology

This research is exploratory in nature. It seeks to assess the state and development of the U.S. refractive eye laser surgery equipment industry and to understand and explain by using industry evolution theories the relationships between key variables affecting the industry during its existence. The research scope was chosen to be the U.S. refractive eye surgery laser industry to enable comparable and related research data to be gathered for the analysis. Another reason is that this market is currently the biggest one in the world. We were thus able to gather a relatively large research population to study. Narrowing down the research scope included selecting the relevant companies by listing all the companies who have received an approval for their laser product from the U.S. Food and Drug Administration (FDA), which allows them to operate in the given markets (Saunders M., Lewis P. and Thornhill A., 2007).

Further empirical data search was carried out by extracting the patent data from the United States Patent and Trademark Office website on all the companies that have an FDA approval or companies that have applied for an FDA approval (FDA 2012). This approach enabled us to construct a timeline for our research as well as to develop an understanding of the industry dynamics, which sheds light on the changes in the industry structure, changes in number of companies and their ability to develop further developments or innovations within the industry at a given period of time. Collected data was quanti-

Table 1. In order to more clearly summarize our research, we have added a list of variables used and the data sources gathered below.

SOURCE	*VARIABLES SELECTED*
The United States Food and Drug Administration (FDA) website	FDA application year FDA approval year FDA introduction year
The United States Patent and Trademark Office website	Patent application year Patent approval year
Organizations' websites and reports Industry statistics and reports (See M&A reference table)	Founding years of companies M&A years of companies

tative numerical data of the application and approval year of the FDA approved products, the patent filing and approval years of the related companies' patents and the companies' entry and exit year to the industry to construct a cohesive timeline of its evolution. For future products that are currently in the pipeline to be presented to the markets if they will be approved by the FDA the data used was the FDA application date.

In order to obtain further understanding of the evolution of the industry, the research choice included a combination of quantitative data and qualitative data (Saunders M., Lewis P. and Thornhill A., 2007). Multiple source secondary empirical data was acquired from organizations' websites and reports, industry statistics and reports and company histories. Qualitative data included the articles, journals and books concerning the theories of Industry Life Cycle (ILC), industrial ecology and evolutionary economics. The acquired research data was cross-evaluated by group members in order to find supportive or contradicting arguments of the research results. Any differing interpretation was discussed in the group to produce a common understanding to produce a solid analysis.

These companies that have an approval from FDA for the LASIK or PRK to be used for refractive surgery are the following: VISX, Inc, Wavelight AG, Technolas GMBH Perfect Vision, Summit Technology, Inc., Nidek, Inc., Laserlight Technologies, Inc., Carl Zeiss, Inc., Bausch & Lomb Surgical, Inc., AMO Manufacturing USA, LLC and Alcon Laboratories, Inc.

Companies that didn't have a laser device yet approved by the FDA, but have filed an application for FDA based on the information provided by Market Scope (2012) were also added to the study. These companies are Quantel Medical, Customvis, Ellex, IOPtima, Oraya, and Avedro.

Patents were searched for all of the FDA approved companies and for a new rising company called Biolase. The objective of the search was to list all patents of these companies with relevance for refractive laser eye surgeries. Search was done by using a function searching

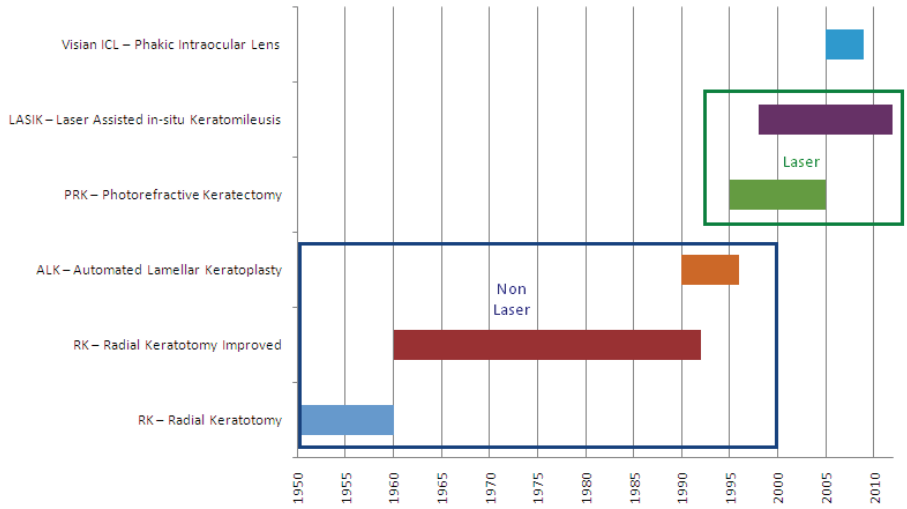


Figure 2- Overall Refractive Eye Surgery development by technology

for words from two groups. To be included in our study the patent abstract had to include at least one word from each group. Group 1 included the words ophthalmic, refractive, cornea, corneal and eye. The group 2 included the words laser, excimer, surgery and surgical.

In order to produce a common understanding of the terms related to our analysis, we shall now give an explanation of all the central terms used throughout the research paper.

FDA application and the FDA approval date were collected as well as information of the year when the company first introduced the equipment to the market. The FDA approval date was used as the date of the beginning of the life cycle of a device, and the time before the FDA approval as R&D for the device.

Entry to industry of a company shall hereinafter be defined as the time of the FDA approval of the first equipment that is presented to the markets. The reason for this is that this is the first clear date after which the equipment manufacturer is allowed to actually operate in the industry. An exit for a company is defined as the state of bankruptcy or being acquired by any other company.

In terms of analyzing the product innovation of companies, innovation is measured by the ability to obtain an FDA approval for the product. When assessing the overall industry innovation, we have chosen as the main metrics the ability for any company to produce and acquire the right to hold patents related to the product in question. Information regarding the mergers & acquisitions and founding years of the companies was gathered using company databases, the companies' annual reports and company news. Because many of the companies have multiple business units in different fields and because they have eye surgery operations internationally, it was challenging to find the relevant years for US refractive laser eye surgery market entry. As stated earlier, we decided to define

entry to market as the first FDA approval. No exits other than acquisitions or joint ventures were found.

Financial data for the companies was not gathered since many of the companies didn't have financial reports publicly available (privately owned) while other companies were not only working in the laser eye industry (medical conglomerates) and often their financial results were not divided by business unit. Also global players' financial reports were not always divided by region. This made it difficult to find financial data that was pertinent to the U.S. laser eye industry. Because of the lack of financial data success was defined as the company's ability to survive as an independent company.

5. Results

Also other phases besides excimer laser surgeries were found in the history of refractive surgeries. The refractive eye surgery has developed since the beginning of the 20th century when the Radial Keratotomy (RK) refractive procedure was developed to correct myopia (Bashour M. & Benchimol M., 2005). This procedure was developed and used until the beginning of 1990s, when a new manual procedure called Automated Lamellar Keroplasty substituted RK.

Between 1980 and 1995 around 70 patents were approved regarding the use of laser for eye surgery that allowed the development of new procedures. In 1995 Summit Technologies, Inc. was the first company to gain FDA approval for PRK and to market its laser in the U.S. to treat people with 'low myopia'. This was the beginning of the Laser Vision Correction (LVC) market (Calloud, O. et. al., 2001).

As the technology improved, a new procedure called LASIK, which could treat most refractive errors, was developed and the superiority of the procedure over PRK became evident. In 1997 the majority of the surgeons began to switch from PRK to LASIK (Calloud, O. et. al., 2001) and LASIK, became the dominant design in the market.

Although a new technology called Phakic intraocular lens has been developed (non invasive procedure) it is not in use. In 2009 the FDA announced that an integrity hold has been removed from the STAAR company's application of the Visian ICL device, which was approved by the FDA in 2005 (MarketWatch, 2012). Thus they removed the FDA approval for this technology. No further FDA applications for the use of this technology have been filed.

To date, LASIK remains the de-facto standard in the market and since 2000 there are only FDA applications regarding this procedure instead of PRK or other procedures. Figure 2 summarizes the development of the different technologies for refractive eye surgery. The generations of different technologies have been divided to laser procedures (the green box) and to traditional surgeries (the blue box).

Figure 3 shows when introductions, acquisitions and joint ventures of companies of the industry have happened. The companies presented in figures 3 and 4 are considered the major players in the US market because they have FDA approvals for their products or, in the case of the future companies in pastel colors, are emerging companies applying for FDA approvals. As we defined suc-

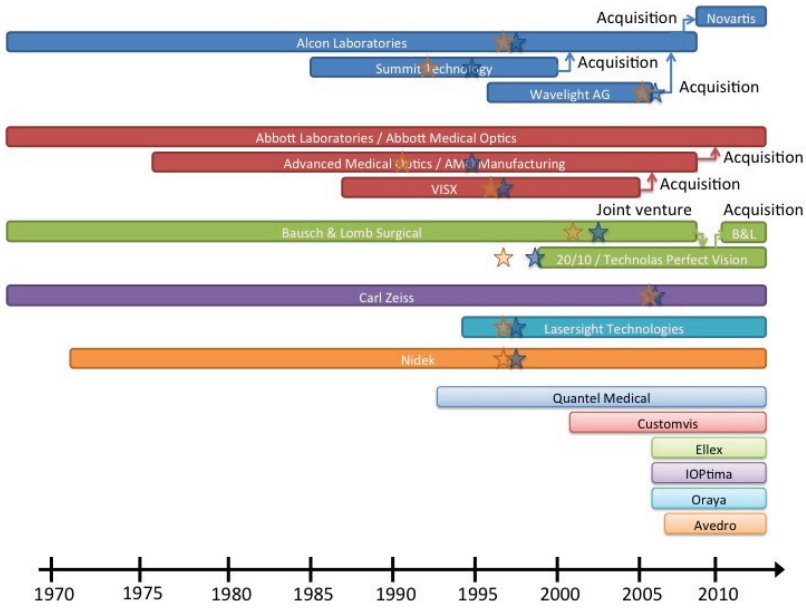


Figure 3- Establishments, acquisitions and joint ventures of the companies. Orange star is the first FDA approval application of a company and blue star is the first FDA approval of a company. (M&A ref. table)

cess as surviving we have in the end 6 successful FDA approved companies and 6 more companies that are applying for the approval. It can be seen that all companies that have exited the market, have been acquired by other companies. There is no information that any companies would have exited the market because of financial reasons. Through acquisitions companies may gain capabilities, e.g. patents, ways of operating or doing research and development. In evolutionary economics theory, gaining capabilities is considered extremely important.

Hypothesis 1, companies that have gotten the first FDA approvals, meaning the early entrants, survive longer than others as independent companies, can be answered based on the information on figure 3. The early entrants are Summit Technology, Advanced Medical Optics and VISX. We can see, that all of these have been acquired. Based on this data and our decision to define acquisitions as exit and not sought after survival the answer to the hypothesis is no.

Hypothesis 2, companies that have earlier experience from relating industries survive longer than others as independent companies, is yes based on this situation. The entrants with previous experience (i.e. de alio entrants), Alcon, Abbott, Bausch & Lomb, Carl Zeiss and Nidek, are almost all surviving and they have bought many other companies. Alcon is the exception, being acquired by Novartis in 2008. Another exception is Lasersight Technologies which has existed in the market only since 1994, but is still operating. These facts sup-

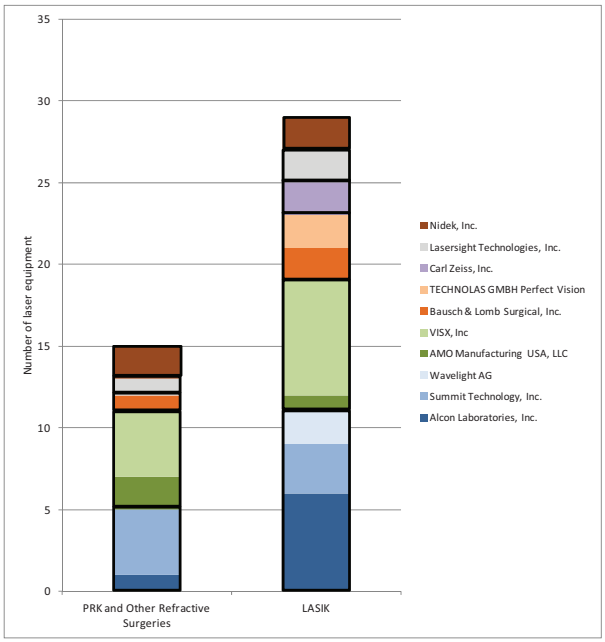


Figure 4. FDA approvals per company for PRK and other refractive surgeries and LASIK surgery

port the ILC principle of de alio or spin off advantage.

Figure 4 shows how number of FDA approvals per company has changed from the first equipment generation (PRK) to the second (LASIK). Companies involved in acquisitions with each other have been colored similarly and have black boxes around their shares. FDA has approved 15 applications for PRK and other refractive surgeries and 29 applications for LASIK surgery. Especially the number of approvals for Alcon Laboratories, Summit Technology and Wavelight, which are all currently owned by Novartis, has increased from the older technologies to LASIK. Figure 5 shows the FDA approvals separated by company and by generation from other technologies to LASIK. Carl Zeiss is a new entrant to the US market for the LASIK technology. Carl Zeiss has been operating in other countries before entering the US market and it has no approvals for the US market for the older technologies.

In addition, there are six potential new entrants to the industry that have applied for an FDA approval but have not yet received one. There are only two companies, Carl Zeiss and Wavelight AG, that have gained approval for LASIK laser without having an approval for the previous PRK or other refractive surgeries (see figure 4). Potentially, Carl Zeiss was earlier not interested in the US market but has been active in other areas, and thus has risen in both FDA approvals and patent numbers only in recent years.

Figure 6 shows the number of com-

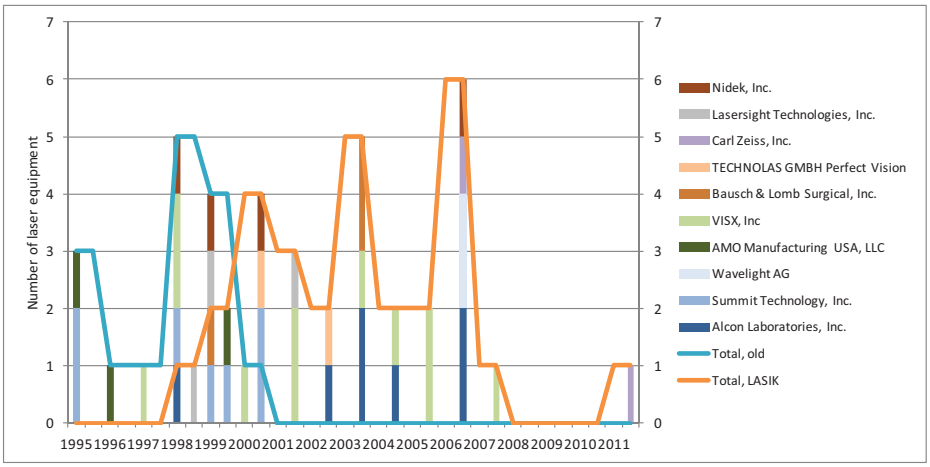


Figure 5 – Approval year of FDA applications per company (LASIK as orange line and other technologies as a blue line). This shows the development cycles of the products (not the use or company cycles).

panies in the industry between 1970 and 2010. This figure includes the companies that have gained an FDA approval or have filed for an approval. It seems that after 2005 there is some decline in the number of companies entering, but the industry cannot be stated to be in maturity stage yet. However, there have been several acquisitions in the industry during the recent years and six new companies have not yet gained an FDA approval and hence they still are not able to operate fully in the market. If the new companies will not get the FDA approvals or the existing big companies acquire them, the industry already shows signs of maturity. It remains to be seen, how the industry develops in the future and how soon it will reach stage of maturity.

Hypothesis 3, companies that have more patents, and so are more innovative, survive longer than others as independent companies, is examined next. In figure 9 we see the total number of patents in a year and the yearly patents by companies according to figure 3 M&A developments. Nidek shows a slight decline, which maybe be due to focusing on other markets than US. The Chinese owned company Lasersight seems to have an exceptional strategy compared to others because of its few patents. Maybe it has licensed technology from others or has not protected its technology with patents. It could also be the case that Lasersight hasn't really built its business according to management expectations and is exiting the industry. Biolase has been included because of its quick rise in patent numbers. It is a company to have an eye on in a future research of this industry.

The number of patents approved has increased heavily in the past ten years, as it can be seen in figure 9. For each period of 5 years, starting from year 2000, more than 140 patents related to laser eye surgery have been approved. The trend doesn't seem to be diminishing, since in the last two years already 50 patents have been approved. The figure also highlights that there have been 3 main companies

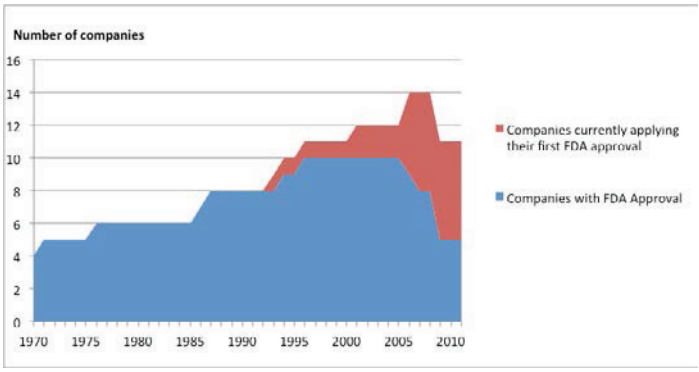


Figure 6 - Total amount of companies having or applying FDA approval for their laser eye surgery machines

that have pushed the development of the laser eye surgery equipment industry during the previous decade; these were Visx, Novartis (created by several acquisitions) and LaserSight. The collective number of patents by these companies account for more than 80% of the patents approved from year 2000.

In figure 10 there are approved patent amounts for all the companies before 2001. Based on this the innovativeness of different companies is evaluated. Alcon, Nidek and VISX are early entrants with high innovativeness. Bausch & Lomb joins the best patent generating companies a bit later, but can still be considered as innovative compared to other companies with lowest patent amounts.

When we compare these four most innovative companies of the early phases of the industry to the later phases we see that they are still doing well. They are still at the top of patent generating companies (VISX as part of AMO and Alcon as part of Novartis), with the exception of also Carl Zeiss joining them. Based on survival (not acquired) the ones still standing are Nidek and Bausch & Lomb. Next success is examined in also other terms than survival. According to our FDA approval amounts (figure 4), the most successful are Bausch & Lomb and the companies that include VISX and Alcon (AMO and Novartis). The only early innovative firm that is not in top in FDA approvals is Nidek. Nidek, Alcon and Technolas (part of Bausch & Lomb) are the only existing FDA companies applying for new machine approvals (table 2). The result thus seems to be positive.

Hypothesis 4, the amount of FDA approvals per year, and so product innovation, decreases as the time passes. To answer this question we have focused on the amount of FDA approvals per technology, legitimization process and future approvals to come in the pipeline.

Based on figure 11, the number of application for PRK or other refractive surgery laser equipment has decreased before 1999. Thereafter, no applications have been filed to get an FDA approval

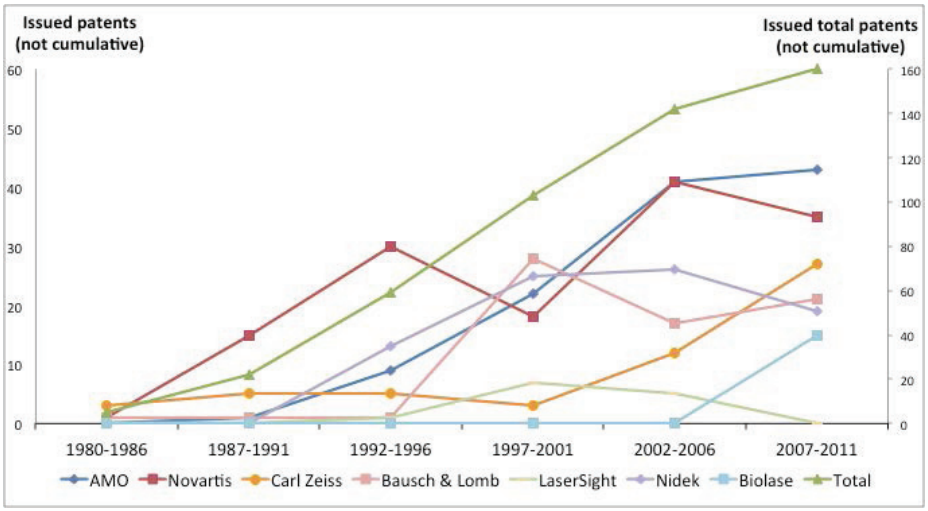


Figure 9 - Total number of Approved Patents and number of approved patents per company per 5 years. Patents and companies are combined according to current ownership, see figure 3.

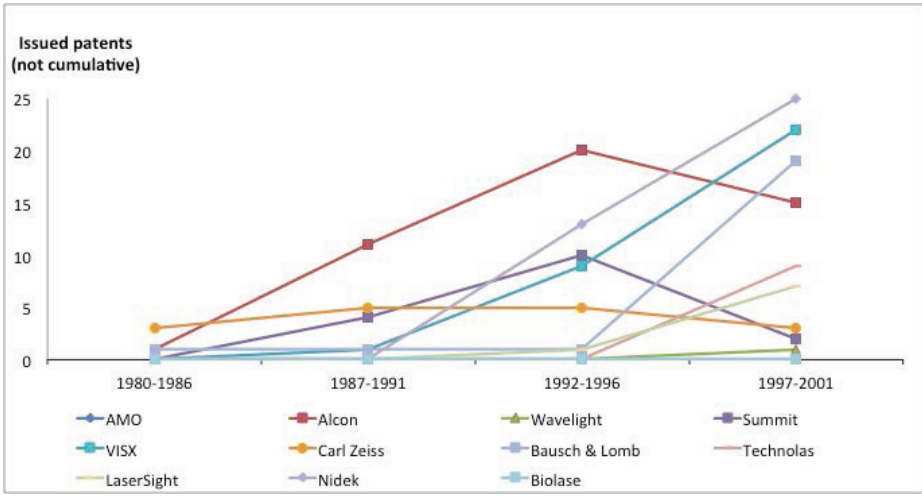


Figure 10 - Number of approved patents per company per 5 years. Patents and companies are not combined according to current ownership. The early years of the industry are examined.

for laser equipment to be used for PRK or other refractive surgery. In figure 12, it can be seen that after an initial high activity in application filing, the number of applications per year has decreased before another increase in 2005. After 2007, most of the companies that have already FDA approvals have not filed for new approvals. However, especially new entrants to the market have applied for approvals in 2009–2012.

As a whole it seems that the industry is filing less applications for approval of new equipment and therefore it can be

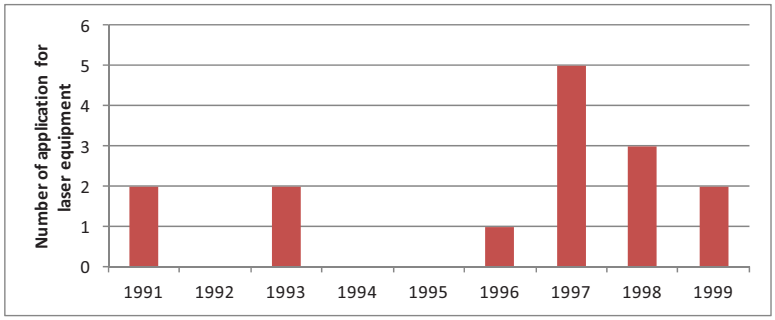


Figure 11, Number of applications sent for FDA approval, PRK and other refractive surgeries.

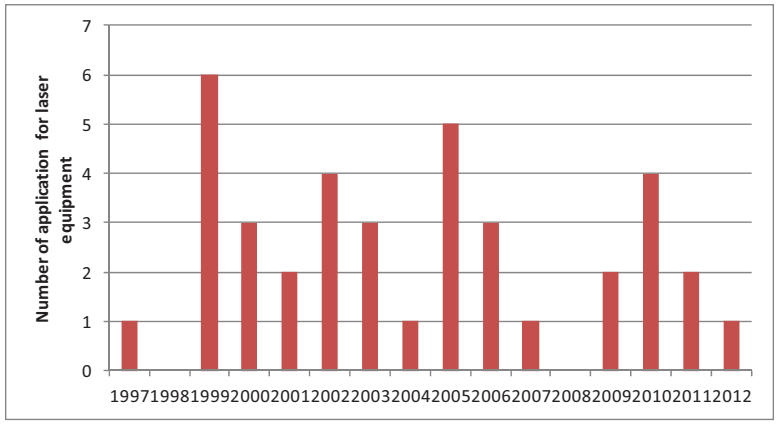


Figure 12, Number of applications sent for FDA approval, LASIK surgery.

assumed that the companies are focusing more on developing the manufacturing of existing products, i.e. on process innovation.

In industrial ecology theory, legitimacy is an important concept describing the formation and stabilization of the industry. One part of gaining legitimacy is that the regulators understand better the products and create clearer rules and regulations for guiding the market. In refractive laser eye surgery equipment industry, an important aspect of regulation is getting acceptance from the FDA that approves the usage of each laser and also restricts the purpose of use of the laser. Based on figure 7, the duration of application handling has reduced clearly since 1990. For the first applications, the duration of handling was several years. After 1997, the duration of application handling was less than two years and after 2003 most of the applications were handled in less than one year. We thus conclude that one important part of legitimation process has become faster. However, looking at the equipment for which an FDA approval has been filed but no approval has yet been gained, the duration of application handling seems to have increased. However, the applications filed in 2009 were both for new kind

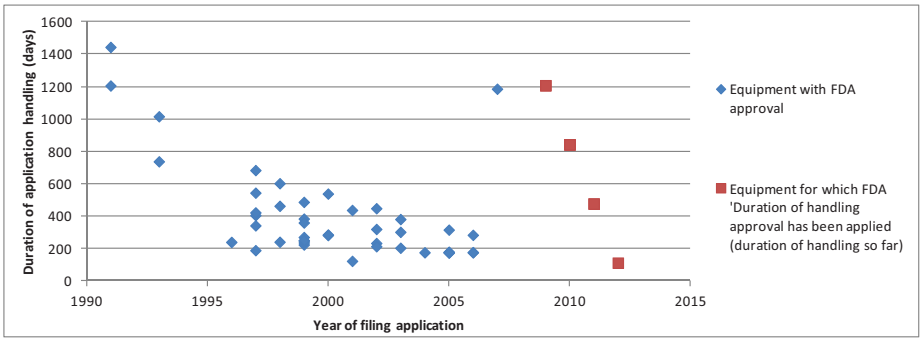


Figure 7 – Duration of FDA application handling per year of application

of laser equipment and thus cannot be compared to the others. For the equipment for which an approval has been applied in 2010 or later, there is no information available that these would be significantly different from current laser equipment used.

Duration of application handling has reduced as FDA has gained more experience. Still as a new technology for surgery is introduced, FDA is likely to be cautious in approving new technologies for wider use. In the beginning, the companies have also less experience of making applications and this is also likely to increase the duration of handling applications in the beginning of a new technology generation.

Figure 8 presents the year of introduction to market, year of filing for FDA approval and year of getting FDA approval for each individual laser type. As a single laser type may be approved for a specific usage, e.g. only for myopia surgeries or a specific range of myopia, the list may include several times the same laser type that has been approved for usage for different purposes.

As can be seen from the figure, the first FDA approvals for PRK and other refractive surgeries were received in 1995 and the last one in 2000. This can be seen as the most active time of development for this generation of laser surgery technology. The first FDA approval for LASIK laser was received in 1998 and until 2000, several companies had already received an approval for excimer laser to be used for LASIK surgery. Thereafter, the development of new laser equipment only focused on LASIK even though PRK is better to be used in some surgeries. During 1998–2007 the most active time of development of lasers for LASIK generation took place. After 2007, only one FDA approval has been given and during 2007–2008 only one application has been filed for FDA. In 2009–2011 there seems to be a new period of development as several applications have been sent for FDA.

This can be interpreted so that the focus of innovation shifts in the industry. When a new generation of technology enters the market, there is a period of product innovation leading to the development of a new technology and various new approvals of the usage of the technology for eye surgeries. After product innovation, the development focuses on process innovation. During this stage companies focus more on making the

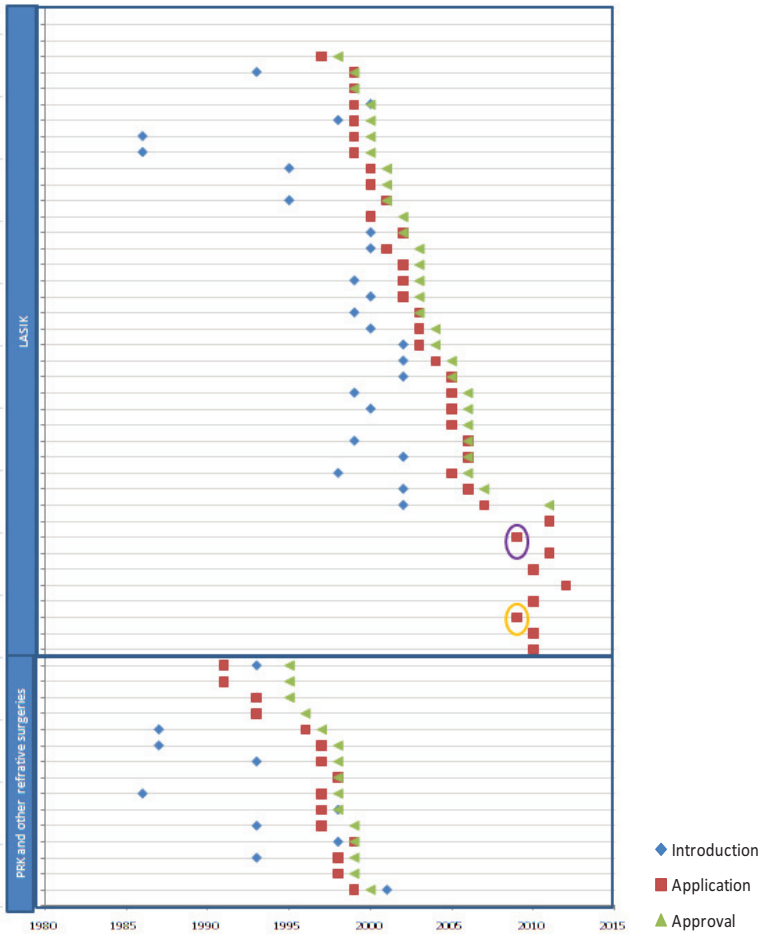


Figure 8 – Introduction to market, FDA approval application year and approval year

production process of laser equipment more efficient and of higher quality and do not create new products that would require FDA approvals.

The figure also shows the latest FDA applications for LASIK, filed between 2009 and 2011, that have not yet been approved. As highlighted before, there has been a period of a couple of years, were not many devices have been approved, nevertheless the filing for new FDA approvals has continued. The figure also highlights (circled) two new devices that do not use excimer laser technology for the LASIK surgery, and have developed the use of the CO2 laser and Solid State Laser for LASIK use. Both companies applied for FDA approval in August 2009, making the span between the application and approval longer than usual. This, as stated before might be due to the FDA being cautious in approving new technologies for wider use.

The new device development is mainly lead by new companies in the market, since only 3 companies, out of

Table 2. The summary of the device name, manufacturer and FDA application date for new devices.

Future Device	Manufacturer	FDA Application Date
IOPtiMate	IOPtima	August 2009
PULZAR™ Z1	Customvis	August 2009
ALLEGRETTO EX-400	Alcon	January 2010
IRay System	Oraya	January 2010
Ellex 2RT	Ellex	April 2010
Navex Quest	Nidek Co, Ltd.	April 2010
Supracor	Technolas	January 2011
SUPRA 577	Quantel Medical	August 2011
KXL System	Avedro	March 2012

6 companies that already have FDA approved devices, have a new device to be released in the pipeline for the upcoming years. The devices applying for FDA approval are listed in table 2. This shows that there are still companies that want to become new entrants in the USA laser eye refractive surgery market, and that the shake out period has probably not yet began.

6. Discussion and Limitations

The U.S. laser eye surgery equipment industry is forecast to keep growing in the upcoming years at a rate of 6% a year, therefore having a good growth prospect. The number of companies in the market is rather stable, where some early entrants have been acquired, and some new entrants have recently tried to join the market.

Although, as stated previously, there is a good growth forecast for the industry, the amount of new players is limited. This can mainly be explained by the market regulations being very tight, the amount of money need to be spent in R&D to come up with new patents and a laser equipment that could be approved by FDA as well as the time that it takes to get FDA approvals, making it a difficult market to get in.

Furthermore, the industry has been able to gain legitimacy from the beginning of the new century, and now the regulators understand better the products and are able to create clearer rules and regulations for guiding the market. The legitimacy can also be seen, in the adaption of this type of surgery between people and the expected industry growth in the future.

Number of FDA approvals for LASIK is twice as much as for PRK and other refractive surgeries. The applications for FDA approval for PRK were filed in 8 year time period (1991–1999) and the applications for LASIK approved so far were filed in a 10 year time period (1997–2007). These observations suggest that LASIK has become the dominant design in the industry. Yet there are no challengers for the LASIK technology. Improvements can be done though, as

LASIK is not suitable for all eye shapes and can cause problems like blurriness in night vision.

It is too early to say at what exact stage is the industry in but our research suggests that there is still more potential of growth and the shakeout period will only come in years to come. A lot of patents have still been approved for this technology in the recent years and the expectation is that more will come to the pipeline. Also, although there has been a shift from product innovation to process innovation, it can not be seen that the industry has reached the maturity state. New technologies to replace the current dominant design, LASIK, may still be introduced.

Limitations of our study are acknowledged and stated here. We have focused only on the U.S. markets. They may be the biggest currently, but as populations in developed countries decrease and the economies of developing countries improve, the biggest markets may be found elsewhere. Also Europe is a major market for laser eye surgery, but was excluded in our study because of lack of information. FDA authority made the U.S. the best research area.

Focusing only on FDA approved or FDA approval applying companies is also a major limitation. Companies doing business in other countries do not need this approval. Companies can also license a technology and so do not need to apply any approvals. Finding the companies entering the business was challenging, because the companies do not need approvals for R&D. Also the amount of FDA approvals is questionable as a criteria for success, because companies can improve their machines a little or start to use same machine for multiple laser eye surgery purposes and so apply approval for the same machine multiple times.

We have not included cataract eye surgery technologies in our research. Cataract is a common problem with aging economies and significant part of laser eye surgeries. If laser treatment for also age vision (hyperopia) is developed, that can alter the industry structure and focus.

Patent data was searched with an automatic function, which can cause errors. We may have not detected the right key words to use in the search or we may have included too many key words and found patents not related to this industry. Also we do not have the necessary technological knowledge to compare the significance of the contents of the patents.

Further topics for research related to this industry could be for example other geographical areas, acquisition reasons for this industry, comparison of development of new technologies (LASIK and possible alternatives), quality of the patents of the FDA approved companies, financial success of the companies and differences in the different generations of technologies (LASIK, PRK and others).

7. Conclusions

Four hypotheses examining the ILC theory suitability for the refractive laser eye surgery equipment industry evolution in the United States were examined. Both qualitative and quantitative data were conducted to test these hypotheses. Based on the results of the results of the M&A analysis, and the decision to define

acquisitions as exit, Hypothesis 1 is rejected. Companies that are early entrants didn't have higher survival rates than later entrants, which is opposing one of the ILC main propositions. The conclusion drawn from this finding is that early entrants could not do the shift to the new LASIK technology, and although they were competitive and had high survival rates during the previous technologies they were not able to cope with the new changes, therefore being acquired. It is probable that if the industry was analyzed at a different phase of time, the results would have been coherent with the ILC theory therefore presenting the challenge on what time frame and how to define an industry.

Hypothesis 2 is accepted, based on the results that companies with earlier experience from relating industries seem to have high survival rates since they are almost all market players at the moment and the quantitative result that six potential new entrants haven't been able to obtain the FDA approval, thus being in disadvantage with the de alio entrants. This supports the ILC theory proposition of related industry advantage. It also shows that there are new entrants to the industry, and therefore it has not reached the maturity stage. Based on the results analyzed we think that the industry might reach maturity in the upcoming years, and when the shake off period occurs, the companies with experience will have much higher survival rates.

Hypothesis 3, companies that have more patents survive longer than others as independent companies, is accepted. The number of patents that a company has seem to correlate to the survival rates of the companies. The conclusion drawn from these findings is that the companies that have more patents, can be considered more innovative, and therefore have better chances of adaptation and survival in the industry. This is aligned with the ILC main proposition.

Hypothesis 4 got mixed results. On the one hand the industry's most important players have been filing less applications for approval of new equipment. Therefore it can be assumed that the companies are focusing more on developing the manufacturing of existing products, and therefore focusing in process innovation. This would prove the hypothesis to be correct. On the other hand there have been FDA applications in the past few years, mainly led by new companies, for new devices and new technologies (such as CO2 laser and solid state laser). This would imply that some companies are still focusing on product development, and would mean that our hypothesis is incorrect. The overall finding seems to be that mature companies tend to focus more at this stage on process development, whereas companies that want to be new entrants to the market tend to focus on product development.

Overall, the research shows that the refractive eye laser surgery equipment in the United States has not yet reached the mature state, since there are still companies that want to enter the market by gaining FDA approval for their new technologies. It also showed that a legitimization process has occurred, and the regulators have understood better the products and have created clearer rules and regulations for guiding the market; thus speeding the FDA approval process for technologies already in place.

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8. Appendices

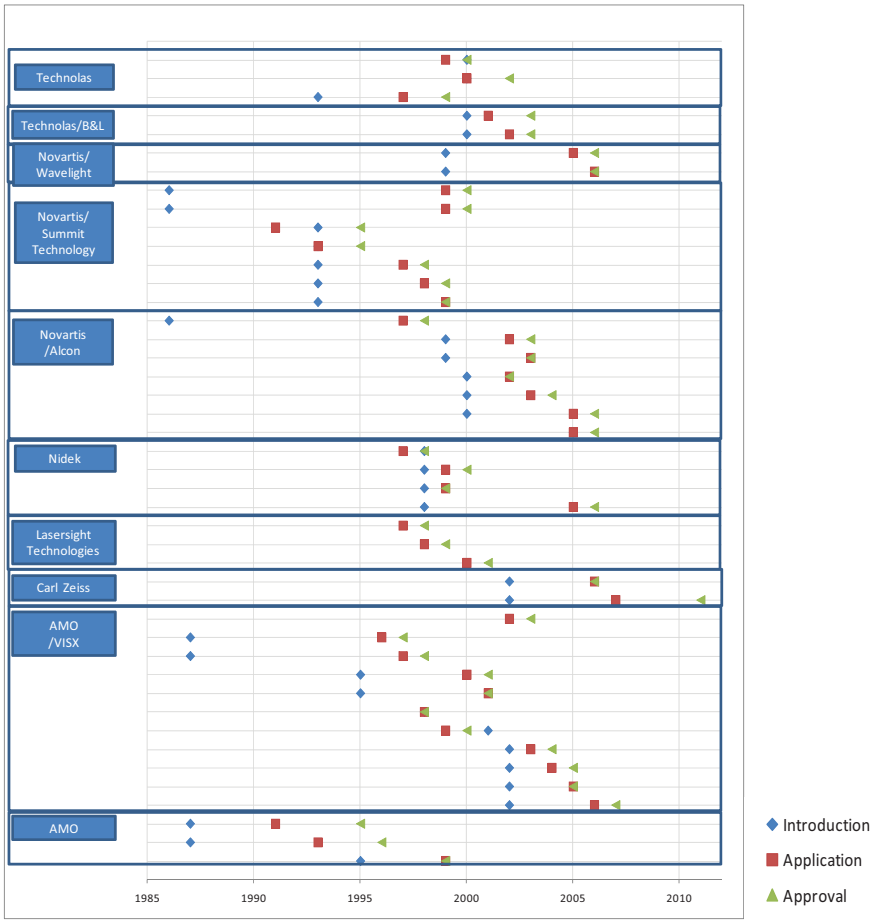

Figure A1. Introduction to market, FDA approval application year and approval year per company (LASIK and older technologies)

M&A reference table for figure 3:

Information gathered:	**Reference websites (visited 24.4.2012):**
Founding dates and acquisition information: Databases for companies	Wikipedia the free encyclopedia, http://en.wikipedia.org/ Bloomberg Businessweek Company Insight Center, http://investing.businessweek.com/research/company/overview/overview.asp Funding Universe company histories, http://www.fundinguniverse.com/company-histories/
Founding dates and acquisition information: Articles	Health professionals' editorially neutral information resource ModernMedicine, http://www.modernmedicine.com/modernmedicine/Ophthalmology/home/40207 Specialty clinical news information website Healio, http://www.healio.com/ophthalmology/
Founding dates and acquisition information: Company Websites	NIDEK Ophthalmic Equipment and Instruments, http://usa.nidek.com/ Abbott Healthcare company, www.abbott.com/ Technolas Perfect Vision femtosecond and excimer laser eye surgery technologies, http://www.technolaspv.com/dasat/images/5/100955-11-12-06-victus-ce-mark-press-release.pdf
New companies information (pastel colors), FDA application dates	The U.S. Food and Drug Administration website, http://www.fda.gov/

Legitimacy of the Finnish payday loan industry[1]

Tomi Hiirsalmi, Ilkka Lampio, Liisa Sallinen and Arttu Vesterinen

ABSTRACT

This paper presents a study discussing legitimacy of an industry, using the rather recently established payday loan industry in Finland as an empirical case. As the industry has a poor reputation, but is still growing and the profits are high, there is a motivation to gain deeper understanding on the factors which constitute the legitimacy of an industry. Drawing from literature concerning legitimacy, we use a framework of and use it to analyze the legitimacy of the industry. Based on the results, legitimacy of an industry consists of 1) density-based; 2) regulative legitimacy; and 3) social legitimacy. Our findings suggest, that the most important legitimacy factor for the payday loan industry is regulative legitimacy, which can be comprehended as a perquisite for the other two legitimacies. With regulative legitimacy, an industry can grow and flourish, even if social legitimacy is not that high.

Keywords: Legitimacy, industry, payday loan industry

1 This study was conducted for the course *Industry Evolution* lectured by D.Sc. Joonas Järvinen and D.Sc. Mirva Peltoniemi, in spring 2012 at Aalto University School of Science. We acknowledge D.Sc. Joonas Järvinen for advice on how to improve this research paper; as well as the opponent students, who also gave us valuable comments and suggestions concerning the paper.

1. Introduction

Legitimacy is an essential asset for the survival of organizations (Hannan & Freeman, 1989; Singh et al., 1986; Aldrich & Fiol, 1994; Alrdich & Ruef, 2006). Ecological approaches to organization populations have assessed legitimacy in organizations at first from density dependence view (Hannan & Freeman, 1972; Hannan & Carroll, 1992; 2000), but later on completed this perspective with sociological perspectives (Aldrich & Ruef, 2006: 186), by discussing legitimacy as social acceptance of an (Suchman, 1995), or as conformance to institutionalized practices (Hannan & Freeman, 1989). Our interest in this study is to examine – by exploiting – these approaches – the legitimacy of an industry, by analyzing a rather new industry that is the payday loan industry in Finland.

A payday loan is a short-term, small and unsecured loan usually between €50 and €400 that you can get in minutes via SMS or the internet. The yearly interest rate is between 250 % and 1500 % and payback time is usually 14 or 30 days. The high interest rates are partly explained by the high default rates of the loans. There was a market gap for this industry as banks do not grant so small loans in such a short notice. The media has claimed that most payday loans are taken because of acute need of money for partying, alcohol, tobacco, food or paying for other bills. Payday loans solve the acute problem, but they might pose other problems for the customer due to payback difficulties. (Studia monetaria – yleisöluento, 2008)

The Finnish payday loan industry is young and rapidly growing. The first firms entered the industry in March 2005 (Markkola, 2010). In Q3 2011, there were already 81 firms in the industry in Finland, and about 50 firms had already exited mostly because of high rates of competition and some regulation. (Kuusisto, 2011) The payday loan industry globally is older and a lot bigger than in Finland. For example, it is estimated that in the US, the payday loan volume has grown from about $8 billion in 1999 to between $40 and $50 billion in 2004 (Murray, 2005). This can be compared to €244 million, the amount of payday loans granted in Finland in 2010.

The payday loan industry invokes lots of discussion and it is visible in our everyday lives because of aggressive advertising, and frequent writing about it in the media. There has been news about payday loan firms making extraordinary profits. The attractiveness of profits combined with very low barriers to entry has tempted several firms to enter the industry. On the other hand, the industry has received lots of negative media attention and it has a rather poor reputation. This can be seen for example from the several, usually negative, internet forum discussions about the payday loans. There has been discussion about regulating the industry. Some members of parliament have even tried to ban the industry. (Kauppalehti, 2011)

In conclusion, it seems that regardless of the bad reputation of the industry, it is rather successful and continuing to grow at a fast pace. This motivated us ask where do these differences emerge from. To our knowledge, no scientific research of these subjects in the payday loan industry has been previously made. Therefore we pose the following research question:

- What kinds of factors constitute the legitimacy of the Finnish payday loan industry?

The research focus of this study is the legitimacy of a rather new industry form. The study draws mainly from legitimacy research in organizational ecology and organizational legitimacy. This study is descriptive and exploratory, since we aim at describe and explain the phenomena relating to the legitimacy. This research is positioned in the field of organizational ecology, and the legitimacy approach.

This report is structured as follows. In the second chapter we will review literature and develop a framework for data analysis. In the third chapter we will present the research method, data collection and analysis. In the fourth chapter, we will present the results. In the last two chapters, we will reflect the results with the reviewed literature. We will also discuss our contributions to related research and end this report with conclusions. Data tables and charts are included in the appendices at the end of the report.

2. Literature review

2.1 Legitimacy of an industry in ecological approach

In ecological research, legitimacy was originally described as a factor of external pressure towards inertia (Hannan & Freeman, 1972). Legitimacy is traditionally perceived to arise from density in organizational populations: The number of firms is said to correlate with the level of legitimacy (Hannan & Carroll, 1992; 2000). However, the downside is that when legitimacy of an industry increases, it becomes more tempting to new entrants and the size of population grows, resulting to tougher competition (Hannan & Carroll, 1992).

Dobrev et al. (2006) argue that when a new organizational population is emerging, the growth in the number of firms is usually slow and unsteady, which accrues from the lack of constitutive legitimacy. In order to gain legitimacy, the industry needs big enough number of new organizations. Lange et al. (2009) have noted that in fact *de alio* entrants can enable the survival of *de novo* firms, because they build the legitimacy of the industry (Lange et al. 2009). In general, the incumbent organizations are considered as more legitimate than new entrants (Baum & Shipilov, 2006). This phenomenon was called *liability of newness*, by Singh et al. (1986). However, the increasing number of firms applying the same form will build trust and confidence in potential customers and partners (Dobrev et al., 2001). Baum and Shipilov (2006) argue that large firms have higher legitimacy than small ones.

Nevertheless, legitimacy of an industry can be understood as a collective good, which all organizations in the industry can exploit (Rao, 1994). Later entrants to an industry can make use of spill-overs from incumbent organizations' legitimacy (Alrdich & Ruef, 2006: 258). However, without distinguishable common identity, it is very hard for an industry to gain legitimacy (Alrdrich & Fiol, 1994).

McKendrick and Carroll (2001) suggested that density dependent models of organizational evolution need respecifi-

cation. They found support that density does not lead to a standard form of an organization. Instead, they argued, that formal institutions are essential in the emergence of taken-for-granted organizational forms. Similarly, on organizational survival Aldrich and Ruef (2006: 183) highlight the importance of adaptation to institutions.

2.2 Organizational legitimacy

Legitimacy in organizational contexts generally refers to the social acceptability of an organization and conformance to institutional environments. According to Suchman (1995): "Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions (pp. 574)." If an organization wishes to gain legitimacy, it merely needs to adopt and maintain widely used and accepted – institutionalized practices (Powell & DiMaggio, 1991). The challenge for an organization is to identify and absorb the particular norms, practices and values, which it has to respect and incorporate in its operations.

Legitimacy is considered to be an asset that is intangible and determines organizations' ability to attract capital and personnel (Hannan & Freeman, 1989). The importance of legitimacy is then obvious for any organization, because without capital or capable personnel, it cannot survive in competition. The legitimacy is closely linked to reputation that according to Rao (1994) is the outcome of, the legitimation process.

2.3 External legitimacy

Legitimacy most often refers to acceptance from outside environment (Suchman, 1995), for example from stakeholders (Mitchell et al., 1997: Aldrich & Ruef, 2006: 186). Aldrich & Ruef (2006: 183) stress the importance of external legitimation on survival of organization. Cattani et al. (2008) have used the term audience-based legitimacy to describe the external environment which is the source of legitimacy. External environment can assist in legitimizing of organizations on few ways, such as publishing community directories and providing opportunities for registration (Singh et al. 1986), or through certifications (Aldrich & Ruef, 2006: 197) and contests (Thompson, 1967; Rao, 1994). Also, governmental bodies, trade associations or professional societies may endorse an organization, and boost their legitimacy (DiMaggio, 1991; Alrdich & Ruef, 2006: 191–3).

Other sources of external legitimation are competitors, complements, or the regulation, which concerns an organizational population (Peltoniemi, 2011), and similar populations, with which the organization's identity overlaps (Dobrev et al., 2006; Ruef, 2000). However, if an organization wishes to get assimilated to another nascent population's identity, it should carefully examine that population, because the organization might get related to the possibly negative characteristics as well.

Singh et al. (1986) have showed that external legitimacy decreases the death rates of organizations. They also explain that the liability of newness in organizations results from the lack of institutional support (Singh et al., 1986). However, the lack of legitimacy among new inno-

vative entrepreneurs can be reasoned by the fact that because their nature is not yet fully understood, it is unclear if their actions are in accordance with rules and practices (Aldrich & Fiol, 1994). Lawrence and Phillips (2004) suggest being proactive when dealing with regulations. Especially early entrants need to be careful to follow the practices suggested by regulatory bodies (Lawrence & Phillips, 2004). However, if the whole industry is new and still in its early stages, there may not yet be institutionalized rules or practices. When the regulation for this type of industry is written, they may follow the form which has been established and applied by a large amount of the incumbent organizations (Ruef, 2000).

2.4 Cognitive and sociopolitical legitimacy

Legitimacy in industry contexts has been divided to socio-political legitimacy and cognitive legitimacy (Alrdich & Fiol, 1994; Aldrich & Ruef, 2006: ch. 9; Hannan & Carroll, 1992). According to Rao (1994), socio-political legitimacy refers to the support of legal authorities, governmental bodies, and other powerful organizations. Following Zucker (1986) and Scott (1987), cognitive legitimacy refers to the assumption that an organization is desirable, proper, and appropriate within a widely shared system of norms and values. Cognitive legitimacy is high, when organization is accepted as part of the society (Aldrich & Ruef: 2006: 186). These two different types of legitimacy have invoked interest and also critique among researchers.

For starters, Zucker (1989) questioned the traditional, density-dependence approach when analyzing cognitive legitimacy, and suggested to seek for another ways to measure legitimacy. Similarly, Baum & Powell (1995) suggested using non-density-based alternatives to analyze sociopolitical legitimacy, in developing institutional approach to organizational ecology developed. Interestingly, however Hannan and Carroll (1995) proposed as a response to Baum and Powell's suggestion, that sociopolitical legitimacy may not be an exogenous variable, because it can also be understood as an end result for the process where the population is growing. Thus, they still defended the density-based approaches to legitimacy. Aldrich and Ruef (2006: 214) argue that density raises cognitive legitimacy.

Indeed, density dependence is closely linked to the number of firms, and cognitive legitimacy refers to the general knowledge and understanding of the industry by the public audience (Alrdich & Fiol, 1994; Hannan & Carroll, 1992), or in other words stakeholders and customers. Aldrich and Fiol (1994) suggest that cognitive legitimation can be measured by investigating the level of public knowledge about the industry. Therefore, the cognitive legitimacy of an industry is free to use for all the organizations in the population.

Sociopolitical legitimacy refers to the acceptance from key stakeholders, the general public, key opinion leaders, or government officials, who can define if the organization is appropriate and right, given existing norms and laws (Aldrich & Fiol, 1994; Aldrich & Ruef, 2006: 186). Sociopolitical legitimacy could be measured by analyzing the public acceptance of an industry, government subsidies to the industry, or the public prestige of its leaders. Since the socio-political environment consists of formal organizations.

Table 1. Types of legitimacy in an industry (adapted from Aldrich & Fiol, 1994; Aldrich & Ruef, 2006: 185)

	Cognitive legitimacy	Socio-political legitimacy	
Legitimacy factor	**Density-based legitimacy**	**Regulative legitimacy**	**Social legitimacy**
	The "presence" of firms: the number of firms, the number of customers; and the amount of distributed information on the industry	Industry's compliance to the prevailing laws and regulations	Industry's compliance to social norms and moral values

2.5 Development of the analysis framework

For a population of organizations to survive, it needs to receive attention especially among its potential customers. The number of organizations is an attribute, which explains the amount of attention, that the entire population gains: The more organizations in the markets, the more they must fight for their space, advertise and approach customers. Accordingly customers begin to notice the existence of the organizational population, or in other words the industry. Indeed, customers may base their perception of the legitimacy of an industry to the information they receive. If the industry is in public and the products or services of the organizations are accessible, customers are in the comprehension that the industry is desirable, proper and appropriate. According to Alrdich and Ruef (2006: 214) density raises cognitive legitimacy. Thus, the legitimacy is based on the presence of the industry and its visibility to its external environment.

The other type of legitimacy, thus socio-political legitimacy assesses the public acceptance as an endorsement from a broad set of institutions and powerful organizations. Alrdich and Ruef (2006: 185) divide socio-political legitimacy to moral and regulatory legitimacy. Accordingly, we suggest that the sociopolitical measures for acceptability or legitimacy can be understood to include different levels:

- legislation and regulation.
- general social norms and values

Both can be expected to contribute to the legitimacy of an industry. Therefore we name these two as regulative legitimacy and social legitimacy. Table 1[2] encapsulates and presents legitimacy in two levels. At the higher level we have the cognitive legitimacy and socio-political legitimacy (Aldich and Fiol, 1993; Aldrich and Ruef, 2006: 185) and at more detailed level we focus especially on regulative legitimacy and social legitimacy. Based on the existing literature, we suggest that on an upper level, the legitimacy of an industry consists of cognitive legitimacy and socio-political legitimacy. Further on, the actual factors, which constitute the overall legitimacy of an in-

2 This framework is adapted from the Table 9.2 in Aldrich and Ruef (2006: 185), in which they categorized strategies that facilitate the growth of new populations. In their categorization, sociopolitical strategies comprise moral and regulatory legitimacy. Cognitive strategies include cognitive legitimacy and learning. For the purposes of our study, the concept of learning is not included in our analysis framework.

dustry are density-based legitimacy, regulative legitimacy, and social legitimacy. In structure our analysis around these factors, but also reflect on the upper level legitimacies.

3. Research method and data

The case study methodology was first described by Yin (1984, 2003) as an empirical research that "investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used." Eisenhardt (1989) later defined it as "a research strategy which focuses on understanding the dynamics present within single settings". Following these, we chose to approach our research topic with the qualitative case study, because our research topic is very topical and in need of descriptive new understanding. Therefore the case study approach is a sound choice.

In our research we used the combination of quantitative and qualitative data. Quantitative information was used to get a background view of the industry. We also used qualitative data in order to get enough rigorous information, which deepens the quantitative information and provides explanations for it. The data for the research was gathered in two ways. First, we searched the quantitative information about the number of payday loan firms, number of payday loans and average loan size in order to get a profound understanding of the industry and its development in Finland. The source for the data was Statistics Finland's outstanding credit data (Tilastokeskus, 2008–2011). The data on firm numbers, exits and entries is limited as there was no company number data prior to 2008. However, this data combined with the number of firms that had operated in the industry before Q3/2011 (Lainamarkkinat, 2011) could be used to estimate the entries and exits. Because of linear assumptions for growth, the data is not perfectly accurate, but it fulfills the requirements set for this kind of a research.

Next, we needed to get to know the legitimacy, and therefore we collected qualitative date which we handled in the following steps:

1. We used data from public sources. We chose the most important Finnish news media which have released news on payday loan industry. The media we chose were Helsingin Sanomat, Kauppalehti, Talouselämä, Taloussanomat and MTV3.

2. We familiarized ourselves with the research topic by reading a comprehensive number of public materials in order to form an overall understanding on the empirical case.

3. We collected the piece of news of the firms into one Excel sheet with the information of release date, medium, title, content shortened to a maximum of three phrases and direct quotations.

4. At the same time the data gatherers went through the articles and provided an assessment whether the undertone is very negative, negative, neutral, positive or very positive

a scale from -2 to 2, minus meaning negative assessment.

5. The assessments were concealed so that others are able to make their own independent assessments without the prior information influencing on their decisions. All in all three assessments were made on each article.

The data was gathered from the time period between 2004 – 2012 using several keywords (in Finnish) such as "pikavippi", "pikalaina", "pienlaina" and most of their Finnish contortions. We found 196 articles to match the search terms. The reason we started from 2004 was that we wanted to know what kinds of public opinions there were even before the industry had even started in Finland. Today we know that the first payday loan firm VIP Finland Oy started under the brand name of Tekstivippi on March 18th 2005. (Ylioppilaslehti, 2010).

The goal behind assessing the different articles was first of all to get to know to the overall legitimacy and public opinions of the industry. Second, we sought to make difference between different years and how the legitimacy might have grown or decreased through time. A significant part of this was to gather both the undertone of the articles and all the remarkable happenings, decisions and regulations of the industry in each year so that we could make a clear view of both cognitive and sociopolitical legitimacy. To gain a deeper understanding, industry expert interviews could have been used. However, our goal was to get an outside view on the industry. Due to the contradictory nature of the industry, the experts might have been defensive and thus distorted the research. Therefore we decided not to use interviews.

Our results are described and discussed following the legitimacy factors presented in the analysis framework.

4. Results

4.1 Background: The payday loan industry in Finland

As mentioned earlier, the first firms entered the payday loan industry in Finland in March 2005. Helsingin Sanomat reported as early as October 2005 that Consumer Agency of Finland (Kuluttajavirasto) is unsatisfied with the payday loan firms. The law did not order the creditors to inform the customers about the effective annual percentage rate of the loans if the loan matures within three months. The agency also criticized firms for giving loans at night. That is basically the first negative piece of news about the industry, only 7 months after the industry started in Finland. At the same day, Helsingin Sanomat published comments from a payday loan firm's marketing director, who admitted that even they were surprised by the increasing demand of such loans.

Many articles discuss high interest rates of the payday loans. Firms are accused of aggressive marketing, not telling the effective annual rates and cruel debt collecting. It is seen as a problem that young people are taking new loans to pay back the old ones. Closer to year 2012 there is also an increasing amount of articles about how many payday loan firms are highly profitable despite big credit defaults. Some articles are telling

about payday loan problems in other countries. In the beginning there was also a problem that people could take loans with somebody else's phone and name. There were some changes made to the identification policy which handled the problem. The average costs for a payday loan have been around 26 %, meaning that €100 loan costs €126 for the customer on average.

According to the numbers, it is clear that a great part of media visibility of the industry is negative. However, there are still some slightly positive stories. The players in the industry are defending themselves by pointing out that they provide the only option to get small loans, since the traditional credit firms do not serve this need. Considering credit cards, many payday loan customers don't have the possibility to get a credit card due to irregular salaries or other similar reasons. So, it can be concluded that the payday loan industry serves different customers and their products are different from the traditional products. So, there clearly is a need for this type of an industry. To prove this the Organization of Payday loans in Finland (Suomen Pienlainayhdistys) made a mystery shopper research. They also suggest that the interest payment of €30 on a €100 should not ruin anyone's personal finances. There are also some studies that not all loans go to spirits and partying, but people also by food and medicine with payday loans.

The organization for payday loans in Finland is actively trying to defend the industry and build up the legitimacy. They have stated that banning the industry in Finland doesn't help because the service providers would move and operate from other countries, where the legislation is more favorable for the industry. In 2007, a number of payday loan firms have formed the Organization of Payday loans in Finland. The organization aims at developing good practices to the industry, relationships to stakeholders and promoting the industry, and improving the reputation of the industry. However, there are currently only a few dozen firms, and the majority of the firms – especially the smaller ones have not joined.

4.2 Density-based legitimacy

We address density-based legitimacy by analyzing the "presence" of firms, in terms of the number of firms, and the development of that number, loan sizes and number of the loans (see Figures 1–4 in Appendix). Regarding the number of firms in the industry (Figure 1) we made an assumption of linear growth before the year 2008 due to incomplete information. Overall at the end of the May 2011 there had been 130 payday loan firms of which 50 had exited the industry.

Since the opening of the markets it has been clear that it is easy to start a payday loan business. This became very clear after the first business, VIP Finland Oy, was presented in Finnish TV in positive light and several new businesses was formed almost instantly (Ylioppilaslehti, 2010). The positive piece of news built cognitive legitimacy for the whole industry which was then only to be changed into negative. Nonetheless, the number of firms has grown largely because of easiness and simplicity of the business model, which has helped to increase the density-based legitimacy as well. We can say that the industry has had low barriers of entry.

In addition to the growth in the number of firms, the average loan size (Figure 3), number of new loans (Figure 2) and financial amount of payday loans altogether (Figure 4) have increased steadily since the establishment of the industry. This reinforces the conception that cognitive and density-based legitimacy have been spreading and growing. At the end of 2011, over €80 million was taken as payday loan per quarter year. Due to the small size of loans, this means over 350 000 new loans in every three months.

Another way to look at the density-based legitimacy is to examine how much news articles there has been in different media and how much the reportage has grown during the lifespan of the industry. The number of news (see Table 5 in Appendix) in the Internet media (see chap.3) has been growing the whole time during the industry's existence, and the tipping point was reached in 2008 when news articles more than doubled.

4.3 Sociopolitical legitimacy

Social legitimacy

An interesting part of the whole discussion here is how media obviously has been trying to defame the whole industry without much of an effect in the revenues of the firms. It seems that there is a serious demand for payday loans even though the public discussion refuses to admit it. As discussed before, legitimacy refers to social acceptance from the stakeholders and outside environment. According to our analysis, (Figure 6), the social acceptance has been negative almost throughout the history of the industry. This fact is contrary to the supposition that legitimacy creates fertile foundation for growth and attracts more players to the industry. On the other hand it may be that Finnish payday loan firms are still in short of capital and employees and the industry would be even larger if the legitimacy was stronger.

Indeed social legitimacy is in the worst shape when compared to other kinds of legitimacy. There has been little or no support from government or any other legal authorities. The organization of Payday loans in Finland was founded in 2007 but gained publicity not until 2011 after which there has been many statements by the organization in different media. This union is the biggest foray of payday loan firms to build their social and regulative legitimacy. The presence of the organization has channeled to more positive news about the industry in 2012 where there is huge increase in the assessments compared to 2011. Despite the efforts by the organization the overall reputation of the industry is bad, based on our analysis.

Regulative legitimacy

Since the industry emerged in 2005 there have been many changes in legislation regarding payday loans. Members of parliament and consumer agency have demanded stricter regulation for the industry.

Payday loans were discussed in Finnish Parliament in fall 2006 and many members of parliament insisted restrictions to payday loans, especially to times when loans are granted. Ministry of Justice set a working group to give a legislation proposal about payday loans in October 2007. Also the Finnish Police made an investigation about payday loans in Finland. They stated that it is not

Table 2. Different types of legitimacies in Finnish payday loan industry

Cognitive legitimacy	**Socio-Political legitimacy**	
Density-based legitimacy	**Regulative legitimacy**	**Social legitimacy**
- ow barriers of entry - igh growth in density since the beginning of the industry - The industry and the number of firms is still growing	- According to the current legislation, the payday loan business is not forbidden - egislation is still changing and taking shape - There are two legislative proposals on the table, that can have significant impact on regulative legislation	- edia's writing about the industry has been negative
ensity-based legitimacy is high.	Regulative legitimacy is high, but expected to decrease if the legislation tightens up.	ocial legitimacy is low

criminal business, and didn't consider it to be usury.

The Market Court of Finland decided in June 2009 to prohibit payday loan firms to transfer money to customer's account before 07.00 if the loan was taken after 23.00. In July 2009 The Market Court prohibited advertising payday loans by highlighting how fast the money gets into customer's account. The new law about payday loans became valid in January 2010. It insists creditors to tell the effective annual rate for every loan. It also forbids creditors to give loans and transfer money to consumers between 23.00 and 07.00.

Next important change in legislation was a law in December 2010. It requires all creditors to register before June 2011 to Creditor Register managed by Regional State Administrative agency of Southern Finland (Etelä-Suomen aluehallintavirasto).

In September 2011 there began a discussion in Finnish Parliament that should all payday loans be prohibited by a law. In December 116 out of 200 of members in Finnish parliament were ready to prohibit payday loans completely. Secretary of Justice stated 13.12.2011 that payday loans cannot totally be banned due to Finnish laws of freedom of living and occupation.

Helsingin Sanomat reported on March 2012 that there are two legislative proposals about payday loans in Finnish parliaments. One insists banning the whole industry, and the other insists only more restrictions.

To sum up all legislative changes regarding payday loans, the legislation is getting stricter. New laws and court decisions have had some effect to the processes and policies of the industry. Registration of the firms is beneficial for the industry, because it might assist building up both social and regulatory legitimacy. Despite the compulsory of registration and limits to marketing and lending times the total number of firms has been increasing. Exits from the industry are more a result of tight competition than tightened legislation. The Organization of Payday loans in Finland is clearly trying to build up social- and regulatory legitimacy. The higher barriers of entry by legislation only make the markets more attractive for the organization's current member firms.

The two current legislative proposals will probably determine the regulatory legitimacy. Banning the industry is not very probable, and it could drive firms to operate from some other country. The other proposal would regulate the industry more than current legislation. It would set clear rules how firms should operate. After those changes it would be harder to judge payday loan firms if they are operating within new legislation that parliament had just set. This should also improve social legitimacy little bit.

Following the analysis framework presented in the literature synthesis, Table 2 highlights the findings on the different types of legitimacy studied in the data, and suggests evaluations on the state of different types of legitimacy of the Finnish payday loan industry. According to our analysis, the cognitive and density-based legitimacy of the Finnish payday loan industry is high; the regulative legitimacy is still high, but expected to diminish, if the legislation tightens and the social legitimacy is low.

5. Discussion

Our research results showed that the cognitive and density-based legitimacy of the payday loan industry is high. The growth of the industry has been rather rapid considering both the number of firms and the number or value of granted loans. There are quite a lot of firms and customers in the industry, so the density is high. This also means that cognitive and density-based legitimacy has grown and has reached a rather high level in this industry.

Regulative legitimacy is also high, meaning that the industry operates according to existing laws. Sociopolitical legitimacy has been said to arise from the support of for example legal authorities (Rao, 1994; Alrdich & Ruef, 2006: 191–3). According to our findings, the payday loan industry has received quite judgmental statements from the authorities, which in its part has weakened the industry's legitimacy.

Furthermore, the high growth rates in the industry have not contributed to growth in socio-political legitimacy. According to existing literature on ecology, new entrants should have increased legitimacy (Lange et al., 2009). In terms of cognitive legitimacy, it seems true. However, the emergence and growth of the industry has decreased socio-political legitimacy which is seen in the assessment of news written about the payday loan industry.

Of the three different types of legitimacy that we assessed, we conclude that the one with lowest levels is social legitimacy. Even though the firms act according to the law, they might still violate social rules and norms. In Finland, taking advantage of the less advantaged is definitely not considered acceptable, even if the law would have loopholes to allow it. Thus the payday loan industry does not follow the institutional norms in the society (Cf. Powell & DiMaggio, 1991). Therefore the situation in the industry is quite the opposite than what is stated in existing literature. Social legitimacy is decreasing, but the number of firms is increasing and financially the industry seems to flourish.

Similarly, the number of customers is high and growing even though social acceptance is low. Thus, the public reputation of the industry seems to be wor-

se than the opinion of the customers to the payday loan firms. However, the customers of the payday loan industry consider the industry as legitimate and acceptable, if deduced from the observation that the customers use increasingly the products of the industry. External stakeholders, such as regulators and authorities however, consider the industry illegitimate and socially not acceptable. This supports the view, that sociopolitical legitimacy (Aldrich & Fiol, 1994) as a term is troublesome since it includes two different legitimacies: Legitimacy from regulatory, law-based establishments; and legitimacy from the public opinion.

The literature describes legitimacy as collective good, which is freely accessible to any organization in the industry (Rao, 1994). However, it seems that one firm not behaving according to the rules or some customers complaining about one firm could affect the reputation of the entire industry. Firms that are trying to behave according to the rules might not be able to fight against this halo effect. The industry in our study has tried to fight against this effect by establishing a register for "well-behaving firms", which could then act as a legitimizing category or a standard, similarly as suggested by Singh et al. (1986). On the other hand, all firms in the industry have basically the same form, so being able to say which firm exploits its customers the least might be impossible, as the legitimacy is collective good (Rao, 1994).

The industry is doing financially extremely good; growth has been and will likely continue to be rapid. Still, especially social legitimacy is poor. This may result from the fact, that social legitimacy is not always necessary for the industry to survive. There still seems to be a particular segment, the customers that want to use payday loan services and consider the industry as legitimate. Customers need the payday loan firms and want to use their services. Regulative legitimacy is also an important factor in this industry due to legislation that has been changing and might change in the future. There is even a possibility of banning the whole industry.

6. Conclusions

Based on our research, the legitimacy of an industry is consists of different factors. Density-based, cognitive legitimacy is the traditional, ecological approach to legitimacy, and refers to the presence of an industry; and its firms, and the overall the size of the industry, the number of firms and customers. Our findings support the view, that sociopolitical legitimacy should be divided in two distinct factors. First, regulative legitimacy, which refers to the industry's conformance with legislation and regulations. Second, social legitimacy, which refers to the general perception whether the industry is "good" or "bad" for the society.

In general, we can suggest that even though an industry has density-based legitimacy, it might still not have social legitimacy. Also, even though an industry has regulative legitimacy, it still might not have social legitimacy. So, only regulative legitimacy, not social legitimacy, is required to pursue density-based legitimacy. An industry can find customers without common social acceptance if there is a true need for the products or services.

Our research has some managerial

implications. Companies in the payday loan industry can benefit from our research by acknowledging the importance of different types of legitimacy. In some situations it may not be necessary to have high social legitimacy, and thus firms don't need to try acquiring it. For firms, regulative legitimacy is not that easy to affect. Regulation doesn't change that often, but when it does, risks are huge. The worst case scenario for payday loan companies would be that the whole industry gets banned when the laws are changed.

Even though the firms are of our study are making quite good profits, they could perform even better if they could affect social legitimacy. The register is a good start, but even more could be done. The firms could affect the public opinion and social legitimacy by proactively advising customers through different kind of advertising or clarifying the terms of loans to potential customers.

This research has four limitations, each however opening up avenues for further research. First, because we analyzed only one industry, a similar research approach could be used to study other legitimacy-wise "controversial" industries, such as the tobacco, alcohol or adult entertainment industries, in order to validate our findings. Second, as the payday loan industry has been in Finland for a fairly short time period, follow-up research would show if our findings still hold, when the industry matures. Third, further research could complement this study with additional data from other sources such as interviews and surveys on public opinion. Fourth, this research is limited to one country, and because country specific factors such as legislation and culture often have large impact on business, research on the payday loan industry in another country would provide opportunities for comparisons.

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7. Appendices

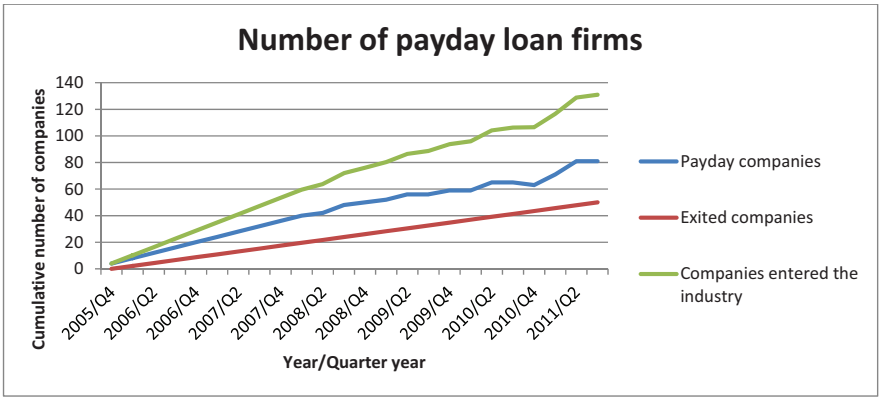

Figure 1. The number of payday loan firms in 2005-2011.

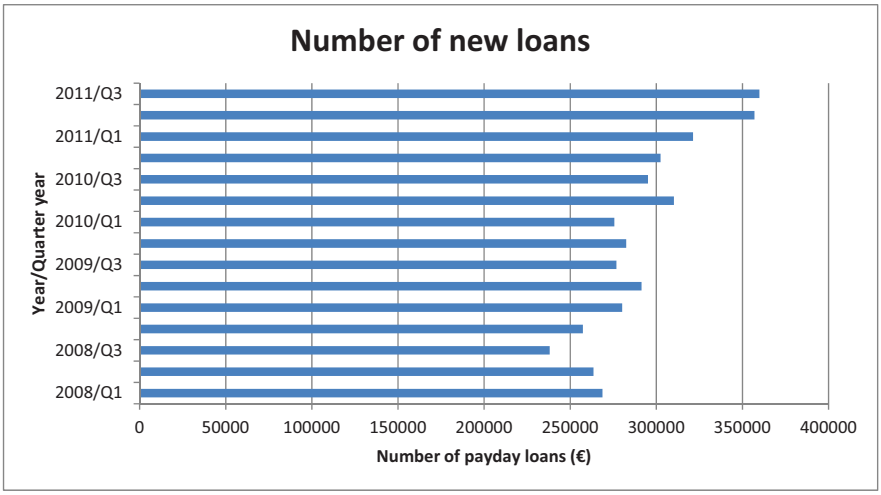

Figure 2. The number of new loans in 2008-2011.

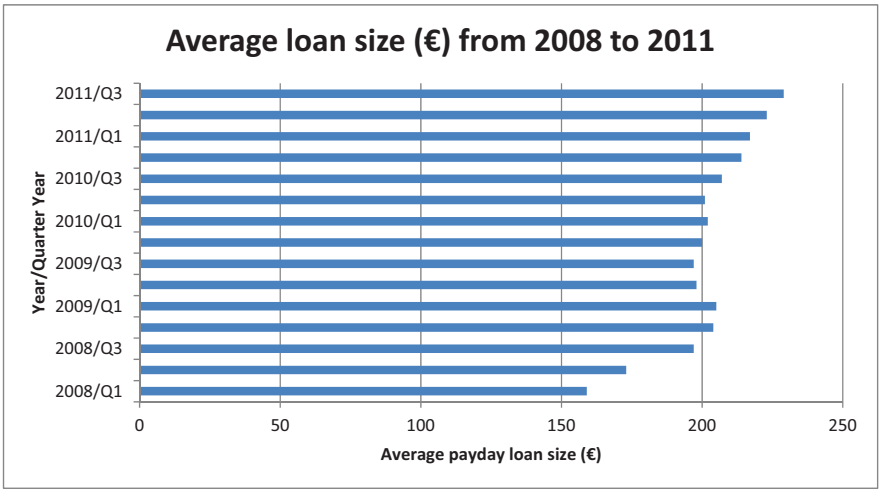

Figure 3. The average loan sizes in 2008–2011.

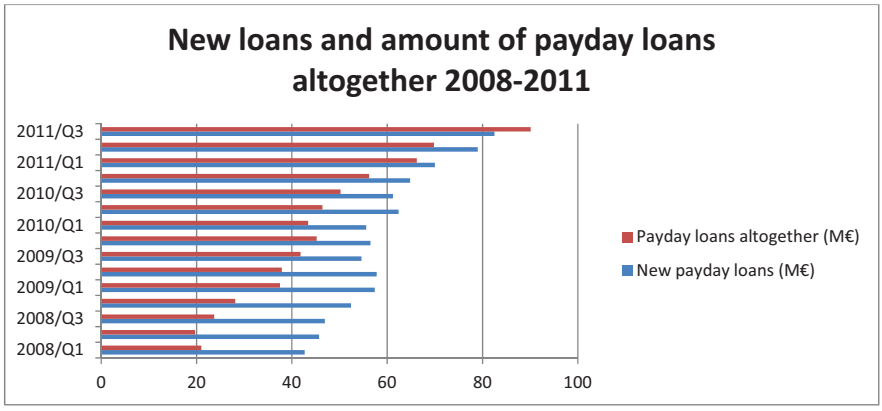

Figure 4. New loans and amount of payday loans in 2008-2011.

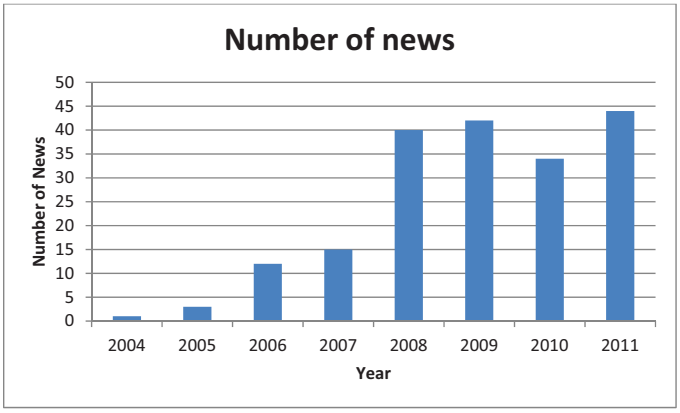

Figure 5. Number of news articles on payday loan industry

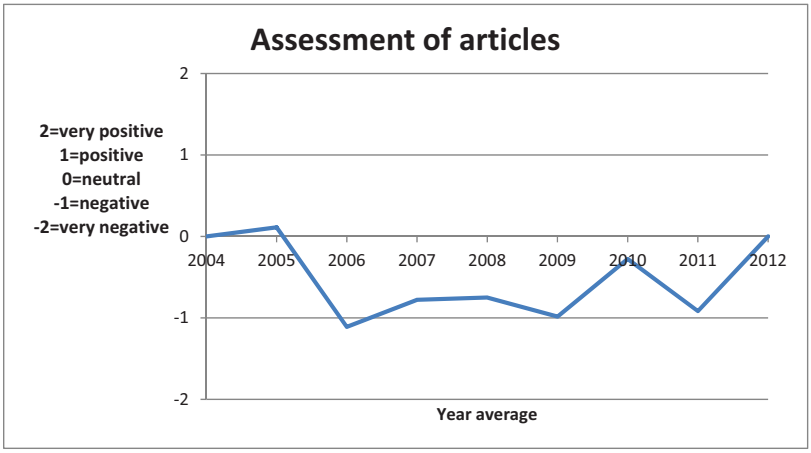

Figure 6. Assesment of the articles.

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