Beyond the Lean Startup: 
Applying the Lean Startup Methodology in Established Firms

by

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ABSTRACT

The lean startup methodology has been successfully applied to product development at startup companies, however many of its principles may also be of benefit to established firms. The purpose of this research was to explore the benefits of the lean startup methodology in established organizations. An electronic survey was administered to product managers and engineers at 44 established companies from diverse industries as well as posted on relevant online community groups. Follow-up up interviews were conducted with select respondents for further in-depth analysis. A total of 44 individuals completed the survey and 5 follow-up interviews were conducted. Overall, 11 respondents (25%) reported use of the lean startup methodology at established firms. Success with the methodology was reported in 6 cases. A high proportion of respondents (66%) were not familiar with the method; however, did report use of specific principles aligned with the lean startup method. Results also suggested that use of the methodology was more frequent in environments with high uncertainty and in companies less than 20 years old. Interview results corroborated survey findings and highlighted barriers to implementation. The findings of this work suggest that the lean startup methodology may provide benefit to established firms, however the application of this method in this context is in its infancy. Implications for best practice and directions for future research are also discussed.

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1. INTRODUCTION

1.1. MOTIVATION

Prior to joining the Massachusetts Institute of Technology (MIT) to complete a degree in System Design and Management, I was a Systems Engineer at Thales, in their transportation division. Thales develops Communications Based Train Control (CBTC) systems for new and existing subway systems throughout the world. Thales’ system serves as a modern signaling alternative to traditional systems that offers greater operational efficiency and increased capacity of trains at reduced operating costs for the transportation authority. The company has successfully deployed a number of projects using their CBTC solution to locations such as Toronto, Kuala Lumpur, Shanghai, Dubai, Hong Kong, Ankara, and London. ("Thales," 2013)

Beginning in 2006, Thales set out to develop a new product offering, known as SelTrac, a moving block train control system that included: a radio based communication system, a train tracking system using radio frequency identification transponders, distributed wayside controllers, and a centralized supervision system. As was typical with large, mature companies delivering complex products at that time, Thales’ product development followed a traditional waterfall methodology, as per the standard Systems Engineering V-Model.

The project was completed in 2009 and successfully deployed in the Chinese market, but not without suffering setbacks including: schedule and budget overruns, unforeseen risks, and difficulties satisfying the end customer. These problems are not uncommon, especially when dealing with complex products. In a study by United States Government of Accountability Office (GAO, 2008), the majority of acquisition programs over the past two decades have experienced similar problems with cost, schedule, and risk.

As a graduate student at MIT, I became interested in entrepreneurship and startups. As part of my studies, I read with interest The Four Steps to the Epiphany (S. G. Blank, 2005),
which presents a customer centric product development strategy for startup organizations. The book highlights many potential failures for startups that try to use a traditional product development method. Extending the work by Blank, Eric Ries’ book *The Lean Startup* (Ries, 2011) presents a series of steps for startup success, termed the lean startup methodology. The lean startup methodology explains a new customer centric product development methodology being used to launch the successful new products of today ("The Lean Startup," 2013). Unlike traditional product development methodologies that result in poor outcomes when uncertainty and risk are present, the lean startup methodology successfully embraces uncertainty and risk by validating assumptions with customers during product development. Using the lean startup methodology, products evolve through a series of iterations that test product and business model assumptions with real customers. Thus, uncertainty and risk are addressed at the forefront of the process in the lean startup methodology, rather than waiting until the end of the product development cycle when the product is fully developed. While most discussion of the Lean Startup focuses on young companies, I hypothesized that much of the methodology could also be relevant for established firms delivering complex products, such as Thales.

The general objective of this thesis therefore, is to investigate whether the application of the lean startup methodology can be beneficial in the development of complex products at established firms.

1.2. LITERATURE REVIEW

The subsequent literature review is divided into the following sections: 1) Origins of the Lean Startup: Toyota; 2) Lean System Engineering and Project Management; 3) The Lean Startup; 4) Product Development Practices; and 5) Relevant Thesis Work.
1.2.1. Origins of the Lean Startup: Toyota

The origins of the lean startup can be traced back to the work done in the realm of lean production/manufacturing at Toyota in the late 1980s. In *The Machine that Changed the World* (Womack, Jones, & Roos, 1990), Womack et al. described the lean production method used by Toyota in their production of automobiles. Toyota made use of a just-in-time inventory to produce cars in small batches, with minimal waste, at a fraction of the cost of their American competitors. Toyota’s relentless focus on quality, eliminating waste, and continuous improvement through Kanban, made them the benchmark for lean production.

Womack went on to describe five lean principles used by Toyota in his follow-up book *Lean Thinking: Banishing Waste and Creating Wealth in your Organization* (Womack & Jones, 1996). The principles are summarized in Table 1. These principles form the basis for lean product development and have commonalities to the lean startup methodology.

**Table 1 – Lean Thinking - Five Lean Principles**

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>“Specify the value desired by the customer”</td>
</tr>
<tr>
<td>Value Stream</td>
<td>“Identify the value stream for each product providing that value and challenge all of the wasted steps currently necessary to provide it”</td>
</tr>
<tr>
<td>Flow</td>
<td>“Make the product flow continuously through the remaining, value-creating steps”</td>
</tr>
<tr>
<td>Pull</td>
<td>“Introduce pull between all steps where continuous flow is impossible”</td>
</tr>
<tr>
<td>Perfection</td>
<td>“Manage towards perfection so that the number of steps and the amount of time and information needed to serve the customer continually falls”</td>
</tr>
</tbody>
</table>

In *The Lean Production Simplified* (2002), Dennis studied the Toyota Production System and highlighted key concepts, one being that Toyota employees continued to seek perfection,

---

1 Adapted from “Lean Thinking: Banish Waste and Create Wealth in your Organisation”
even when they knew it could not be achieved. Also, Toyota emphasized the use of team members, not industrial engineers, as the ones to develop standardized work.

Like Dennis, Liker (2010) focused on key principles developed through studying Toyota in *The Toyota Way*. Of these 14 principles, several helped to form the basis for the lean startup methodology. Toyota focused on process; using the right process will produce the desired results. Toyota also judged employees based on team success, often organizing individuals from cross-functional disciplines in teams of 4-5. Additionally, problem solving at Toyota focused on thorough understanding, using consensus-based decision making to swiftly implement solutions by the teams.

1.2.2. **Lean Systems Engineering and Project Management**

The emerging field of lean systems engineering has worked to apply the lean principles from Toyota into the development of complex socio-technical systems. Likewise, project management has begun to adopt lean and agile principles in an effort to improve performance when delivering complex socio-technical systems. In a manner similar to the Lean Startup, Lean Systems Engineering is viewed as a potential way to improve delivery of complex products at established firms.

Building on the lean thinking principles from Table 1, Slack focused on value, specifically customer value in his thesis titled *The Lean Value Principle in Military Aerospace Product Development* (Slack, 1999). Slack developed a model and an equation for estimating customer value using the conflicting attributes of performance, cost, and schedule. All three attributes were noted earlier as problem areas for complex products.

to solve the faster, better, cheaper paradigm without sacrificing one of the three. Using the lean principles defined for manufacturing at Toyota, Oppenheim created equivalent rules for product development. The paper focused on mature technologies with low risk in the aerospace and defense programs. Oppenheim et al.’s 2011 paper *Lean Enablers for Systems Engineering* defined a set of lean enablers, or rules, under the set of lean principles from Table 1 (B. W. Oppenheim, Murman, & Secor, 2011). Oppenheim et al.’s work focused on the emerging field of lean systems engineering.

The work of Rico looked at scaling lean and agile project management methods for application to large-scale, distributed projects. Agile project management focused on four core values: customer collaboration, iterative development, self-organizing teams, and adaptability to change. Rico found that agile project management could result in 50% improvements, on average, in cost, schedule, quality and resource allocation (Rico, 2010). In a similar study, Maglyas et al. concluded that project management based on the lean principles in Table 1 could help an organization overcome common problems related to delivering on time, fitting customer needs, and reducing the time to market (Maglyas, Nikula, & Smolander, 2012).

A paper by Letens et al. (Letens, Farris, & Van Aken, 2011), *A Multilevel Framework for Lean Product Development System Design*, highlights some of the challenges with replicating the Toyota results, and proposes a framework for applying lean product development to complex systems. Letens et al. focus on three levels for their framework: functional, project, and portfolio within the confines of a traditionally structured organization.

### 1.2.3. Lean Startup

In a recent article by Carmen Nobel, Intuit founder Scott Cook stressed that established firms need to adopt a lean startup model, perhaps even more than startups. Intuit successfully applied
the lean startup methodology in their development of Fasal, an agricultural pricing tool for farmers in India. The lean startup methodology can be especially successful for creating innovative products in large companies (Nobel, 2013).

The lean startup movement is generally credited to two individuals, Eric Ries and Steve Blank, although others such as Bob Dorf, Alexander Osterwalder, and Yves Pigneur also contributed to the movement. Additionally, an early practitioner, Frank Robinson, was applying a similar method for customer discovery and validation as early as the late 1980s. The lean startup focuses on customer development and validation, and the application of agile practices in delivering successful products or services in an environment of extreme uncertainty.

Blank wrote in his book, *The Four Steps to the Epiphany*, that products developed with extensive customer input are many times more likely to succeed than products developed in-house using a traditional product development model. In his book, Blank contrasts the traditional product development model with the customer development model (see Figure 1). In traditional product development, the customer is not part of the process until the test phase. In contrast, the customer development model constantly makes use of customer feedback throughout product development. Using an iterative approach, the customer development model cycles through each step until “escape velocity” is achieved. Blank highlights a number of successful products that involved customer centric designs, such as the Toyota Prius and the Swiffer, as well as a number of product failures using a traditional product development model, such as WebVan.com and the Sony MiniDisc Player (S. G. Blank, 2005).
In 2013, Blank wrote an article Why the Lean Start-Up Changes Everything. In this article, Blank suggests that the biggest payoff of the lean startup methodology may be for large companies that embrace the methodology for developing innovative products. Companies such as General Electric, Qualcomm, and Intuit have already used the lean startup methodology to create innovative products within their businesses (S. Blank, 2013).

Eric Ries' book, The Lean Startup is often considered the bible for the lean startup methodology. In his book, Ries talks about the five principles of the Lean Startup, shown in. Ries used the ideas from Toyota's lean production system to develop lean thinking applied to innovation. Ries' book was based on his first-hand experience as a co-founder of IMVU, a social entertainment website founded in 2004. Using the lean startup methodology, Ries was able to grow IMVU into a $50 million company by 2011 (Ries, 2011). A full description of the lean startup methodology is described in section 2.1.

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Figure 1 – Product Development vs Customer Development Models

2 Adapted from “Four Steps to the Epiphany”.
Table 2 – Five Principles of the Lean Startup\(^3\)

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneurs are Everywhere</td>
<td>Entrepreneurship includes anyone creating new services or products under extreme uncertainty</td>
</tr>
<tr>
<td>Entrepreneurship is management</td>
<td>A specific management style for extreme uncertainty</td>
</tr>
<tr>
<td>Validated Learning</td>
<td>Using experiments to test elements of an entrepreneur’s vision</td>
</tr>
<tr>
<td>Build Measure Learn</td>
<td>A fast feedback loop about building products, measuring their success with customers, and learning where to pivot or persevere</td>
</tr>
<tr>
<td>Innovation Accounting</td>
<td>Using metrics to measure progress</td>
</tr>
</tbody>
</table>

Ries developed the Build-Measure-Learn cycle (see Figure 2) as a process of developing an idea into a prototype, testing it, and using feedback to pivot or preserve the idea. Earlier work by Thomke explored the benefit for quick testing using prototypes and discussed some possible methods for rapid prototyping (Thomke, 2001). Earlier work by Reinertsen also explored the use of rapid development and early feedback loops for learning and gaining information, and the benefits of small batch sizes to speed up learning and to control costs in product development (Reinertsen, 1997). Additional work by Reinertsen and Smith stressed the use of independent project teams as a way to speed up decision making and thus, speed up development times (Smith & Reinertsen, 1998). Both Reinertsen’s work and Thomke’s work were inspirational to Ries in developing the lean startup methodology.

\(^3\) Adapted from “The Lean Startup”
Figure 2 – Build Measure Learn Feedback Cycle⁴

An early criticism of the Lean Startup approach was that its methods would be difficult to implement when trying to scale a company from a small startup to a mid-sized business. In a presentation on IMVU, Brett Durrett, CEO, stated that a focus on the customer and metrics led to a revenue stall in the second quarter of 2007, at approximately $8 million annual revenue. The company faced increased technical debt, unaligned vision across groups, and competing metrics. Furthermore, the immediate customer feedback loop put focus on features over infrastructure. IMVU was able to add effective product management, centralized strategic planning, and adopt a culture change as a means of overcoming this stall. By the third quarter of 2008, IMVU had successfully returned to high levels of revenue growth and has since achieved revenues of $40-$50 million as of 2012 (Durrett, Birchler, & Fitz, 2010).

1.2.4. Product Development Practices
In an article on software product lines, Bosch and Bosch-Sijtsema (2011) highlighted the difficulty in using agile development approaches for large-scale software development. Some of the issues included customer representation, architecture evolution, and managing scale. The

⁴ Adapted from theleanstartup.com
paper highlights the learning and key elements from using a lean approach on Intuit Quickbooks.

Four elements were credited with the successful implementation of the lean startup approach: self-directed, managed teams; continuous customer involvement; introduction of solution and code jams; and feature alphas presented to customer (Bosch & Bosch-Sijtsema, 2011).

Conboy and Duarte (2010) suggested that further research is needed in developing a systematic understanding of agile adoption, tailoring, and execution for complex product development. The authors cited a growing adoption of lean principles in software intensive product development; however, they remarked that the fields of systems development and safety critical systems were relatively unexplored domains in terms of research (Conboy & Duarte, 2010).

Early work by Alan MacCormack looked at deploying a more flexible product development process in the light of uncertainty (MacCormack, 2001; MacCormack, Verganti, & Iansiti, 2001). MacCormack’s work found that a flexible product development strategy should focus on getting the product to the market early and working with customers to co-evolve the design. Later work by MacCormack suggested that projects of varying degrees of uncertainty require different development environments (MacCormack & Verganti, 2003). In this work, MacCormack and Verganti found that using a traditional staged-gate process (ie. waterfall) is best only when there is little to no uncertainty. Flexibility is required for projects with greater uncertainty. In a study of Hewlett Packard, MacCormack et al. found that the benefits of using a full specification in a waterfall development process can be overcome by releasing an early prototype (MacCormack, Kemerer, Cusumano, & Crandall, 2003). Finally, in a 2012 paper by MacCormack et al., it was suggested that products designed for stable markets needed a different product development strategy then those designed for new, break-through uses (MacCormack,

1.2.5. Relevant Thesis work

To date, only limited research theses have been devoted to the Lean Startup Methodology. Several theses have been produced out of Chalmers University of Technology in Sweden. A thesis by Degeryd and Graffner tested the hypothesis that large firms have an exploitation bias to innovative products (Degeryd & Graffner, 2013). Their work highlighted 11 barriers to producing innovative products at the subject firm; most of which could be overcome by incorporating Lean Startup principles. A second thesis from Chalmers focused on how new ideas were implemented in large firms, and the barriers that existed for implementing the lean startup methodology in these large firms (Karlsson & Nordström, 2012). The authors stated barriers for implementing the lean startup methodology in these firms being: problems accessing customers for a large firm, a risk of disclosing information, and potential of damaging the brand. A third and final thesis out of Chalmers looked at using the lean startup methodology for a large manufacturing company (Qvillberg & Gustafsson, 2012). This thesis found difficulties in implementing the methodology in a manufacturing setting due to limited access to customers, difficulty in rapid prototyping, and difficulty implementing the minimum viable product.

A thesis by Blomberg from the University of Copenhagen considered applying the lean startup methodology to a low-tech manufacturing firm that the author ran (Blomberg, 2012). Blomberg found that while the lean startup methodology could offer benefit to a low-tech manufacturing firm, he suggested seven findings for further study to improve the Lean Startup Methodology for this specific context. Highlights included: more resources spent on developing
prototypes leads to a biased favoring of the prototype, and the more time spent in the office fine
tuning a prototype without showing it to customers will increase favoring of that concept.

1.3. SUMMARY OF RESEARCH OBJECTIVES AND HYPOTHESES

The lean startup methodology has found success, to date, when applied to start-up companies.
Established companies, dealing with more complex products, tend to use a more structured
product development process. A recent insight by Intuit founder Scott Cook, echoed by others, is
that the lean startup methodology could be more beneficial to established companies than to
startups (Nobel, 2013). The main objective of this thesis is to evaluate the application of the lean
startup methodology at established firms. The primary hypothesis of this thesis is as follows:
1. The lean startup methodology can provide positive benefits to established firms delivering
complex products.

The secondary hypotheses examined in this thesis are as follows:
2. The lean startup methodology is beneficial in product development for established firms
when product uncertainty is high.
3. The lean startup methodology is more likely to be adopted by established firms in industries
where innovation is high than in industries where innovation is low.
4. The lean startup methodology is more likely to be adopted by established firms less than 20
years old than by firms greater than 20 years old.
5. Principles of the lean startup methodology are being adopted within established firms without
employees being aware of the methodology.
2. RESEARCH METHODS

2.1. LEAN STARTUP METHODOLOGY

Historically, startup companies have operated based on the following model. First, a detailed business plan is created that includes a five year forecast based on assumptions. From there, investors are convinced to fund the business. Next, countless hours are invested in developing a product ready for launch. Finally, only after the product is ready, is customer feedback elicited to determine whether or not the product is successful (S. Blank, 2013). Unfortunately, using this traditional approach, startups have less than a 25% success rate according to Blank.

A novel approach to the traditional method of launching a startup was developed by Eric Ries, under the tutelage of Steve Blank. Their approach, known as the lean startup, uses hypothesis driven entrepreneurship to test a startup’s business model through a series of experiments. The lean startup methodology is based on three key ideas: experimentation; early and continuous elicitation of customer feedback; and use of iterative, agile design methods (S. Blank, 2013; Eisenmann, Ries, & Dillard, 2012).

The lean startup methodology consists of the steps shown in Figure 3 and described in the following sections.

2.1.1. Building on a Vision

An entrepreneur at a startup, or an individual with “entrepreneurial spirit” at an established company, begins with a vision for a novel product or service. From there, the entrepreneur translates the vision into a set of testable business model hypotheses, related to the customer value proposition, strategy, profit formula, market plan, and so on. Next, the entrepreneur completes successive tests to validate the hypotheses using quantifiable data. It is expected that these tests will be iterative and continue to evolve as the business model matures. The
entrepreneur subsequently develops a series of minimum viable products (MVPs) used to facilitate hypotheses testing. An MVP is the smallest set of features or functionality to allow a hypothesis test to produce meaningful quantitative results. MVPs are produced with using an agile approach in small batches and with short cycle times (Eisenmann et al., 2012).

2.1.2. Measure using Actionable Metrics
When testing the MVPs, the entrepreneur plans to effectively target key customer groups. These include potential customers that the company would target with the completed product or service. The test set is limited to the smallest number of customers needed to yield statistically significant results. Testing is prioritized based on risk with the over-arching goal of minimizing project costs. Metrics used to evaluate MVP testing are actionable, accessible and auditable. Actionable metrics demonstrate clear cause and effect. For effective learning, metrics also need to be accessible by all employees, not just a small set of executives. Finally, metrics need to be credible with supporting data to ensure their accuracy and to facilitate review (Eisenmann et al., 2012; Ries, 2011).

2.1.3. Validated Learning
Using results from the actionable metrics, the entrepreneur evaluates the data and must decide whether to pivot, preserve, or perish. If the MVP test yields positive results, the entrepreneur moves on to test additional hypotheses. If the MVP test yields negative results, the entrepreneur must decide whether to pivot or perish. A pivot results in a change to some element of the business model and developing new MVPs to test, while maintaining the core aspects of the original vision. Finally, if the MVP test is a resounding failure, and no suitable pivots exist, the entrepreneur abandons the vision and the product or service perishes (Eisenmann et al., 2012).
2.1.4. Time to Scale

Once all the MVP tests have been successfully completed, it is now time for the entrepreneur to scale the enterprise. At this stage, the product or service has achieved a product-market fit, meaning that product has demand and profit potential exists. At this stage, operations are ramped up aggressively with additional infrastructure, staffing allocation, and added investments are made into the product or service to address the proven customer base. It is recommended that entrepreneurs continue to test hypotheses using the build-measure-learn cycle in the lean spirit of continuous improvement (Eisenmann et al., 2012).
Figure 3 – Lean Startup Methodology Steps

5 Adapted from Hypothesis-Driven Entrepreneurship: The Lean Startup
2.2. **STUDY DESIGN**

The methodology used to meet the objectives of this thesis are comprised of two parts: a survey and phone interviews.

2.2.1. **Survey**

An electronic survey was developed in an effort to test the main hypothesis, namely, that the lean startup methodology can provide positive benefits to established firms delivering complex products. The survey questions related to familiarity with and use of the lean startup methodology, and outcomes applying the methodology within the organization. The survey also dealt with the secondary hypotheses through a series of questions on innovation, uncertainty, company age, and unknown adoption. A survey template is available in Appendix A for reference. The survey was pilot tested for clarity with 7 individuals prior to its use.

2.2.2. **Subjects**

**Base Group**

A total of 44 companies were initially identified across industries as companies delivering complex products in competitive landscapes. Companies selected were established firms, meaning that the firms were publically owned, or in the process of issuing an initial public offering; had stable revenues; and were among the leaders in their selected industries. Companies ranged in age from 3 to 150+ years, ranged in size from 150 to 400,000+ employees, and ranged in revenues from $50 million to over $200 billion. Industries represented included: technology, aerospace, defense, automotive, industrials, and consumer products, among others. A complete list of the targeted companies is shown in Appendix C.
Participants in product development, engineering, or product management were targeted to improve the accuracy of the results. Respondent contact information was obtained using a variety of sources including: the author’s personal network of contacts, extended network of contacts via classmates, active MIT personnel, and MIT alumni.

**Extended Group**

Due to the low proportion of respondents with experience using the lean startup in the base group the same survey was re-issued to target individuals with experience using the lean startup methodology at established firms in an effort to increase the sample size. In order to find these individuals, the author actively engaged the following online lean startup communities: the Lean Startup Circle, the Lean Enterprise Institute, and Lean Startup. The author engaged community members through a variety of sources such as: Google Groups, forums, LinkedIn groups, and Twitter. Unlike the base group, members of the extended group chose to participate individually, without being personally invited.

**2.2.3. Phone Interviews**

Survey respondents who volunteered to be contacted for a follow-up interview, and met the selection criteria, were contacted for a follow-up phone interview. A total of 5 individuals were contacted for follow-up interviews. The criteria for selection for a follow-up phone interview were: 1) had completed a project at their firm using the lean startup methodology; or 2) were not familiar with the lean startup methodology; yet, were already incorporating aspects of the methodology. Phone interview questions delved deeper into the application and result of using the lean startup methodology and overall impressions of the methodology. For those unfamiliar with the methodology, questions were related to adoption of specific aspects of the lean startup methodology. A phone interview template is available in Appendix B for reference.
3. RESULTS

The results of the study survey and phone interviews are summarized below. Select survey results for the base group and detailed results for the extended group are presented separately.

3.1. SURVEY RESULTS FOR THE BASE GROUP

3.1.1. Response Rate and Use of the Lean Startup Methodology

A total of 69 surveys were issued to the companies listed in Appendix C. A total of 32 individuals responded, representing a response rate of 46%. Based on feedback obtained while issuing the survey, the response rate was significantly lower for “cold contacts”, where the author had no previous communication with the individuals in question.

3.1.2. Use of the Lean Startup Methodology

Respondents were asked whether or not they were familiar with the lean startup methodology. Of the 32 respondents, 6 (19%) were familiar with the methodology, while 26 (81%) were not (see Figure 4). Those familiar with the method but not using it most commonly cited that it was too much of a change for the organization, and a lack of understanding. Focusing on those that had used the lean startup methodology, only 2 (6%) had applied it to 1 or more projects, while 4 (13%) were familiar with the methodology and had not applied it. Finally, 1 (3%) respondent reported success using the lean startup methodology while 1 (3%) reported that success was unknown at this time.
Are you Familiar with the Lean Startup Method

6, 19%

26, 81%

No
Yes

Figure 4 – Familiar with the Lean Startup Methodology in Base Group

3.2. SURVEY RESULTS FOR THE EXTENDED GROUP

3.2.1. Response Rate and Company Type

A total of 12 additional individuals responded to the survey after it was re-issued to target lean startup practitioners at established firms; among these, 9 reported use of the lean startup methodology at their firm. Combined results for the base group and lean startup practitioners are shown hereafter.

Respondents were asked to identify their industry, company size, company age, and existing product development methodology. Industries most cited by respondents, in order of frequency, were: Technology (12), Software (6), Automotive (6), and Consumer (5) (see Figure 5). Company size ranged from less than 1000 to over 200,000 employees, with the most frequent size reported between 10,000 and 99,999 employees (see Figure 6). Company age ranged from 1-19 years to 100+ years, with 20-39 years being the most common (see Figure 7). Product development methodologies most used at the companies were: waterfall - 25 (57%), pure agile - 20 (45%), and lean - 16 (36%). A full list of the reported product development methodologies are shown in Figure 8.
Figure 5 – Industries Represented

Figure 6 – Company Size
A total of 15 respondents (34%) were familiar with the lean startup methodology, with 11 respondents (25%) having applied it to 1 or more projects. Within the group that had applied the lean startup methodology, 6 reported success, 2 reported not being successful, and 3 reported that success was unknown at this time (see Figure 9).
Were you successful using the Lean Startup Methodology?

Figure 9 – Successful using the Lean Startup Methodology

Respondents who stated success were asked to cite reasons (see Figure 10). Five cited that they succeeded by iterating rapidly through the build-measure-learn cycle. Three cited pivoting early after feedback, empowering employees, achieving buy-in from employees, and developing key new features. When the group of respondents who claimed success was asked to cite the benefit, a range of responses were noted, including: lower cost, early feedback, less rework later, better understanding of the customer, and higher customer approval, among others (see Figure 11). The two respondents who stated failure with the method were asked to cite reasons. Common responses were: project scope too large, and resistance from management (see Figure 12).
How did you succeed?

- Iterated rapidly through the Build-Measure-Learn...
- Empowered employees [3]
- Developed key new features [3]
- Pivoted after early feedback [3]
- Achieved buy-in from employees [3]
- Worked closely with customers [2]
- Other: Decided Market was too small (perished) [1]

Figure 10 – Reasons for Success

What was the benefit?

- Lower cost [3]
- Early feedback [3]
- Better understanding of the customer [2]
- Less rework later in development [2]
- Higher customer approval [2]
- Better schedule performance [1]
- Other: Great insight into the market potential [1]
- Other: High benefit realisation [1]

Figure 11 – Benefits of the Lean Startup Methodology
Reasons for Failure

<table>
<thead>
<tr>
<th>Reason</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational restrictions</td>
<td>1</td>
</tr>
<tr>
<td>Lack of access to customers</td>
<td>1</td>
</tr>
<tr>
<td>Project scope too large</td>
<td>2</td>
</tr>
<tr>
<td>Extent of change too significant</td>
<td>1</td>
</tr>
<tr>
<td>Resistance from management</td>
<td>2</td>
</tr>
<tr>
<td>Lack of buy-in from employees</td>
<td>1</td>
</tr>
<tr>
<td>Other: failure to adhere to the method</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 12 – Reasons for Failure

The 11 respondents that applied the lean startup methodology were asked to rank the innovation content, and uncertainty of the projects in question. Innovation content was ranked using a 5-point Likert scale, with 1 representing low innovation and 5 representing high innovation. Innovation had a mean score of 3.4 with a standard deviation of 0.64 (see Figure 13). Project uncertainty was also ranked using a 5-point Likert scale with 1 = low uncertainty and 5 = high uncertainty. Project uncertainty had a mean score of 4.1 with a standard deviation of 1.0 (see Figure 14). All respondents, including those that failed and did not yet complete the projects (16/16) cited that they would use the lean startup methodology again on future projects. The project scope and project duration for the 11 respondents that completed one or more projects with the lean startup methodology are shown in Figure 15 and Figure 16, respectively.
Figure 13 – Project Innovation Content

Figure 14 – Project Uncertainty
Respondents who were familiar with the lean startup methodology and had not applied it were asked to cite reasons. Most common responses were: too much of a change for the company, and lack of understanding of the methodology.
3.2.3. Not Familiar with the Lean Startup Methodology

Respondents who stated that they were not familiar with or had not used the lean startup methodology were asked a series of questions to assess whether their company was in fact already using principles of the lean startup methodology at their firm. Results are shown in Figure 17. Within the group, 16 (57%) cited the development of a minimum viable product (MVP); 19 (68%) had used actionable metrics to test success or failure of an MVP, feature, or business assumption; 22 (80%) stated that they iterated through a Build – Measure – Learn cycle; 18 (64%) had scaled operations only after achieving a product-market fit; and finally 19 (70%) stated that they had taken the results of actionable metrics and pivoted, perished, or preserved the course of the product or feature.

![Figure 17 – Use of Lean Startup Elements in Existing Product Development in Base Group](image-url)

Figure 17 – Use of Lean Startup Elements in Existing Product Development in Base Group
3.3. Interview Results

Following the survey, a total of 5 interviews were conducted with select respondents from the survey who had volunteered to participate in a phone interview. The author asked a series of open ended questions to participants based on the script contained in Appendix B. Respondents were split between those that had completed a project at their firm using the lean startup methodology, and those that were not familiar with the lean startup methodology; yet, were already incorporating aspects of the methodology. Results from the phone interviews are shown in the following sections.

3.3.1. Software Engineer at Amazon

Ari, an Engineer at Amazon working on the Kindle project, stated that his team had used the lean startup methodology for a special, confidential project. Building off an idea, a small team of 4 engineers started from scratch and deployed the lean startup methodology on the project. Ari highlighted strengths of the method as: fast feedback and a low cost model. He stated that Amazon prided themselves at extracting maximum value at minimal cost. Competition is fierce and the need for innovation is high within the technology sector. The company focuses on keeping project costs down; building and deploying products using teams resembling startups makes the company faster and more responsive. Another benefit of the lean startup methodology was that it generated excitement among the engineers. As a small team, they were able to work on a new innovative project, take on various roles and responsibilities including the user interface, product management, testing, and coding.

Ari noted that at a big company, a challenge of using the lean startup methodology is putting products in front of customers of poorer quality, as this can have a negative impact on the company’s reputation. He also noted that due to the confidential nature of the project, the
company was forced to use internal employees as customers. The team has now transitioned from using the lean startup methodology, to using agile scrum. Ari stated that it is not typical for projects at Amazon to use the lean startup methodology; his project was a special case. As such, he was unsure whether the company would continue to use the lean startup methodology going forward.

3.3.2. Design Engineer at an Automotive Firm

A Design Engineer at a major automotive firm (name and company kept confidential) stated that their firm was not using the lean startup methodology. He noted that obstacles to using the method were the necessary training required for staff and being able to empower employees to use the methodology. He sees the method being best applied to select components within an automobile, where development times are shorter and there is less rigor required to pass through design gates. Also, the company might be more inclined to adopt the lean startup methodology as a response to an adoption by other firms in the industry, much in the same regard as lean manufacturing and six sigma that came before.

The company currently uses aspects of the lean startup methodology in their product development lifecycle. They develop MVPs to quickly test product assumptions and iterate to increasingly advanced states until a high fidelity MVP is developed. The company also makes use of actionable metrics for these MVPs, but only after they can undergo prototype testing. Based on the results, the company then decides whether to pivot, preserve, or perish from plan.

Reported challenges the company would face in using the lean startup methodology were scaling only after obtaining a product-market fit and working with customers early on. Customer clinics are used only after a durable prototype is developed. Low fidelity prototypes do not achieve the necessary value when attempting to gather early customer feedback. Finally, the
engineer noted that the company does not have the ability to perish, or pivot significantly in response to late customer feedback on a new vehicle offering. At that stage, it is too difficult to shut down production planning based on current procedures.

3.3.3. Senior Product Manager at IBM

Suzie, a Senior Product Manager at IBM, reported that her firm was not using the lean startup methodology. Her division of IBM had recently adopted a new methodology called IBM design thinking, which has many similarities to the lean startup methodology. IBM design thinking uses continuous engagement of sponsor clients to define and iterate on a wide variety of solutions, in a series of release hills, until they converge upon their proposed solution. According to IBM literature, design thinking also focuses on streamlining the process, by reducing deliverables and increasing visibility through metrics (Llitjos, 2013).

Suzie noted that IBM might consider switching methodologies in order to: remain current with market trends, allow them to shorten cycle times, and to meet or exceed the expectations of their clients.

IBM’s design thinking parallels some aspects of the lean startup methodology. It uses MVPs to gain early feedback from customers on a particular solution/design/feature and then refine the MVP based on the feedback. IBM works through a series of “hills” with each hill consisting of a more complete solution. At each hill and within hills, they iterate the process, similar to the build-measure-learn cycle of the lean startup. With their new process, IBM will now also iterate on solutions that contain actual code. In addition, the company will adopt a more customer centric methodology, allowing them pivot, preserve, or even perish as required based on customer feedback. In the past, Suzie noted that it was difficult to perish features that were present in the full-year plan, as companies came to expect all features listed in the plan. Finally,
IBM’s design thinking methodology makes use of actionable metrics to test for completeness in achieving each hill. Each hill contains at least 3 actionable metrics that are evaluated using customer interaction and feedback.

3.3.4. Product Engineer at an Automotive Firm

A product engineer at a major automotive firm (name and company kept confidential) stated that their firm is not using the lean startup methodology, nor is he personally familiar with the method. The company uses a traditional V-model waterfall product development process. At present, adopting a new method like the lean startup methodology would be difficult to implement due to the size of the company and the significant change required.

The company currently uses some aspects of the lean startup methodology without formal knowledge of the method. Design prototypes are developed and tested with real customers, similar to a minimum viable product. They use a large quantity of actionable metrics when testing prototypes as criteria for selecting the best design among different variants. He stated that they also iterate with the design prototypes and repeat the testing process with customers, similar to the build-measure-learn cycle.

The company’s method differs from the lean startup methodology in that once the design process starts for a new automobile, the product or feature is never abandoned (perish) as described by the lean startup methodology. The engineer also noted that the company does not necessarily pivot in the same manner described by the lean startup methodology. Instead, they may make small iterations to accommodate feedback from customers, but tend to keep the key product design requirements intact. Additionally, the company does not scale only after a product-market fit. They have long lead items which force them to make decisions about scaling for new automobiles prior to completion of the design process.
3.3.5. Senior Consultant at Frank H Robinson & Company

David was previously a consultant at Frank H Robinson & Company, a firm specializing in customer discovery and validation for large firms. The firm pioneered a method very similar to the lean startup methodology in the late 1980s, prior to Steve Blank’s *Four Steps to the Epiphany* and Eric Ries’ *The Lean Startup* (S. G. Blank, 2005; Ries, 2011).

David described a consulting project at a major chip manufacturer. This chip manufacturer had developed a magneto optical disk drive that would store 128 MB, which was a large storage volume for the early 1990s. The chip manufacturer already had one major client on-board, under the stipulation that the chipsets be reduced from 5 to 2. The company hired David’s firm to investigate the potential market by applying their method.

David identified 4 different market segments that the device would be sold to. The team went to the field and called on users within these segments (e.g., print shops, graphics professionals, etc.) to identify the customer demand. After applying the method and analyzing all the data, the team determined that the potential market for the storage product was approximately one half to one third the size estimated by an independent research firm. Of note, the research firm later revised their estimate down in-line with the estimates made by David’s firm. David presented the results to senior management who decided not to go ahead with the project.

According to David, their consulting firm worked mostly with companies that were producing next generation products, where uncertainty is high. Based on his experience, up to 80% of the time, the findings of the method reveal that the company should abandon the product. However, for a large corporation, deciding to perish a product can be as important as finding a successful product-market fit.
4. DISCUSSION

The primary hypothesis for this thesis was that the lean startup methodology can provide benefit to established firms delivering complex products. Based on the results of the survey and phone interviews, the key findings of this research are as follows:

1) Results indicate a lack of widespread knowledge of the lean startup methodology at established firms and a low overall usage rate of the methodology.

2) Established firms are showing signs of using elements of the lean startup methodology without full knowledge of the method.

3) Among those applying the lean startup methodology at established firms, preliminary research suggests that benefit is being achieved using the methodology.

4.1. LACK OF USE OF THE LEAN STARTUP METHODOLOGY

4.1.1. Adoption at Established Firms

The results of the survey with the base group, representing a wide spectrum of established companies across different industries, indicate a low use of the lean startup methodology at established firms. Within the base group, 81% of respondents surveyed were not familiar with the lean startup methodology. When focusing on those who reported use of the methodology, only 2 of the 32 initial respondents (6%) had applied the method to a product or service within an established organization. Based on these results, it is clear that adoption rates of the lean startup methodology at established firms remain quite low.

The Lean Startup was written by Eric Ries in 2011. Since 2011, the lean startup movement has grown considerably, with a number of books, papers, forum groups, talks and conferences that now exist on the subject. Yet, two years later, adoption of the lean startup methodology remains in its infancy at established firms. Referring to the diffusion of innovation
chart by Rogers et al., the adoption of the lean startup methodology at established firms can be viewed as in the early adopters phase of the adoption lifecycle (Rogers, Singhal, & Quinlan, 2009).

![Diffusion of Innovation at Established Firms](image)

Figure 18 – Diffusion of Innovation at Established Firms

4.1.2. Comparing Adoption of Lean Startup Methodology to Agile Adoption

Agile software development, the current market leading methodology for software development in the industry, rose out of the agile manifesto, written in 2001. In the early years, agile development was received with enthusiasm by a few early adopters and with skepticism by others. In the 12 years since the release of the agile manifesto, the number of publications, conference papers, research, and journal articles has grown significantly as agile methods have become mainstream. (Dingsoyr, Nerur, Balijepally, & Moe, 2012)

In a Forrester research study published in 2006, agile approaches (eXtreme Programming, Scrum, Feature Driven Development, etc.) were being used by 17% of companies,

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6 Adapted from Diffusion of Innovations
with awareness of agile at about 48% (Schwaber & Fichera, 2005). By 2009, a new Forrester research report showed that agile had gone mainstream with adoption rates exceeding 35% and general awareness above 80% (West, Grant, Gerush, & D’Silva, 2010).

As discussed above, the lean startup methodology is approximately two years old. Although written for a start-up audience, the lean startup methodology is being adopted by established firms working on complex products. Like agile before it, in year 2, the lean startup is currently being utilized by early adopters in the industry. It took approximately 7 to 8 years for agile methods to reach mainstream adoption levels. By comparison, the lean startup methodology has the potential to exceed this speed to mainstream, defined as adoption by the early majority as shown in Figure 18, through amplification due to social media.

In his webinar, *Lean Startup for the Enterprise*, David Bland offers some suggestions for using the lean startup methodology at established organizations. (Bland, 2012) David noted that the lean startup methodology is best applied when neither the problem, nor the solution are known (see Table 3). Bland also suggests that the lean startup methodology must be combined with business model innovation and continuous delivery. With this approach, companies can develop new business models, quickly iterate to validate or invalidate assumptions using the lean startup methodology, and deliver value to the customer quickly with continuous deployment. Neglecting any one of these three factors will cause a company to be at a disadvantage. (Bland, 2013a)

**Table 3 – Mapping of Process to Problem – Solution**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known</td>
<td>Known</td>
<td>Waterfall or Agile</td>
</tr>
<tr>
<td>Known</td>
<td>Unknown</td>
<td>Agile</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>Lean Startup</td>
</tr>
</tbody>
</table>

7 Adapted from *Lean Startup for the Enterprise* by David Bland.
4.2. USE OF ELEMENTS OF THE LEAN STARTUP METHODOLOGY

Results from the extended group showed that 33 of 44 (75%) respondents were either unaware of or not using the lean startup methodology within their organization. These respondents were then asked questions related to elements of the lean startup methodology to assess whether their companies were already incorporating elements of lean startup within their existing product development practices. A total of 28 subjects responded to questions on five lean startup methodology principles. Respondents noted use of the following principles: 1) iterated through the build-measure-learn cycle; 2) use of actionable metrics; 3) applied one of pivoted, perished, or preserved; 4) scaled operations only after product-market fit, 5) use of an MVP.

Iteration through the build-measure-learn cycle was used by the vast majority of respondents (79%). Given that iteration is already an incorporated principle in agile development and that 35 of 44 (80%) of those sampled cited use of an agile methodology, this result is not surprising. In the interviews, the product manager at IBM noted that their design thinking process relied heavily on iteration through design hills, a process that aligned closely with the build-measure-learn cycle of the lean startup methodology. Two engineers from automotive firms both stated that their companies iterated on prototypes with increasing degrees of fidelity. However, only the design engineer from one of the companies reported that the prototypes were tested with actual customers.

The use of one of pivoting, preserving, or perishing was noted by 68% of respondents. During interviews, the design engineer at an automotive firm reported that minor pivots and preservation of features were more common than making major pivots or perishing. Similarly, the product engineer from a second automotive firm also stated that minor pivots were common, but perishing a product or feature was difficult after development had begun. The product manager at IBM noted that although their new design thinking process would now allow them to
perish features in addition to pivoting or preserving, previously, perishing was not well received due to the release of full year product plans to customers. For established firms, it can be difficult to perform major pivots or perishing an MVP. Both of these steps may be viewed of as a failure for the team. However, if established firms want to make the most out of the lean startup methodology, they need to accept that pivoting or perishing are necessary steps in deploying the lean startup methodology. Firms will need to re-evaluate how they measure performance. It cannot be measured strictly on the success or failure of a product, but on the learning that is being achieved. Further, as stated earlier, up to 80% of the time, the findings of the lean startup methodology can reveal that the company should abandon the product.

Scaling operations only after achieving a product-market fit was reported by 64% of respondents. Both automotive engineers stated that this principle was not incorporated into their existing methodologies. On scaling, the design engineer stated that scaling begins early in the process of developing a new automobile, to accommodate long lead times. The product manager at IBM also responded that scaling after achieving a product-market fit did not occur with their Design Thinking process. Scaling is also a difficult principle to adopt for established firms. Unlike startups, established firms are not starved for money and resources. As such, they have tendencies to prematurely scale operations on new products prior to achieving a product market fit. Established firms need to delay planning and avoid premature scaling, in order to make effective use of the lean startup methodology.

Finally, the concept of a minimum viable product was noted by 57% of respondents. The engineers at automotive firms stated that their prototypes closely aligned to the concept of minimum viable product. However, it is of note that neither the design engineer or the product engineer stated that these prototypes were used to test hypotheses, as described by the lean
startup methodology. The design thinking process, recently adopted by IBM, does make explicit use of a minimum viable product, and is possibly a direct result of influence from the lean startup methodology.

These findings suggest support for the hypothesis that principles of the lean startup methodology are being adopted within established firms without employees being aware of the methodology. For established organizations, customer discovery and customer involvement in their product development is now imperative under a competitive landscape. As awareness of the lean startup methodology increases at established firms, the author postulates that further adoption of the lean startup principles into existing product development methodologies will continue. Additional research will be required to determine whether or not established companies are incorporating these principles in the method described by the lean startup methodology or if they are tailoring the principles to suit their specific needs.

4.3. Benefit Achieved Using the Lean Startup Methodology

Results from the survey showed that among those with experience using the lean startup methodology 6 of 11 reported success (54%), while 2 (18%) reported failure and another 3 (27%) were unsure as they were still working on a project using the lean startup methodology. Based on these results and interviews with Ari and David, it is postulated that the lean startup methodology can provide benefits to established firms delivery complex products (hypothesis 1).

Factors contributing to success of the method were: iterating rapidly through the build measure learn cycle; pivoting early after feedback; and developing key new features. Most commonly cited benefits of using the method were: lower costs; better understanding of the customer; early feedback; less rework later in development; and higher customer approval. Further evidence of the lean startup methodology benefiting established firms can be drawn from
the fact all 11 respondents cited that they would use the methodology again on future projects, including the 2 that reported a failure when using the methodology.

Focusing on uncertainty, hypothesis 2 postulated that the lean startup methodology is beneficial in product development for established firms when project uncertainty is high (see Figure 19). Among those with experience using the method, uncertainty was rated, on average, as a 4 out of 5. Based on these results, among those surveyed, there was a tendency to use the lean startup methodology when project uncertainty was high. For established firms, project uncertainty is highest among new products being introduced to the market. For these products, there is no benchmark to understand how well the market will accept the product, nor is it known whether the solution the product is selling is truly a frustration point with customers. Of the methodologies listed in Figure 19, waterfall, agile and lean startup methodology, the lean startup methodology performs best when uncertainty is high, as it allows teams to perform series of tests to dispel uncertainty prior to scaling operations for new product development.

![Diagram of Project Uncertainty vs Development Approach](image.png)

**Figure 19 – Project Uncertainty vs Development Approach**

Hypothesis 3 postulated that the lean startup methodology would be more beneficial in industries where innovation is high than in industries where innovation is low. Innovation was rated as an average of 3.4 out of 5 among those who had used the lean startup method. As such,

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8 Adapted from *Lean Startup for the Enterprise* by David Bland.
it does not appear that innovation was an important factor among those surveyed. Further research with larger samples would be necessary to prove or disprove this hypothesis.

It was also anticipated that the lean startup methodology would be more likely to be adopted by established firms less than 20 years old than by companies exceeding 20 years of age. Results were equivocal, with 6 of 11 respondents (55%) using the lean startup methodology that were less than 20 years of age. Of note, of the entire sample surveyed only 11 of 44 respondents (25%) were less than 20 years of age which likely impacted this finding. In future work, a broader sample of companies will be necessary to fully investigate the influence of company age on uptake and benefit from using the lean startup method.

4.3.1. Examples of Established Firms using the Lean Startup Method highlighted in The Lean Startup Conference (December 2013, San Francisco, California)

Other examples of established organizations who have adopted the lean startup methodology can be found in recent presentations from the Lean Startup Conference, held Dec 9 – 11, 2013, in San Francisco California and hosted by Eric Ries. The conference featured presentations from a number of established firms who had applied the methodology to complex products within their organization. Relevant examples are discussed below (Graban, 2013).

General Electric

Sarah Broderick, Stephen Liguori, Michael Mahan, and Jeffrey Schnitzer of General Electric (GE) discussed their deployment of the lean startup methodology with help from Eric Ries, under the branding of FastWorks. GE piloted the method on a high-end refrigerator line called Monogram. Since January 2013, GE has gone through 15 iterations of MVPs for the Monogram project. They are also using the lean startup methodology as a way of cutting down on waste, in a similar manner to the principles of Toyota highlighted in Lean Thinking (Womack & Jones, 1996).
One way that adoption of the lean startup methodology has been successful at GE was through buy-in and support from key executives, including CEO Jeff Immelt. To guide the initiative, GE hired Eric Ries to train 80 coaches on the lean startup principles for deployment across the company. To date, the company has launched approximately 100 FastWorks projects worldwide. ("The Biggest Startup: Eric Ries and GE Team Up to Transform Manufacturing," 2013)

**Intuit**

Laura Fennell, Hugh Molotsi, and Brad Smith, of Intuit, spoke on how their leaders give employees freedom to pursue ideas in the form of internal startups. Intuit teaches employees lean startup techniques; how to use data, techniques to get products into the hands of customers, and how to test and iterate. At Intuit, they state that it is more important to ensure that customers will love a product than whether or not a minimum viable product will drive profits.

Intuit previously developed Fasal, a mobile application that provides daily crop prices to farmers in India. Fasal currently has a subscription base of over 1.2 million. Fasal began as a series experiments using the lean startup method within Intuit. The team interviewed farmers questioning how, where and when the farmers sell their crops. Through a series of iterations, Intuit built a product that would allow farmers to receive crop prices at their request, through SMS. The product is designed as a two sided market: one side for farmers, which is free, and the other for advertisers, which is paid (Rammohan, 2013).

**Etsy**

John Goulah, of Etsy, explained how they are using concepts of the lean startup methodology by pushing code up to 30 times a day. This is the lean concept of continuous deployment using small batch sizes. Through continuous deployment Etsy can gather immediate feedback and
make improvements to their product. Etsy relies on metrics, trust among team members, and the motto: keeping it simple.

**Toyota**

Toyota’s software development has traditionally been waterfall. Matt Kresse and Vinuth Rai took the initiative to run a project using the lean startup methodology with a team in Mountain View working on a connected car. One of the goals for the team was to reduce the time it took to learn from their customers, from 3+ years to a matter of days. The team ran experiments for a heads up display using an MVP based on a wired-in Android tablet. The team reached out to actual customers to trial the MVP into their cars. They had success with the initial experiment, with 60% of customers keeping the MVP after the one month experiment.

Adopting the lean startup methodology forced the team to be more creative and helped them gain fast feedback from customers without having to wait for a new vehicle to launch. One difficulty cited was that the team would, at times, fall back on old habits and build what they wanted, not what was being stated by their customers.

Beyond the first experiment with the heads up display, the team is now working with two other Toyota USA sites to incorporate customer feedback into their design methods. As a group, they identified a number of prioritized features to tackle and are using the lean startup principle of learning from real customers.

**4.3.2. Other Established Firms using the Lean Startup Methodology**

**The Library Corporation**

The Library Corporation (TLC), a 40-year old West Virginia library solutions company, trained staff and began implementing the lean startup methodology within their organization in 2012. The team currently applies aspects of the lean startup methodology to new projects: using MVPs,
getting out of the building and working with customers, iteration, and using data to validate decisions to pivot, preserve or perish. The Chief Operating Officer stated that through the use of the lean startup methodology, TLC was able to launch a new business venture that is forecast to earn $1-million in revenue in its first year. Also, a second project using the lean startup methodology was over-subscribed by early adopters prior to the product launching. *(TLC: Lean Startup Implementation Results, 2013)*

**British Telecom - O2**

Paul Golding, in an article called *Lessons learned using “lean start-up” with a big corp* suggests that using the lean startup methodology might be more efficient in determining the viability of a product than traditional product methods for big corporations. Golding described his work with the United Kingdom’s best carrier, O2, on establishing two new services, #Blue and connFu. In order to be successful, Golding noted key lessons that were followed: hiring a hurdler to manage money, contracts, and resources; explaining the project to various departments ahead of time; staying on point to avoid distractions; moving as fast as possible to get an MVP into the hands of real customers; hiring a skeptic to win over and report back to the main unit; and finally, keeping a safe distance from the main unit *(Golding, 2012)*.

### 4.3.3. Best Practices for Applying the Lean Startup Methodology at Established Companies

The application of the lean startup methodology at established firms has the community divided. Some experts argue that the lean startup methodology is best applied as a separate organization outside the bounds of the existing corporate structure, while others suggest that the entire organization is required to adopt the lean startup methodology for it to be truly successful.

**As a Separate Organization**
Eric Ries, in an interview with Jim Euchner, stated that he was surprised that the lean startup methodology was garnering a lot of attention at established companies (Ries & Euchner, 2013). The early incantations of the lean startup at established companies tended to operate within an ad-hoc waterfall development. As such, the company would evaluate resources for a product based on return on investment (ROI). This resulted in the classic innovator’s dilemma, where projects with good ROI would receive allocated resources, while those without would not.

In the Innovator’s Dilemma (Christensen, 1997), Clay Christenson states that innovation and resource allocation are linked. Only projects that get funding, staffing and management support will succeed, while those that do not will fail. To succeed, Christenson states that resource allocation must be tied to customers want and desire for a product. Low level managers select which projects to back based on the types of product and customers that are most profitable. Christenson cites the need to learn quickly through failure and iteration as keys to commercializing disruptive innovation. Additionally, Christenson states that “despite their endowments in technology, brand names, manufacturing prowess, management experience, distribution muscle, and just plain cash, successful companies populated by good managers have a genuinely hard time doing what does not fit their model for how to make money.” (Christensen, 1997)

Eric Ries (Ries & Euchner, 2013) notes that successful deployment of the lean startup methodology hinges on creation of innovation teams separate from the main entity at an established organization. The innovation team is given 1 percent of customers. Therefore, even if the team fails, only 1 percent of the company’s customers are affected. The team is given full autonomy within this sandbox and is responsible for handling all issues that arise with their customers. Eric suggests that if the internal startup is successful, the company can grow a new
division of the company around the startup, rather than integrating the startup into the existing
division. Additionally, Eric suggests reassigning a sales person full-time to sell the innovation
team’s offering, rather than incorporating the entity into the existing company.

The term Skunk Works\textsuperscript{9} was first used by Lockheed Martin’s Advanced Development
Program for a team of engineers that developed a jet fighter. The team worked independently,
isolated from the remainder of the company, and charged with developing innovation ("Skunk
Works," 2013). In modern times, skunk works is synonymous with innovative teams working
independently and autonomously within established organizations (Croll & Yoskovitz, 2013).

An article by Ron Ashkenas titled, \textit{Can a Big Company Innovate Like a Start-Up?},
describes companies such as Google who are trying to emulate startups within established
organizations. The author suggests that established firms not emulate start-ups; instead, he
suggests focusing on carving off skunk works teams with limited budgets and real rewards
(Ashkenas, 2011).

In Lean Analytics, Croll and Yoskovitz (2013) describe a set of rules for entrepreneurs
working within established companies (known as intrapreneurs) who are trying to make a change
from within the company. Highlights of their 14 rules include: having authority through senior
level sponsorship; use of a small, agile team of high performers; having the ability work outside
of existing corporate structure and supply chain, as required; and having day-to-day interaction
with real customers (Croll & Yoskovitz, 2013).

\textbf{Within an Established Organization}

In an interview by Lisa Regan, the authors of \textit{The Lean Entrepreneur}, Patrick Vlaskovits and
Brant Cooper, were asked questions regarding bringing the lean startup methodology to
established companies (Regan, 2013). The authors state that common reasons that established

\textsuperscript{9} Registered Trademark of Lockheed Martin
companies do not apply the lean startup are due to concerns with the necessary changes in culture, process, and organization required to implement the method. A second reason is lack of support from senior management. Results from the current survey most commonly cited that the lean startup methodology was too much of a change for their organization.

Vlaskovits and Cooper note that established companies typically do not implement the method in its entirety; rather, companies apply it only to new product endeavors. Additionally, established organizations apply the lean startup methodology only as an overlay to an existing product design methodology. The authors suggest that for established companies to be truly successful, lean startup methodologies should be applied to the entire organization for continuous innovation. For this to succeed, the authors suggest that organizational change has to come from the bottom, the employees, as well as from the C-level executives at the top (Regan, 2013).

Experienced lean startup practitioner, David Bland (2012), stated that established companies may want to decouple a product under development using the lean startup methodology from existing brands to help protect brand image. When capturing data, David recommends that a communication network be established to ensure that those measurement learnings are communicated back to the product owners. Finally, David suggests that companies start small, validate results with real users, either internal or external, and to pair product owners with analysts for maximal learning (Bland, 2012).

In an interview with David Bland, the author asked how the lean startup methodology should be deployed; as a separate organization, or within an existing corporate structure. David responded that for the method to truly be successful, it needs to permeate into the entire organization. If lean startup methodology is deployed under a separate organization, any product
developed will fail on handover, as members unfamiliar with the lean startup methodology become involved with the product (Bland, 2013b).

Taken together with the survey results, these findings suggest that established organizations should first deploy the lean startup methodology for a trial period using teams isolated from the existing corporate structure. This approach will help alleviate employee discontent from a process change, should the lean startup methodology not kept beyond the trial. Once the trial period completes, the author suggests that the organization should then deploy the methodology across the entire organization. Keys to success for deployment across the entire organization are through buy-in and support from key C-level executives, who evaluate teams not through the success or failure of products, but through the ability to learn quickly and adapt. The lean startup methodology is best applied to new product offerings, where uncertainty is high, as an overlay to an existing agile process. Teams should be kept small, consisting of diverse, cross-functional members. The lean startup methodology should be combined with business model innovation and continuous delivery. Finally, the most important key to success of deploying the lean startup methodology at established firms is working with real customers throughout the process.

4.4. LIMITATIONS

The results of this study highlight the fact that the lean startup methodology is still in its infancy at established firms. The base survey had 32 respondents out of 69 surveyed. Those surveyed were split among 44 companies in diverse industries. Sampling bias was introduced, as the majority of those surveyed had an affiliation to the Massachusetts Institute of Technology, as current students, alumni, or professional contacts. Furthermore, those contacted were located in one of two countries, the United States or Canada.
Within target companies, the number of individuals contacted ranged from 1 to 4 individuals. As such, it is entirely possible that the results expressed by those individuals contacted do not necessarily represent the results that would be achieved from a widespread survey deployment across said company. In fact, since the lean startup methodology has been shown to be piloted in small teams, it is possible that some companies were already using the lean startup methodology without the knowledge of the respondent selected. Secondly, those contacted volunteered to respond to the survey introducing volunteer bias; this is especially true for the extended group. It is also possible that select individuals who were contacted chose not to reply to the survey while their companies were piloting the lean startup methodology in secrecy.

The extended survey was issued openly to lean startup groups through social media. Those who chose to reply are current members of lean startup groups. As such, their opinions may be biased with respect to the lean startup as a methodology. Furthermore, the results of the survey are entirely anonymous with respect to the companies represented by the extended survey. It is unknown whether these respondents’ companies met the criteria outlined for selection in the base survey. Finally, the low response rate of the survey precludes any definitive conclusions and formal hypothesis testing.

4.5. DIRECTIONS FOR FUTURE RESEARCH
Repeat administration of this survey, or a similar survey, targeted at a much larger audience will be required to perform formal hypothesis testing on a more representative sample. In order to increase response rate, the author would suggest that backing and support be obtained from lean startup leaders. Beyond the initial survey, future studies should delve deeper into the workings of the lean startup methodology at established firms to investigate potential hybrid or customized applications of the method.
The ultimate outcome of future work would be a set of guidelines or best practices for adoption of the lean startup methodology at established firms. Going forward, the author would also suggest a yearly survey be issued to track awareness, adoption, success/failure, and best practices of the lean startup methodology, similar to the Forrester studies on agile adoption (West et al., 2010).
5. CONCLUSIONS

The lean startup methodology has found considerable success as a product development approach for startups. Recently, several established companies including General Electric, Intuit, and Qualcomm have found success implementing the methodology within their firms. The primary purpose of this thesis was to explore whether the lean startup methodology could provide positive benefits to established firms.

A survey was issued to two target groups, a base group representing 44 diverse companies across multiple industries, and an extended group including respondents from lean startup groups representing early adopters at established firms. Additionally, five phone interviews were held with respondents for further in-depth discussion. Results from this research demonstrated that the lean startup methodology is not well known to employees at established firms. Only early adopters were found to be using the methodology for product development within established firms. Some parallels were drawn between the adoption of agile methods in the mid-2000s and the forecasted adoption of the lean startup methodology.

Secondly, results suggested that adoption of one or more principles of the lean startup methodology are being used at established firms without full awareness of the methodology. Among those principles cited, iteration through the build-measure-learn cycle was shown to be most prevalent among respondents.

Thirdly, results from the survey and interviews confirmed that the lean startup methodology can provide benefits to established firms delivering complex products. Benefits most commonly cited were: lower costs; better understanding of the customer; early feedback; less rework later in development; and higher customer approval.
Finally, synthesis of the literature and viewpoints from industry practitioners suggest that the lean startup methodology is best applied to new product offerings, where uncertainty is high, as an overlay to an existing agile process. For success, teams using the method should be kept small and consist of diverse, cross-functional members. For an organization, the lean startup methodology would be best applied in two steps: first, as a trial using a team outside the existing corporate structure, then applied to the entire organization upon success of the trial. The lean startup methodology should be combined with business model innovation and continuous delivery for the highest likelihood of success.
6. REFERENCES

Ashkenas, R. (2011). Can a Big Company Innovate Like a Start-Up?
Degeryd, K., & Graffner, E. (2013). Barriers to Exploratory Innovation Projects Managing the exploitation bias in large established firms.


Regan, L. (2013). Key Questions for Bringing Lean Startup to Established Companies.


*TLC: Lean Startup Implementation Results.* (2013). leanstartupmachine.


7. APPENDIX A – SURVEY TEMPLATE

Lean Startup Methodology
* Required

1. Are you familiar with the Lean Startup Method? *
   Developed by Eric Ries, the lean startup method explains a new customer centric agile development approach for launching products at startups.
   *Mark only one oval.*
   
   ☐ Yes       Skip to question 2.
   ☐ No        Skip to question 13.

2. Has your company tried to develop a product or service using the Lean Startup Methodology? *
   *Mark only one oval.*
   
   ☐ Yes       Skip to question 3.
   ☐ No        Skip to question 4.

3. Were you successful using the Lean Startup Methodology? *
   *Mark only one oval.*
   
   ☐ Yes       Skip to question 5.
   ☐ No        Skip to question 7.
   ☐ Unknown at this time       Skip to question 8.

4. Reasons not to use the Lean Startup Methodology *
   (select all that apply)
   
   ☐ Lack of understanding
   ☐ Poor timing
   ☐ Market issues
   ☐ Insufficient access to customers
   ☐ Too much of a change for company
   ☐ Not suitable for industry
   ☐ Resistance from management
   ☐ Other:

   Skip to question 13.
5. How did you succeed? *  
*Check all that apply.*

- [ ] Achieved buy-in from employees
- [ ] Worked closely with customers
- [ ] Pivoted after early feedback
- [ ] Developed key new features
- [ ] Empowered employees
- [ ] Iterated rapidly through the Build-Measure-Learn cycle
- [ ] Other:

6. What was the benefit? *  
*Check all that apply.*

- [ ] Lower costs
- [ ] Better understanding of the customer
- [ ] Early feedback
- [ ] Better schedule performance
- [ ] Less rework later in development
- [ ] Higher customer approval
- [ ] Other:

*Skip to question 8.*
7. Reasons for failure *
(select all that apply)

☐ Failure to understand method
☐ Improper implementation
☐ Organizational restrictions
☐ Timing / Market issues
☐ Lack of access to customers
☐ Project scope too large
☐ Extent of change too significant
☐ Resistance from management
☐ Lack of buy-in from employees
☐ Other:

8. Project scope using the Lean Startup Methodology *
(choose dollar amount)
Mark only one oval.

☐ 0-10k
☐ 10-100k
☐ 100-250k
☐ 250-500k
☐ 500k-1M
☐ 1M-5M
☐ 5M+

9. Project duration *
Mark only one oval.

☐ 0-1 month
☐ 1-3 months
☐ 3-6 months
☐ 6-12 months
☐ > 12 months
10. Project innovation content *
How innovative was the product or service that the company was developing?
*Mark only one oval.*

1 2 3 4 5

Low Innovation  〇  〇  〇  〇  〇  Radical Innovation

11. Project uncertainty *
How much uncertainty was there with regards to the need for, or the use of, the product or service being developed?
*Mark only one oval.*

1 2 3 4 5

Low Uncertainty  〇  〇  〇  〇  〇  High Uncertainty

12. Do you plan to try the methodology again on future projects? *
*Mark only one oval.*

〇 Yes  Skip to question 18.
〇 No  Skip to question 18.

The following questions will test whether your company is currently using aspects of the lean startup methodology in product development.

13. Have you developed a minimum viable product to test product or business assumptions with real customers? *
A minimum viable product has just the necessary features to allow it to be deployed to gain relevant feedback, and no more.

〇 Yes
〇 No

14. Do you use actionable metrics to measure success or failure of a minimum viable product, feature, or business assumption? *
Actionable metrics tie specific and repeatable actions to observed results.
*Mark only one oval.*

〇 Yes
〇 No

15. Have you taken results of these actionable metrics and changed focus (pivoted), stayed the course (preserved), or abandoned the product or feature (perished)? *
Check all that apply.

☐ No
☐ Yes - Pivoted
☐ Yes - Perished
☐ Yes - Preserved

16. Have you repeated this process (Build - Test - Learn) to test subsequent iterations of your product, feature, or business assumptions? *  
Mark only one oval.

☐ Yes
☐ No

17. Have you scaled operations only after achieving a product-market fit through a series of minimum viable products? *  
Scaling means to ramp up staff, invest capital, and/or develop a fully functional product.  
Mark only one oval.

☐ Yes
☐ No

Skip to question 18.
18. Product development methods that your organization uses *
(select all that apply)

- Waterfall
- Agile
- Scrum
- Feature Driven Development
- Extreme Programming
- Lean
- Formal Methods
- Quality Rapid Product Development
- Spiral
- Other: ________________________________

19. Industry *
(select the closest matching industry)
*Mark only one oval.*

- Aerospace
- Automotive
- Consumer
- Defense
- Education
- Embedded
- Energy
- Enterprise
- Firmware
- Healthcare
- Industrial
- IT
- Manufacturing
- Social Media
- Software
- Space
- Technology
20. Company Size *
(number of employees - globally)
*Mark only one oval.*

- [ ] 0-999
- [ ] 1000-9999
- [ ] 10,000-99,999
- [ ] 100,000-199,999
- [ ] 200,000+

21. Company Age *
(age in years based on the founding date of the earliest division)
*Mark only one oval.*

- [ ] 1-19
- [ ] 20-39
- [ ] 40-59
- [ ] 60-79
- [ ] 80-99
- [ ] 100+

22. Would you be interested in being contacted for a follow-up phone interview *
*Mark only one oval.*

- [ ] Yes  
  Skip to question 23.
- [ ] No  
  Skip to "END OF SURVEY."

**Contact Info**

23. Name

______________________________

24. Email Address

______________________________

25. Phone Number

______________________________

**END OF SURVEY**

Thank you for taking the time to complete the survey. Your results will be kept confidential.
8. **APPENDIX B – PHONE INTERVIEW TEMPLATE**

**Name:**
**Company:**

**If they used the Lean Startup: (if not, skip to part 2)**
Describe the project; tangible product? or service?

Talk about strengths of the method;

Talk about weaknesses or problems with the method;

Was there an overall benefit? Describe the benefit.

How was it different then your previous product development method?

Does the company plan to continue using the lean startup methodology? Why or why not?

How much did industry competition and need for innovative products factor into using LSM?

**(Part 2)** **If they did not use the Lean Startup:**
Are you now familiar with the lean startup methodology? What are your thoughts…

What is your main product development method currently in use?

Describe any factors that would cause a switch methodologies?

Go through questions from survey:
Have you developed a minimum viable product to test product or business assumptions with real customers? If Yes - Describe the project and situation.

Do you use actionable metrics to measure success or failure of a minimum viable product, feature, or business assumption? If Yes - Describe

Have you taken results of these actionable metrics and changed focus (pivoted), stayed the course (preserved), or abandoned the product or feature (perished)? If Yes - Describe

Have you repeated this process (Build - Test - Learn) to test subsequent iterations of your product, feature, or business assumptions? If Yes - Describe

Have you scaled operations only after achieving a product-market fit through a series of minimum viable products? If Yes - Describe

**Can I use your name and / or company name in my thesis write-up?**
Yes / No
## 9. APPENDIX C – LIST OF COMPANIES IN BASE GROUP

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<thead>
<tr>
<th>Company Name</th>
<th>Category</th>
<th>Revenue (Millions)</th>
<th>Size (employees)</th>
<th>Age (yrs)</th>
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