Pushing the envelop on Lean Startup:
Comparative analysis of Dutch brick-and-mortar startups

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Abstract.
Although rooted in software development domain, 'Lean Startup' (LS) is gaining considerable traction in the startup scene and becoming one of the most popular Agile approaches in practice. The challenge, however, is our limited understanding of LS in non-web domain. In addition, the concept seems to be mainly driven by practitioners and empirical academic studies are remarkably limited. This study aims to empirically explore the application and applicability of LS in non-web, or Brick and Mortar (B&M) settings. By delving into several B&M startups, this paper studies commonalities and nuances between web-driven and non-web driven startups in applying LS.

Keywords: Lean Startup, Brick-and-Mortar, Case study

Introduction

It is evident that the relatively stable market place in the 20th century have been superseded by an unprecedented dynamic and uncertain business market of 21st century, marked by globalization, fast-moving technological advancements, increasingly demanding customers, and shortening Product Life Cycle (Earl & Wakeley, 2010; Neary, 2003). The impact of the industrial evolution on the startup scene is equally significant. For instance, the linear product development techniques with their inherent focus on process governance and risk reduction (or even avoidance) that were dominant in any project are largely substituted with agile principles and methods (Bhidé, 2003; Vespers, 1993). With its genesis in the field of Information Technology (IT), agile is a movement officially started in February 2001 (more information available at www.agilealliance.org). The agile methods generally represent iterative, short and incremental development cycles where business requirements and solutions evolve, enabling a rapid learning from − and flexible and often cost-effective response to − changing customer demand (Beck, et al., 2001; Ambe, 2010; Christopher & Towill, 2002).

One of the agile concepts that has gained worldwide popularity among startups is the 'Lean Startup' (LS) approach (Blank 2013; Ries 2011). LS is inspired by the well-known Lean philosophy that is brought to attention by Womack et al. (1990) based on their study on Toyota Production System (TPS). LS provides startups structure and guidance to their product development and launch efforts while maximizing efficient use of their available resources and effectively capturing the needs and desires of customers. To this end, various learning approaches and experimentation methods are proposed to ensure continuous validation expressed − and proactive exploration of tacit − customer needs. Ries (2015, p. 8) defines LS as "a set of practices for helping entrepreneurs increase their odds of building a successful startup."

Despite the growing number of LS practitioners, there are several critical questions around the concept, including biases inherent in the LS informal hypothesis testing and decision making (York & Danes, 2014), lack of qualitative methods for data collection and feedback evaluation around

customer (Müller & Thoring, 2012), mainly focused on market uncertainty while overlooking technology uncertainty (Harms et al., 2015), and 'too fast' rejection of good ideas based on customer 'incorrect' feedback (i.e. false negatives) (Ladd, 2016). The shortcoming that this study aims to tackle is, however, the effectiveness of LS in 'non-web' driven startups, i.e., brick-and-mortar (B&M) which is defined as "relating to or being a traditional business serving customers in a building as contrasted to an online business" in Merriam-Webster). Hitherto, the LS literature is largely based on 'pure-players' (i.e., fully web-based startups) or click-and-mortar (C&M) businesses where arguably the effort and budget needed for product development and launch, as well as, product re-evaluation and revision, are considerably lower than in the physical production settings (Nobel, 2011). Especially in the heavily regulated, risk-averse and flaw-intolerant sectors such as healthcare, pharmaceutical or aerospace, the applicability of LS is questioned (Nirwan & Dhewanto, 2015). This study aims to empirically explore the application and applicability of LS in the B&M settings, with a central question: "how LS is applied in the B&M startups?". To address this question 14 Dutch B&M startups that were knowledgeable about LS are selected and interviewed. The collected data helped to better understand whether and how 'traditional' LS practices are applied or adjusted to the B&M idiosyncrasies.

The remainder of this paper is structured as follows. First, the LS concept, that is, the method and the related practices, are concisely discussed. Next, the research method in general and in specific data sampling, collection and analysis are explained. The findings are provided in the fourth section where the nuanced differences between B&M and C&M in application of LS are detailed. The paper concludes with theoretical and practical lessons drawn from the analysis. At the end, besides the limitations of this study, several fruitful areas for future research are discussed.

What is Lean Startup?

The concept of LS seem to be build upon three core principles of Lean philosophy, that is, (i) voice-of-the-customer (VOC), i.e., interacting with customer in understanding their needs and validating assumptions around them, (ii) hypothesis-driven experimentation, i.e., collecting data through systematic experiments to address knowledge gaps, (iii) continuous improvement, through small-scale iterative adjustments to refine an idea toward a value-adding solution (Blank, 2013; Ries, 2011). In line with the Plan-Do-Check-Act (PDCA) improvement method, the kernel values of LS are embedded in a cyclic model called Build-Measure-Learn (BML) (Ries, 2011):

Build

The BML cycle is initiated with the 'building' stage where a first set of requirements of the product is detailed, the 'value hypotheses' are formulated and the first version of the product is crafted. The value hypothesis targets customers' perceived values once they are using it (Ries, 2011). After detailing the idea and formulating the value hypothesis, the product is being build following a limited set of requirements, resulting in a Minimum Viable Product (MVP). A MVP is that "version of a new product which allows a team to collect the maximum amount of validated learning about customers with the least effort" (Ries, 2009, p.1). MVP helps to keep the up-front investments for product experimentation and development at a minimum. Moreover, scaling too early leads to all kinds of waste when it turns out that customer is not interested in the product (Ries, 2011). MVP is in line with the high level Lean principles, including small batches (i.e., conducting fast, iterative experiments), waste elimination, data-driven and customer-oriented decision-making.

Measure

Once the first product is brought on the market, customer appeal and product performance can be measured. In doing so, innovation accounting is proposed in which entrepreneurial progress is monitored through standardized metrics, so the deliverables and milestones can be prioritized and planned (Ries, 2011). The measurements are visualized and compared to the forecasted goals and deviations present a new departure point for experimentation to refine the product. Innovation accounting is derived from Lean performance measurement, which is commonly used to indicate value and waste in the production process (Ramadan, 2015; Bhasin, 2008). Additionally, the Lean focus on visualization (e.g., product performance, churn rate, satisfaction level) and standardization (e.g., measures and metrics) appears to be critical in this stage.

Learn

In the learning stage the value hypotheses are validated, based on which the entrepreneur decides either to 'continue' the development of the product and improve the product through incremental changes (i.e. 'Kaizen' or continuous incremental innovation in Lean terms), or to 'pivot', that is to radically change the course of actions and pursue a complete different set of objectives with the product (i.e., 'Kaikaku' or fundamental and radical changes to a production system). From the Lean perspective, Andon is another approach that (visually) urges the entrepreneurs to stop the development process whenever deviations and anomalies emerge to learn about it and solve it as early as possible (Womack & Jones, 2003). To maintain the process flow, inspired by Lean, the concept of Kanban is proposed by Ries (2011) as well. Kanban helps to keep the process manageable by limiting the number of hypotheses, tests and deliverables in the pipeline. There is also an emphasis on on-site learning or 'Genchi Gembutsu' (i.e., "go and see for yourself). Entrepreneurs are encouraged to 'leave the building' and expose themselves to the reality of customer's problems to boost the learning experience (Ries, 2011). Moreover, Lean philosophy underlines the importance of collective learning, and accordingly, problem-solving and decision-making by multidisciplinary teams is repeatedly brought forward by Ries (2011).

Although the Lean principles have proven to be useful in a broad variety of contexts (Elbert, 2016), the settings where the LS practices (such as MVP, quick iterative experiments, pivoting) have been applied are generally web-based. The examples used in the Ries' seminal book in 2011, and virtually all the succeeding empirical studies on LS are predominantly focused on online solutions and web-based services, and accordingly, adopted by software development scholars and startups (Bosch et al., 2013; Harms et al., 2015; May, 2012; Miski, 2014). There are a few exceptions, such as the application of LS in GE (Power, 2014) or healthcare (Silva et al., 2013), however, the commonalities and differences between B&M and C&M is not the foci of interest in either of these studies.

Research method

To address the aforementioned gap, the application and applicability of LS in B&M, a qualitative explorative case study is deemed to be most appropriate. Case study helps to gain a detailed account of the context in which a phenomenon is happening, including the underlying social arrangement, behavioral dynamics, explicit and implicit rules, intensions and needs (Eisenhardt, 1989; Miles & Huberman, 1994). In doing so, a long list of B&M startups was created, which were directly or indirectly part of the authors' extensive personal network. The advantage was that the authors would have a higher likelihood of gaining access to these startups, but evidently at a price of selection bias (Geddes, 1990). To overcome such bias, once the C&M's were filtered out of the initial long list, the most 'diverse' remaining startups in terms of industries were selected (Seawright & Gerring, 2008). Upon invitation, 14 substantially heterogeneous set of startups accepted to take part in this study (Table 1).

Table 1. Startups participated in this study

Startup	Roles	Size (FTEs)	Domain	Product/Service	Location	Years
(A)	Founder/CEO	4	Textile	Label design	Amsterdam	3
(B)	Founder/CEO	18	Construction	Ecological roofing	Amsterdam	6
(C)	Co-Founder/ CEO	3	Consumer electronics	Navigation	Amsterdam	3
(D)	Founder/CEO	10	Food	Food platform festivals	Amsterdam	5
(E)	Founder/CEO	4	Consumer electronics	Headphones	Amsterdam	3
(F)	Founder/CEO	10	Food	Veggi pizza	Amsterdam	2
(G)	Co-founder/ CEO	4	Hardware vendor	Monitoring solutions	Amsterdam	2
(H)	Co-Founder	2	Retail	German wines	Amsterdam	2
(I)	Co-Founder	4	Leisure	Cardboard tents	Amsterdam	3
(J)	Co-Founder	2	Retail	Beer	Den Haag	3
(K)	Co-Founder	10	Construction	Modular homes	Utrecht	21
(L)	Co-Founder	2	Food	Chocolate sprinkles	Amsterdam	4
(M)	Co-Founder	3	Textile	Luxury raincoats	Amsterdam	3
(N)	Co-Founder	5	Brewery	Craft beer	Amsterdam	3

The data collection is based on semi-structured interviews (Saunders, 2011). During the interviews, the interviewees were requested to share other additional information sources such as product brochure, business plan, and financial statements. The interviews were structured according to the LS framework presented in previous section. As such, the interviewee questions were mainly focusing on the interviewees knowledge and experience in building, measuring and learning, and what methods and approaches are used in each phase (e.g., questions such as "how is ideation stimulated and facilitated?", "how are ideas prototyped?" "how is knowledge captured and reused?"). The interviews resulted in 17 hours of interview recordings and over 200 pages of transcripts.

The analysis of the data is based on coding guidelines by Miles & Huberman (1994) First open coding is applied to identify a set of recurring set of codes (Bluhm & al., 2011; Straus & Corbin, 2008). In this stage, a broad view of the problem at hand can be developed; the delineation of a figurative 'playground'. Next, in line with axial coding (Miles & Huberman, 1994), the identified codes are compared, contrasted and clustered into higher-level themes (or constructs), which imply how the problem at hand is structured; the lineation of the figurative playground. The entire process of analysis is carried out on Atlas.ti (version 6.2.28), which is a computer program that facilitates a systematic coding process on large bodies of textual, graphical, audio and video data.

Findings

In the ideation stage, the startups appear to be in line with LS thoughts when it comes to value hypotheses; i.e., they initiate their product development process with clear questions as what values should be delivered to targeted customer group and how? Interest in customers involves openness:*"We are very open towards our customers and we always ask our customers for feedback. Is there room for improvement in our service. What would our customers prefer differently. A good example was the Efteling (a Dutch amusement park) where we did a large festival. We had a rather poor performance there and we instantly wanted to know exactly what the real reason behind our poor performance was. We extensively evaluated that project to find the real cause of the problems and to make sure we will prevent it going forward" (Food platform festivals).* And proactive curiosity towards customers' wishes:*"At various events, we get in touch with our customers to find their true opinions about the cardboard tent. It allowed us to pinpoint problems in the design and improve them. At consequent events, we ask users again to see if we actually have improved our products." (Cardboard tents).*

However, some startups seem to reflect on the hypotheses based on their personal needs, problems, or their interpretations of trends around them, and not customers tacit needs per se as suggested in LS literature. It even goes beyond problem identification (based on which a solution can be developed); there seem a higher-level purpose at stake: *"and then ecological roofing as a topic appeared on my desk while I was still working at... (an engineering company) and I thought wow, this is interesting!....The other two founders –one doing research into ecological roofing at university and one that owned a company building rooftops, discussed the idea with me and we initiated the company.... I have not become an entrepreneur to make clients happy per se but more because I believe in this company's mission. Of course, I do need customers in order to achieve this mission so ultimately I need to convince them as well, but it was not my departure point" (Ecological roofings).* Or personal frustration: *"For work my co-founder needed to ride his bike in Amsterdam wearing a suit to get from one appointment to the other. He wore a Range raincoat, but still got wet pants and asked me to come up with a fashionable idea to stay dry without using rainpants ....I did some research into existing raincoats and other available solutions for on a bike and we came up with one design that would keep you dry while biking and fashionable at the same time!" (Luxury raincoats).* Also, personal competence can be the driving force: *"I worked in a distillery company where we used a lot of botanicals in order to flavor gins and other spirits. And then I thought why not use those botanicals to brew beers and that is how I came up with the idea" (Craft beer).*

Although building that follows ideation is part of the same activity, B&M startups seem to be working significantly longer on their first prototype compared to the software engineers 'alpha version': *"It takes about a year for us to release a new version, that is how fast as it gets. We try to process all iterations at once. I believe this is a large difference between the Lean Startup method and*

us. LSU is lot more difficult when you have a product. It is easier to use short iteration cycles for software or for your website." (Headphones). The reason seems to be mainly related to operations and production: *"We need to batch our iterations because we need to achieve some volume, otherwise the [extra] production cost would be too high" (Headphones).* In addition, the length of the iteration cycles seems variable; some cycles are long and others are short: *"…I placed this cardboard tent in my garden for a month or two…And the tent was still dry on the inside after two months" (Cardboard tents).* In general, the startups try to maximize the economies of scale; for instance some use standard components that are low-cost and produced in bulk. For them, too iterative development (this implies small batches) is not desired since it exponentially increases the average cost per unit produced. In order to facilitate learning, some startups tend to experiment with various materials (as a compensation for lack of small scale experiments): *"… using punch knives which is a more flexible production technique helps to maintain the experimentation cost and have iterations. It would have allowed us to learn and develop a mature product much quicker" (Cardboard tents).*

That being said, prototyping is a crucial part of product development in the interviewed startups, even in the food industry where prototyping is less expected: *"We develop prototypes and always with clear target settings. For example, the beer needs to be 4% alcohol. It needs to be 32 EBU in terms of bitterness, 20 EBU in terms of color and 12° plato, or X amount of CO_2 gas content. We then compare what we put into the brewing process and the value that comes out. If the values do not match the targets, we think about the adjustments that need to be done. When we do get the targeted values, we then ask consumers on festivals for instance, what they think of our output" (Craft beer).* Or *"…innovating a product was the difficult part for me. I started to 'design' pizzas in my own kitchen. After that I asked lot of people to taste the pizza to see whether I had nailed the targeted requirements"(Veggi pizza).* However, in physical goods MVP seem not to be as effective as in digital context. According to some B&M entrepreneurs, consumers need to see the (almost) finished product before being able to assess its value: *"we made a 3D image of the first version of the tent and we send this to festivals. Most of them did not respond and the ones that did question whether we thought of all the requirements. This route was unsuccessful for us….we then went back to our manufacturer and produced the minimum order quantity with them, tested and went back to the festivals with the actual product and we sold all of them" (Cardboard tents).* Moreover, the step from MVP to a large scale production is experienced as too risky in B&M context; often the large production requires a totally different design that can not be captured by MVP: *"Sometimes MVP is great, but sometimes you just really need to think things through before you develop your product because you are stuck with choices you made once the product is in production phase…Small scale production would have been a solution but it's not always possible with minimum order quantity imposed by suppliers. You need to think about this carefully since again, everything you do wrong now, we will pay for it in the future" (Clothing labels).*

Conform LS school of thought, measurement is an undeniable part of product development in B&M context, often based on customers feedback: *"we did lot of trial and error in order to identify our segment as sharply as possible. We knew that our customer group is largely musicians, but that appeared to be only 25%. So 75% of profiles were kind of unknown! In order to understand our customers better we pursued A/B tests in the hope it will help us narrow down profile specifications. To scale we need to understand this better. (Headphones).* However, customer feedback is not the only source. The B&M entrepreneurs seem to use a broader range of sources to assess customers needs, e.g., experts valuation: *"We have not tested the taste of our sprinkles with our target customer group. Instead we have asked a Michelin star chef to taste our sprinkles and measure the amounts of our ingredients." (Chocolate Sprinkles)*, or insights from supply chain partners: *"We are doing big data tests with Albert Hein [a large Dutch supermarket]. They are testing which stores are doing well and which don't. We follow up on those insights by looking into why we don't perform in certain stores. Usually social media exposure is low in these areas as well and we try to see how we can change this" (Veggi pizza).* The measurement itself does not seem to be quantitative per se; in fact, qualitative methods are more often used as the sample sizes are often limited: *"We selected a top 20 from all clients that reward us with a "10"-score – and are not from our inner circle – and invited them to join a focus group. We recently asked them what kind of reward for their referral they would*

prefer. They indicated that they would like yellow buttons on their headphones. We retrieve these type of ideas mainly from these focus groups." (Headphones). Sometimes the startup is well-known in the local community and lucky to receive customer feedback voluntarily from the community: *"In a small shop like ours, unsolicited feedback is easily available. Most people living in the neighborhood feel very much involved and advise us. This worked nicely for us" (German wines).*

The most notable difference between the web and non-web startups seem to be their access to complete sets of customer data: *"LS puts an emphasis on quantitative testing while for us this gathering of sufficient data in order to perform such a test was extremely difficult. Perhaps heavily funded startups can manage to have about 100k visitors a month in the beginning. Only then is A/B testing an option but how the hell do we get that much traffic in order to validate our product? This costs a lot of marketing money. A friendly startup building an electric scooter managed to do this but they spend something like 13k on online ads; quite expensive" (Headphones).* Moreover, the processes around products, e.g., usage and value creation, do not lead to data generation: *"I always found innovation accounting difficult because of the amount of data this requires. We do a low number of sales transactions but with a high individual value. For us, innovation accounting can only be done at very high transaction costs. I believe that Ries puts such a strong emphasis on the quantitative side of things because he comes from the software industry. Ries sells zeroes and ones, and these are way easier and cheaper to keep track of." (Modular homes).* Data that B&M entrepreneurs are dealing with are also incomplete. For instance, data produced by prospects that drop out of the sales funnel is barely available and this limits the startups options to improve their proposition based on the data: *"...during the summer we go to festivals mainly because we normally don't get much data about customers. This way we have a chance to reach out to people that are not buying our product and ask them why" (Headphones).*

And finally, the learning stage where insights are translated to actions, seem to be equally important for B&M startups, but similar to web-based businesses, learning should be focused on 'prioritized' knowledge gaps: *"we got responses from our customers indicating that the text on our bottle was not clear enough. They thought it was chocolate milk so we adjusted the line on the bottle into 'chocolate for breakfast'. We never tested this again to see if customers better understand it now, we just went with it. You cannot test everything over and over again, you just do not have the time" (Chocolate Sprinkles).* Particularly, formulating (key) performance indicators or targets makes the learning process much easier: *"we have agreed on clear success criteria with our customers. If our quantitative tests do not meet the criteria, we need to look at why we did not meet them. The process is very straightforward" (Monitoring solution).* What differs in the B&M context is biased or heavily subjective data that is collected with qualitative methods. To address the problem some startups seem to seek help from outside the company: *"we hired somebody to look at the problem. Just to looking the list of issues and a list of ways to solve them. A fresh pair of eyes helps us to better understand our customers 'true' needs" (Cardboard tents).* Startups also seem to collect various types of (qualitative) data to compensate for limited data: *"We selected a top 20 from all clients that reward us with a "10"-score – and are not from our inner circle – and invited them to join a focus group… through surveys we study customer preference regarding wireless…For one of our products that is online for pre-sale right now, we A/B-tested the product using photoshopped images.." (Headphone).*

Conclusion
The data shows several confirmatory and disconfirmatory results. While, the former implies a broader generalizability of LS, the latter adds nuances to the LS approach in the B&W settings. It appears that all the LS high-level principles (i.e., idea-building, product-measuring, and data-learning) are generic in nature, and accordingly actually used in B&M settings as well. However, the B&M startups seem to have contextualized the LS principles with subtle adjustments in how these principles are prioritized and implemented. In sum startups appear not to be always entirely customer-focused; there seem to be a strong passion and appreciation for craftsmanship and aesthetics that (consequently) encourage them to be more reliant on vision and intuition (possibly a more artistic mentality rather than entrepreneurial); (b) prototyping (e.g., MVP) is mainly used internally and not for customers since their understanding of product can mainly be gauged with fully working products; also, MVP

lacks in providing specific requirements needed for even a preliminary production (i.e., technical feasibility), which might lead to high production costs that startups generally cannot afford, (c) data collection is taken seriously but generally performed in a qualitative way (this is in line with the criticism by Müller and Thoring (2012) who advocate an extension of LS with more qualitative methods), (d) given the qualitative data – subjective of nature with limited (often skewed) samples - often experts need to be consulted to interpret the customers' behavior; (e) there are often suppliers involved who can be approached for various types of data; (f) production is predominantly paced by manufacturers, and therefore, startups plan and prioritize 'a set of' new features for their new releases, to both meet the suppliers production planning and minimal batch order, and enjoy the benefits of economies of scale.

Overall, the findings of this study helps to better understand whether and how the conventional web-oriented LS principles and practices are adjusted to the B&M idiosyncrasies. Theoretically speaking, this study provides empirical evidence around LS generalizability (Edison et al., 2018; Furr & Dyer, 2014; Power, 2014). That being said, this study has several inherent limitations. First, a larger pool of startups, preferably based in various geographical areas, would have improved the study's external validity. Accordingly, it is attempted to select a diverse set of startups for the purpose of this research. Second noteworthy limitation is startups general vulnerable (market) position that might cause the respondents to provide socially desirable answers, which deteriorate the study's internal validity. To address this shortcoming, the respondents are requested to review the transcripts to prevent any possible incorrect or misinterpreted data. In addition, the data is anonymized. Future research can help in both fronts, i.e., more data from a larger number of startups from various domains; triangulation of method (e.g., qualitative-quantitative multi-method approach) would minimize possible biased data; also, more in-depth analysis of LS application by startups (e.g., action research) would lead to more fine-grained understanding of how LS principles are adjusted and used.

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