

30th CIRP Design 2020 (CIRP Design 2020)

Migration of the Lean-Startup approach from High-Tech startups towards product design in large manufacturing companies

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Abstract

Global competition, rapid market changes and the need for more and faster innovations lead to a new risk situation for manufacturing companies. As dynamics increase due to the Digital Transformation, the reliability of success forecasts decreases and many of the product design innovations launched on the market fail. Manufacturing companies, which design products down to the last detail and then develop them over a long period of time and with high investments are highly likely to find that their product will not be accepted on the market. To reduce this risk, agile processes and iterative product design is useful. This approach is based on multiple, iterative tests with customers and the possibility of implementing the knowledge gained. It is important to constantly check, whether the products meet the demand of the market and to design the product in such a variable way, that changes can be taken up immediately and learning effects can be implemented. The Lean-Startup approach is based on these principles. It has been established as a way of thinking for startups and young High-Tech companies who want to optimize their initial market approach through iterative testing of prototypes and continuous improvement through learning. However, the Lean-Startup approach is also suitable for larger companies, which want to make their product development more agile and flexible. This enables companies to react more flexibly to external influences, such as market competition, technologies and politics and to integrate customer needs more effectively into the product design process. This constant monitoring of the product market fit reduces the risk of developing past the market. This paper introduces an approach for migrating the Lean-Startup approach to large manufacturing companies.

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Peer-review under responsibility of the scientific committee of the CIRP Design Conference 2020

Keywords: Lean-Startup; Innovation; Manufacturing companies; Startup; Customers

1. Challenges in product innovation

Many product innovations launched on the market fail due to misjudged customer needs and market developments. This increases the risk of being overtaken by the market. Globalization and Digital Transformation are increasingly leading to this existentially threatening risk situation for companies. In the past, customers bought locally available products from limited supply, and technologies and trends changed much more slowly. Today, they have worldwide and transparent access to innovative products, and dynamic and global trends and market shifts are occurring. This is forcing companies to innovate more and faster, with traditional innovation management methods such as trend analysis and focus groups becoming more unreliable and slower due to increasing dynamics [1].

For most large manufacturing companies, product development consists of linear, non-variable processes and predefined structures [1]. At the beginning of the development process, customer needs are determined through intensive market studies and research and then a product is developed on the basis of these findings. The individual steps are carried out consistently, so that at the end there is a product that is in line with the market and adapted to customer needs. Due to the often strongly hierarchically organized companies and long information chains, the product development process in many large manufacturing companies takes up a lot of time [2].

This linear, non-modifiable type of product development has worked for a long time, but is no longer suitable due to the influencing factors mentioned above, such as global competition and shorter product life cycles, since customer needs are subject to dynamic change and market conditions are not taken into account. For this reason, it is becoming increasingly common for large manufacturing companies to find that, despite market research at the beginning of the process, the customer does not want and need the new product and the market does not need the product. [3]

2. Approach and Research Methodology: Overview

2.1 Approach overview

First of all, the concept of a startup must be stated. For this purpose, three common definitions are combined:

Blank, 2013	"A startup is a [temporary] company looking for a scalable business model" [4].
Andreesen, 2019	A startup must have a "product market suitability", i.e. "to be in a good market with a product that can satisfy this market". Market suitability is also always associated with a foundation and concrete establishment on the market [5].
Achlneiter, 2018	Startups are "young, not yet established companies, which are set up to realise an innovative business idea [...]" [6].

Based on those three definitions, the authors understand a startup as:

A young, newly founded company looking for a repeatable and scalable business model for its innovative marketable product or service.

Another fundamental concept of this work is "innovation". It should be noted that so far there is "no closed, generally valid innovation approach or generally accepted definition" [7]. The authors therefore refer to the common definition of the Business Encyclopaedia:

General:	"Term [...] for the (complex) innovations associated with technical, social and economic change. [...]"
Characteristics:	(1) novelty or (re-)innovation of an object or a social action, at least for the system under consideration and (2) change through innovation in and by the enterprise, i.e. innovation must be discovered/invented, introduced, used and applied" [7].

The "Lean-Startup approach" [1] is described in chapter 3.2, there is no uniform definition yet. Fundamental features of the Lean-Startup approach are early and recurring customer feedback as well as constant iterations. By these the search for an innovative business model, as well as the market fitness of a product, is to be accomplished faster and more flexible. Manufacturing companies must become more dynamic in order to withstand Globalisation and Digital Transformation. To achieve this, product development must become more agile, flexible and faster so that learning effects can be absorbed and changes implemented immediately.

The Lean-Startup approach is based on these principles and has established itself among other things in High-Tech startups and has already led to success in many places. Active customer feedback guarantees a high acceptance of the product. This should also create space for active employee commitment through new structures and support and realize ideas that do not fit into daily work [8]. This method is presented in the following paper and can be used as a solution for the problems mentioned in chapter 1.

2.2 Hypothesis and methodology overview

The authors of this paper hold the theory that a product development method known from High-Tech startups as the Lean-Startup approach, can be applied to large manufacturing companies. Manufacturing companies should be able to use the Lean-Startup approach and to react flexibly to market situations through this adaptation, as well as to innovate their production process, which can lead to a faster production process.

In order to find out how the Lean-Startup approach can help manufacturing companies become more agile, flexible and faster, and for the sake of gaining the best possible insight of the topic the authors defined a methodology of investigation in four main phases:

- **Phase I:** Preliminary study aiming at definition of the research goal and determination of the research method, furthermore a secondary research regarding state of the art of the research topic and identification of challenges, chances and possible benefits of using the described methods.
- **Phase II:** Expert interviews to examine in detail the procedure for introducing the Lean-Startup approach in their company. Transfer of the research results of the preliminary study and the findings from the expert interviews to the needs and circumstances of SMEs. Conception of a method for customization of the Lean-Startup approach to SMEs.
- **Phase III:** Pilot-implementation of the concept with a selected medium-sized company and evaluation.
- **Phase IV:** Final works: Validation, refinement and final conclusion. Publication.

3. Preliminary study: Phase I

3.1. Study overview

In order to verify the authors' thesis, the **Phase I** of the study contained in this paper is divided into three parts: First, the motivation of a manufacturing company is examined to integrate a method of startups, called the Lean-Startup approach, into their company.

The second part examines three large companies that have already adopted the Lean-Startup approach.

In the third part the Lean-Startup approach will be evaluated in the context of its application to large manufacturing companies and its prospects of success and challenges. This is supported by a survey of companies that have expressed their views on the Lean-Startup approach.

3.2 The Lean-Startup approach

The urgency of change demanded by Globalization and Digital Transformation forces many larger companies, which have an entrenched production chain, to integrate new and flexible ways of innovation into their business models. Startups open these paths and use own methods to ensure the required flexibility and innovation.

According to Blank (2013), traditional practices of developing new products do not fit into a startup because traditional companies adopt a linear path between idea and production, [4] while the product development process in startups can rather be described as "spiral-shaped", with new input from the customer being collected at the nodes.

With the understanding that startups have a different working style than traditional companies, the methods used by startups should differ from those used by traditional companies. Startups apply hypothesis-based learning to understand customers' needs and ensure that their product or solution meets a real need. Thus, for a startup early customer-focused testing is essential, in order to start developing a prototype as early as possible, while keeping the necessary flexibility. Through constant feedback from customers, product characteristics can be refined and the production process optimized [9]. During the process it is possible to identify a number of questions

that a company can use to examine and evaluate the results of this cycle of customer involvement:

- „Have we recognized a problem that the customer wants solved?
- Does our product solve or satisfy this problem or need of the customer?
- If so, do we have a viable and profitable business model?
- Have we learned enough to go out and sell something?“ [10]

High-Tech startups can gain various advantages through this customer-oriented testing: research literature (including Cooper & Vlaskovits, 2013) states that early learning from customers helps startups to move in the right direction. On the other hand, rapid iterations and changes in business direction are assumed to be common and thus part of the natural development process. Thus, the readiness for flexibility and change is given at all times; at the right moment processes can be changed and concepts discarded and replaced by others [11].

This corresponds with the current state of research. Many authors, such as Ries, Cooper, Vlaskovits, Kansikas, Blank or Andreessen, endorse prompt customer feedback [4, 5, 8, 11, 12, 13].

According to Blank, the Lean-Startup approach increases the value of the work and provides the tools which help to increase competitiveness and profitability. He carries on, that companies which stick to the Lean-Startup approach are very fast and flexible due to the joint development of products and services with their customers [4].

Cooper & Vlaskovits state, that in order to grow successfully, companies must focus on their customers, regardless of the size of the company or the industry in which they operate [11]. They also indicate that the principles of the Lean-Startup approach are not new, and that similar elements such as “user experience (UX) design or discovery-driven planning can be found in design thinking” [8, 11].

Some authors recognize overlaps with the research area of intrapreneurship [8, 14]. Kansikas (2007) points out that in the service sector the majority of companies prefer some form of intrapreneurship in their companies. Customers and employers hope that products and services will continue to evolve and that employees will be able to solve customers' problems in innovative ways [12].

Ries (2011) states that the Lean-Startup approach applies to companies of all sizes and every entrepreneur can use it. “That means entrepreneurs are everywhere and the Lean-Startup approach can work in any size company, even a very large enterprise, in any sector or industry” [13].

In a survey by Innovation Leader of 165 executives working in research, development, strategy and new product development in large manufacturing companies to analyze the challenges and benefits of the Lean-Startup approach in companies [15]. Figure 1 shows a number of challenges companies have seen in implementing the Lean-Startup approach.

The executives see the biggest challenge in showing customers products before they were finally developed [15]. This shows that established companies with a large number of customers have greater concerns about introducing their product (too) early than startups without an established customer base.



Figure 1: The challenges large companies face adopting a Lean-Startup approach [15]

However, the participants in the survey also identify many potential benefits.

The two most frequently mentioned benefits are, that decisions are being made based on evidence and data, “rather than internal biases and opinions” [15] and increased speed of development.



Figure 2: The benefits large companies say can be gained from a Lean-Startup-Approach [15]

3.3 Best practice examples from large companies

Some large companies have recognized the opportunities of the Lean-Startup approach. They use similar methods to make their product development more flexible and customer-oriented.

3.3.1 Daimler AG

A successful example of the implementation of the Lean-Startup approach is Daimler AG, headquartered in Germany. By cooperating with the startups in its own accelerator "Startup-Autobahn", Daimler recognized the innovation potential of agile and flexible processes and decided to scrutinize its own processes and structures.

To achieve this, the corporate incubator “Lab 1886” was established in 2007, and supports the enterprise with innovative products and business models which are developed outside the corporate structure in an unconventional way. "Lab 1886" intelligently combines the know-how and power of the Group with the speed and culture of startups" [16]. In recent years, innovative ideas have developed into viable business areas through agile processes, as the example of Car2Go shows [16].

After the idea was developed in the "Lab 1886" at the end of 2007, a first pilot project of the car sharing provider was started in Ulm (GER) at the beginning of 2009. The feedback was used for improvements and Car2Go started in Austin (USA) in 2010. Gradually more cities were added and Car2Go currently offers 15,000 vehicles to 3.6 million users in 25 cities worldwide for flexible use [17].

3.3.2 Alibaba

The successful Chinese Technology and Internet Group Alibaba is another example of the successful application of the Lean-Startup approach. The company first started in the E-Commerce sector and offered a platform for international trade. Alibaba continued to develop and adapt to changing market conditions. With the rise in private consumption in China, the Taobao online retail shopping platform came into life. Alibaba then founded the Alipay online payment system and Aliwangwang instant messaging service. Starting in 2008, Alibaba continued to adapt to current customer needs and offered infrastructure services such as cloud computing. By continuously monitoring customer needs and market conditions, Alibaba has added many other businesses, making it one of the largest and most valuable companies in the world today [9, 18].

3.3.3 General Electric

The US company General Electric has responded to current developments with its "FastWorks" program in order to become more innovative and faster. FastWorks is based on the Lean-Startup approach and involves customers right from the very beginning of the product design process. As soon as the first prototype for a new product is created, it is presented to customers. The development team uses the feedback and adapts the product to the customers' needs. This helps General Electric to directly identify and optimize unwanted features, colors and designs [19]. The first attempt at the concept was carried out with a new refrigerator model. After just one month, the first prototype was presented to the customers. Due to the frequent replacement, the sixth version of the refrigerator could be presented after one year, which has held its ground very well on the market. Instead of new designs every five years, General Electric now plans iteration cycles of one year involving the customer [19, 20].

4. Preliminary study results

4.1 Identified challenges

Even though the Lean-Startup approach seems to be very successful there are numerous obstacles and challenges on the way to establishing the Lean-Startup approach in the production process of a company. The flexible basic structure and spontaneous working methods of startups contrast with the conventional production chain. In traditional companies there are clearly formulated goals that should be precisely implemented and achieved [14]. There is little room for creative and flexible reformulation of these goals. If a goal cannot be achieved, the financial means are withdrawn from this production arm - a restructuring or reformulation of the product is normally not considered [8]. With the help of the Lean-Startup approach, a different approach can be taken in such situations by iterating and flexibly reformulating the goals. The results of the customer surveys not only provide information about the success of a planned product, but also show alternative ways that can deviate strongly from the pre-formulated goal. Another challenge is, that communication within large companies is generally slower than within startups, as more people are involved in any given project. Furthermore it has emerged that companies find it difficult to present their products to customers before they are fully developed.

These challenges show that the establishment of the Lean-Startup approach takes time as employees must be given the opportunity to learn and reflect. This means that adopting the method can also be seen as a kind of long-term investment – an investment in employees, departments and the entire production process. Nevertheless, possible setbacks must be taken into account.

4.2 Identified chances and expected benefits

In High-Tech startups, the Lean-Startup approach is already established and has led to many successes. Although it is more difficult for large manufacturing companies to use this innovative and agile method, as established structures and processes need to be changed or even broken up, it also brings chances and must therefore not be ignored. With the agile Lean-Startup approach, companies can quickly adapt to the ever faster changing market conditions and customer needs and thus reduce the probability of the failure of a long prepared innovation. The data obtained through customer feedback is a sound basis for bringing about desired improvements. Decisions are being made based on evidence and data, which increases the accuracy of product development.

In addition, it is recognized early on whether or not a product is accepted by the customer, the development process can be discontinued in good time, which in turn increases efficiency.

Data-based decisions increase the accuracy of product development and the speed of development can be explained through a leaner product development process. But instead of detailed market, competition and customer analyses, which can stretch over a long period of time, companies can use the Lean-Startup approach to regularly determine current customer needs and thus save time.

With the help of the Lean-Startup approach, innovation activities can be designed to save time and resources [1].

It turns out that many aspects of the Lean-Startup approach have a strong appeal in large companies where lengthy coordination and approval processes often slow down innovation [15].

5. Conclusions and next steps

Due to global challenges, such as Digital Transformation, large manufacturing companies are being urged to become more dynamic and flexible. In the Preliminary Study, specialist literature was used to demonstrate that the Lean-Startup approach, which is being successfully used by startups, can also be successfully applied to larger manufacturing companies. To support this assumption, three global companies, which have already integrated the Lean-Startup approach into their existing production processes, were examined and potential challenges and opportunities were identified.

All three companies achieved great success with this approach, which confirms the initial hypothesis that the Lean-Startup approach can also be successfully applied to larger companies.

The next step will be the application of the Lean-Startup approach to SMEs. Therefore, the authors will adapt the research results of the preliminary study to the needs and circumstances of SMEs and conceptualize and customize the Lean-Startup approach to SMEs. To achieve this, the next step is to conduct interviews with experts who have already applied the Lean Startup Approach in an established company.

After the theoretical customization a pilot-implementation of the concept with a selected medium-sized company is planned. An evaluation of the outcome shall deliver the answers for the questions:

- Is the Lean-Startup-approach relevant for the process of increasing innovation potential and simultaneously cutting the duration of the innovation process?
- To which extent can it be considered?

In the last phase a validation, refinement and final conclusion as well as a publication are planned.

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