

An analysis of the *Bluetooth Terminal* development pivots from Lean Startup perspective: Experience and Lessons Learnt

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ABSTRACT

This paper presents an analysis, as a case study, of the development of the “*Bluetooth terminal*” application, a tool to monitor Bluetooth devices. The objective is to get further insight on how to use pivots to get a product closer to its users, and on how to introduce creativity during a new product early stage development. Another issue analyzed is how pivots can be determined based on the user’s feedback, introducing the of the Build Measure Loop, and how assumptions or new ideas can be evaluated following the path created by the Build Measure Loop and the Minimal Valuable Product.

CCS CONCEPTS

•**Software and its engineering** → *Software design techniques*;

KEYWORDS

Pivot, Lean Startup, Agile, Minimal Valuable Product, Build Measure Learning, Creativity

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1 INTRODUCTION

New product development is, and has been for years, an area on which a heavy research activity has been focused. Software Startups, known also as digital startups, [5] develop new software intensive products, innovative, and within a limited time frame and with limited resources. Methods such as Lean Startup [8], implied the introduction of new paradigms. Lean Startup is based on concepts such as Minimum Viable product (MVP) and pivoting. MVP can be defined as a “version of a new product which allows a team to collect the maximum amount of validated learning about customers with the least effort”; pivoting is “structured course correction designed to test a new fundamental hypothesis about the product, strategy, and engine of growth.”[8]. Duc and Abrahamsson interpret MVP, in

[4], as a design artifact, a boundary spanning artifact and a reusable artifact. Being considered as a design artifact, MVP can be used as a facilitator of creativity [4]. This interpretation helps us to relate MVP, a result from pivoting, with those features introduced or changed, that can be considered as an indicator of new ideas that are transformed into products by pivoting[8, 9].

For a startup, it can be difficult choosing how to pivot, or to find a systematic way to pivot, because pivots may have a great impact on the product and, subsequently, on the company success [15]. A pivot can be created for different reasons such as: to help the product fit into the market [15], or to satisfy customer’s needs, or to find a new source of revenue model for the company [14]. In fact, pivots reflect the need for change to sustain the business model [14] and can imply a change in the direction of the product [15].

Startups have to face different challenges[3]; in fact, failures are common. It is important to consider that a failure is a complex phenomenon that can have a serious and detrimental impact on numerous aspects of an entrepreneur’s life [2]. Reference [2] describes six spheres in which failure is significant: financial, emotional, physiological, social, professional and entrepreneurial.

Internet of Things (IoT) is a concept that is often used these days designate systems with a huge number of components connected, though loosely coupled, via the Internet. From an innovation point of view, the Internet of Things means many new opportunities of producing highly disruptive innovations. At the same time, many efforts are wasted as the performance of the new products is lower than the expected. Therefore, to get a better understanding of (1) those factors that increase performance, and (2) when creativity plays a significant role, is important. This paper analyzes one product in the context of the IoT, the “*Bluetooth terminal*” [7], to find out how features that can be related to creativity resulted in a higher number of downloads (better product performance). “*Bluetooth terminal*” is an application that was developed in 2013, that serves to monitor Bluetooth devices, and that has been updated five times later. “*Bluetooth terminal*” is a small application, with few features, and this means that it is easy to associate a good or bad performance to specific features. The “*Bluetooth terminal*” was developed as a real product, what it is at the present moment. The analysis is performed as a retrospective case study [13].

In the section 2 we will make a short introduction to MVP and the BML loop; in Section 3 the drivers for pivots in early stage startups are outlined, in Section 4 the “*Bluetooth terminal*” development case study is analyzed. Finally, some conclusions are presented in section 5.

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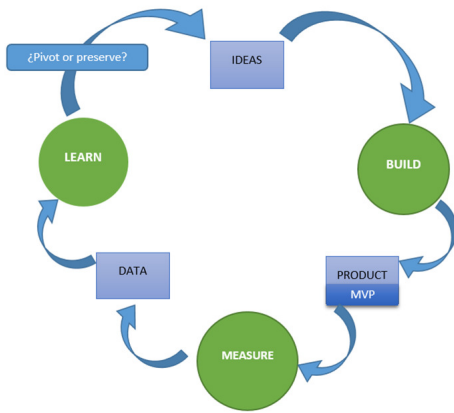


Figure 1: BML loop feedback for MVP, adaptation from [8]

2 INTRODUCTION TO MVP AND THE BML FEEDBACK LOOP

Validating thoughts and ideas that should become products is a difficult task in most of the cases[2]. According to this fact, it is really useful to have a methodology to measure and evaluate how well products based on ideas, hypothesis or assumptions perform. In this section we will introduce the BML loop and the MVP concept, and, how both can help us in this objective.

The Build Measure Learn (BML) feedback loop [8] helps address questions such as, *should this product be built or could we build a sustainable business around this product?* The proposed approach in [8] is to build a first product, measure and assess the adequacy of what has been built, and learn from that evaluation and the errors made. After learning, the direction can be changed. This would introduce the concept of pivoting [8].

The Minimum Viable product (MVP) is the simplest and fastest way to get through the Build-Measure-Learn feedback loop with the minimum amount of effort[8]. For example, the first version of a product can be used to start a learning cycle in order to validate a hypothesis about a product, feature or service[15]. The BML (Build measure learn) feedback loop help us to measure how customers respond, and then learn whether to pivot or preserve [8]. In the Figure 1 a BML feedback loop adaptation is shown.

With MVP and BML you can keep iteratively developing, experimenting, and validating hypotheses [14]. A feedback is generated from the interaction between costumers and product [14]. This feedback can be estimated by measuring indicators. For example, how the number of users increase or decrease[15] can be measured. In fact, measurement is considered the most important part of the BML loop[15].

It is really convenient to enter in the BML circle as soon as possible in the process with the MVP[8]. It is inadequate to build a prototype that is evaluated solely for internal quality by engineers and designers. To get in front of potential customers to gauge their reactions[8] is also needed. For any software startup it is really essential to get feedback from customers to adjust the product to the user needs. For a startup the information obtained from the

BML loop could be more important than getting economic revenues in the sort term.

3 PIVOTS

A pivot, already discussed before in the previous sections, can be considered as a new feature that we wish to add to our product, an improvement over a particular feature of the product, a complete product, or a small change in architecture based on a consumer need, or simply to adapt it to the market. Once we have gathered the necessary information from the introduction of our MVP in the BML loop, we can clearly know if we need to pivot. In the case that we see that we need to pivot it will be important to identify which type of pivot we need to perform. Even if you decide to preserve, it can be understood that there is a pivot in which the feature that we decided to preserve will be improved.

A pivot arises when a change is necessary, and usually in a kind of experiment used to adapt the product to the market or meet user’s needs. Any experiment should be as fast and cost-efficient as possible, to be able to change direction quickly if market or technology demands [15]. A pivot can arise whenever we need to face a challenge during the development of a Startup. Table 1 shows the most common pivots [1], which will be used to analyze our study case below. Whereas product related pivots could be clear and easy to understand from an engineering perspective, market related pivots could not. That is, enlarging the customer segment by including users of any of two languages can be technically easy: e.g. including two languages can be automatically supported by a platform, for instance; however it can an important move from a business organizational perspective: questions to support/help staff will get in two languages, and staff speaking any of the two languages (or the two of them) will be required, as well as accounting support for the two different communities will be needed after.

4 DESCRIPTION OF THE BLUETOOTH TERMINAL AS MVP

4.1 Our MVP from the creative perspective

Creativity has been recognized as important in requirements engineering [6]. It can include any discovery, invention, method, devices or even programming environments that enable teams to

Table 1: Pivots in software Startups [1]

Pivots	Kind of pivot
Product Related pivots	Zoom-in pivot
	Technology pivot
	Platform pivot
	Zoom-Out Pivot
Market Related pivots	Customer need pivot
	Customer segment pivot
	Channel pivot
	Zoom-In pivot
Other types of pivots	Complete pivot
	Side project pivot

accelerate development of their own software projects [10]. During the past half-century, computing professionals have developed powerful productivity support tools that reduced manufacturing costs [10]. Creativity supportive tools have been focused on specific tasks such as science discovery, design exploration, engineering innovation, and imagination in the arts [10].

4.2 The “Bluetooth terminal”

“*Bluetooth terminal*” is an application that was first developed in 2013. It emulates a Bluetooth terminal, that can be connected to any device or Bluetooth–serial adapter, allowing bi–directional communication between the smartphone and the Bluetooth device. The leading idea for “*Bluetooth terminal*” was born when the developer was working in a prototype that made use of Bluetooth technology, and realized that he had no tool to easily monitor messages with this communication protocol. Thus, the creation of the “*Bluetooth terminal*” application, provided developers, researchers or any other user, with a tool that allowed them to use this type of wireless technology without needing to know the details behind the Bluetooth protocol and therefore allowing to focus more on the application they were developing than on the implementation details, reducing the application development time. It is compatible with Android 2.3 and higher, supporting most of the existing Android devices in the market. The application is completely free and free of publicity; it is available as “*Bluetooth terminal*” in the Google Play Store [7]. Five updates have been released since the first product release. It has currently more than 90,000 downloads worldwide. Acknowledging the current number of downloads and positive reviews [7], it can be concluded the favorable welcome and the diffusion of the tool in the community developers and users.

4.3 Description of the MVP

The development of the “*Bluetooth terminal*” has been analyzed as a retrospective case study [13]. The experience obtained can help improve the understanding about how MVP can be used as an instrument to pivot in the good direction. The “*Bluetooth terminal*” was always devised as a MVP through all its development stages.



Figure 2: Bluetooth Terminal icon [7]

One of the most important design criterion applied during the development of the “*Bluetooth terminal*” was to create a very simple graphical interface, in which users could interact easily. Figure 3 shows the “*Bluetooth terminal*” interface; as it can be observed, it only contains the basic elements required for the application to work properly. Simplicity in the graphical interface was appreciated as a developer, and as a future user of the “*Bluetooth terminal*”.

The application was developed as *fast as possible*. Actually the development time for the first release was only two weeks, and performed by just one programmer.

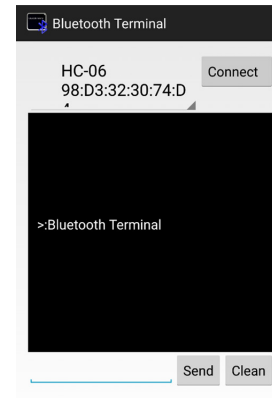


Figure 3: Bluetooth Terminal user’s interface [7]

4.4 Pivots in the case study

Pivots test our creativity when we are making decisions about the direction to take, or how to deliver solutions, so that these solutions can be, the result of the adaptation to a changing market, a new business model or to emerging user’s needs. There are, therefore, important reasons why it is really essential to identify the required pivots, to meet expectations, in time, and adequately.

This section details the pivots that the “*Bluetooth terminal*” required, based on the feedback from users, and the response to this feedback.

During the time that the application has been available, it has suffered two pivots: The first one in version 4, and the second one in the version 5. In the Table 2 we can see the different releases of the application, the pivots applied and how these resulted in the total number of downloads.

As mentioned before in this section, identifying pivots is an essential part to know the direction or the changes to make. For the two pivots made to the application “*Bluetooth terminal*”, Table 3 displays the two pivots according to the classification presented in [1]

With respect to *pivot 1*, in version 4 the graphic interface of the application had 2 buttons, one for connection and another for disconnection; in addition, the application communicated with the Bluetooth devices when the smart phone went to sleep mode. Downloads and error reports [7] reflected that users did not like this characteristic. For this reason, for version 5 the developer decided to replace the two buttons (for connection and disconnection) by a single one that allowed connection and disconnection at the same time. Moreover, auto disconnection feature was added when the smartphone went to sleep mode. This changes turned out a considerable increase in the number of the application downloads, allowing the user to connect more easily to the different Bluetooth devices and also saving energy when it was not used.

Concerning *pivot 2*, before version 5, the application only supported the Spanish language; this meant a market limitation to exclusively Spanish speakers. Additionally, the developer received several comments requesting the support for a new language [7]. Since English is considered as an universal language, for version

Table 2: Releases until November 6th, 2013

Release	Date Released	Pivot	Downloads	Details
1	2/08/2013	No	0	Minor bugs fixed
2	2/08/2013	No	20	Minor bugs fixed
3	3/08/2013	No	7	Minor bugs fixed
4	3/08/2013	Yes	2	Improve connection mode
5	4/08/2013	Yes	527	English support required
6	20/09/2013		1000	

Table 3: Pivots in “Bluetooth terminal”

Pivot	Description
1	Technology pivot
2	Customer Segment pivot Technology pivot

6 it was decided to update the application including support for Spanish and English languages (Default language was English). It turned out that the market and the number of users that could be reached was enlarged. The *Customer Segment pivot* [1] involved a *Technology pivot* [1]; more specifically an *Architectural pivot*, because the architecture of the previous version did not allow the support of multiple languages. In fact, the architecture of this version had to be totally modified. It can be seen that the number of users downloading the application increased by two.

Version number 6 was the last stable version published; it has currently obtained more than 90,000 downloads worldwide[7]. In Figure 4 the total number of downloads per version until November 15th, 2016 are displayed.

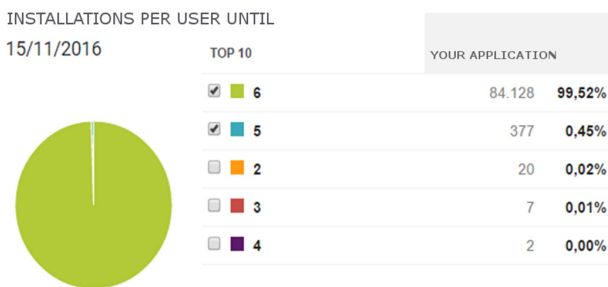


Figure 4: Number of installations per release [7]

4.5 From BML loop feedback

The feedback from our study case is based on the number of downloads, ratings and reviews that the *app* has received from users. This information has been provided directly from the “Developer Console” provided by the *Play Store* for all the Android developers. Until November 30th, 2016 earned an average rating of 4 out of 5, with 400 scores and 89 reviews[7]. The analyzed reviews, the updates and therefore the derived pivots are shown in the Table 4.

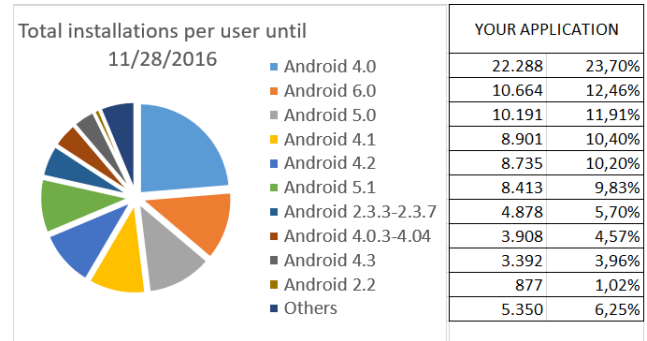


Figure 5: Percent downloads per Android version [7]

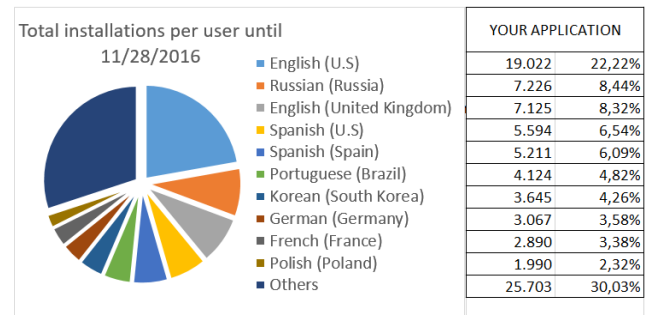


Figure 6: Percentage of downloads per language [7]

Table 4: Pivots required in the application “Bluetooth terminal”

Pivots	Description
Customer need pivot	Update User Interface
Customer segment pivot	Add support for more languages
Technology and Platform Pivot	Update Android platform Increase compatibility
Zoom-out pivot	Increase functionality
Zoom-in pivot	Keep a simple UI

Table 4 shows those new features identified as required for the application. Additionally, applying the BML loop, it can be inferred some features that users liked, such as the simplicity of the graphical

interface and the simple way to connect to Bluetooth devices. These are characteristics that should be preserved, as most the users liked. It should be considered that the decision to update the application so that it runs on top of the most recent Android version, or to enhance the functionalities requires to sacrifice the simplicity of the user interface implementing a more complex interface that satisfies the new user's needs.

One of the current limitations of the application is that it only supports serial communication services. Therefore, it is necessary to make it compatible with other services listed in the Bluetooth standards [11], as well as to support new BLE (Bluetooth Low Energy) technologies, included in versions 4.0, 4.1, 4.2 and 5.5 of the Bluetooth standards [12].

5 CONCLUSIONS

Pivots in any startup, are visible; deciding the way to take will become one of the hardest steps to get product success. Any pivot during early stages can imply some kind of loss. It should be readily assumed that, in fact, it is recommendable, first of all, to evaluate and experimenting with our ideas, supported by MVP. Feedback allows us to know not only errors but also the things that we are doing well.

In the case of the "*Bluetooth terminal*", through user's ratings we could determine which features should be added, deleted or improved. Very often, it is easy to make incorrect assumptions about the user needs, or what the users likes. Therefore, evaluating a product with real users becomes essential, and gives us a guide to the direction to follow. In many of the cases it will even influence the way we can adapt our creativity to fill all user needs. It is important to keep close to customer's needs and feelings, so that customers can provide relevant information to improve the product performance, minimizing the chance of a failure and increasing the chances of success. The MVP concept and BML model, are tools that in used in conjunction can be applied to understand how to pivot, and how we can adapt our ideas to fit into the market.

Based on what was studied, and taking the experience on how the BML loop was applied to MVP, it is planned to perform a new application update in order to evaluate how the number of downloads of the application behaves. There will be characteristics of the application that will be sacrificed in favor of increasing others that are necessary. According to that, it will be important to analyze more in depth how the pivots and new features will affect the number of total downloads and what kind of new challenges we must faced. In will be investigated if a basic, more formal, model that allows to determine how to pivot can be systematically defined, and so that the product performance will increase during the development.

The "*Bluetooth terminal*" application is completely free and always remained free of publicity to maintain a clean interface. The application has not been updated since 2013, but, currently, an update is being developed where a business model based on donations is planned to have a highly competing and up to date application.

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