Growth Engine Strategy Analysis Based on Lean Startup Approach: Case of a Brazilian Startup

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Abstract

Elaborate models that explicit the patterns of how startups execute their growth can assist entrepreneurs in this important part of their life cycle. Ries (2011), in a very popular book, suggests that in order for the startups' growth to be coherent, their entrepreneurs should prioritize specific metrics based on three distinct growth categories or growth engines: paid, viral and *"sticky"*. This work's objective is to analyze the structure e behavior of these three growth engines suggested by the author, through a study case of an information technology Brazilian startup specialized in retailer B2B market that received financial support. Thus, literature analysis and semi structured interviews with the startup CEO were conducted in order to establish the stocks and flows model simulation for each growth engine. As a result, it was possible to identify gaps in the concept of each engine through the comparison of literature, simulations and CEO perception. The intended contribution of this work is to help give more reliability to dynamics conceptual definitions, develop entrepreneurs mental model and incorporate the dynamics systems methodology in an environment which lacks dynamic analysis and models: technology-based startups in Brazil.

1. Introduction

The strategy definition process of new ventures takes a much higher level of uncertainty and risk in comparison to mature business (Côrtes *et al.*, 2005). In inexistent or early developing markets, for example, the "market rules" are not yet established, making strategic decisions harder (Carter *et al.*, 1994; Prahalad and Hamel, 1990).

In this sense, it is very important to understanding this process, especially about growth strategies. In order to keep operating in a satisfactory way for a long term in an uncertain environment, it is necessary for the growing company to create mechanisms that attract new customers and/or make their current customers come back constantly to buy the service or product offered by the company.

The literature research about entrepreneurship considers business growth as a primary indicator of success and a necessary step for organizational profitability. New researches about growth of in-development companies considers that is necessary to build a more consistent theoretical and practical knowledge basis (Wright and Stigliani, 2013). However, the factors favoring and impeding growth in new ventures are still no consensus in the literature about entrepreneurship and strategy (Garnsey, Stam, and Heffernan, 2006), being fundamental case study researches for understanding these factors.

New businesses based on technology have been showing to be important for the development of economies in emerging and developed countries mainly by their contribution to job creation (Hitt *et al.*, 2001). Compared to non-technology companies, the technological ones are created operating in more dynamic, uncertain and complex environments. In addition, they are engaged in more activities of planning, establishment of legitimacy and combination of resources (Liao and Welsch, 2008).

As a technology new venture, a startup can be defined as *"a human institution designed to create a new product or service under conditions of extreme uncertainty"* (Ries, 2011). According to Blank (2005), startup is a temporary organization used in the search of scalable and reproducible business models.

Unlike consolidated companies, startups face challenges related to limited resources (Kähling, 2011), whether technological, human and financial. In addition, they are immersed in uncertain environments (Blank, 2005), thus entrepreneurs have difficulties in identifying consequences of their decisions throughout the early life cycle of these new companies, by limited market information or inadequate experience to the new context (Alvarez, Barney, and Anderson, 2013).

Given the above, because of this constant uncertainty in the competitive environment, coupled with the difficulty of capturing, processing and making decisions based on reliable information on the suitability of the product that is under development by startup to meet a market demand, there is the need of organizational policies consistent with this scenario for the new companies not only "survive", but also grow sustainably over time.

According to Ries (2011)[1], startups utilize mechanisms to acquire new customers through *growth engines*: each engine presents specific metrics to monitor the company's sustainable growth range. According to the author, there are three different growth engines: a) Sticky

[1] In this very popular book on entrepreneurship, Lean Startup, the author proposes an approach to startups through rapid cycles of product development with experiments directed by hypotheses, iterative product releases and validated learning. More information on: http://en.wikipedia.org/wiki/Lean_startup

engine, in which the organization will focus on customer retention; b) Viral engine, which aims to spread the product knowledge and use it in an epidemic and automatic way; and c) Paid engine, where the company focuses on investing in advertising and sales. According to the author, each of these growth engines generate growth through specific feedback loop.

The low perception of the relevant system limits for the company, the dynamic relation between the strategic resources of the company, as well as the feedbacks and systems' behavior, makes the entrepreneur take linear, repetitive and limited decisions, damaging the company growth (Bianchi, 2002). In this context, the adoption of simplified mechanisms for decision-making, while useful in some cases, can lead the decision maker to ignore important elements in the structure of this dynamic complexity phenomenon, as feedback links, multiple interconnections, delays and other elements (Sterman, 2000). The system dynamics is widely used to understand growth (Forrester, 1968), but there are no systems dynamics models covering many aspects that guide the growth in startups (Huang and Kunc, 2012).

In this sense, this article aims to analyze the three growth engines suggested by (Ries, 2011) through the simulation models provided by System Dynamics in a case study of an Brazilian IT startup specialized in the retail B2B market, which recently received a financial contribution investment.

The value proposition of this startup is to monitor in real time through wireless cameras the flow of people entering the stores of their customers and provide the manager with demographic profile of these people intelligently, enabling him to plan and measure marketing strategies according to the qualitative and quantitative data provided. The startup began its activities in 2013 and is currently undergoing an acceleration process to increase its operational and technological capacity and expand its activities in Brazil.

2. Growth

The firm's growth is a major research topic related to the entrepreneurship field (Bianchi and Winch, 2009; Levie and Lichtenstein, 2008; McKelvie and Wiklund, 2010) and "why and how" startups grow one of the least understood issues in this field (Heirman and Clarysse, 2005). This difficulty in establishing a pattern or a solid theoretical construct of the mechanisms and variables that influence and determine growth in startups may be related to the wide range of business types that these organizations undertake operating in different economic and social contexts where each business requires certain features and intrinsic capabilities.

According to Bianchi and Winch (2009), the literature about growing small business focuses on many aspects of this phenomenon, including practical advice, typically describing growth strategies, tips to maintain growth and identifying the challenges of it. This lack of focus to this research topic while allowing a comprehensive analysis - but often not very thorough - of the various aspects involved in the development of startup, also

promotes a "no cohesion" crossing data from different studies, as they have different literature bases, methodology and approach to analyze the results.

Likewise, find an optimal growth measurement indicator is another of the difficulties of research in theoretical field, because several different types of growth measurement has been used in the literature, including, sales, profits, number of employees and Market-Share; resulting in different conclusions in the area (McKelvie, Wiklund, 2010; Heirman; Clarysse, 2005).

In this context, the growth theories formulated so far are inadequate and suggests that the theory should be replaced by empirical work, while recognizing that growth rates between companies are discrepant (Coad, 2007).

In general, two types of studies has dominated the literature about this topic: studies of factors associated with growth and case studies on growth stages (Garnsey *et al.*, 2006). McKelvie and Wiklund (2010) state that the diversity in the literature on the subject identify three different ways of growing businesses: organic, acquisition, mixed, and so can be related to the market strategy of the company. Organic growth is what happens "internally" due to the natural growth of their activities and revenues. In this case, the larger an organization, the harder it is to keep the corporate growth initiatives without ceding responsibility for it to the operating units (Favaro, Meer, and Sharma, 2012).

Growth by acquisition is when the firm adopts strategy of acquiring other companies in the market and thus increases its assets. There is evidence that the difference between these two types of growth depends on firm size: smaller companies grow organically; and large companies grow primarily acquiring other (McKelvie and Wiklund, 2010). In this process, many of those who choose to grow organically loose the capability (Favaro *et al.*, 2012).

The hybrid growth is an alternative way between the organic growth and acquisition growth or a combination of both, consisting of contractual relationships that link players outside the firm, but that it still has some control over how assets are used, as in franchising model, licensing and strategic alliances/joint ventures, for example.

It is important highlight that many startups growth strategy are not successful. Bianchi (2002) argues that the main cause of crisis in small businesses are aggressive business strategies, such as lower prices and terms of delivery to promising products sold, that can lead to big profits in the short term but cause a financial crisis in long term. This strategy referred to as *"Get Big Fast (GBF)"* causes a number of negative feedbacks that reduce the quality of the product and degrades the competitiveness of the firm, because once the firm develops a poor quality service reputation, the same positive feedback that allowed the growth of the firm at the beginning become a vicious cycle involving all stakeholders with the consequent bankruptcy of the organization (Oliva, Sterman, and Giese, 2003).

Such understanding that an aggressive marketing strategy can not only undermine the growth, but eventually lead to the collapse of startup, is of vital practical importance for

entrepreneurs, once that in the beginning of the startup operations the entrepreneurs may opt for this type of strategy to achieve the fast capture of new customers and try to leverage the startup in an erroneous and often irreversible way.

Forrester (1968) states that the manager, through policies that drive organizational decision making, creates a systemic structure of feedback loop that determines the growth of the organization. Following this line of reasoning, Bianchi (2002) confirms that a qualitative and dimensional growth depends on how the entrepreneur is able to discern the relationship between current decisions and long-term goals, with the understanding of the system in which it operates being so important as acquiring external capital or technical and conceptual skills.

This point of view is quite revealing regarding to growth from a short to long-term perspective, but at the same time imposes a practical implementation challenge to the entrepreneurs, since most of the entrepreneurs often make operating decisions - non strategic - and are not aware of the systemic effects of these decisions on a larger time frame.

In this context, two ways of startups *"abnormal"* growth can be identified: dwarfism, where the firms remain in a state of no growth, often because growth is not the primary goal of the entrepreneurs; and gigantism, where the startup has a high initial growth driven by external sources of capital, but enters in a collapse after a while. Such phenomena occur by lack of understanding of the strategic resources system (Kunc and Morecroft, 2008), delays and inertia effects coming from external factors (Bianchi and Winch, 2006; Bianchi and Winch, 2009).

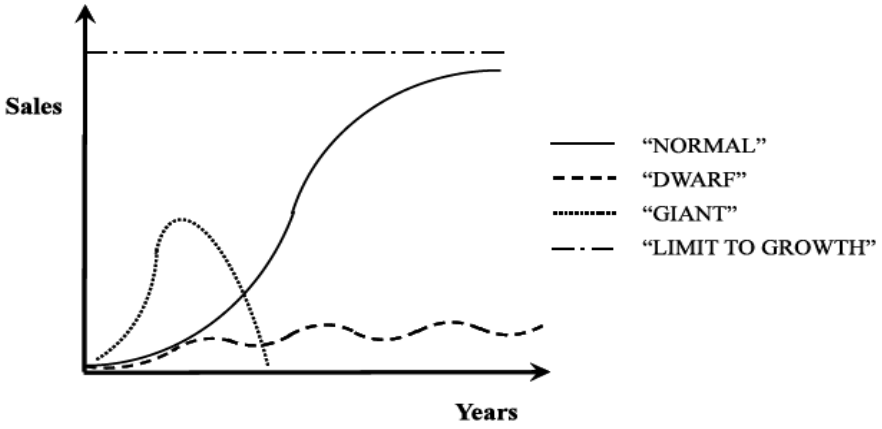

Figure 1 - Trajectories of normal and abnormal growth (Bianchi and Winch, 2009)

Figure 1 also shows a pattern to be pursued by startup: the "normal" growth ("S" curve). In this case, occurs a initial growth caused by early adopters of products or services; followed by further growth and finally the achievement of business maturity, when the company reached some limit to growth.

Another research bias that can not be omitted is that many small business entrepreneurs do not have the intention to achieve growth, and as some of the reasons for this "no growth" is to remain independent of other stakeholders and the lack of capacity of the company to keep growing (Delmar and Shane, 2003; McKelvie and Wiklund, 2010).

Given the above, there are many difficulties and challenges faced by researchers studying the growth in start-ups, because it is a recent field of study in scientific research and there are a variety and complexity of factors that influence this phenomenon.

3. Startups Growth Engine

For entrepreneurs, is vital to the continuing operations of the startup in the market to know the best way to make decisions that impact directly on attracting and retaining new customers and define an appropriate metric to their business to monitor whether the company is growing gradually and steadily.

Ries (2011, p.201) defines growth engine as *"the mechanism that startups use to achieve sustainable growth."* For the author, growth must be "sustainable" by executing activities that really determine a solid and viable long-term growth at the expense of actions that can have positive effects of short-term, but that do not generate long-term value. This sustainable growth results from new customers attracted by the actions of past customers.

Growth engines may also be understood as feedback loops that are moved by these sources of sustainable growth and each engine has particular metrics to monitor if the startup is growing in a sustainable way. The definition of which growth engine the entrepreneur should take to manage his startup must be done carefully because it is from the growth engine that are defined the marketing operational policies (attraction and retention) and how these policies will be financed.

3.1.Paid Growth Engine

In this engine, growth is the result of startup investments in attracting new customers through initiatives such as paid advertising or external sales force. This investment should result from the customer revenue during the relationship with the company, that when deducted variable costs, is referred to as "Lifetime Value" - LTV of the customer.

On the other hand, each client has a cost to be attracted, and this value is called "cost per acquisition" - CPA. The difference between LVT and CPA will determine the growth rate of the engine. If the former is larger than the latter, the growth will be positive. For a company to increase the growth rate is necessary to increase revenue per customer or reduce cost per customer (Ries, 2011).

In this manner, the entrepreneur must define an investment policy that considers the sales channel, the customer profile and the level of competition that impacts the acquisition costs.

3.2.Stick Growth Engine

In this growth engine, entrepreneurs should seek the loyalty of its customers, finding a better way to retain them, ensuring that they return to buy the product. The startups that use this engine should monitor the turnover rate of customers on an ongoing basis. Ries (2011, p.204) defines the turnover rate as *"customer fraction of any period that do not remain committed to the company's product."*

In this way, if the new customer acquisition rate is higher than the rate of customers who give up buying the product, the startup will grow. The growth velocity occurs at what Ries (2011) calls the composition rate, which is the natural growth rate less the turnover rate.

3.3.Viral Growth Engine

The viral growth engine aims to disseminate knowledge about the product in an epidemic and automatically way, by the simple use of the product by customers. Unlike word of mouth marketing, in the viral model, customers do not have the intention to release the product as its disclosure is intrinsic to use.

The viral motor feedback loop is called "viral loop" and its speed is determined by the "viral coefficient", measuring the amount of new users who will use the product from each new registered user. So the startups that use this type of growth engine should focus on increasing this viral coefficient above all, because even small changes in the coefficient cause large changes in the amount of attraction of potential customers (Ries, 2011).

Ries (2011) also states that more than one growth engine can work in a company at a time, but successful startups specialize in only one growth engine at a time, focusing on their specific metrics and actions necessary to make them work.

The three growth engines are a viable way to know if the startup reached the "fit product / market", defined as the time when the startup is in an environment in which there are several potential customers who want to purchase the product from the source company. In this perspective, growth engines are therefore a practical and viable alternative to develop operational policies and establish appropriate monitoring metrics for the sustainable growth of startups, considering their business models and product features.

4. Methodology

This work can be characterized as a descriptive exploratory research, subtype study case (Yin, 2003). To carry out this study, it was initially performed an content analysis of the three growth engines in the literature (Ries, 2011), so that the logic of each engine could be converted into a model of flow and stocks (initial model).

Then two interviews approximately 150 minutes were performed with the entrepreneur responsible for the startup marketing to understand the business model, present the growth

engines and so the intended logic for each engine in his view. The initial model was extended to incorporate startup specific features.

There were then included quantitative data, based on the perception of the entrepreneur, and then it was made the analysis simulation of each engine, the way it was originally designed, according to it settings. Finally, adjustments for each model to generate scenarios that growth prevailed and analyzes of the limitations of the growth engines were conducted.

For data modeling was adopted "Vensin PLE" software, suitable for the construction of models involving the interrelationship of resources and feedback system. The qualitative analysis - interpretation of results – was based on the structure and behavior generated by the models, confronting theory and results given by the models. Gaps were then identified between the definitions of the growth engines, its simulated model and the perception of the entrepreneur on these engines in the startup.

System Dynamics already allows the use of a rich process to capture the knowledge of the organization's functioning through feedback models and structure of internal policies. Researches on System Dynamics have made numerous contributions to various sub-areas of administration, including the organizational strategy field (Gary *et al.*, 2008).

A simulation model is based on explicit policies that guide decision-making in accordance with the conditions that may emerge within the system to be modeled, and the decision-making being defined as the process of transforming information into action (Forrester, 1992). From the foregoing, a systems dynamic perspective has a powerful logic that offers substantial improvements in dealing with issues of strategic management (Warren, 2005).

Forrester (1991) endorses that the use of computer simulation methods can reveal the implicit behavior present in the systemic structure built based on knowledge of how individuals make decisions and how they are connected, and allows to observe the consequences of organizational policies. Based on this, the simulation validates the assumptions that decision makers have and test alternative policies to achieve the expected business results (Sterman, 2000).

5. Discussion

Through the simulation scenarios built, it was possible to identify the startup's growth impact upon the prospects of viral, retention and paid growth engines in a simulated future scenario during 60 months.

5.1.Paid Growth Engine Analysis

According to the entrepreneur, the startup plans to invest in advertising to acquire new customers and growth will take place through two different ways: hiring a Public Relations firm, focused on inserting materials in traditional media and identification of potential customers interested in the product; and through inbound marketing, content marketing involving tools in internet, such as blogs and search mechanisms.

Figure 2 shows the structure of this growth engine and following texts from Ries (2012) are described with model elements identification. The auxiliaries: *stores per customer* and *unit price* (necessary to define revenue) were embedded into the model for the specificity of the startup.

"Each **CUSTOMER [level CUST]** pays a certain amount of money over his or her "lifetime" as a customer **[CUST inflow: new customers] [LTV inflow: revenue]**. Once variable costs are deducted **[LTV outflow: variable costs]**, this usually is called the customer lifetime value **[LTV level]**. This revenue can be invested in growth by buying advertising[2]. **[sales team investment variable]** ... this ad has a cost per acquisition **[CPA variable]**... The margin between the LTV **[lifetime value per customer LTV variable]** and the CPA determines how fast the paid engine of growth will turn **[marginal profit variable]**... Most sources of customer acquisition are subject to competition **[rivalry auxiliary]**... Over time, any source of customer acquisition will tend to have its CPA bid up by this competition. **[IMPACT RIVALRY ON CPA level] [IMPACT RIVALRY ON CPA inflow: increasing impact]**"

The following figure 2 shows the structure of this growth engine.

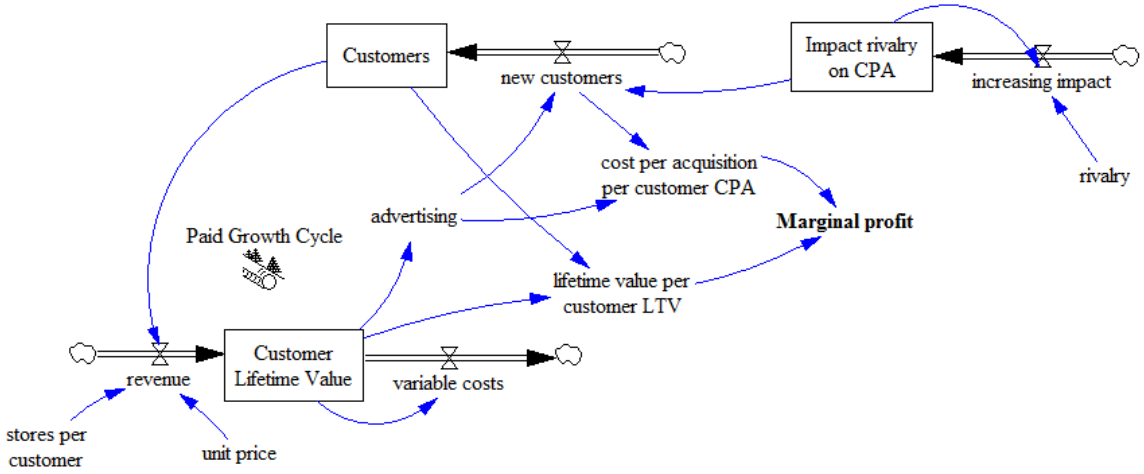

Figure 2: Paid Growth Engine Model

Based on the figure, it is possible see that the paid growth cycle is featured by the revenue from the customers that increase the Customer Lifetime Value used to invest in advertising and attracting new customers. The primary metric used in this engine is the **marginal profit** (represented in bold in the figure), obtained by subtracting the cost per acquisition per customer (CPA) from the lifetime value per customer (LTV).

[2] The author explains that the growth investment can may occur through sales force: *"Although I have explained the paid engine of growth in terms of advertising, it is far broader than that. Startups that employ an outbound sales force are also using this engine".*

Given the model structure constructed from Ries (2012), it was possible to identify two gaps. The first is the absence of a stock representing the total estimated amount of customers in the market. This gap gives the feeling that the market is unlimited. The second gap is the customer outflow absence. Without this flow, customers remain with the startup throughout the simulation time. Therefore, these important limitations must be considered in the startup's growth policy.

Based on data reported by the entrepreneur was possible to notice in the simulation that the company would not grow. The following figure 3 shows the behavior of main growth variable: marginal profit as well as the variables that define it: CPA and LVT.

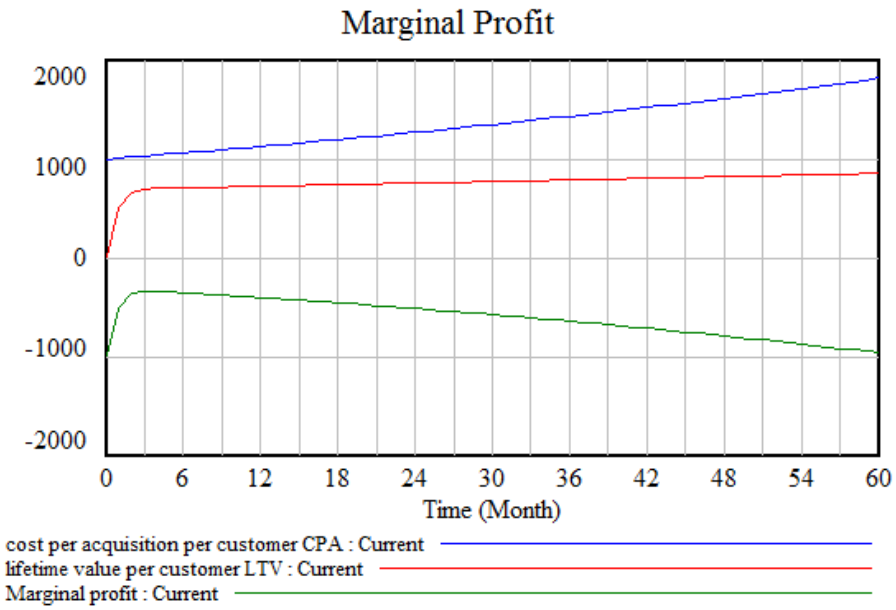

Figure 3: Marginal Profit simulation

In this growth perspective, we observed that the startup under analysis did not reach the necessary growth since the marginal profit remains negative value during the 60 months. This is because the LTV value is always less than the value of the CPA. These results surprised the entrepreneur, given the huge amount of customers acquired by the startup at the end of the simulation (695.170.000.000!).

This led the entrepreneur and researcher to reflect on how to reduce acquisition costs (CPA) or the lifetime value (LTV) by analyzing the model structure. To reduce acquisition cost, it was identified the need to constantly monitor the advertising actions of companies contracted in order to acquire more customers with the same investment. This implies a close proximity between these companies.

To increase the value lifetime, an alternative would be to analyze the change in the customer profile. Instead of customers with 2 stores on average, companies with 30 stores. That would mean changing the advertising strategy (to include, for example, sale force).

The entrepreneur suggested a change in the model to generate growth: external investment for a certain period would generate a customer critical mass resulting in growth. However even with this investment the simulation showed that the company growth rate continues to decline, consistent with Ries (2012).

5.2.Stick Growth Engine Analysis

In the case, the main startup's strategy is to invest on research and development to keep the customer as long as possible and generate growth. More specifically, these investments are aimed to provide new reports to customers from the images generated by wireless cameras, since today only a limited demographic profile is captured. The following figure 5 shows this model and the following text based in Ries (2011) explains how the model elements were identified.

"Therefore, companies using the sticky engine of growth track their attrition rate or churn rate very carefully. The churn rate **[*attrition rate* variable]** is defined as the fraction of customers **[*CUSTOMERS* level]** in any period who fail to remain engaged with the company's product **[CUSTOMERS outflow: *customers leaving*]**. The rules that govern the sticky engine of growth are pretty simple: if the rate of new customer acquisition **[CUSTOMERS inflow: *acquiring customers*] [*acquisition rate* variable]** exceeds the churn rate, the product will grow. The speed of growth is determined by what I call the rate of compounding **[*compounding rate* variable]**, which is simply the natural growth rate minus the churn rate... The way to find growth is to focus on existing customers for the product even more engaging to them."

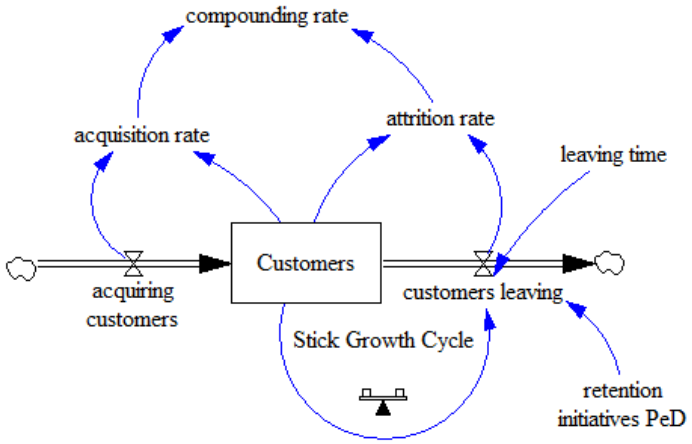

Figure 4: Stick Growth Engine Model

In this model, the growth results from the acquisition rate (representing the percentage of new clients) subtracted from the turnover rate (representing the percentage of customers who leave the company). The main policy aims to minimize the amount of customers leaving the company.

Two gaps between Ries (2011) and the structure created is important to be pointed. One is that it does not have a reinforcing feedback loop, despite that the author's claim otherwise. There is no causal link to justify the growth in this case, which makes the engine ineffective for their purposes. In addition, there are no guidelines as to the acquisition of clients, which is considered a "normal" rate of growth with no details.

Consequently, the simulation results have shown that even with a policy in order to minimize the customers leaving the startup through P&D, (which at the start of the simulation customers leaving the startup represents 8% of existing clients and 8 months after it becomes zero) the growth engine does not have it effect.

A possible change in this case would be to incorporate the paid engine to enable sustainable customer gain, and enhance the growth by minimizing the loss of customers. This view is aligned to the perception of the entrepreneur himself. He still identified the necessity to execute other initiatives to retention beyond R&D as a retention policy based solely on R&D takes a long time to get results. The following figure 6 shows the behavior of the principal metric of the sticky engine: the compounding rate.

From the figure it is possible see that even the first 12 months of simulation in which no customers leave the startup, the composition rate decreases along with the acquisition rate.

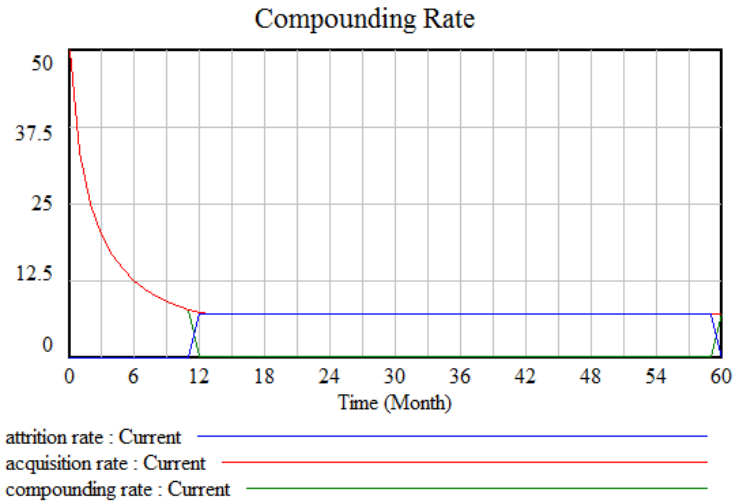

Figure 5: Sticky Engine Compostion Rate

5.3.Viral Growth Engine Analysis

To generate startup growth from the viral engine, the entrepreneur intends, through contacts with investors, achieving what he calls the *viral icons* or potential customers who are members of commercial organizations with several associates (other retails owners) and admittedly have a strong influence on the other members. Those viral icons are represented in the model by *customers using the product.* The other model elements are described as following:

"Awareness of the product **[auxiliary: product awareness]** spreads rapidly from person to person similarly to the way a virus becomes an epidemic…Instead, products that exhibit viral growth depend on person-to-person transmission as a necessary consequence of normal product use…Growth happens automatically as a side effect of customers using the product **[auxiliary: customers using and spreading the product]**…Like the other engines of growth, viral engine is powered by a feedback loop that can be quantified. It is called the viral loop, and its speed is determined by a single mathematical term called the **viral coefficient [auxiliary]**. The higher this coefficient is, the faster the product will spread. The viral coefficient measures how many **new customers [CUSTOMERS inflow: new customers]** will use a product as a consequence of each new customer who signs up **[*CUSTOMERS* level]**."

This description results in the figure 7.1. However, based on the entrepreneur mental model, the structure is different without a feedback loop. In his view, the startup policy should promote the attraction of viral icons, make them customers so they can attract and influence others customers (followers). The figures of these models are shown below.

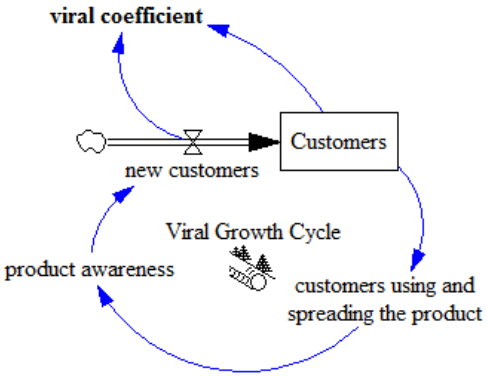

Figure 6.1 – Viral Growth Engine based on Ries (2011)

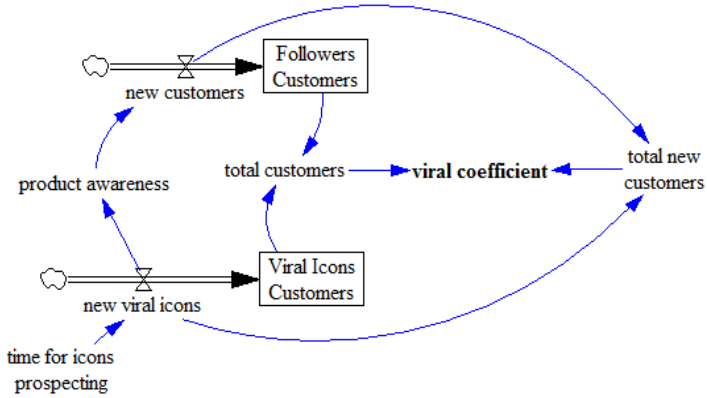

Figure 6.2 - Viral Growth Engine based on entrepreneur mental model

Thus, in entrepreneur model (figure 6.2), the viral coefficient, primary metric suggested in Ries (2011), is based on the number of customers that brings new customers (calculated by dividing the number of new customers by the amount of existing customers). However, the figure does not represent any feedback loop, the contagion is directed performed by few specific customers (viral icons), discarding the possibility of customers in stock participate in the viral cycle.

This makes the engine inefficient due to a strategy that does not consider a viral effort or product. Is worth noting that this gap occurs between the original definition of this growth engine in literature, that considers the existence of the feedback loop, and the perception of the entrepreneur, who does not conceptualize a growth engine based on a feedback loop when set your viral strategy.

Figure 7 shows the viral coefficient behavior and its small impact on the acquisition of new customers for the startup.

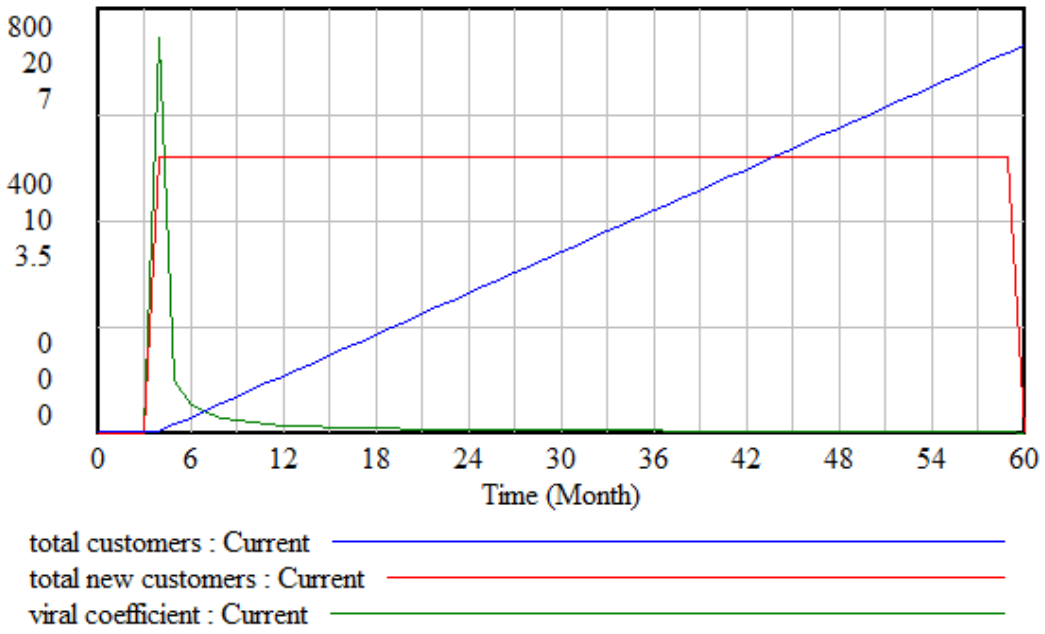

Figure 7: Viral Coefficient behavior based on Entrepreneur Mental Model

As a result of misalignment between the mental model of the entrepreneur and the viral growth engine proposed by Ries (2011), the viral coefficient reaches a brief initial peak (month 4), when the viral icons begin to become customers, but then remains in a value far below 1 until the end of the simulation compromising growth.

This behavior is the result of an increasing amount of followers customers in relation to the relativity fixed amount of viral icons. Therefore, there is not a policy to promote product virality for all customers but only for a specific and limited group. This can be explained by the fact that this entrepreneur have not given much attention to this engine compared to others

The table 1 below shows the gaps identified between the model originally proposed in (Ries, 2011) and the one simulated as well as from the perception of the entrepreneur and the simulation and original setting.

Gaps Identified	Paid Engine	Sticky Engine	Viral Engine
Between Entrepreneur mental model AND Ries (2011)			Startup policy ignores reinforce feedback loop (no policy to promote product virality for all customers but only for a specific group)
Between Entrepreneur mental model AND model behavior	The startup do not growth even acquiring many customers (Reduce acquisition cost and/or Increase Customer Value)	Delays in R&D retention policy (Other initiatives to retention beyond R&D) Constant acquisition of new customers (paid → stick engine)	-
Between Ries (2011) AND model structure	Absence of total estimated amount of customers in the market Customer outflow absence	Absence of a reinforcing feedback loop Absence of an acquisition policy for new customers	

Table 1: Identified Gaps in Research

6. Conclusion

With the results achieved in this study, we conclude that the structure and dynamic simulation models of growth in information technology startups can be adopted to facilitate more detailed analysis of concepts presented in the literature, particularly those of a dynamic nature, collaborating with the development of the model mental entrepreneurs and the concepts.

Currently, there are a lot of publications in the area of entrepreneurship on new concepts such as lean startup, customer development, among others, and the large number of events, competitions and organizations facing rapid and consistent growth of new business in Brazil, including the support of the Federal government. Such initiatives occur in misalignment with the research conducted in the area, which may contribute to the delay in the development of theories in entrepreneurship.

In this regard, the proposed growth engines, presented in a book of quite insertion in the entrepreneurial community of startups, The Lean Startup (Ries, 2011) helps to explain dominant and dynamic logic that should be favored by entrepreneurs after minimally validated their models business, but they need to make decisions and have more focused metrics of growth. Through organic growth mechanisms proposed by the author, it is

expected that entrepreneurs do not lose focus during this process and know even when changing engine, evaluating decisions and performance over time.

However, besides the gaps identified in this study, such engines proposed by the author demonstrate a limitation related to the fact that give an emphasis on the development cycle of market demands and do not favor internal aspects of the organization, such as capacity building and investment feedback loops, as the market growth model originally developed in and widely disseminated in publications such as in System Dynamics community (Forrester, 1968; Morecroft, 2007; Sterman, 2000; Warren, 2002).

This study has some important limitations. One is that the analysis was not performed after the startup's growth, although it occurred after its business model already tested a few times in the market, to the point of even receive financial support from venture capitalists. It also presents results based on the perception of an entrepreneur of a startup and was not considered competition between companies.

As future research proposals, it is intended to identify these engines in action after the growth of startups in order to understand how they present themselves, and to evaluate whether there are other growth patterns not covered by the research. Such research can promote a better understanding of the entrepreneur influencing their decisions.

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