

Lean development evaluation in small Brazilian company

Lean
development
evaluation

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Abstract

Purpose – The small Brazilian companies are responsible for a large part of national GDP and formal jobs in the country. This expressiveness is contrasted with the specificities of companies of this size possess, including the need to innovate to survive. Research shows that 83 percent of Brazilian SMEs have launched new products and services, obtaining positive results through this innovative process. This competitive advantage is weighted by a great feature of the small organization: resource constraint. The paper aims to discuss this issue.

Design/methodology/approach – Research was carried out in three stages: one qualitative research (by using focal groups) and another two quantitative research works (descriptive and cross-sectional).

Findings – The author identified three factors that are important for teenagers when influencing the purchase of the family car: safety, sportiness and comfort. The identification of these factors shows that the millennial generation tends to emphasize aspects of individual interest, such as status and performance, and family context, such as safety and comfort, rather than social aspects, such as the type of fuel and environmental impact.

Social implications – The authors recommend the development of automobiles that prioritize the three factors mentioned herein in order to reverse the trend of declining car purchase.

Originality/value – The authors presented the relevant attributes in buying decisions of family cars according to teenagers. The authors also indicated which automobile attributes are relevant for a more informed, connected, and with an increasing purchase power generation in contrast with previous generations, whose social context was prior to the emergence of social media.

Keywords Lean, Desenvolvimento de Produtos, Desenvolvimento lean, Lean development, Lean product development, Pequenas empresas

Paper type Technical paper

1. Introduction

According to a commissioned research by Sebrae titled “Micro and Small Companies Contribution in Brazilian Economy” (free translation) since July 2014, nearly 9m of micro- and small companies have been responsible for, about, 27 percent of the Brazilian GDP and 52 percent of the formal jobs in the country. These rates have increased over the past few years, indicating that this group of companies is significant and have become more important for the country’s economy. As reported by Luiz Barreto, Sebrae Nacional’s Chief Executive Officer, when the survey was carried out, “Data demonstrated the importance of encouragement and qualification for smaller enterprises, including Individual Micro-Entrepreneur.”

The same importance is stated in a Sebrae/SP study called “Micro and Small Enterprises Panorama from Sao Paulo, 2015” (free translation) and in IPEA (2012) called “Micro and Small Enterprises Labor Market and Individual Micro-Entrepreneur” (free translation) (Sebrae, 2014a, b, p. 6).

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On the contrary, according to another study from Sebrae itself called “Causa Mortis – Companies’ success and failure in their first five years of life” since June 2014, most of these companies have been closed after a short operation period (58 percent in up to five years according to the Panorama of micro- and small business in São Paulo, from Sebrae/SP) due to failures in the advanced planning, business management shortcomings/deficiencies and inappropriate entrepreneurial behavior. Furthermore, it is known that the Brazilian scenario is classified as hostile for new enterprises (The World Bank Group, 2016).

Therefore, to evolve, good management practices are a crucial point to this segment and a source of survival to companies within this size.

Coupled with the evolution of good management practices, it is the gain core or competitive maintenance for corporate innovation. According to the study “Fastest Growing Brazilians SME” (Deloitte & *Exame*, 2016), there are five principles which support a healthy growth of this kind of organization:

- (1) investment continuity;
- (2) seek for efficiency;
- (3) market and performance monitoring;
- (4) cooperate governance; and
- (5) focus on business sustainability.

According to this study, “with technological evolution in the business world, the investments in innovation on start-up companies must be aligned with the best governance practices and the pursuit for greater productivity and efficiency.” Therefore, the investments in innovation are revealed as an important source of competitiveness (Table I and Figure 1).

In accordance with the same study, 83 percent of the researched SMEs had launched new products and services in the cycle, achieving positive results such as gain market share and increase of total profit margin. At this point, innovation is added to the development of new products and to its positive financial outcome of this strategic choice. Therefore, product development becomes a source of innovation and corporate survival, fighting against the previously found high mortality rate (Sebrae, 2014a, b) (Table II).

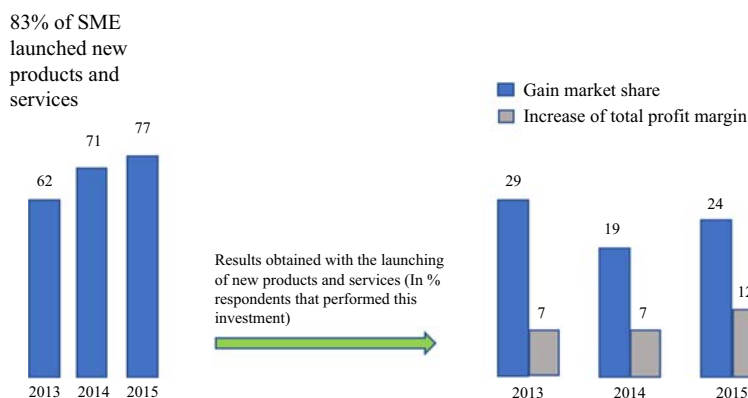
Additionally, 78 percent of the research respondents believe that sustaining constant product innovations is an action focused on continued growth for next periods and 57 percent believe that expanding the portfolio of products would produce the same result. These data demonstrate the importance of product development subject in small companies, from the perspective of the entrepreneurs themselves.

Innovation promotion practices
(In % of respondents; multiple answers)

Constantly investing in technology	75
Seeks to disseminate an open-minded culture for new perspectives in problem solving	72
Train qualified professionals able to deal with a wide range of possible challenges	64
Partner with suppliers for product or services development	64
Provide research and development areas	54
Implement a business formal strategy that prioritizes innovation	46
Maintain an acknowledgment policy for employees who contribute with innovative ideas	35
Count on metrics to evaluate if the innovative ideas can be reflected on business	23

Table I.
SME’s innovation
promotion practices

Source: Deloitte & *Exame*, 2016 (adapted by the authors)



Source: Deloitte & Exame, 2016 (adapted by the authors)

Figure 1. SME's results obtained with the launching of new products and services

Perspectives – actions to maintain growth and success until 2020
(In % of respondents; multiple answers)

Expand customer base	85
Maintain constant innovation in products and services offered	78
Maintain current good professionals until 2020	67
Increase productivity	60
Expand products and services portfolio	57
Expand operation's geographic market	53
Search for new partnerships with companies from our customers and supply chain	23
Acquire new companies or assets from other companies	23

Source: Deloitte & Exame, 2016 (adapted by the authors)

Table II. SME's perspectives – actions to maintain growth and success until 2020

Justifying the research choice, the authors found shallow knowledge about lean in product development and no practical sign, in exploratory research together with SMEs' trade associations and consultancy in Brazilian market. For that reason, subject relevance is identified, assumptions on concept application in a small company are tested, and the matter on how the lean method for product development can or cannot be adherent in a small company is brought up.

The technical report to be presented is from the company Vendo Móvel, real name withheld by the studied organization, founded in 2011; it is the first online store in Brazil specializing in the sale of complete sets for babies, children and young teenagers, selling furniture and decoration items. Therefore, it is placed within the value chain of the large Brazilian furniture market, retail chain. Brazil is the world's fifth largest furniture producer, and it has more than 20,000 producers manufacturing more than 430m of pieces a year, corresponding to 58bn reais annually in products, according to Brazilian Furniture Institute. Despite the online store, it has also expanded through showroom in Sao Paulo, granting a new shopping experience for customers, by providing them personal visualization of several inspiring environments. The company aims to offer to its clients not only product purchase but also the environment transformation, with rooms filled with emotions and dreams coming true. In its market, there are a number of competitors, several virtual stores as followers, including the largest in the industry and many physical stores distributed all over Brazil on in a pulverized way. Since the company finds itself in a highly competitive market and operates in an equally competitive sales channel, in which the consumer can easily compare the products and tend to

opt for stores with lower prices, Vendo Móvel established as their main strategy the development of their own products, with innovative design, including these items in their portfolio, in other words, product differentiating position in a market that demands innovation in design. Nowadays, the company draws and coordinates development projects with their manufacturing partners who develop according to this perspective.

The company, through this strategy, grew in revenue from R\$1.5m in 2013 to, nearly R\$ 30m in 2017 and could achieve the level of 50,000 orders annually with an organic growth and a highly innovative attitude in their own products. In/by 2013, they began developing their own products, five to start with, and are currently developing 30 a year. These represent around 30 percent of their annual revenue and these pieces parts hold a superior higher contribution margin if compared to traditional resale items. Likewise, they represent a great asset to generate financial outcome and business value.

Nowadays, Vendo Móvel works with more than 100 factories of House and Decoration, their associates are aware of the process practical difficulties, and they have broad access to this supply chain with a high capacity of influence over their suppliers-partners.

In this context, observation is expected in real application value of lean concepts to product development in an SME.

It is important to point out that what enriches this case study is the practical observations, sporadic visits, access to internal documents and also the conducted and quoted interviews in this study.

2. Theoretical review

The literature review particularly addressed lean concept applied to product development, observing matters assessed in a real company of this size.

In addition, literature review listed characteristics of small-sized companies and family management, given the need to observe and to determine some singularities of this type of organization, this paper's object of study.

2.1 *Small company's characteristics and specificities*

There are several reasons why a person decides to open their own business start. Some scholars arouse motives that explain these motivations.

The reasons that lead entrepreneurs to start their own business are, in order of importance, finding a business opportunity; having previous experience; being unemployed; having available time; having capital; being dissatisfied at work; being fired and receiving compensation (Tachizawa & Faria, 2004).

Therefore, the motivations that lead to entrepreneurship, in the sense of opening starting new enterprises (business), might depend on material or personal matter or may be related to entrepreneurship out of necessity or opportunity (Lemes Junior & Pisa, 2010).

Personal motivation includes familiar tradition, put into operation acquired skills, need of professional self-fulfillment, need of social status, contribution to social development and the need of being your own boss (Lemes Junior & Pisa, 2010).

Material motivation includes make money (increase income or become rich), resource availability, unemployment, envision of an innovative opportunity, existence of a support body and funding and booming market (Lemes Junior & Pisa, 2010).

Regardless the existing motivation to open a business, this organization will have some characteristics and will go through some challenges if it wills to survive and grow.

However, it is necessary to correctly understand which these characteristics are important in order to classify a company as a micro- or small company, within Brazil.

Officially, in Brazil, according to the Micro- and Small Companies General Law of 2006, the companies' size is classified based on gross revenue ranges (Sebrae, 2008a):

- individual micro-entrepreneur: a legalized person who works alone, with annual gross revenues up to R\$81,000.00. Micro-entrepreneur can have one employee and cannot be associate or owner of another company;
- micro-enterprise: limited company with gross revenues equal or lower than R\$360,000.00; and
- small-sized company: if the annual gross revenue is higher than R\$360,000.00 and equal or lower than R\$4,800,000.00.

There is also a classification according to Sebrae/Dieese (Table III), including the number of employees to classify the companies.

Small-sized enterprises have got particular and distinct characteristics compared to large organizations (Terence, 2008). Some characteristics of an organizational nature are highlighted as follows: simple structure, centralized, need of a lesser amount of administrative functions, low-level of maturity and personal management by the manager. Other characteristics pertain to the decision-making process: decisions are made based on the manager's experience or intuition, usually short-term. The other characteristics are particular: the intention is centralized where an individual plays the dominant role, the paternalistic owner-manager (Terence, 2008).

Environmental, organizational and behavioral limitations of small company's manager might have a consequence as unfair competition with large companies; great bargaining power of clients and suppliers; little or no power of influence in face of impositions and changes in macro-environment; non-formalized and reduced organizational structure; lack of qualified individuals; lack of financial and material resources; non-use of formal administrative instruments; informality in the relationships; and lack of ability in time management, according to Cêra and Escrivão Filho (2003). Consequently, the small company and its specificities are seen through a wider perspective. The included specificities are (Migliato & Escrivão Filho, 2004): environmental (sectorial bargaining power from the small company), structural (usually simple and centralized structures), strategic (usually without long-term plans, the manager deals with small management crisis in short-term), technological (usually small organizations have non-industrial or standard technology due to lack of capital), decisional (manager's lack of time forces short-term decision-making, short-time to strategies) and behavioral (performance's little monitoring and difficulty to share knowledge, little inclination to deal with strategic issues).

Small companies may follow family structures. These have their own characteristics; Gersick, Lansberg and Hampton (1997) created a three-circle model, in which they classify family business into three independent and related systems: business, family and ownership/property. Figure 2 demonstrates the concept.

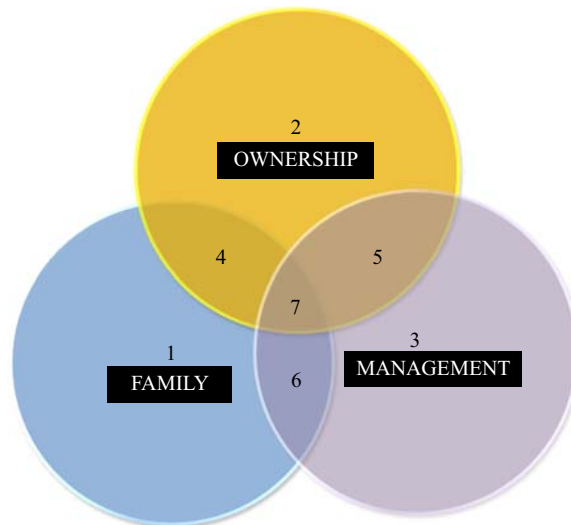
There are seven intersections in this model, called sectors:

- (1) family member, who is neither the owner, nor employee;
- (2) shareholder, who is neither a family member, nor employee;

Size	Definition of companies' size according to the number of employees	
	Commerce and service (employees)	Industry (employees)
Micro-enterprise	Up to 9	Up to 19
Small-sized enterprise	From 10 to 49	From 20 to 99
Medium-sized enterprise	From 50 to 99	From 100 to 499
Large-sized enterprise	100 or more	500 or more

Source: Sebrae/Dieese (adapted by the authors)

Table III.
Company's size by
number of employees



Source: Gersick *et al.* (1997) (adapted by the authors)

Figure 2.
The three-circle
models of
family business

- (3) employee, who is neither owner, nor family member;
- (4) owner, who is a family member, but does not work in the company;
- (5) owner, who works in the company, but is not a family member;
- (6) family member, who is employee, but it is not owner; and
- (7) owner, who is a family member and works in the company.

Within the concept, by positioning people who belong to a familiar business in one of the seven sectors, it is possible to understand how each one of them sees and feels the organization, in other words, their interest and compromise size (higher or lower), within the role that they play. This generates complexity to family business administration, even being a small company (Gersick, Lansberg & Hampton, 1997).

Petry and Nascimento (2009) produced an interesting synthesis from several authors and pointed out the main shortcomings/deficiencies found among in a large number of family businesses in Rio Grande do Sul searched/surveyed in their referenced file:

- (1) power centralization by the founder;
- (2) employment and indiscriminate promotion of family members by favoritism in detriment of knowledge and professional competence;
- (3) absence of targets and clear goals;
- (4) resistance in establishing formal management control;
- (5) fragile or non-existent strategic planning and operational systems;
- (6) fragile or non-existent accounting and cost determination systems; and
- (7) quantitative familiar shareholding structure in exponential growth.

Other structures, even though not familiar, face typical problems of small companies. Oliveira and Melhado's (2008) article, although directed to companies of building project,

listed performance bounders found in this business management segment, which were extrapolated by the authors for small companies in general: limited financial, human and technological resources; high dependency of entrepreneurship degree and leadership of their holders; their owners operate both in technical and administrative management and, overall, are unfamiliar with the main management techniques available.

Oliveira and Melhado (2008) also mention Schel (1995), who listed the following characteristics of small companies and for reduced number of employees as well:

- (1) simple organizational structure with few hierarchical levels and a great authority concentration;
- (2) takes a well-defined space in the market which acts;
- (3) gets local flexibility, spreads through the whole national territory and plays an important role in development internalization;
- (4) gets higher work intensity;
- (5) the owner and the administration are highly interrelated, in other words, in general there are no differences between particular and business issues, since it is common for entrepreneurs to use the same bank account of the company; and
- (6) there is absolute predominance of national private capital.

To sum up and taking the findings in the theory of this technical report, it is established that small-sized organizations carry/have characteristics that might limit or hamper the growth of companies. It may be due to the limitations of financial and human resources, power centralization and multidisciplinary and owner management inefficiency. Such characteristics, probably, demand the owner focus on efficiency and willingness to change, in order to create an organization capable of growth also through innovation of products and services development.

2.2 Lean concept applied to product development

The method for product and process development is referred to a range of activities whose outputs are product specifications and its manufacturing processes. It is also applied to provision of services. These new products or services must be aligned to a market demand and to existent technological limitations (Rozenfeld *et al.*, 2006).

The method for product and process development, as it is known or in its traditional way, flows in strict and, usually, long stages, from needed identification, concept design, choice of solution, prototyping and commercialization (Table IV).

In a dynamic business environment, as in current days, it is a matter of survival streamline of this process, since it is a source of innovation and competitiveness for organizations (Clark & Wheelwright, 1993).

Lean concept applied to product and process development aims to streamline this process and cuts the waste off. For development processes, Agile approaches drew the public's attention recently, showing significant decreases in project lead time and in its

Product's life cycle							
Before		Development				After	
Project planning	Informational project	Conceptual project	Detailed preliminary project	Production preparation	Product launch	Use/service	Recycling screening residue

Table IV. Product's development workflow

Source: Dal Forno *et al.* (2008) (adapted by the authors)

delivery cost (Rigby, Sutherland & Takeuchi, 2016). Lean management style can be characterized by seeking to remove waste, including dispersion, transfer and empiric information (Ward & Sobek, 2014), which arose with Toyota Production System. The first refers to the loss of permanent exchange in the process, the second refers to sharing responsibility between who designs and who executes, and the third refers to loss by decision making without data as a base.

It has been created a set of five main aspects of lean concept applied to product and process development in order to achieve fundamental points:

- (1) Fast learning cycle and minimum viable product (MVP): one of the main concepts is to assure that learning (either with mistakes or successes) is internalized as fast as possible, this is the main idea of fast learning cycle. A good example is the MVP concept, which is a range of tests made to validate products viability, with practical experimentation (prototyping) that is developed with product introduction (part of it or some isolated functionality) to a sample of the target audience. In order to test a solution for an identified given situation, the solution must offer minimum functionalities to perceive the practical result, in other words, how the market will react to it. This learning is explained by the feedback loop Build-Measure-Learn by Eric Ries (2012) as shown in Figure 3. MVP is that product version that allows the accomplishment of a complete loop of flow Build-Measure-Learn, with minimum effort and less application time (Ries, 2012). Test results must lead to a clear path, in the case of failure, pivot development (search for another solution), or, in the case of success, persevere development. Unlike traditional model, which comes in the end of the process, lean model learning is generated during the process.
- (2) Entrepreneurial leadership: development process must have the figure of an experienced entrepreneurial leader. This leader relevance is very high since his/her responsibility permeates through almost all dimensions of development process involved. The leader must know deeply final customer's desires and aspirations, must assure project's profitability, must administrate the deadlocks, reaching agreements, and must offer support to the others. As the ultimate goal, must be capable of guiding the whole process in order to ensure its success. This element

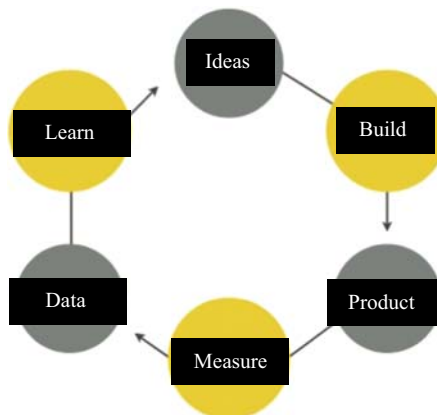


Figure 3.
Feedback loop
Build-Measure-Learn

Source: Fonte: Eric Ries, *Startup Enxuta*, 2012
(adapted by the authors)

comes from the Toyota production system and it is one of the key foundations for success and perpetuation of lean concept in product and process development.

- (3) Team of specialists: the specialists must be part of cross-functional teams; sufficiently autonomous and co-responsible for the projects. The mission of creating new knowledge, systematizing them and communicating them to the people involved in the project is in at the discretion of the responsible specialist team. These specialists are responsible for the transposition of technology and knowledge barriers involved in the search of simple and profitable value stream. This group of people, in order to ensure production and registration of new knowledge, provides waste reduction mentioned in previous chapter. The primary objective of any initiative for process improvement is to build a “continuous improvement culture” led by a “bottom-up” approach, in which continuous suggestions and teams or workers improvement lead to the implementation in the company (Mann, 2010).
- (4) Set-based concurrent engineering: a lean model, initially, makes the team reflect over the range of possible alternatives (and not only one), and, as the time for the stage conclusion approaches, this set of alternatives is reduced, as in a funnel. The result does not change, only the way and the solution are permanent. Consequently, learning is speeded up by working simultaneously with several subsystems. The greatest advantage of working with small batches is that quality problems can be identified long before (Ries, 2012). The result is different from the traditional method, which would usually test a single solution in the end of the development process.
- (5) Cadence, continuous flow and pull/traction: cadenced rhythm and continuous flow and pull logics are also essential operational elements that guarantee agility and low cost of product and process development methods. It must be ensured that information and knowledge flow in a cadenced way, continuous (no wait-time, no loops) and pull (according to a real demand of the next stage) during the whole development. In this way, waste is avoided. The right information must be available at the right time, in the right place and in at the appropriate amount.

The application of these concepts to product and process development leads to a waste reduction and agility gain and, as a result, a lower risk and greater assertiveness solution, promoting, theoretically, a greater economic benefit.

3. Methodology

3.1 Methodological issues

Administrative research was developed modernly both in scientific articles and technical reports, and, considering their differences in depth and range, properly underpinned by the scientific method that seeks to gather, analyze, interpret and report information so that administrative decisions become increasingly effective. Administrative research aims to make the best decisions (Hair, Babin, Money & Samouel, 2005).

Therefore, the current technical report arms itself with a search strategy for simple case study in order to provide better analysis about the studied company and other similar situations selected by the audience who will reach this study matter.

Case study strategy research is about an empirical investigation research phenomena within its real/actual context (naturalistic research), where a researcher do not have control over events and variables, seeking to learn the whole situation and, creatively, describe, understand and interpret the complexity of an specific case (Martins & Theóphilo, 2009).

A case study is an empirical investigation that examines a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly defined (YIN, 2014).

According to YIN, a case study research must contain study issues and propositions, analysis unit, connect data to propositions and interpretation criteria.

Initially, as a study issue, it is shown how the lean method for product development can or cannot be adherent to a small company. The research lists three initial propositions:

- (1) the method is unknown by entrepreneurs;
- (2) limited resources hampers migration of development method; and
- (3) the method can be used by a small organization in an adapted way.

The unit of analysis will be from a single company, as a single case study, substantiated by the following points:

- The studied company holds, in its business model, continuous innovation, what allows the observation of until what point this strategy is eased in the market with a product whose technology is not digital.
- Many studies focused innovation in small business through start-ups, which by nature, necessarily, demonstrate a high innovation rate and obsolesce in its products whose materiality demands less fixed assets and, however, more pivot mobility.
- In the studied case, there is an opportunity to verify if a lean approach would also fit in a company the products of which are not physical and at the same time is a company that presents less pivot mobility.
- This scenario is not rare/uncommon in the market; however, the companies end up overlooking lean approaches since they might find more detailed reports in other cases from digital world. There should be, consequently, a demonstration effect for other types of business applying a lean approach, properly adapted to SME's physical products market.

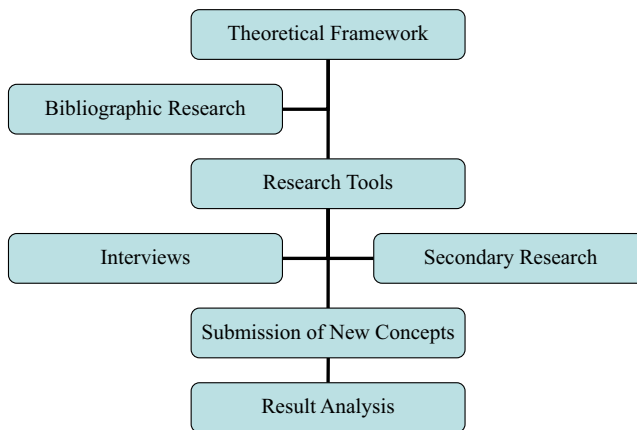
The technical report was structured in four chained stages to provide a connection between data and intervention propositions. As this is about intervention propositions with extension level to SME in general, is employed/used scientific research tools to reach out these goals. According to Figure 3, the following stages were executed:

- Theoretical framework: a bibliographic survey was conducted including the main authors from this subject, consistent with a selection carried out.
- Research tools: research was held on secondary bases (internal documents given by the company. Financial statement reports, result reports based in the product development, research and development cost demonstrative), and interviews with the public's sample, a research qualitative tool, are detailed in the following paragraphs. Interviews were held with the manager in order to observe the importance given to product development, regarding strategy and how this development is accomplished. Besides that, frequent visits focusing in observation of reality were also carried out. At least two visits were on-site to observe reality (awareness of workflow and of products involved, as well as the physical shop and office of the studied company).
- Suggested use for applied concepts: some topics were listed in order to submit them to the company under study, regarding the explored theory. These topics were submitted to the studied company in order to obtain applicability perception and usage benefits.

- Result analysis: the results will be derivatives from the comparison between collected data in the research through the interviews, internal documents, actual visits and the theories investigated. For this purpose, the interviews were divided into two questionnaires: the first, focused on understanding the development method executed by the company, containing four open questions related to product development theory. The second questionnaire was set containing six large question groups. The first group called “general questions” sought to understand deeply the development method used until that moment. The remaining groups, frequent in the questionnaire, aimed at getting return about the adherence of each element to lean aspects and product development, it was organized in a way to ease/facilitate the relation with the literature. After the conducted interviews, the answers were treated, compared with the theories and organized focusing in conclusions, relating to the central problem of this report.

The definition and utilization of research tools were originated through stages, in a logical, chronological and interdependent sequence, which was made for a proper execution and conclusion of this research in terms of technical production methodology. Expecting to achieve all objectives, an initial framework correlating objectives, intervention/research nature, method/techniques analysis and review procedures was produced, called Figure 4 (Table V).

Primarily, a review and an in-depth bibliographic research had been were carried out, studying the subjects related to the research problem, checking theories and published studies about the defined scope. This topic was handled in the chapter regarding



Source: Own authorship

Figure 4. Research structure

Secondary objectives	Conceptual basis	Method
Raise lean concepts that may be applicable to the company	Ward, Sobek, Ries	Bibliographic research
Submission of lean concepts to user/decision maker	Ward, Sobek, Ries	Qualitative (interview public: responsible for product development)
Validation of results		Triangulation

Source: Own authorship

Table V. Adapted association matrix

theoretical framework and it is about the need of a research strategy in order to conduct any scientific research.

Subsequently, secondary data were collected through internal document retrieval delivered by the studied company. The actual visits carried out enabled gathering information on-site about the subject studied. Two interviews were also held, which will be explained afterwards.

Next, the intervention stages of technical reports, its strategy, its collection procedures and analysis will be explained.

3.2 Conceptual model

For this application questionnaire proposition, the authors carried out a bibliographic research in lean area applied to products and services development. Allan Ward, Durward Sobek and Eric Ries developed concepts were used. Since the organization in question was classified as a user of product development's traditional method and it would contrast for the first time with lean concept, the research went from an existent model (from main areas of lean philosophy, explained in the previous chapter) from a reliable source. It was decided that the application questionnaire (to be used in interview) would go with answers in main questions by subject awareness. Five topics belonging to lean, applied in product development from Ward and Sobek were used. Figure 5 illustrates the created and applied model.

This model provided a formation of a second questionnaire to the interviewees/respondents, in order to obtain their views in terms of inclusion of lean elements in the company's development process and its benefits. Second questionnaire included the set of questions made to interviewees/respondents.

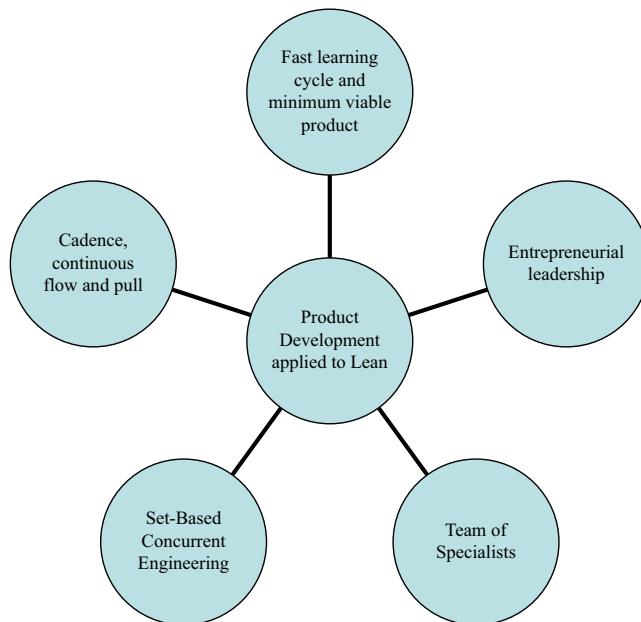


Figure 5.
Main lean concepts
applied to product and
process development

Source: Adapted by the authors

Second questionnaire:

(1) A – General questions:

- What is the average time between a new project's design and its availability in the market (for sale)?
- What is the average financial value spent by development?
- Are development stages always made by you and the marketing director? Is each one with their own responsibility?
- Which are the improvements identified by you to enhance the product development process in your organization?

(2) B – Specific questions:

- Fast learning cycle/MVP:
 - Question: Would it be possible to apply the concept in the organization in a way that the prototypes were created quickly (even if virtually)? Is it possible to test it in real customers to get feedback and feed the development process? Do you aim at learning quickly to increase final product's assertiveness? What are is today's feasibility and what benefits it would bring in your opinion?
- Entrepreneurial leadership:
 - Question: Today you perform this role. But could you increase contact with final costumer and with financial data? And, also, this kind of leader should lead the whole process and engage the team members. Do you see feasibility and benefits in such practices to the organization?
- Team of specialists:
 - Question: Is it feasible and beneficial to the organization? Is today a team composed?
- SBCE (Set-Based Concurrent Engineering):
 - Question: Is it feasible and beneficial for the organization to work with multiple alternatives simultaneously in development process?
- Cadence, continuous flow and pull:
 - Question: Mostly about the matter of providing information over the product development to the organization. Would following the lean advice about the subject be feasible and beneficial to the organization?

Source: Own authorship

3.3 Data acquisition, presentation and analysis

In order to evaluate the potential use of lean method for product development in small companies, it was carried out a first interview with the director responsible for product development in the company in question to identify their current development process and its importance for the company. On this purpose, Questionnaire A was created and sent by e-mail to the interviewees/respondents, it is as follows.

Questionnaire A:

- (1) What is the importance of own product development for your company?
- (2) Who is responsible for product development? Is there a responsible division?

- (3) Which are the stages involved in the development of an own new product in your company? What is the flow?
- (4) What are the greatest difficulties concerning own product development in your company?

Source: Own authorship

For the assessment of potential use of lean method, the research proceeded with the same director who was previously interviewed, realizing a second round of questions. The aim was to verify the user's perception about lean's method applicability and its benefits for the company. For this purpose, Questionnaire B was created and was sent by e-mail to the interviewee/respondent, as it is shown below. The result will be explained in the analysis chapter.

Questionnaire B:

(1) A – General questions:

- What is the average time between a new project's design and its availability in the market (for sale)?
- What is the average financial value spent by development?
- Are development stages always made by you and the marketing director? Is each one with their own responsibility?
- Which are the improvements identified by you to enhance the product development process in your organization?

(2) B – Specific questions:

- Fast learning cycle/minimum viable product:
 - Question: Would it be possible to apply the concept in the organization in a way that the prototypes were created quickly (even if virtually)? Is it possible that it had been tested in real customers to get feedback and feed the development process? Do you aim at learning quickly to increase final product's assertiveness? What are today's feasibility and what benefits it would bring in your opinion?
- Entrepreneurial leadership:
 - Question: Today you perform this role. But could you increase contact with final customer and with financial data? And, also, this kind of leader should lead the whole process and engage the team members. Do you see feasibility and benefits in such practices to the organization?
- Team of specialists:
 - Question: Is it feasible and beneficial to the organization? Is today a team composed?
- SBCE (Set-Based Concurrent Engineering):
 - Question: Is it feasible and beneficial for the organization to work with multiple alternatives simultaneously in development process?
- Cadence, continuous flow and pull:
 - Question: Mostly about the matter of provision of information over the product development to the organization. Would following the lean advice about the subject be feasible and beneficial to the organization?

Source: Own authorship

Finally, it was used a methodological triangulation strategy with data received during the assessment undertaken in technical report, drawing on several evidence sources collected during the interviews, document examination and direct observations.

4. Data analysis

Vendo Móvel is the company whereby the potential use of lean method for product development in small companies was assessed.

This organization is the first online store in Brazil specializing in the sale of complete sets for babies, children and young teenagers, and it was founded in 2011 by two partners, with complementary experiences in large organizations, equity and limited capital. Later, a third partner joined in, with additional competences in logistics and product development, to direct the operation and innovation division. There was not any external financial contribution from then on, growth was completely organic. Their aim is to offer to their clients not only products purchase, but also environment transformation, rooms filled with emotions and dreams coming true. Despite having a large thematic diversity and specialized products, their key differentiator is respect toward consumer. They spare no effort in providing a full care for the customer, not only during the sale, but also through the whole process, including delivery and after-sale. To this end, they choose not to have outsourced workers in customer service. The choice of suppliers was prioritized through strict criteria in environmental certification and respect to technical safety regulations. Therefore, they developed partnerships with responsible companies. Nowadays, they also develop exclusive and innovative products with their own brand. Besides the online shop, the organization expanded also through showroom in Sao Paulo, providing a new shopping experience for customers and allowing them to visualize personally several inspiring environments.

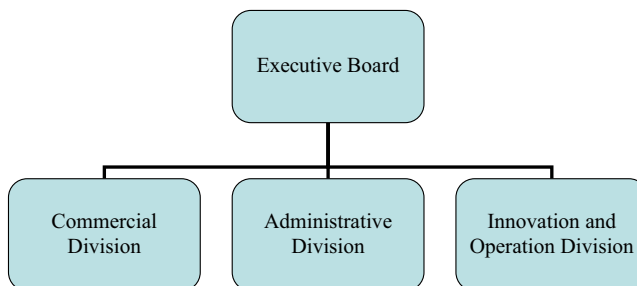
The company could achieve the level of 50,000 annual orders and a revenue of, approximately, R\$30m a year with organic growth and a highly innovative posture with their own brand.

Currently, the company works with more than 100 house and decoration factories, its associates are familiar with the processes of practical difficulties, besides a broad access to this supply chain with a high ability to influence the suppliers.

It is important to know the companies' organizational chart, from top-level (Figure 6).

The associate responsible for marketing and commercial functions is a telecommunication engineer graduated by Paulista University with an MBA Degree by FIA. He has worked for 14 years in a large company in the telecommunication sector.

The associate responsible for administrative and financial functions is an electrical engineer graduated by Engineering Faculty of the University of Sao Paulo with an MBA



Source: Adapted by the authors

Figure 6.
Organization chart
Vendo Móvel

Degree by FIA. He has also worked for 10 years in telecommunication and network sectors in large multinational companies.

The associate responsible for operation and innovation functions is graduated in product design, post-graduated in engineer design, project and analysis by Senai Mechatronic Engineer program. He has got more than 16 years of experience with product development in automotive, electro-electronics and telecom industries.

By the business characteristic itself, to be a pioneer ecommerce is seen as a crucial point of innovation for Vendo Móvel's competitiveness. Through this need, own product development is a very important foundation for business sustainability.

Apart from held interviews, the research employed different data source to apply in the analysis afterwards, such as:

- File documents and records: several constant data in corporate informational system such as sales report, contribution margin report and income statement demonstrative was raised.
- Direct observation: one of the research works performed several visits in his period of business consulting which he realized periodically. This allowed him to acquire several views about the subject in question.

In his observations, through internal documents the financial relevance of internally developed products was proven. These products hold a great value in revenue, currently around 30 percent, and cooperate to the overall result in a pronounced way, since they possess a higher margin of contribution in relation to traditional resale products, around five to ten percentage points. Own product development started in 2013 and grows each year. Currently, around 30 new products a year are developed and the goal is to reach 100 products by 2020. Additionally, the innovative physical environment in their physical store is observed, demonstrating the capacity to tangibilize the design innovation that goes beyond the virtual environment.

Data collected on-site were compared with the interviews held with the associate director of operation and innovation, primarily to understand how the process of product development occurs today and what is its importance. Subsequently, in order to get the right insight in terms of use of lean derivatives elements and its benefits.

As concerns to the first interview, the following answers were observed:

- development process is of vital importance for the organization, it is part of the medium and long-term strategy and refers to business survival;
- development is performed in a partnership with the commercial and development areas, headed by operation and innovation director (who accumulates this role);
- development flow was designed according to Table VI; and
- the greatest difficulties for product development are budget constraint for development and boosts, to find manufacturing partners to develop prototypes

Perceived or created Need	>	Technical project and design	>	Prototype production and final alignment	>	Packaging, labels for boxes and assembly manual development	>	Final prototype photograph, formulation of product's technical file and content generation for site registration	>	Placement of the first order for production in the factory
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Table VI.
Product development macro stages in Vendo Móvel

Source: Own authorship

and small initial batches (currently the main partner requires a large batch in the first order) and the cost for product maturation in its lifespan (and becomes profitable).

The current process for product and process development follows the flow:

- Perceived or created need: this is the stage in which the idea arises from market behavior observation, it is perceived as a need and then a product is created so that this gap is filled and the existent demand covered.
- Technical project and design: in this stage, with the product's concept already founded on the presented need, starts, effectively, item's design production. In this stage in which the design is being created, an effort is made to transform it into an attractive product, without making it technically unfeasible, always considering the target audience. Being able to create an attractive product within the cost production that the market is willing to take, it is a challenge and a goal for Vendo Móvel.
- Prototype production and final alignment: it is in this stage that what was designed takes shape, and it is possible to have a future physical perception and provide project's modification. However, despite looking simple ease, a prototype construction demands much more work and attention than a series production, because this stage is where flaws are perceived during the project and there is the opportunity to fix them. Neglecting the prototype stage results in a disastrous launching with high costs for parts replacement and customer complaints. This prototype construction usually occurs in partners factories which will be responsible for the production of the proposed items. To this end/for this (*sugestão para variar pois você já usou* "to this end" *em parágrafos anteriores*), it is important to have a good relationship with suppliers to be able to launch a product without the need of an initial production containing many parts, which is also a challenge. For the industry, a small production batch results in a high-cost machine setup. For a store owner, a production with a large number of units to be launched means a high investment risk. It is not possible to know if the product will be well accepted by the market in this stage.
- Packaging, labels for boxes and assembly manual development: is in this stage of product creation where the packaging of the new product is defined. In this organization's case, which commercialize furniture and send them all over Brazil, a study to find the number of boxes, cardboard quality and arrangement of the pieces can result in savings on shipping, reduction in the number of technical assistance, that the product may present by damages in transport stages until its final destination, the customer's house, and costs with storage. It is in this moment that labels from the boxes and the customer's assembly manuals are created too.
- Final prototype photographs, formulation of product's technical file and content generation for site register: after conclusion of the modifications in the creation of prototypes, the next stage is a day in which a photographic studio will take pictures that will be as advertise in the website. It is important that these are good-quality pictures and that the setting of the scene is perfect. For Vendo Móvel business, the way the product is presented represents a lot and can be a key decision for pending the sale. In parallel to the pictures, the technical file with products' characteristics (dimensions, materials, color, texture, capacity, application, among others) is created in order to register the product in the online shop.
- Production of the first order in the factory: after the previous stages are finished, the shipment of the first order to the manufacturer remains. It is important to point out that, even before the beginning of prototyping, this first production was already arranged considering the minimum amount of production established by the

manufacturer as well as the item's cost price. It is strategically for Vendo Móvel to possess a wide range of suppliers because the final cost price of an own product may vary significantly between suppliers. This variation is given basically for three particular factors to each manufacturer: industrial park (machinery variety and production processes), expertise in the kind of product and fixed costs. After these stages, the product can become available for sale in the online store. The sales can happen even before the shipping of the first batch in the distribution center, in a category called "pre-order" with a final delivery deadline extended to the customer.

In the first interview and in data collected in visits, it was verified that the model currently utilized in Vendo Móvel is a traditional model.

The second interview was made with the intention of observing questions of use and benefits of lean elements to the process of product development in the organization. It adds to it the existence of a research protocol the observations result in company's operation. Below, the main points of the answers and the collected observations are followed:

- A product with own and exclusive design takes, on average, two to three months since the conception of its idea, crossing through all mentioned stages until its commercialization in the online store. Currently, around 30 new products are developed per year and the goal until 2020 is to reach out 100. In the visits, a concern with their internal capacity of development to reach this goal with their current method was found, in other words, the need to improve their own product development method in order to expand their capacity for new launches was verified.
- A cost of approximately 7,000 reais for each new development is estimated, without considering the additional working capital value regarding to the first batch (which is not small). Presently, this value is not calculated.
- An improvement identified by the interviewed would be to have an internal development team, capable of proposing solutions that were adherent to the market.
- Fast learning cycle and MVP: they could implement a directed research, even with virtual models, seeking to gain public acceptance in relation to the proposal. It is quite common in this segment that many products face barriers in the market after its launching. Usually, this ends up in jeopardy and product discontinuity. It happens because in project's stage, important matters might not have been considered or valued. The tests will allow the identification of problems and will give the opportunity to solve them still in product development stage. In the held visits, it was verified that, currently, the company does not carry any research, however, small, with real customers utilizing their prototypes. This practice would cooperate for cost reduction in losses (do not manufacture something non adherent to the customer's need) and would reduce the development cycle.
- Entrepreneurial leadership: ideally there would be internal specialists developing market surveys and seeking to find opportunities. One of the greatest difficulties of this market is being able to offer a product that the customer wishes, for a price that he considers fair enough or can afford. This equation is not simple, since this is the case of kids' furniture, the playful element is very important. A leader more familiar with this market, and who possess technical and intrinsic training, would result in a great benefit. It would better integrate the companies' departments and would certainly increase agility in products' creation. However, as in many businesses of the same size of Vendo Móvel, the cost of maintaining a leader with this profile is still a limiting factor. That is why the development is still maintained under the associate's management.

An observed alternative would be the use of strategic partners to meet this diversion, in other words, human resources qualified to temporarily execute these activities with a defined purpose.

- Team of specialists: the organization is currently in this stage, formulating a team of specialists. It was identified that the heads of the company need to walk more freely in order to gain agility in process and decrease dependency. There are small teams being developed and a team formation for product development in the company was noted. Without questioning, a qualified developing team should have a macro-vision of companies' processes and of the organization as a whole. This vision will result in a better integration between the creation stages of the product, reducing time and other resources.
- Set-based concurrent engineering: it is beneficial. Moreover, it is applicable to a business model including the product's raw material to be developed. In this universe of product creation, there are some material options that may be considered for the furniture production. Material possibilities as well as production process will impact directly the final result and the cost without, necessarily, compromising the initial design proposed. Therefore, the initial work with multiple simultaneous alternatives, especially in the stage that precedes the prototype is considerable viable. During the visits, it was observed that the multiple alternatives are not considered, not even with supplier partners. An instant change would be involving even more the key suppliers in the process of development in the preliminary stages, in order to generate and work with concurrent engineering, what would bring agility and even greater efficiency to the process.
- Cadence, continuous flow and pull; each stage of product development generates specific demand for people or departments within the organization. Providing each one with the necessary and fair amount of information in accordance with the immediate need that the task demands is without questioning, a huge challenge. However, information overloading or insufficient is one main factor for the waste of time and resources in the company. Consequently, lean concept can be applied to this organization. It was verified in the visits that the lack of structured reports focused on product development, for example, management of their own development funnel. As a recommendation, the need to implement personal and simple management systems for administration of this funnel was verified, assuring a greater communication between the people involved, including key suppliers.

In conclusion, all proposed lean elements would bring benefits on the interviewed perception; however, there are some limitations which will be explained in the next chapter.

5. Conclusions and final considerations

5.1 Objective accomplishment

Interviews, bibliographic search, internal documents, registered analyzed files and visits (as directed observation) allowed the understanding of Vendo Móvel's process of product development nowadays, its importance and accurate result. Furthermore, the benefits and the challenges of incorporating lean elements into the process were verified.

This way, data subsidize the intervention proposal in SME with lean development concepts established as the aim of this technical report (Table V).

As a result of data collection and methodological triangulation, the findings and sources can be summarized according to Table VII.

Table VII.
Findings and results
matrix

Investigated category	Interview findings	Procedures, documents and observed facts in interviews findings	Result
Product development current method and its importance for business	<p>It is part of medium and long-term strategy</p> <p>Development is carried through partnerships between commercial and development areas</p> <p>Low financial resource allocated to product development (by low margin of the business itself)</p> <p>Difficulties in finding manufacturing partners to develop small batches (financial limitation)</p> <p>Have experience in the products' curve, involving financial risk in maturation</p> <p>Difficulty to gain scale in development process</p>	<p>30% of the revenue (Source: Analytical Sales Report)</p> <p>Upper margin if compared to other products (Source: Contribution Margin Report)</p> <p>R\$7,000 by each product development leaving aside initial working capital (Source: Management Report)</p> <p>Visit observation: innovative showroom, developed products called customers' attention when exposed, design truly creative</p> <p>Visit observation: the fact that the directors have limited work time, restricts product development</p>	<p>Development process is crucial for organization. It is part of medium- and long-term strategies and refers to business survival</p> <p>Development is carried through partnerships between commercial and development areas, headed by operation and innovation's director (who accumulates this role)</p> <p>The greatest difficulties for product development are: budget constraint for development and boosts, to find manufacturing partners to develop prototypes and small initial batches (currently the main partner requires a large batch in the first order) and the cost for product maturation in its lifespan (and becomes profitable)</p> <p>The need to improve their own product development method in order to expand their capacity for new launches</p>
Fast learning cycle and minimum viable product	<p>Common market barrier to the product acceptance in this market, usually generates financial loss by discontinuity and effort with no result in development</p>	<p>In the held visits it was verified that, currently, the company does not carry any research, however, small, with real customers utilizing their prototypes</p>	<p>To implement a directed research, even with virtual models, seeking to gain public acceptance in relation to the proposal. It happens/this is because in at the project stage, important matters issues might may not have been considered or valued. The tests will allow the identification of problems and will give the opportunity to solve them still in product development stage. This practice would cooperate for cost reduction in losses (do not manufacture something non adherent</p>

(continued)

Investigated category	Interview findings	Procedures, documents and observed facts in interviews findings	Result
Entrepreneurial leadership and team of specialists	The ideal would be to exist internal specialists developing market research seeking to find opportunities	Observed in income statement demonstrative, budget constraint to upgrade development team Observed in visits the technical high level of the director, who manages the development	to the customer's need) and would reduce the development cycle A leader more familiar with this market, and who possess technical and intrinsic training, would result in a great benefit. It would better integrate the companies' departments and would certainly increase agility in products' creation
Set-based concurrent engineering	It is beneficial. Moreover, it is applicable to a business model including the product's raw material to be developed. In this universe of product creation, there are some material options that may be considered for the furniture production	The cost of maintaining a leader with this profile is still a limiting factor. That is why the development is still maintained under the associate's management. An observed alternative would be the use of strategic partners to meet this diversion, in other words, human resources qualified to temporarily execute these activities with a defined purpose	The cost of maintaining a leader with this profile is still a limiting factor. That is why the development is still maintained under the associate's management. An observed alternative would be the use of strategic partners to meet this diversion, in other words, human resources qualified to temporarily execute these activities with a defined purpose
		In the visits, it was observed that currently the multiple alternatives are not considered even with supplier partners	Material possibilities as well as production process, will impact directly in the final result and in the cost without, necessarily, compromise the initial design proposed. Therefore, it was considerable viable the initial work with multiple simultaneous alternatives, especially in the stage that precedes the prototype. An instant change would be involving even more the key suppliers in the process of development in preliminary stages, in order to generate and work with concurrent engineering, what would bring agility and even greater efficiency to the process

(continued)

Table VII.

Investigated category	Interview findings	Procedures, documents and observed facts in interviews findings	Result
Cadence, continuous flow and pull	Each stage of product development generates specific demand for people or departments within the organization. Providing each one the necessary and fair amount of information in accordance with immediate need that the task demands is undoubtedly a huge challenge. However, information overload or its lack is between the main factors for waste of time and resources in the company, according to the interviewed director	It was verified in the visits, lack of structured reports focused in product development, for example, management of their own development funnel	As a recommendation it was verified the need to implement personal and simple management systems for administration of this funnel, assuring a greater communication between the people involved, including key suppliers

Source: Own authorship

5.2 Management implications

Therefore, through analysis of all collected evidences, the main conclusions can be summarized as potential evaluation developed in this technical report:

- (1) All main lean concepts were considered as beneficial in the studied organization, a small organization that aims to develop products.
- (2) The current product development model of the studied company is adherent with a traditional model, characterized by divided functions, deliberated and detailed planning of all steps before suppositions' validation.
- (3) There are difficulties in measuring waste in the studied company's traditional method.
- (4) Product development is seen as a strategic function and as an element that generates competitive advantage, in the studied organization. The investment continuity item (innovation) as a factor of growth for SMEs identified in Delloite's study is also evidenced in the studied company.
- (5) Financial and partners limitations are the main obstacles for lean concept's incorporation to product development process in the studied company, in entrepreneur's view; however, lean development concept has its foundation in the creation of new products with less waste and, consequently, lower financial contribution if compared to the tradition. There is a clear mistaken perception or misunderstanding that needs to be worked on in the diffusion of this new concept. As it was evidenced in the research of Cera e Escrivão Filho, small companies' characteristics are, among others, unqualified human resources and limitation regarding financial and material resources. This way, it is very important to seek the optimization of resources utilizing tools such as lean development to assure competitiveness.
- (6) Internalizing the process of product development (including prototype generation, that currently is in charge of partners in the studied company) is the best solution (the entrepreneurial leader and team of specialists is formed); however, the cost can exceed the expected benefit, if there is not a better use of the existent resources, including cross-functional, in the studied company's perception. It becomes a great challenge to apply it in a small company, according to the studied company.
- (7) It was identified in the visits and interviews adherence to MVP concept, for example, with the usage of virtual prototypes, which may enable testing with an affordable cost in the studied organization. Besides that, it allows rapid learning by interacting with real customers. This path might be enabled to small organizations, as the studied company perception.
- (8) The figures of the entrepreneurial leader and the team of specialists are crucial elements for the studied organization; however, their cost perception is high, hampering on the identified limitations, because there is the understanding that, in order to do it, it is mandatory to hire additional people for the structure. In contrast, according to lean start-up concepts (Ries, 2012), in the beginning of the enterprise this apparent obstacle is a result of a traditional thinking. What is expected in the lean concept is a cross-functional work on a key person already existing in the corporation. Here lies the particularity of the Brazilian entrepreneurial environment, to prepare Brazilian entrepreneur to exercise it and being effectively cross-functional.
- (9) Set-based concurrent engineering is viable and beneficial for the company studied; however, it must be adapted to product development process in organizations within

this size through employment of MVP concept, allowing a construction of prototypes or economic simulations, with serial and gradual available resources.

- (10) Excess or lack of information was identified in the studied company. A crucial point to be worked on in a small company is the availability of information in the right moment, in an assertive manner and affordably, avoiding waste and applying lean elements.

In short, lean elements are very well evaluated and desirable by a small company in terms of conceptual evaluation of their principles and recommendations, those organizations that understand the product development process as a key factor to their own existence. However, it must be adapted to the reality of a small organization, mostly, in terms of resource limitation (human, financial and temporal). In the studied case, the limitation of human resources was seen by the entrepreneur as an obstacle and in direct observations this obstacle was linked to a traditional form of organization, which actually worsen the lack of systemic view because the work is divided and their routine is in a way that depth is lost. An adaptation to be investigated is the use of cross-functional work with a key person who would be the developer of an internal team. The identification of this key person as SHUSA is a potential to be explored as a solution to the obstacle raised by the entrepreneur. Another limiting resource identified is the financial resource, which directs efficiency gain in management. Small company's specificities presented in the theoretical framework chapter were identified through interviews, observations and internal documents and these were configured as challenges for product development in the organization. Mostly, in the aspect of lack of resources, centralization of activities in the owners, few strategic activities and decisions focused on short-term. Therefore, some adaptation using lean tools for product development can support small companies to be innovative through this process but is worth to point out that the behavior aspects from the owner are highly relevant in this transformation.

5.3 Limitations

Research limitation applied in this technical report is the fact that it is about a single case study; however, it is still relevant since it is an opportunity to understand deeply product development in SME, with strategic base in innovation, through proper deepening by the evaluative intervention here developed.

5.4 Theory contribution

The authors offered to investigate the lean literature applied to product development, especially concerning its application in small companies. The literature is strongly focused on large organizations and start-ups. The authors found little available literature over lean product development in small companies. Technical report structured as a single case study sought to provide their findings for future consultations, for academic and professional purposes.

5.5 Future studies

For future studies, it is suggested the investigation if the mentioned lack of human resources is a tendency from the entrepreneur for lean development application or if in fact it could be surpassed by a cross-functional key person according to lean start-up and lean development premises for small-sized organizations.

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