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CONTENTS

Title	Page No
Study on Lean Startup Methodology with Lean Critical Tools and Lean Research Framework for Sustainability of Startups <i>Dr. Dipak U Tatpuje & Dr. Avinash Ganbote</i> Founder and Research Advisor, VidyaDeep Foundation, Satara, Associate Professor, VPM Institute of Management, Baramati, Maharashtra, India	01-10
An Analysis of Online Reviews: How Positive and Negative Reviews Influence Purchase Intentions <i>Ms. Vijayashri Machindra Gurme & Dr M A Khan</i> Research Scholar, Sydenham Institute of Management Studies and Research and Entrepreneurship Education, University of Mumbai, India	11-18
Sustainable Textiles: Antimicrobial Finishes Using Natural Resources <i>Mr. S V Chavan & Mr. P V Kadole</i> D K T E Society's Textile and Engineering Institute, Ichalkaranji, Maharashtra, India R I T, Islampur, Maharashtra, India	19-24
Overview of Issues, Challenges and Strategies for Effective Management of E -Waste in India <i>Dr. Varsha Rayanade,</i> Assistant Professor, School of Business, CSIBER, Kolhapur, Maharashtra, India	25-29
Understanding ESG: A Conceptual Framework <i>Ms. Anuradha Gaikwad</i> Assistant Professor, School of Business, CSIBER, Kolhapur, Maharashtra, India	30-37
Comparative Study of Use and Environmental Implications of Renewable and Non-Renewable Energy Resources in India <i>Priyanka S Chavan & Dr. Pooja M Patil</i> Assistant Professor, School of Environmental Science and Management, CSIBER, Kolhapur, Maharashtra, India	38-41
The Unaccounted Cost: Assessing the true Economic Impact of Environmental Damage <i>Dr. Dhanashree Kulkarni</i> Assistant Professor, School of Business, CSIBER, Kolhapur, Maharashtra, India	42-51

Study on Lean Startup Methodology with Lean Critical Tools and Lean Research Framework for Sustainability of Startups

Dr. Dipak U. Tatpuje

Dr. Avinash Ganbote

Abstract

In the age of globalization, a startup's objective is to determine what it should build to meet the needs of its customers and make a profit as soon as possible. A long, consistent operating history and a comparatively unchanging environment are prerequisites for the accuracy of traditional management techniques. Startups have neither! And so, the Lean Startup with critical Lean tools and Lean research framework for the startups came into the picture.

This paper examined the three key pillars of the Lean Startup Methodology—Vision, Steer, & Accelerate—and how a startup may use them to lower potential risks along the way. We also looked at the various Critical Lean Tools and the Lean Research Framework that are helpful for the sustainability of startups.

This paper also explores awareness and its adoption about the Lean Startup methodology and other related aspects in first generation rural entrepreneurs those who undergo training in entrepreneurship education and Integrated Digital Entrepreneurship Training and startup methodologies. The sample size was 126 startup founders-entrepreneurs for the collection of primary data.

Methodical delivery of the contents with Project Based Learning was found useful for capacity development of the first-generation rural entrepreneurs for the adoption of Lean Startup Methodology with Lean Critical Tools (LCT) and Lean Research Framework. Holistic approach of these three is found useful to improve livelihood of rural entrepreneurs with sustainability of the startups.

Keywords: Lean Startup Methodology, Learning School, Strategy, Effectuation, Business model validation, Critical Lean Tools, and Lean Research Framework.

Introduction

Startup operates on an engine known as the "engine of growth." Every new product version, feature, and marketing campaign is an effort to strengthen this engine of development to ensure the long-term viability of entrepreneurial activity. Much of a startup's existence is spent fine-tuning the engine by improving the marketing, goods, and other aspects of the business.

The startups fail for a variety of reasons. The attraction of a solid strategy, a good plan, as well as in-depth market research, is the initial problem. Previously, these factors were used to predict market success. Entrepreneurs have a strong desire to apply these principles to startups as well, but this is ineffective because startups operate in an uncertain environment since they are still unsure of their target market and the nature of their goods. As the entire world grows more unclear due to the rapidly changing environment, it becomes increasingly difficult to anticipate the future. In an ever-changing environment, traditional management practices are inadequate. Reliable planning and forecasting are only possible in an environment that is largely constant and has a long, consistent working history.

The second reason for failing startup is that the traditional management fails to solve the problem with investors who have thrown up their resources as well as adopted the "Just Do It" an academic approach. According to this method, chaos is the solution if management is the issue (Anthony, S. D. 2014). Lean startup's theoretically based assumptions and boundary constraints are becoming more widely accepted, which should strengthen the method's theory-practice understanding and enable future iterations of similar approaches (Leatherbee, M., & Katila, R. 2020).

The goal of the LSM (Lean Startup Methodology) is to teach businesspeople how to drive their businesses. Startups With a Build-Measure-Learn feedback loop may make continuous improvements rather than creating intricate plans that are heavily predicated on assumptions. The LCT are ten in number. These tools focus more on process comprehension, waste detection, error prevention, and act documentation (Minitab, 2023). In the context of international development and humanitarian work, the Lean Research Framework (LRF) is helpful in directing and enhancing the practice of conducting field research with individuals and communities (Root Capital & McCreless, M., 2015). According to Tyagi, S., Cai, X., Yang, K., & Chambers, T., (2015), A collection of 10 lean tools and approaches are provided to help increase the effectiveness of the knowledge generation method. The methodology begins by establishing a framework for knowledge creation in the product development environment, followed by a methodical demonstration of how these 10 lean tools and methodologies conceptually fit into and play an important part in that process.

This article addresses the Vision, Steer, and Accelerate parts of the LSM, as well as the LCT and LRF, which are important for startup sustainability. "Vision" presents a case for a novel type of entrepreneurial management. Validated learning (VL) requires an entrepreneur to explain a new method for his company in order to assess

whether it is progressing. To obtain such learning, we'll examine how a startup, whether in a garage or inside an organization, may utilize scientific experimentation to figure out how to develop a viable firm. "Steer" delves into the Lean Startup technique in depth, demonstrating one significant step of the Learn feedback loop, the basic Build, and Measure. Here, we'll look at how to create a minimal viable product and how to decide whether to pivot (change direction with 1 foot planted to the ground) or continue. We'll examine strategies under "Accelerate," which enable Lean Startups to continue to develop while completing the Build-Measure-Learn feedback cycle as rapidly as feasible. The value of small batches is one of the lean manufacturing concepts we shall examine that may also be applied to startups (Baker, T., & Nelson, R. E., 2005).

Objectives of the study:

- To explore practices of Lean Startup Methodology.
- To study awareness about LSM with Vision, Steer, and Accelerate.
- To explore Lean Critical Tools and its application.
- To explore Lean Research Framework.
- To know awareness about LSM, LCT, and LRF and identify gaps for the holistic approach.
- To explore opportunities for enhancing Awareness for the first generation of Startup entrepreneurs.
- To conclude about the holistic approach to LSM, LCT and LRF.

Research Design and Methodology:

In this exploratory research study, the design is trying to focus on the current problem instead of conclusive answers to the stated questions. To explore the deep understanding the LSM, LCT, and LRF, this study is carried out and annoying to emphasize the implementation of a holistic approach for well-established and new startups and through a literature survey with research paper mapping on Litmaps. LSM, LCT, and LRF are the keywords used to explore the related papers and their mapping. The paper reviews on LEAN are available in fewer numbers on these three aspects in various database and hence primary data was collected to see the awareness about these lean aspects and its adoption in the startup. The sample consisted of 126 first generation trained startup founders-entrepreneur youths from rural area with Project Based Learning (PBL) methodology. The purpose of the research questions of this study is to explore the learning of start-ups and its measurement of progress with LSM, LCT, and LRF and to see its holistic adoption with awareness for the sustainability of the startups as the reviews on these three LEAN aspects are available in less number on various database.

Literature Review:

We utilized Google Scholar and the SCOPUS database to conduct a literature study on the holistic approach of LSM, LCT, and LRF. Out of 36 publications, 20 research papers were cited to discover the gap after mapping the other 20 research papers with Litmaps. Figure 1 shows research paper mapping.

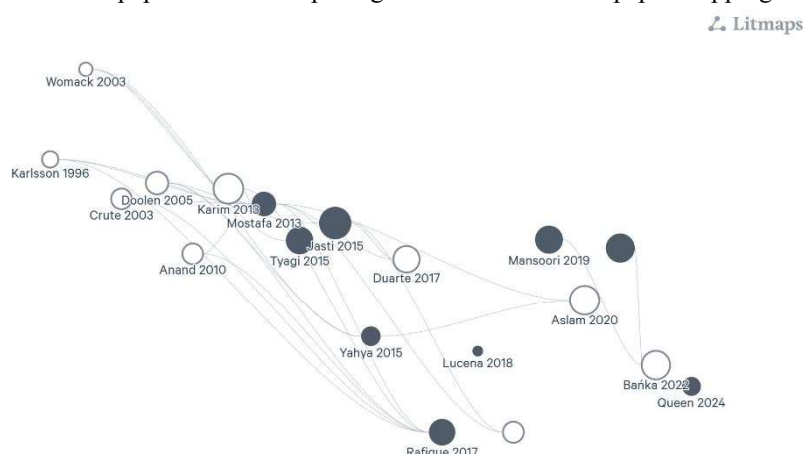


Figure 1: Research Paper Mapping using Litmaps

In an increasingly international market, first-generation well-trained entrepreneurs frequently generate distinctive concepts for start-ups. Other entrepreneurs frequently start new enterprises with very rudimentary notions and insufficient resources. A transitory company founded to find a scalable and replicable business concept is commonly referred to as a startup. In light of this, academics agree that a startup company lacks a viable and cohesive business plan that can support the long-term goals of the organization (Chesbrough and Rosenbloom 2002; Chrisman et al. 2005; Teece 2010). Chesbrough and Rosenbloom (2002) suggested that an original model

of business of the company is the hypothesis or unclear understanding of how to provide the client with value. Complements by pointing out that the best model of the business rarely emerges in a startup's early stages. In today's worldwide market, first-generation well-trained entrepreneurs frequently generate distinctive concepts for start-ups. Other entrepreneurs often launch new businesses with little more than a few simple concepts and little funding. A startup is sometimes defined as a short-term firm established to find a scalable and replicable business plan.

Accordingly, academics agree that a new company in its early stages lacks a viable and cohesive business plan that can support the long-term goals of the organization (Chesbrough and Rosenbloom 2002; Chrisman et al. 2005; Teece 2010). Chesbrough and Rosenbloom (2002) suggested that the original model of the business of the company is the hypothesis or unclear understanding of how to provide the client with value. Adds that it is uncommon for the best business plan to appear in the early phases of a firm.

Many experts think that the capacity of an organization to conduct tests along with experiments, learn from its business model, and grow is what determines its success amid situations and conditions of significant ambiguity, complexity, as well as speed of change, specifically for novel business ventures or startups. As a result, the drafting of a company Plan with a Model has become a top priority in a few company sectors. Most specially, Internet-based businesses are thought to be the most example of a situation where the speed of commerce demands that business models be continuously tested and modified.

In the era of a globalized market, many times first-generation well-trained entrepreneur develops specific concepts for the start-ups. Other entrepreneurs frequently launch new companies with little more than basic ideas and a little amount of available capital. A transitory organization created to look for a repeatable as well as scalable business model is one definition of a startup that is frequently used.

Accordingly, scholars generally concur that a startup company in its early stages of operation usually does not have a coherent & long-lasting business strategy that may support the long-term objectives of the company (Chesbrough & Rosenbloom 2002; Chrisman et al. 2005; Teece 2010). According to Chesbrough and Rosenbloom (2002), the original model of the business of the company is a hazy theory or hypothesis about how to give value to the client. complements, pointing out that the best business plan is rarely present in the initial phases of a startup.

In highly uncertain, complicated, and rapidly changing contexts and situations—particularly for startups or new company ventures—many academics think that an organization's ability to test, experiment, learn, and adapt from its business model is what determines its success. Hence preparation of Business Plan with Model has become top priority in few sectors of the business areas. It is believed that Internet-based companies are the best example of a situation where the speed of commerce demands that business models be continuously tested and adjusted.

Entrepreneurs must use lightweight, adaptable, and straightforward approaches, tools, and processes to accomplish this cycle of development from their business model. This will enable them to progress from simple product prototypes based on ongoing customer feedback. In this context, the phrase "Lean Startup" has been developed and defined to represent a technique engineered to assist firms in conducting tests, iterations, and pilots in search of a viable business model. His work has had a wide-ranging commercial impact and attracted the attention of new businesses.

Lean Startup Methodology:

The Lean Start-up Methodology can foster smart innovation in start-ups. It has the potential to reduce risk while also improving collaboration. It also helps the startup's commercial viability. LSM, LCT, and LRF must all be implemented in conjunction.

Vision with Lean Thinking:

The revolution in lean manufacturing gave rise to the Lean Startup. Shingo and Taiichi Ohno are credited with its development at Toyota. Supply chains and production systems can be improved with the help of lean thinking. It allows for just-in-time manufacturing and inventory control, batch size reduction, cycle time acceleration, and the expertise and inventiveness of individual workers (Blank, S., 2013). It draws attention to the difference between waste and activities that add value. It also showed how excellence can be infused into things from the inside out. The Lean Startup extends these principles to the context of entrepreneurial enterprises, arguing that entrepreneurs evaluate their success distinctly than other types of businesses do. Manufacturing progress is often judged by the creation of high-quality physical products. VL is a separate unit of progress used by the LSM. Using scientific learning as a guide, we may identify and reduce the causes of waste that plague entrepreneurship.

All elements of an early-stage company, such as the concept and idea, product development, organizational structure and design, marketing & sales, collaborations, scaling up, and distribution, should be covered in a comprehensive theory of entrepreneurship. It must set up a framework for evaluating advancement in the face of significant ambiguity. It provides entrepreneurs with precise instructions on how to make the many trade-off choices they encounter, such as whether and when to invest in process, formulation, and planning, as well as specific infrastructure; when to work alone and when to collaborate with others; when to react to criticism and when to

remain true to the vision; and how and when to make investments in business scaling. Above importantly, it should enable entrepreneurs to make predictions that can be tested (Blank, S. & Dorf, B., 2012).

Validated Learning:

The vision component of the LSM also takes into account learning. The essential purpose of entrepreneurship is to develop an organization in the face of severe uncertainty. Its most important role is learning. We must understand which components of our plan are effective in achieving our objective. Instead of focusing on what customers say they want or what we think they ought to want, we need to find and understand what they actually want. We need to assess if we are headed toward creating a long-lasting company. The Lean Startup paradigm rehabilitates learning through a concept known as VL. VL is neither an after-the-fact justification nor a nice narrative used to conceal failure. As companies grow, VL is a strict method of demonstrating progress in an atmosphere of extreme uncertainty. VL is the empirical demonstration of a team's discovery of important facts regarding a startup's current and upcoming commercial potential in the market. It is more specific, precise, and timely than market forecasting or traditional business planning.

Value Vs. Waste:

Which of our effectiveness provide value, and which are wasteful? The lean manufacturing revolution's most urgent question is this one. Every follower of lean manufacturing is instructed to ask this question first. VL must identify waste and then eradicate it systematically, as it has done with lean firms. According to lean thinking, value is anything that benefits the client; anything else is waste. Customers at a manufacturing company are more concerned with the product's functionality than its assembly (Brinckmann, J., Grichnik, D. & Kapsa, D., 2010). In a company, it must be understood that who the client is and what the consumer could find useful are unknowns, which is part of the ambiguity that defines a business.

Customers rarely know exactly what they want ahead of time. In this instance, we must experiment, allowing customers to test something and then measure their behavior. Learning is a crucial component of the work that is not required to advance companies. This is verified learning since it consistently results in positive changes in the startup's main KPIs. It is simple to deceive yourself regarding what you believe your clients want. It is also simple to learn information that is entirely unrelated. Thus, verified learning is supported by actual information gathered from real consumers.

Experiment:

Many entrepreneurs struggle to solve issues such as what they should work on next. What may be altered safely, and what could irritate customers? Which consumer opinions, if any, should we consider? How should we prioritize among the several features we may develop? Which features are critical to the product's progress, and which are optional? What would satisfy today's customers at the expense of tomorrow's?

The startup can use the LSM to test its plan and determine which aspects are great and which are crazy. A real experiment follows the scientific process and it starts with a well-defined hypothesis that forecasts what is expected to occur (Chang, S.J., 2004). It then conducts empirical testing to validate these predictions. While startup testing is driven by the startup's objective, scientific experimentation is grounded on theory. Every startup experiment aims to determine how to develop that idea into a long-term business. Experimentation yields significantly more corporate insights for strategic decision-making.

Task into Components:

The first step would be to deconstruct the big vision into its constituents. To derive conclusions, entrepreneurs use two key assumptions: the value hypothesis as well as the growth hypothesis. The value hypothesis establishes whether a good or facility actually adds value for consumers once they utilize it. What is a decent indication of whether individuals value contributing their time? It could be answered via a poll, but it would be inaccurate because most individuals struggle to objectively judge their emotions.

Tests offer a more precise choice. What could we observe in real time that would be a stand-in for the benefits that volunteers were receiving? Opportunities for a limited number of individuals to volunteer may be identified, and their retention rate could then be examined (Chesbrough, H. & Rosenbloom, R.S., 2002). How many of them agreed to volunteer again? When individuals actively spend their time and attention in a program, it is a good indication that they think it worthwhile. We may do a similar study for the growth hypothesis, which examines how new buyers find a good or facilities. How will the program expand once it is up and operating, from early adopters to broad adoption?

Viral growth is a possible avenue for this program's expansion. If that is the fact, the most critical thing to measure is behavior: would the early participants actively spread the word to other people? A straightforward experiment in this situation would entail selecting a relatively small number of people and possibly offering them a unique volunteer opportunity (Eisenmann, T., Ries, E. & Dillard, S., 2011). The goal is to identify early adopters rather

than the ordinary client. Customers who have the most acute demand for the goods. Those clients are more forgiving of faults and quick to provide feedback.

An experiment, according to the Lean Startup concept, is both a theoretical investigation and an initial product. The manager may begin his/her campaign by enlisting early adopters, adding people to all subsequent experiments or iteration, as well as eventually starting for manufacturing a product if this or any other trial proves successful. During this stage, the good is prepared for widespread distribution and will have existing clients. It will have addressed real-world issues and other thorough specifications for what must be built. Instead of anticipating what could work tomorrow, this specification will be based on input on what is working today, as opposed to a standard strategic planning or market research procedure. This is the main factor that has to be considered while using LSM.

Steer:

Startups act as catalysts, turning concepts into completed goods. Customers create data and feedback when they use such goods. Both qualitative as well as quantitative comments are provided, including the number of users and their perceptions of its value. A startup's goods are essentially experiments, as we saw in part one, and the results of those trials are lessons learned about how to create a viable firm. Since it has the power to shape and impact the next generation of ideas, such information is far more significant for startups than money, accolades, or media attention (Furr, N., & Ahlstrom, P. 2011). LSM can visualize with these three-step processes (Figure No. 2). The foundation of the Lean Startup method is this Build-Measure-Learn feedback loop.

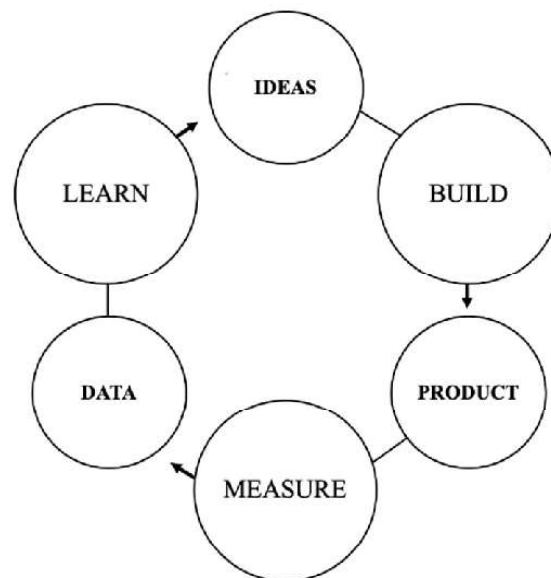


Figure 2: Build-Measure-Learn Feedback Loop
Source: (P. Brecht, R. Kerres and et all 2020)

One aspect of this feedback loop is emphasized in the professional training of many persons. For engineers, it often means understanding how to construct things as effectively as feasible. Some managers are quite skilled at brainstorming and learning at the whiteboard. Many entrepreneurs concentrate their efforts on the people who have the greatest first product design, the best product concept, or who are obsessed with statistics and metrics. In actuality, none of these pursuits are really significant on their own. Rather, we must concentrate on reducing the overall amount of time spent in this feedback loop. This is the section that involves leading a startup.

Exploring the significance of learning as a gauge of a startup's growth was the aim of the earlier concepts. We can steer clear of a lot of the waste that now befalls startups by concentrating our efforts on proven learning. Similar to lean manufacturing, knowing when and where to invest energy saves both money and time. We must decide which hypotheses to test in order to apply the scientific procedures to a startup. These components—a leap of faith assumptions—are the most dangerous in a startup's plan as they are the ones that depend on everything else. The value hypothesis as well as the growth hypothesis are the 2 most crucial presumptions. They result in tuning variables that govern the development engine of a startup (Allen, K. R. 2015). Every startup integration is an effort to spin this engine and see if it will turn. The procedure repeats once it is operating, moving into higher gears for improved performance.

The initial stage is to launch the Minimum Viable Product (MVP) into the Build phase as soon as possible after these leap-of-faith assumptions are established. According to Blank (2005), the MVP is the version of the good that allows for a complete cycle of the Build Measure Learn loop including the small quantity of work as well as time

of development. Many elements that might later prove crucial are absent from the minimal viable product. In other respects, though, developing an MVP necessitates additional effort since we need to be able to gauge its effectiveness. For instance, engineers' and designers' internal quality. Additionally, we must expose it to prospective clients to assess their responses. As we will soon see, we might even have to attempt selling them the prototype.

Assessing whether the efforts being made to develop the product are producing tangible success will be the largest hurdle during the Measure phase. Whether we were doing it on schedule and within our budget. We must employ a quantitative technique known as "innovating accounting," which enables us to determine if our engine-tuning efforts are paying off. As an alternative to conventional business and product milestones, it also enables us to establish learning milestones. Entrepreneurs may utilize learning milestones to correctly and impartially evaluate their development, and managers and investors who have to hold entrepreneurs accountable can also benefit greatly from them. The pivot is the most crucial element. After finishing the Build-Measure-Learn cycle, we are faced with the most challenging decision an entrepreneur must make: should we stick with the original plan or change it? A significant shift to a new strategic hypothesis should be made if we have found that one of our assumptions is incorrect (eMarketer 2012).

It enables startups to realize when it's time to pivot sooner, the LSM reduces time and money waste and helps create capital-efficient businesses. Even yet, we represent the feedback loop as Measuring, Learn, and Building due to the inverse sequence. We determine what we require to learn, determine what we require to measure to determine whether we are gaining VL, and then determine what product we require to develop to conduct the experiment & obtain the measurement using innovation accounting (Ries, E. 2009). By using the Build, Measure, and Learn feedback loop with the LSM, all of the methods are intended to reduce the overall time.

Accelerate:

The majority of the decisions made by startups are not definitive. How frequently should a product be released? From an efficiency perspective, product releases frequently leave less time for product development since they come with overhead. On the other hand, waiting or taking very long to release might result in the ultimate waste—something that no one wants. How much time and effort should businesses put into early planning and infrastructure to succeed? If you overspend, you lose valuable time that might be used for education.

If you don't put in enough time, you can miss out on early success as well as market leadership to a quick follower. What should workers do during the day? How can we, as an organization, hold individuals responsible for learning? Conventional departments establish incentive programs to help employees stay committed to achieving excellence in their fields, such as product development, marketing, and sales. If cross-functional cooperation is in the best interests of the business, startups require organizational structures that counteract the excessive unpredictability that is their worst opponent. On the production floor, the lean manufacturing movement encountered comparable issues. With a few adjustments, their responses also apply to startups.

The important main question for any lean transformation is, which activities create value and which are a form of waste? After you comprehend this difference, you may start applying lean methods to eliminate waste and boost the effectiveness of the value-creating processes. These strategies need to be modified to fit the particulars of entrepreneurship to be applied in a startup (Ries, E. 2011). Validated knowledge on how to create a sustainable firm is more valuable in a startup than producing goods. What goods do consumers desire? Who is our client? Which clients should we pay attention to, and which should we overlook? How will our company expand? To increase a startup's chances of success, these are the issues that must be addressed as soon as possible because it is what adds value to a startup's success.

As businesses mature, bureaucracy and lethargy are not their inevitable fate. As a starting point, lean startups may develop into lean businesses while retaining their adaptability, focus on learning, and innovative culture. Lean startups use just-in-time for scalability, experimenting with goods without making significant upfront expenditures in planning and design, much like lean manufacturing has aimed for a just-in-time strategy for product development, minimizing the requirement for in-process inventory. A startup may focus its efforts where it will have the greatest impact on expanding the firm by determining the growth engine it is employing. To select new experiments and assess the performance of new products, each engine has to concentrate on certain criteria. These metrics enable companies to determine when their growth is about to run out and make the necessary adjustments when combined with the previously discussed innovation accounting method (Startup Lean, 2015).

The same forces that force today's businesses to discover new methods to invest in disruptive innovation also affect startups as they develop into established businesses. Businesses now need to become proficient in managing a portfolio of disruptive and sustainable innovation. The idea that businesses move through distinct stages and abandon prior types of labor, including invention, is out of date. Instead, contemporary businesses need to be adept at handling several types of tasks concurrently. Companies should foster innovation teams inside the framework of an established business to achieve this.

Lean Critical Tools (LCT):

The LCT is 10 in number. It contains the following: Quick Changeover, Standard Work Combination Chart, Line Balancing, Kaizen Event, Value Stream Map, Gemba Walk Interview Sheet, A3 structured template, 5S Audit, and Waste Analysis by operation (Minitab Engage). Understanding the process, identifying waste, avoiding errors, and recording your actions are all made easier using LCT. Lean aims to make doing things correctly simple and doing them incorrectly difficult.

The Lean Suite claims that there are 10 LCTs. There are several real-world instances of how Lean adoption has benefited various industries. Significant cost, lead time, and inventory reductions, along with several other enhancements, have been observed globally. The first LCT tool, both value-added as well as non-value-added, that follows goods or facilities from start to finish to the consumer is a Value Stream Map (VSM).

- The goal of Gemba Walk is to watch, comprehend, and eventually enhance a process. It may be used to verify reality using the Gemba Walk Interview Sheet. It includes several inquiries, different types of information, and observables. The interview sheet offers a structure for ongoing communication and reliable feedback.
- The practice of equalizing for the amount of time needed to achieve these goals is known as line balancing.
- A3 is for ongoing improvement and problem-solving. It became an excellent Lean tool because it provides a straightforward, organized method, and visual communication, and encourages cross-team cooperation.
- 5S is a collection of tools that help teams arrange their workspace in a methodical and systematic way. To adhere to the numerous acts consists of 5 steps: Set in Order, Sort, Sustain, Standardize, and Shine.
- Kaizen is a committed and targeted event that promotes process improvements. The project's goals are clearly stated and properly organized. Workers are dragged away from their regular tasks to take part.
- Manufacturers may establish accurate estimations for upcoming scheduled activities and upgrades by using the Work Element Time Study (WETS), which helps them understand how long a task takes to complete.
- Waste Analysis by Operation quantifies and color-codes the degree of waste at each process stage by documenting the categories of waste. When carried out by several observers, both inside and outside the process, the Waste Analysis exercise is most successful.
- A method for analyzing your present processes and contrasting them with future states is called Quick Changeover (AC).
- Another LCT tool is the Standard Work Combination Chart (SWcC). The process is made clearer, consistency is guaranteed, staff training is accelerated, and a benchmark for future progress is established by the definition of "standard work."

Under the guidance of LCT practitioners, the startup can adopt LCT as it entails comprehending precise concepts and appropriate methods for implementing its many components.

Lean Research Framework:

In the modern period of the fourth and fifth industrial revolutions, it serves as a framework for directing and enhancing the practice of doing field investigations with individuals and communities in the background of humanitarian work and international development. According to J. Aker, L. Budzyna, et al. (2015), research in these settings is frequently carried out to comprehend and enhance the effects of different project activity interventions on the lives of communities dealing with poverty, vulnerability, and other issues. Rigor, Respect, Relevance, and Right Size are the "4R" principles of the LRF.

Rigor: The integrity of the research process and its findings are always guaranteed by high levels of rigor. Research ought to be useful to stakeholders and considerate of participants' time. Lean research is carried out in accordance with research methodological standards and pragmatic considerations that are most appropriate for the particular activity being studied. It provides findings while safeguarding sensitive subject data and overcomes problems with both internal and external validity.

Respect: All ethical considerations are covered in respectful research, together with the enjoyment and dignity of the human research subject. The research briefing, discusses a transparent, informed consent procedure where stakeholders are genuinely free to decline involvement without worrying about the repercussions. Subjects find the study experience interesting and useful for drawing conclusions if they want to participate.

Relevance: All parties involved may clearly and significantly benefit from relevant research. For research participants, study communities, investors, and decision-makers, it tackles the most important problems and queries. All stakeholders, including study participants, practitioners, and policymakers, may easily comprehend and obtain the research findings.

Proper Size: Research is appropriately sized when its techniques and scope align with its goals and the importance of its questions to stakeholders. Because it must be and because all superfluous questions, actions, and processes are eliminated, properly scaled research can occasionally be time-consuming, difficult, and expensive. Appropriate research size yields appropriate solutions to the problems.

There are few such other LRFs for the specific context. Working in a lean startup might be difficult for a variety of reasons, but since quality and speed are crucial, we developed a flexible framework to assist you in establishing the methodology of a research project (Oriol Banus, 2020). In order to identify and reduce apparent wastes, J. Wanitwattanakosol and S. Noamna (2018) state that their research framework consists of five steps that primarily followed processes of the action research cycle. Interviews and an examination of operational manuals are used to gather preliminary data. The IDEF family is chosen to document activities and investigate component relationships. To talk about a root cause, a cross-level, cross-functional focus group is used. In a case study, a Necessary Condition Analysis is used to determine the degree of lean hurdle. Critical wastes are eliminated with the use of developed lean technologies. Lean IT tool modifications are a result of the action evaluation stage's findings.

Data Collection and Analysis:

First Generation-trained Start-up Founders-Entrepreneurs are the population for the primary data. The sample size for the data collection is 126. Collection of the data is done through the multiple-option questionnaire with two point and five-point scales.

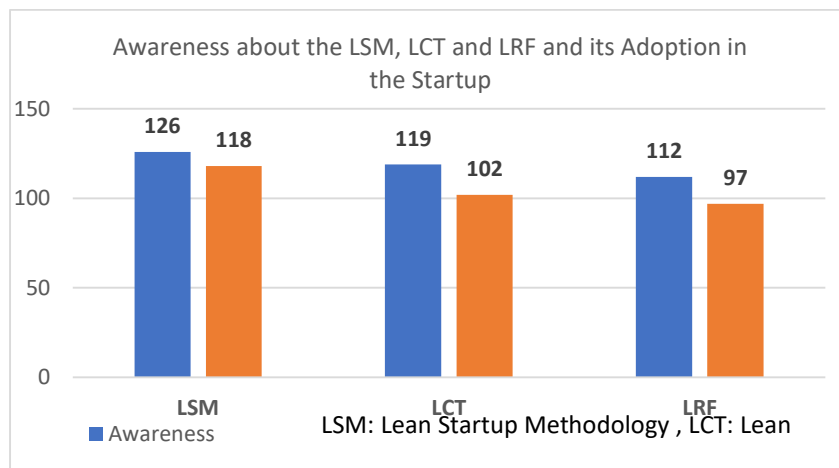


Figure 3 Awareness about the LSM, LCT and LRF & its adoption in the Startup

Awareness and adoption of LSM, LCT, and LRF by the startup entrepreneurs for sustainability of startup-enterprise is shown in the Figure 3. It shows that highest number of entrepreneurs are aware about LSM than LCT and LRF. Research framework component is less popular as compared to the others two.

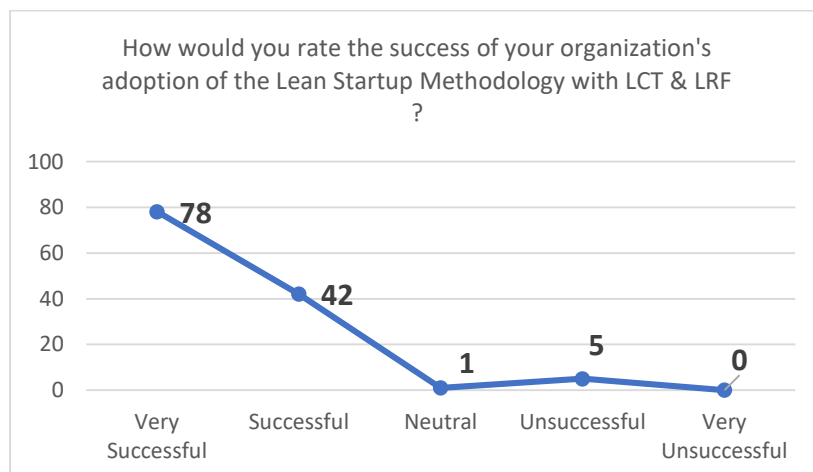


Figure 4 Rate of Success on adoption of LSM, LCT, and LRF

Figure 4 shows success rate with adoption of LSM, LCT and LRF in organisation was 95.23% as 120 out of 126. The unsuccessful rate was 3.96 % as 5 out of 126. One remains neutral.

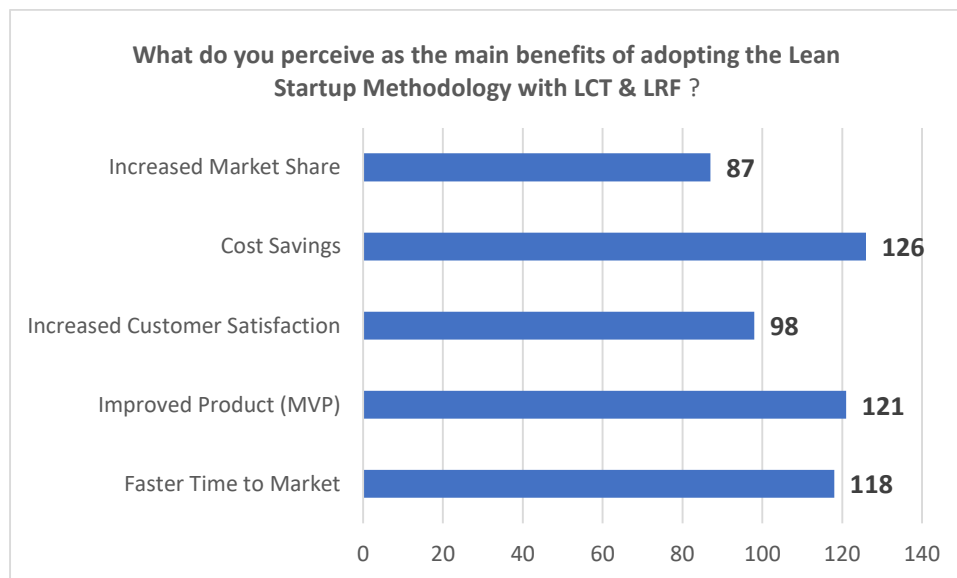


Figure 5 Benefits of adopting LSM, LCT, and LRF

Figure 5 shows the data on the benefits with adopting LSM, LCT, and LRF on the five aspects of Increased Market Share (69%), Cost Saving (100%), Increased Customer Satisfaction (77.77%), Improved Product MVP (96%), and Faster Time to Market (93.6%).

Analysis shows that the Holistic approach of LSM, LCT, and LRF was found useful for the sustainability of the startup with various identified Lean parameters. Project Based Learning Methodology for understanding Lean concepts to apply for field practice was found 100% successful in the one of the other questions answered during the survey.

Conclusions:

We recognized and synthesized the professional and scientific underpinnings that precede, support, and enhance the key ideas, procedures, and techniques promoted by the Lean methodology with LSM, LCT, and LRF because of the LSM's significance and popularity, particularly among practitioners.

Furthermore, by placing the Lean methodology in the context of other strategic and entrepreneurial tools that have been studied in recent decades, we discovered a group of related and preemptive approaches that can help the Lean methodology be implemented by giving the entrepreneur new tools and supporting procedures for sustainability.

Awareness among the first-generation entrepreneurs needs to be rebuilt with capacity development programs for sustainable startups to improve the livelihood of the rural youths. Lean methodology process implementations aspects should be under the lean practitioners for effectuation. Holistic approach of the LSM, LCT, and LRF with "Project Based Learning" methodology improves sustainability concern of the startups.

According to our review, the core ideas of the Lean methodology with a holistic approach are strongly aligned including the foundations and tenets of the Learning School of Strategy & the Effectuation and Bricolage schools of Entrepreneurship. They are also explicitly supported by the Lean philosophy's techniques and principles, which originated in the manufacturing context.

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