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Lean startup orientation and performance in South Africa

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Lean startup orientation and performance in South Africa.

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in Entrepreneurship and New Venture Creation

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21 June 2022

ABSTRACT

Knightian uncertainty predicts a disequilibrium in the market which provides an opportunity for Entrepreneurs to capitalise on. Unfortunately, traditional managements theories do not provide guidance for entrepreneurs as they firstly rely on causal logic and secondly assume Startups are just smaller versions of large businesses. Because this has been disproved new management theories have been developed for entrepreneurship. These include Bricolage, Effectuation, Discovery Driven Planning and the Lean Startup Methodology (LSM).

In the last 20 years the LSM has gained a cult like following amongst entrepreneurial practitioners. Academics on the other hand have been sceptical of this theory stating a lack of theoretical grounding as the Achilles heel of this theory.

This research study firstly set out to investigate the theoretical soundness of the LSM. As this research study is a follow on of a research study in the software industry in Germany (Schwery, 2018) it secondly set out to establish what effect the Lean Startup Orientation (LSM Construct) had on the performance of the Startups. The effects of following secondary factors were also was studied: Radicalness of Innovation, Technology Uncertainty, Market Uncertainty, Industry, Entrepreneurial Experience and Source of Funding. This study has built on this study by improving the performance metrics to non-financial metrics.

In terms of the theory this study has contributed to the entrepreneurial body of knowledge by showing there is sufficient evidence that the LSM is founded on the theories of bricolage and effectuation. The LSM can easily be improved upon by incorporating it with theories like Design Thinking and the Business Model Canvas. From the statistical analysis the insignificant correlations were observed with all the variables but not enough to make any conclusion with statistical significance.

In the context of developing countries, the LSM provides a framework for administrators of the incubators to use to assist the Startups within the incubators to flourish without having qualified, experienced and trained entrepreneurial mentors. The LSM did however show

promise as a commercialising mechanism for radical innovation in corporates and academic environments.

Key Words: Lean Startup Methodology, Lean Startup Orientation, New Venture Performance.

DECLARATION

I, Frederick Jacobus van Eeden, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the Field of Entrepreneurship at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Frederick van Eeden

Signed at Centurion

On the 21st day of June 2022.

DEDICATION

I dedicate this report to my wife, Lynette, who gave me the opportunity and supported me through this journey of obtaining my MMENVC. Thank you for all the sacrifices you made during this process and without you this would not have been possible.

Thank you to our children who were supportive and endured my absence in their lives.

AKNOWLEDGEMENTS

I would like to acknowledge Prof. Boris Urban whose guidance and input as my supervisor was invaluable.

A Special recognition must be given to Ms. Paula Nagy (Founders Factory Africa) and Ms. Anita Palmer (Propella Business Incubator) who supported this study in facilitating access to their Startups.

Lastly, I would like to acknowledge the contribution of Mr. Honest Muchabaiwa who mentored and guided me with the statistics part of this report.

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1. INTRODUCTION

1.1. Context of the study

Frank Knight in his 1921 book “Risk, Uncertainty and Profit” stated that constant flux in the business world provides fertile grounds for businesses to make a profit from the changing landscape. Although his theories were not widely researched further, he left us with a distinctive definition of uncertainty: he divided it into Risk and True Uncertainty.

Risk, he defined as the objective measurement of a situation where we do not know the outcome but we can measure the odds accurately. True Uncertainty on the other hand he defined as the subjective measurement of a situation where we cannot know all the information and thus cannot even determine the odds.

In an everchanging world businesses have imperfect knowledge of the future, some scholars called this the unknowable and thus became known as Knightian Uncertainty (Bhidé, 1999).

True uncertainty thus implies predictions of any sorts are irrelevant, because the future is unknowable (Sarasvathy, 2001)

In South Africa today in 2022 we are emerging from a truly unknowable period during the covid lockdown of over 2 years where our country was run by a central command council who at the drop of a hat made it illegal for businesses to trade.

On the regulatory front legislation is constantly changing in terms of BEE, Labour Laws, Expropriation without Compensation, Prescribed Assets and National Health Insurance making it hard for a business to operate. Legislative uncertainty has most investors both locally and internationally refraining from investing in commercial endeavours in South Africa. This can be seen by the reduction of Foreign Direct Investment (FDI) in South Africa over the last couple of years.

The 2021-2022 rampant looting and floods in KwaZulu-Natal and Gauteng has highlighted the intricate and uncertain social-political-economic scenario currently in South Africa.

According to Knight all this uncertainty provides opportunity for entrepreneurs to profit from yet South Africa is struggling to grow economically and the average South African citizen is struggling financially.

Since 2011 South Africa's Gross Domestic Product (GDP) per capita has steadily declined. Fig. 1.



Source: https://www.macrotrends.net/countries/ZAF/south-africa/gdp-per-capita

Fig. 1: South Africa's Gross Domestic Product

This graph indicates that the economic growth is not keeping up with population growth. These indicators imply that the average South African is becoming poorer in real terms. The only way to reverse this trend is to grow the South African economy faster than the growth of the population.

Entrepreneurship has the ability to drive economic development in a country on a macroeconomic level (Quadrini, 2009). Further Christenson, Ojomo, & Dillon (2019) stated that Market Creating Innovation has the ability to grow the economy, create jobs and improve the prosperity of the people in the economy.

So, it seems South Africa needs to learn how to create more businesses that focus on innovation, which in turn will create new markets that will grow the South African economy.

Even with all these uncertain factors at play in South Africa, “70-80 % of small businesses fail within 5 years” (Lose & Tengeh, 2015) according to the ongoing study of small businesses by the University of Western Cape. This corresponds with research done by Harvard Business School’s Shikhar Ghosh that shows 75% of businesses in the USA fail. (Blank, 2013).

Startup businesses have had to rely on traditional strategic management theories which are based on causal logic: if you apply these inputs, you are likely to get these possible outputs. Many multinational corporations have spent millions of dollars to try and predict the future only to get it terribly wrong. An example of this would be Nokia who lost its dominant market share in the cell phone Industry.

Instead, this is where new exploratory and experimentative business model theories like Effectuation could come to their own right and provide new avenues for Startups to pursue. Effectuation starts with the premise that because the future is unknowable we start where we are, with the resources we have on hand. We then collaboratively and iteratively explore and develop with other stakeholders to see what effects can be obtained (Heikkilä & Heikkilä, 2017). So according the Effectuation theory, the entrepreneur is not just a passenger but has an important role to play in creating the future (Sarasvati, 2001).

Many other business theories like Lean Startup Methodology (LSM), Discovery Driven Planning & Design Thinking follow this philosophy of exploration, experimentation and feedback to co-create the future.

During the research phase, the LSM stood out as a theory worth investigating. It had been developed in the heart of Silicon Valley in response to the many failed software Startups by Eric Ries (2011). Due to the complex and volatile nature of software development, traditional business management theories were failing to deliver sustainable businesses with saleable products within the time and budget constraints.

1.2. Theory section

In the 1960's the principles of Business Planning were introduced into the business world. By the 1970's they were accepted and widely applied, and by the 1990's Scholars like McGrath and MacMillan started applying them to entrepreneurship (Mansoori, 2019).

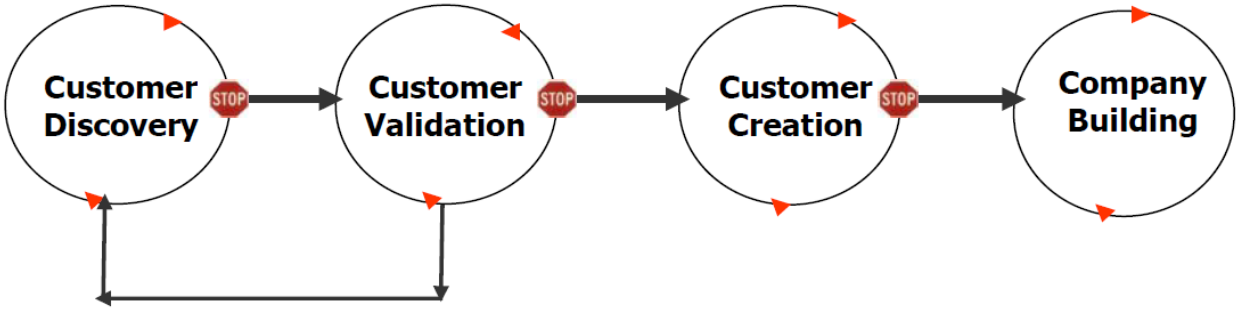
Unfortunately, after the new millennium scholars and entrepreneurs like Steve Blank (2013) realised through trial and error that Startups were not smaller versions of traditional businesses. In fact, they weren't similar at all and thus required other theories and methodologies to guide them.

Today Entrepreneurship has developed into its own branch of business studies. Entrepreneurship Theory and Practice divides the Entrepreneurial Process into 3 phases (Venter, Urban, Beder, Oosthuizen, Reddy, & Venter, 2018), they are:

- Pre Startup Phase: Opportunity Recognition and Evaluation
- Startup Phase: Action and Opportunity Exploitation
- Post Startup Phase: Sustainability and Growth

This study will be a cross sectional study and will only look at the startup phase of Startups in business incubators in South Africa. Further the study will investigate what effect the LSM has on the success of Startups in these business incubators.

The LSM was initiated by Steve Blank (2013) and further development was done by Eric Ries (2011), one of Blank's students. Blank's "Four Steps to the Epiphany" (Blank, 2006) is shown in Fig. 2 and it was based on his personal experience and academic studies.

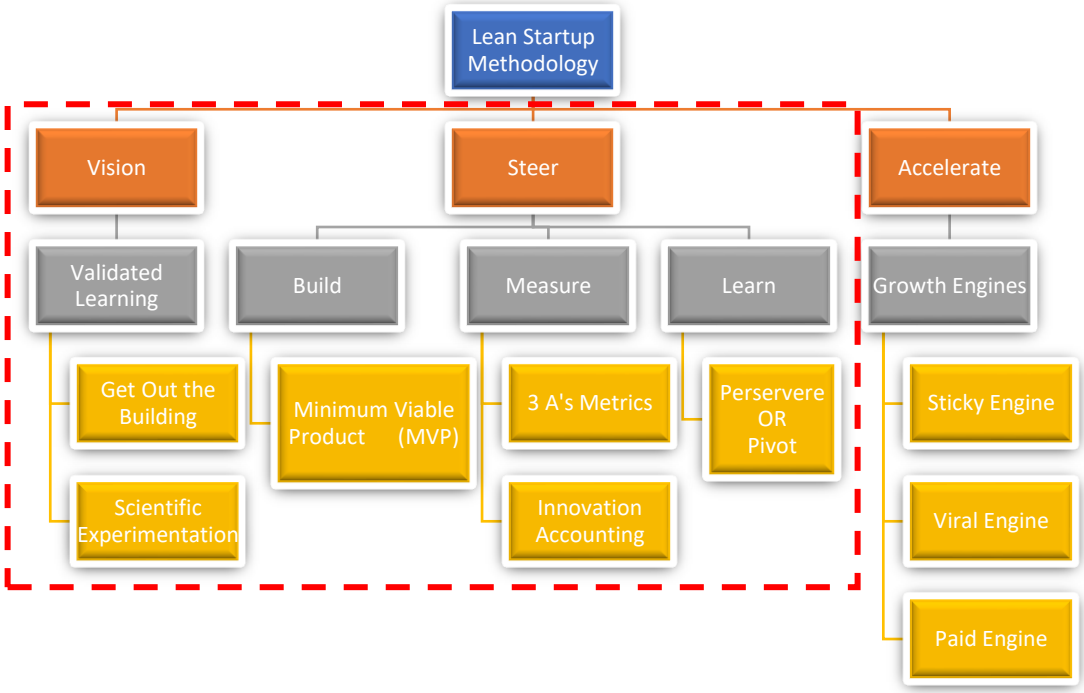


Source: Blank, S. 2006, Four Steps to the Epiphany. Lulu Press. pg 16

Fig. 2: Four Steps to the Epiphany

Eric Ries (2011) combined Blank's methods with other methods used in other industries like the Lean Manufacturing and Agile Project Management. Having only been developed fairly recently (2000's) LSM is still in its infancy and though it has gained much traction under entrepreneurial practitioners it is perceived to lack the academic foundation when compared to a similar entrepreneurial theories like Effectuation (Sarasvati, 2001).

An overview of the Lean Startup Methodology can be seen in Fig. 3. This study will only focus on the Vision and Steer parts of the LSM (red rectangle, Fig. 3).



Source: Created from Ries (2011).

Fig. 3**:** Lean Startup Methodology Diagram

In an attempt to dissect and understand LSM scholars have operationalised LSM into the Lean Startup Orientation (LSO). Many qualitative studies were done to find scientific evidence for the LSO elements. The core of the LSO is the Build-Measure-Learn (BML) Loop (Dillard, 2013; Eisenmann, Ries; Frederiksen & Brem, 2017; Patz, 2013; Rübling, 2016). Ostewalder (2017) later added Think to front of the BML Loop.

Schwery (2018) further refined the conceptualisation of the LSO to what is seen in Fig. 4. Where each of the four phases has been grounded in the relevant theory.

THINK	BUILD	MEASURE	LEARN
Hypothesis testing Customer Orientation	Iterative Experimenta-tion	Validation	Learning

Source: Schwery, M. (2018). Lean Startup Orientation: Empirical Evidence of Venture Success (Masters thesis), University of Twente, The Netherlands, pg 63

Fig. 4: LSO Conceptualisation

In Schwery's study (2018) he endeavoured to see whether the LSO had a positive effect on the Startup's Performance in software startups in Munich, Germany. The performance in this study was measured according to traditional project management metrics of Time, Quality and Cost. In line with lean principles these metrics for performance don't fit/align as you can deliver a product on time, at the right quality and under budget but the customer has no need for the product whatsoever, thus only delivering waste.

The aim of this study is to establish the same correlation between LSO and Startup Performance as Schwery's Study (2018) but instead using non-financial metrics to measure the Startup's performance. The non-financial metrics are defined by Ghezzi, Cavallaro, Rangone & Balocco (2015) as: (1) Survival Rate, (2) Product Development Cycle, (3) Venture Organisation Activity (VOA), (4) Equity Funding and (5) First Customer Acquisition (FCA).

This relationship between LSO and Startup Performance is affected by the uncertain entrepreneurial environment which consists of technology, economic, regulatory, political & legal, socio-cultural, sustainability and global & international factors. Schwery (2018) whittled the key factors down to Market Uncertainty, Technology Uncertainty, Radicalness of Innovation and Business Type. He investigated the effect of these factors on the relationship between LSO and Startup Performance.

From Schwery's Study (2018) Business Type did not significantly affect the relationship. In Schwery's conclusion and future recommendations he advised that future studies could investigate the moderating effect that Business Industry, Entrepreneur Experience and Source of Funding has on the relationship between LSO and Startup Performance.

1.3. Motivation for the study and problem statement

An uncertain entrepreneurial environment, caused by factors ranging from BEE to looting, as discussed in the introduction, does not create a conducive environment for business and instead of assisting, the South African Government, keeps coming up with onerous regulations for businesses to comply with. South Africa has slid from 32nd (2008) to 84th (2020) in the "Ease of Doing Business" ranking by the World Bank.

It is not surprising that in South Africa most Startups dismally fail or fail to perform sufficiently to remain self-sustaining, 70% of our small businesses fail within 5 – 7 years (Bushe, 2017). The main reasons for business failure in South Africa can be attributed to lack of entrepreneurial skills, lack of funding, lack of planning and lack of adequate market (South African Entrepreneurship Magazine, 2015).

If Schwery's Study (2018) can be replicated in South Africa it would prove the applicability of the LSM not just in developed countries but also developing countries. If similar results are obtained in South Africa, it would provide incubator administrators a methodology to improve the performance of the Startups they are trying to nurture. In turn this improvement will deliver more bang for the governmental spend on the various incubators and invariably subsequent economic growth will help improve the GDP per capita in South Africa.

1.4. Research purpose, research question and aims of the study

In search of a solution to this cumulative problem this study looked abroad to the USA where evidence can be found that the LSM has gained an extensive following because of the success achieved by delivering positive results in Startups in the volatile and competitive world of Silicon Valley. Many highly ranked accelerators, such as Y Combinator, Techstars, 500 Startups, and AngelPad structure their services following the guidelines of the LSM (Mansoori, 2019). Surely if it can deliver positive results in Startups in volatile markets there it could possibly be a solution for Startups in South Africa?

This leads us to the main research question: To what extent does the Lean Startup Orientation (LSO) affect the Startup's Performance in South Africa?

Can we find evidence of Lean Startup Methodology being used in successful Startups in South Africa?

This study will further investigate how 6 of the major entrepreneurial uncertainty factors affect the relationship between LSO and Startup Performance:

1. How does the **market uncertainty** affect the LSO-Startup Performance relationship?
2. How does the **technology uncertainty** affect the LSO-Startup Performance relationship?
3. How does the **radicalness of the innovation** affect the LSO-Startup Performance relationship?
4. How does the **type of business industry** affect the LSO-Startup Performance relationship?
5. How does the **entrepreneur's experience** affect the LSO-Startup Performance relationship?
6. How does the **source of funding** affect the LSO-Startup Performance relationship?

1.5. Conceptual definition of terms

The construct for this research project can be seen in Fig. 5. The **LSO** is the Independent Variable and the **Startup Performance** is the Dependent Variable. This is followed by 6 Moderating Variables affecting the relationship between LSO and Startup Performance.

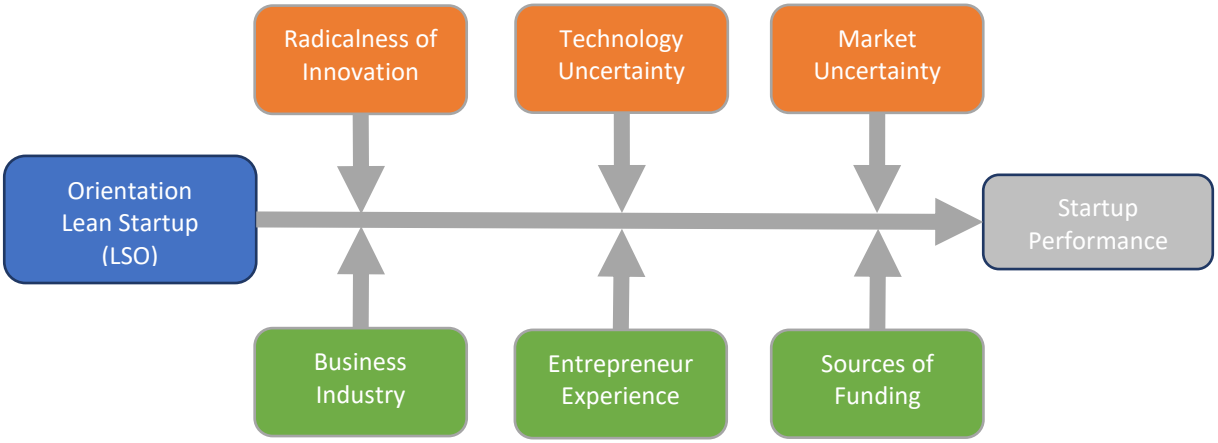


Fig. 5: Research Proposal Construct

The **LSO** Construct consists of the following items. These items are defined in more detail in Section 2.2:

- Think
  - Hypothesis Testing
  - Customer Orientation
- Build
  - Iterative Experimentation
- Measure
  - Validation
- Learn
  - Learning

The **Startup Performance** Construct consists of the following items. These items are defined in more detail in Section 2.4:

- Survival Rate
- Product Development Cycle

- Venture Organisation Activity (VOA)
- Equity Funding
- First Customer Acquisition (FCA)

The **Market Uncertainty** Construct consists of the following items. These items are defined in more detail in Section 2.6.2:

- Customer Preferences
- New Products
- Customer Needs
- Predicting Change

The **Technology Uncertainty** Construct consists of the following items. These items are defined in more detail in Section 2.6.2:

- Newness of technology
- Complexity
- Technology shifts
- Frequency of change

The **Radicalness of the Innovation** Construct consists of the following items. These items are defined in more detail in Section 2.6.1:

- Rating of improvement
- Rating of innovativeness
- Ease of substitution
- Level of advancement

The **Business Industry** Construct consists of the following items. These items are defined in more detail in Section 2.6.3:

- Level of competition
- Ease of entry
- Threat of substitutes
- Buying power
- Bargaining power

The **Entrepreneur Experience** Construct consists of the following items. These items are defined in more detail in Section 2.6.4:

- Management experience
- Previous ventures
- Failures
- Personal entrepreneurial view

The **Source of Funding** Construct consists of the following items. These items are defined in more detail in Section 2.6.5:

- Cashflow
- Tangible assets
- Patents
- VC Financing
- Warranties
- Source of Funding

1.6. Contribution of the study

In Shepherd and Gruber's (2021) study they analysed the LSM in 5 areas/blocks from a theoretical perspective: (1) Business Model, (2) Validated Learning / Customer Development, (3) Minimum Viable Product (MVP), (4) Perseverance vs Pivot & (5) Market-Opportunity Navigation. The aim of their study was to provide academic support for the LSM framework in these 5 areas and to provide the groundwork for future research. One such future avenues they proposed was to look at the how the LSM framework affects the performance of the Startup. This would be the starting point of this study.

This research study will look to validate the relationship between the LSO and Startup's Performance in Startups in South Africa.

The construct of this study will be based on Schwery's Study (2018) in Germany where they mainly looked at software Startups in the Berlin area. Because the field of LSO is relatively new there is limited verification of its application in a developing country like South Africa. This study will give a view from the South African entrepreneurial perspective in this fledgeling field.

By changing the metrics of the Startup Performance form the traditional project management metrics of time, cost and quality to non-financial metrics used in 2 other preceding studies it is believed the construct developed by Schwery (2018) will be improved upon.

From his study it was established that the business type did not significantly moderate the LSO-Performance relationship. Based on Schwery (2018) recommendation, 3 further mediating variables were added that should improve the construct and theoretical understanding of LSO in an uncertain entrepreneurial environment.

This study will only look at Startups in incubators in South Africa. This will be the most likely location where this methodology would be applied due to its relative immaturity. It will not look at whether the LSO can be used in corporate environment although this area seems promising to apply the LSO to as it will provide corporates with a methodology to grow organically whilst protecting the new Startup from typical initial problems of lack of financial and human capital.

If the positive correlation between LSO-Performance can be established in the context of an uncertain entrepreneurial environment, then the value of the methodology will have been validated in the South African context. This means the practical Lean Startup Methodology can be taught to entrepreneurs in South Africa and it would be reasonable to expect that the positive correlations will be replicated by practitioners.

2. LITERATURE REVIEW

2.1. Introduction

According to Venter et al., (2018) the entrepreneurial environment is affected by technological, economic, regulatory, political, legal, socio-cultural, sustainability, global and international factors.

The dynamism of the entrepreneurial environment is measured along 2 axes: Changeability and Predictability. Changeability is the extent to which the entrepreneurial environment is likely to change and can further be divided into (1) Complexity – extent to which the factors mentioned above affect the entrepreneurial environment. (2) Novelty – to which extent new situations materialise. Predictability can further be divided into (1) tempo of entrepreneurial environment changes and (2) clarity of the future state (Venter et al., 2018).

If we highlight just some of the factors currently at play in South Africa from Covid 19 restrictions through regulatory volatility, looting and economic hardships it can be concluded that the entrepreneurial environment is very complex. To use 2 examples of legislative changes, the 1st being the ban on tabaco products and the 2nd being the proposed Employment Equity Bill (B 14B—2020) where the minister can decide to change employment race quotas at any time for your particular industry. These 2 examples paint a scenario where a business operating today could find themselves operating illegally tomorrow, putting entrepreneurs in new and unique situations they were not prepared for.

With Moore's Law becoming more and more prevalent we can see the rate of change in technology is being echoed in the entrepreneurial environment. In South Africa the metered taxi industry was turned upside down by the technology driven ride hailing services of Uber & Bolt.

The ability to look into the future and make market predictions has been assimilated to looking into a crystal ball for CEO's and entrepreneurs alike. Entrepreneurs do not only have to monitor their industries but must look to adjacent industries, technologies and not

forget to be on the lookout for small Startups in foreign countries that could impact their business. An example would be a small Startup like Airbnb back in 2007 in the USA has a dramatic effect on the business of a South African company like Sun International that has been operating since 1966.

All these factors and dynamisms aren't all negative for the entrepreneur. The changing entrepreneurial environments leads to a disequilibrium in the market which in turn leads to opportunity according to the Individual-Opportunity Nexus (ION) theory (Venter et al., 2018).

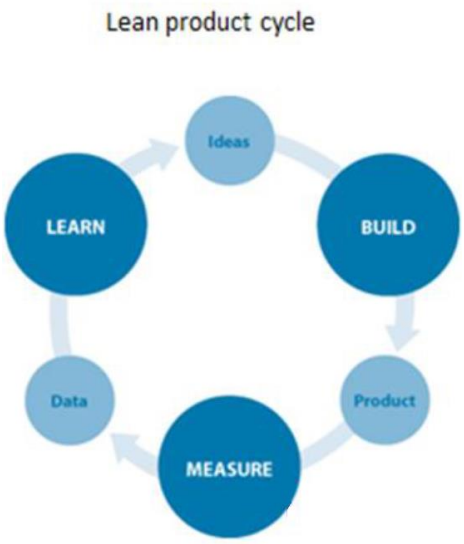
To capitalise on the disequilibrium in the market a theory is required that can deal with the uncertainty, mitigate risks, limit investments and measure progress in the early stages of a Startup's life. This is where the LSM could be of benefit.

The LSM was developed by Ries (2011). This theory is based on Blank's (2006) "Four Steps to the Epiphany", Lean Manufacturing which started off as the Toyota Production System (TPS) developed between 1948 and 1975 and Agile Project Management.

In the LSM everything that doesn't lead to validated learning is defined as waste. In the volatile environments where Startups are created, the Lean Startup Methodology provides a framework to mitigate risk whilst starting a business, running it and scaling it up.

2.2. Discussion of the Lean Startup Orientation (LSO)

To operationalise the LSM scholars created the LSO which mainly focused on the Build Measure-Learn Cycle (Fig. 6).



Source: Ries, E. (2011). The Lean Startup. How constant innovation creates radically successful businesses. London, UK: Penquin Publishers. pg. 5

Frig.6: Build Measure-Learn Cycle

2.2.1. Think

Before we can start with the Build-Measure-Learn Cycle we need to start somewhere, and we need to have a vision of where the Startup wants to go. Thus, the Startup must start with an assumption or a hypothesis.

2.2.1.1. Hypothesis Testing

In a Startup the uncertainties experienced are formulated into hypotheses. These are typically formulated in some sort of business model. According to Ries (2011) entrepreneurs must start with the biggest uncertainties which he calls the “Leap of faith assumption” hypotheses. Is there a need for the product I am developing? Will the customer pay for this product? Can I produce the product at this price and make a profit?

It is important to note that the hypothesis must be falsifiable. That means the assumption could be incorrect based on validated feedback from the customer in a measurable experiment. This integrates scientific rigour into the LSO.

Ostewalder & Pigneur (2005) came up with the Business Model Canvas (BMC) which is a visual tool that divides the Startup into 9 areas or building blocks that the entrepreneur can use to design and test the value proposition of the Startup. The BMC can easily be integrated with the LSM.

2.2.1.2. Customer Orientation

After each experiment, feedback is directly obtained from the customer. This provides feedback and information that will be used to refine the next experiment. This indicates that each hypothesis is validated by the customer.

By using the customer as the focal point for each experiment it means the Startup team gets to understand the customer's needs better and better. This ties in with IDEO's Design Thinking Principles where the designers look at the problem from the customer's / user's experience (UX) point of view. They develop empathy for the customer.

2.2.2. Build

In the Build phase we learn by doing. The experiments are driven by uncertainty and a need to test the hypothesis.

2.2.2.1. Iterative Experimentation

According to Ries (2011) the Lean Startup Methodology deviates from traditional waterfall project planning in favour of agile project planning which is a series of short sprints with a defined goal in each sprint. After each sprint the iteration is reviewed based on feedback from the customer. The performance of each iteration is further measured against a pre-set criterion.

Thus, each iteration can be formulated as a scientific experiment. The experiments are expressed in the form of a prototype or proof of concept. Something that can often be touched, felt and experienced.

The prototype referred to above is defined as the Minimum Viable Product (MVP) in LSM. In other words, it is the minimum/smallest/cheapest version of a product that will enable the team to test the hypothesis or assumption of this cycle. Typically, this MVP can be a mock-up of paper and cardboard, video, concierge (automated process being done manually) and Wizard of Oz (actual function is circumvented and “magically” happens) (Ries, 2011).

2.2.3. Measure

In continuous improvement anything that doesn’t get measured can’t be improved upon. It is important that the metrics be quantifiable, unambiguous and not left open to interpretation. The criteria used to measure the performance of the MVP is defined as the 3 A’s metrics and must comply as follows:

- Actionable – Must show cause and effect
- Accessible – Must be easily understood and available to everyone
- Auditable – Can’t be ambiguous or left open to interpretation

2.2.3.1. Validation

It is important that the metrics used for the evaluation needs to be defined before the experiment ensues. The hypothesis needs to be validated or rejected based on the metrics which are based on feedback from the customer.

Traditional ways to measure projects like man hours spent and percentage of completion do not work in the LSM as the Build-Measure-Learn Cycles are not linear but cyclic. Instead, it turns to Innovation Accounting as a measuring tool. Innovation Accounting has the following 3 steps listed below:

- Baseline

  The MVP is used to establish actual data in the current situation. It establishes a baseline of how far we are from our goal (Ries, 2011).
- Tuning

From the baseline we use the Build-Measure-Learn Cycles to fine tune every aspect of the business with the goal of moving towards the goal of product-market fit. The 3 A's metrics are used to gauge this progress.

- Pivot or Persevere
  After each cycle a decision must be made. Do we continue on the current path (Persevere) or do we change direction (Pivot)? This concept will be explained in more detail in the following section.

2.2.4. Learning

Mike Tyson once said that everyone has a plan until they get hit in the face. The same goes for a hypothesis as soon as it is hit by a real-world situation it will most likely fail or be modified.

According to studies done by Bhide (1999), 93% of successful businesses abandon their original business strategy. This is echoed by Zuzul and Tripsas (2020) by stating that Startups who persist with their original idea might be less successful than Startups who continuously update their model.

This is because Startups evolve their business models through perpetual experimentation and learning to overcome numerous hurdles during the growth and maturation phases (Picken, 2017). Mullins and Komisar (2010) established a theory called the "Journey to Plan B" that provides a framework and monitoring panel to be combined with the LSM to assist entrepreneurs to validate their hypotheses. Thus, fixed plans like Mike Tyson said don't last past first market contact (or a punch in the face).

In the LSO all assumptions and hypotheses are run past the customer to validate whether the customer agrees (Ries, 2011). Often the customer doesn't know what he/she wants, or they cannot articulate it until something is put in front of them or shown to them on a screen. This validated learning means the entrepreneur can make better decisions based on the information at hand. This leads to the Pivot or Persevere decisions that affect the next hypothesis and Think/Vision Phase.

From the initial “Job to be done” (Christensen, 2019) entrepreneurs need to establish if there is a real need for the product/service. Ries (2011) defines these assumptions as the “Leap of Faith Assumptions”.

Bocken and Snihur (2020) expressed their view that the LSM does not place enough emphasis on defining the problem and inadvertently mis-specifies the hypothesis development ethos. According to them it is not just a guess and the LSM doesn’t address the upfront idea/problem phase. Blank called this phase the “problem curation phase” which was the process of getting to the root cause of the problem and articulating it. This is like Design Thinking’s 1st 2 Steps: Empathy and Defining the Problem (Felin, Gambardellab, Sternc, & Zengerd, 2019).

Only once you get feedback from the client can you decide on what to do next. This brings us to the 1st important principle of validated learning – get out of the building.

Traditionally product development teams and engineers like to get a brief from the marketing team or even better they simply start with a great idea and develop it until it is “market ready” and then present it to the market. When the customer sees the product for the first time, they could possibly dislike the product and all the hours of work put in up to that point would be waste as it did not contribute towards the value as perceived by the customer.

The principle of “get out the building” and go and see the problem yourself and talk to the customer is driven by the LSM from the beginning all through the process. This principle is based on Lean Manufacturing principle of “Genchi genbutsu” which translates to “go see for yourself” (Liker, 2004).

Next some comparative entrepreneurial methods to the LSM will be explored and compared.

2.3. Comparative Entrepreneurial Methods

Mansoori and Lackeus (2019) compared 6 entrepreneurial methods/theories. Three scholarly-grounded entrepreneurial methods: **Effectuation**, **Discovery-driven Planning** & **Prescriptive Entrepreneurship** with 3 practitioner-grounded entrepreneurial methods: **Design Thinking, Lean Startup Methodology & Business Planning**.

The comparison of the 6 methods was done in 3 steps. In the 1st step the 6 methods were mapped on a three-tiered framework namely:

- Logic: The encompassing way of thinking that leads to actions and is used as an anchor point.
- Model: Provides a visualisation tool for the entrepreneurial process and provides common terminology.
- Tactics: Dictates the activities, exercises and practices to follow in sequence, encompassing logic and model.

In **Effectuation** the future is unknowable and thus is controlled rather than predicted, through collaborative human endeavours. The entrepreneur starts with what he has at his disposal and continuously interacts with stakeholders. 5 Heuristics form the core of the effectual methodology (Sarasvati, 2001).

In **Discovery-driven Planning** business planning is combined with continuous learning to show vital discoveries (McGrath & MacMillan, 2000). Uncertainty can be reduced by transforming presuppositions/assumptions to knowledge. 6 areas of guidelines are provided in the methodology.

Prescriptive Entrepreneurship is based on the idea that decisions should be based on information collected from meticulously planned experiments. It provides theoretical guidelines for discovering opportunities that are constrained to the entrepreneur's experience and specific knowledge. This prescriptive model has 5 steps.

In **Business Planning** several potential courses of action are determined, weighed up against each other and the best course will be pursued. The Business Plan indicates the

process that is going to be followed and formulated around internal business functions and departments and it is very rigid.

Design Thinking is based on the iterative, circular, human centred practices based on user research. The process begins with defining the problem that customers/users experience, understanding it extensively, creating a possible resolution and testing it. This is finally concluded by reflecting on the results (Carlgren, Rauth, & Elmquist, 2016; Liedtka & Ogilvie, 2011). The model consists of 5 steps repeated.

In the 2nd Step of the analysis these levels (logic, model & tactics) were compared to one another. Finally, a more in-depth framework consisting of nine conceptual dimensions were used to rate the methods and finally a comparison was obtained. The nine conceptual dimensions will be discussed in detail below, followed by a summary of the comparative summary and lastly a comparison with Design Thinking and Business Model Canvas (BMC) is made.

2.3.1. Uncertainty Management

For the purpose of this study the meaning of uncertainty is split into 3: 1st the meaning in terms of Effectuation is ontological in that “the future is unknowable” (Sarasvathy, 2001). The 2nd is in terms of Discovery-driven Planning and is epistemological in nature where the future is knowable through the collection of information. The 3rd meaning is epistemological again and is defined trough LSM and is found in terms of ambiguity and risk.

Effectuation, Discovery-driven Planning, Prescriptive Entrepreneurship & LSM explicitly or implicitly address uncertainty to manage or reduce it. Discovery-driven Planning is ineffective in a highly uncertain market (Mansoori & Lackeus, 2019).

LSM specifically formulates uncertainty in terms of hypotheses. These are then tested experimentally where they can be falsified with feedback from the customer directly.

In Mansoori and Lackeus' (2019) study Effectuation superseded LSM in terms of addressing uncertainty because the LSM is lacking in addressing uncertainty from either an ontological or epistemological perspective.

2.3.2. Resource Management

In the Entrepreneurial Process how you manage current scarce resources and how you acquire new resources is paramount to success.

Effectuation starts with the resources at hand and considers what resources they are willing to expend. They collaborate with role-players/stakeholders who invest resources to shape the future. Business Planning and Discovery-driven Planning provide guidance on how current resources should be utilised but not how new resources should be managed. Design Thinking provides no guidance on how to manage resources. Prescriptive Entrepreneurship defines resources mainly as information pertaining to discovery of opportunities (Mansoori & Lackeus, 2019).

LSM specifies that the least number of resources should be spent, in realising the minimum viable product (MVP), in order to prove a hypothesis (Ries, 2011). LSM is further based on the principle that what doesn't create value for the customer is defined as waste and all waste must be eliminated. Thus, LSM promotes optimal use of scarce resources.

2.3.3. Knowledge Expansion

There is a strong connection between Uncertainty Management and Knowledge Expansion. The more knowledge you gain about the uncertainty the better you can manage it (Mansoori & Lackeus, 2019).

In Business Design, knowledge is merely illustrative and representational. Effectuation and Prescriptive Entrepreneurship put a strong focus on existing individual knowledge as the initiating point (Mansoori & Lackeus, 2019).

Design Thinking, Discovery-driven Planning and LSM focus on growing the entrepreneurs' knowledge regardless of the starting point. In Effectuation knowledge is added by new

stakeholders joining the network. In Design Thinking and LSM knowledge is grown through experimentation and feedback.

In LSM knowledge is expanded through validated learning with feedback directly from the customer.

2.3.4. Redirection Power

In the entrepreneurial process we encounter new information, failures and unexpected surprises necessitating the entrepreneur to change course.

Business Planning has a linear approach and does not allow for many direction changes that deviate from the original plan. Prescriptive Entrepreneurship and Discovery-driven Planning guide Entrepreneurs to avoid unforeseen events while Effectuation, Design Thinking and LSM actively embrace unforeseen events and promote contingencies (Mansoori & Lackeus, 2019).

Effectuation, Design Thinking and LSM are cyclic in nature making them adept at changing direction. They can change direction at any point. Discovery-driven Planning and Prescriptive Entrepreneurship can only change direction at the end of a cycle (Mansoori & Lackeus, 2019).

In LSM this direction change is referred to as a Pivot. Based on the validated information of an MVP an entrepreneur changes direction of the venture.

2.3.5. Continuous Learning

Feedback provides opportunities for learning for the entrepreneur. Feedback can be obtained through a purposeful process of gathering information as in Discovery-driven Planning, Design Thinking and LSM. In Effectuation and Prescriptive Entrepreneurship this is more due to luck or just normal occurrences (Mansoori & Lackeus, 2019).

All the methodologies except Business Planning place the emphasis on perpetual learning and the foundation of the new venture being built on the new insights obtained. Feedback from the customer is the source of continuous learning (Mansoori & Lackeus, 2019).

In Effectuation continuous learning is more of a by-product of following other guidelines. In Design Thinking to a lesser extent and especially in LSM validated learning is the corner stone of continuous learning. Assumptions are checked and revised based on continuous validated learning (Ries, 2011).

2.3.6. Iterative Process

The entrepreneurial process is dynamic and needs flexibility and regular adaption (Bruyat & Julien, 2001). Except for Business Planning all the other methodologies allow for the Entrepreneurs to react to environmental changes and new information in continual cycles (Mansoori & Lackeus, 2019). There is an explicit closed loop and reiterative aspect to them that suggests continual revision of assumptions and the regeneration of the process as new data/information is discovered (Argyris, 1976).

The vital difference between the methodologies is when the iterations are initiated. In Effectuation the iteration is initiated when a new stakeholder joins the process with new information. In Prescriptive Entrepreneurship, Design Thinking, Discovery-driven Planning, and LSM the iteration is initiated by the introduction of new information. The difference lies in the size of the iterations. Design Thinking and Effectuation are grounded in iterative cyclic processes. Discovery-driven Planning, Prescriptive Entrepreneurship have limited feedback loops that may not result in a perpetual process.

LSM is based on agile project management that has continuous iterative cycles where the output from each iteration is fed as input into the next iteration thus improving the quality of each subsequent iteration.

2.3.7. Stakeholder Interaction

Entrepreneurs interact directly or indirectly with stakeholders of a new venture. Neither Business Planning, Prescriptive Entrepreneurship or Discovery-driven Planning provide any guidance for the interaction between Stakeholders (Mansoori & Lackeus, 2019).

Effectuation, Design Thinking and LSM use Stakeholders as a source of feedback and information. Effectuation considers any stakeholders as participants in the process where in Design Thinking and LSM is used only for feedback and customers are kept at arm's length (Mansoori & Lackeus, 2019).

According to Mollick (2019) LSM relies too much on the customer's feedback. It is not the job of the customer to know what he/she wants/needs, that is the job of the entrepreneur. The more the entrepreneur focuses on the customer feedback the better the change of only obtaining incremental innovation. The entrepreneur should focus more on their hypothesis of the world based on their unique knowledge and beliefs (Mollick, 2019).

The majority of customers often reject disruptive innovation, it is only Early Adopters that obtain value from not as good disruptive innovations (Christenson et al., 2019).

2.3.8. Team Collaboration

This involves the diverse and complementary skill sets of individuals in the entrepreneurial process. The entrepreneurial process seeks to mine and capitalise on the diverse competencies of the individuals in the team (Mansoori & Lackeus, 2019).

The boundaries of a team in Effectuation are fluid and dynamic. Anybody who commits resources is considered part of the team and cannot be replaced easily.

In Prescriptive Entrepreneurship, Design Thinking and LSM teams are made up of individuals with complementary skills and team members can easily be replaced with a person with similar skill set and experience.

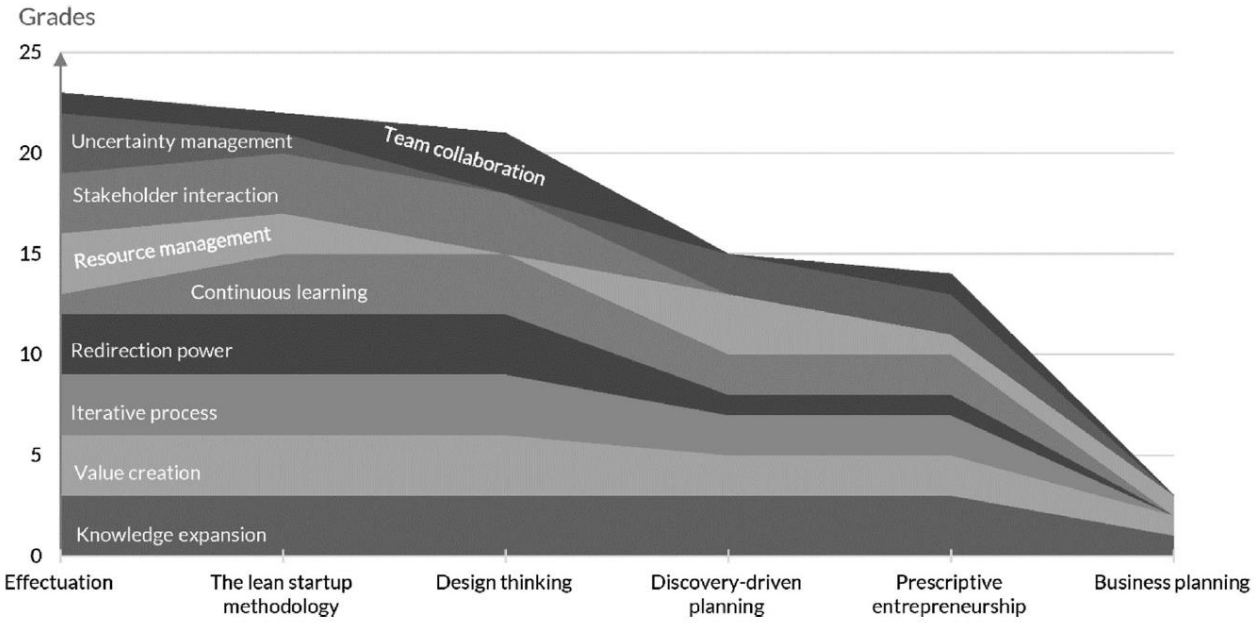
2.3.9. Value Creation

The goal of the entrepreneurial process is the creation of value, regardless of who the recipient is.

All the methodologies except Business Planning have Value Creation as their main focus. The main beneficiaries of these 5 methodologies are the entrepreneurs and their collaborators

2.3.10. Comparative Summary

Mansoori and Lackeus (2019) together with a team of scholars graded and compared the various entrepreneurial methodologies. The results from the comparison can be seen in Fig. 7.



Source: Mansoori, Y. Lackeus, M. (2019). Comparing effectuation to discovery-driven planning, prescriptive entrepreneurship, business planning, lean startup, and design thinking. Small Business Economics. Springer Publishing. Pg 810.

Fig. 7: Entrepreneurial Methodologies Comparison

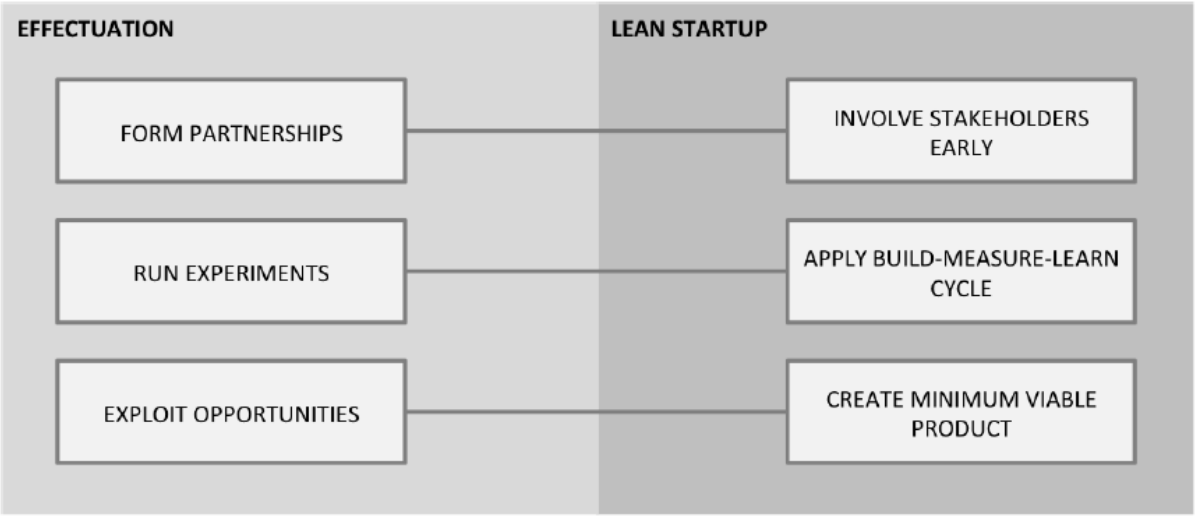
The study compared three scholarly grounded methodologies: Effectuation, Discovery-driven Planning & Prescriptive Entrepreneurship and three practitioner grounded methodologies: LSM, Design Thinking & Business Planning. What is interesting to note is that 2 of the top three came from practitioner driven methodologies whilst Effectuation, the

only representative from the scholarly grounded methods, scored the best out of all the methodologies, yet it is worth noting that mainstream business has largely ignored it.

Instead of one methodology/theory being superior to another we should rather note the following. Practitioner grounded entrepreneurial methods could improve the theoretical rigor of their prescriptions by relying on scholarly grounded entrepreneurial methods to delineate them. Scholarly grounded entrepreneurial methods on the other hand can improve their practicality by providing tactics to execute the methodologies (Mansoori & Lackeus, 2019).

Other researchers have built on this reinforcing point of view discussed above and instead of comparing methodologies/theories they looked for similarities and alignment e.g., according to Ghorbel (2021) Effectuation and LSM have the affordable loss, iterative and progressive development of Startups in common.

Researchers like Hinz and Eisenbart (2019) looked at further alignment between Effectuation and LSM, where either methodology could substantiate the other. A summary of their framework and confirmed relationships can be seen in Fig. 8.



Source: Hinz, A. Eisenbart, B. (2019). Connecting the Dots Effectuation and Lean Startup, pg 311.

Fig. 8: Effectuation vs LSM

Tran and Laursan (2021) combined Design Thinking, Effectuation and LSM in a construct to teach industrial design engineering master students how to generate revenue with a functional innovative new product that solves a real-world problem.

In the business sector today LSM has received a lot of attention and following, whist Effectuation on the other hand has had limited interest. This could be because scholarly grounded methodologies are often difficult to understand by users and many people don't have access to research papers and rely on the internet or published books to search, disseminate and understand topics.

Effectuation is great methodology when the entrepreneur is still developing the business concept. All the roll players contribute towards the vision to eventually become the founding members. The team then set out to establish whether their assumptions in terms of a "job to be done" (Christenson et al., 2019) and whether there is a market large enough to justify a value proposition.

This is where the Design Thinking comes into its own right. It provides a structured process to validate hypotheses with feedback from the customer. Entrepreneurs must take the necessary corrective steps when the feedback indicates the team is moving away from a product-market fit and not towards it.

The following step is to consider the criticism of LSM. According to Molick (2019) entrepreneurs must not abdicate their responsibility to the customers to come up with ideas. They must have a vision and use experiments to obtain information to make breakthrough incites. It must be noted that existing customers and markets are bad with identifying and predicting radical innovation.

The LSM adds many elements to the entrepreneurship body of knowledge but unlike Blank (2013) who states that LSM changes everything, Felin et al., (2019) identified the limitations and pointed out the shortcomings of the LSM.

As mentioned before LSM is lacking in the area of problem analysis and ideation but where LSM makes a big contribution towards entrepreneurship is the scientific metrics, iterative process combined with validated feedback from the customer. Experimentation enables learning, reduces uncertainty, assists with convincing customers and stakeholders alike and legitimises the Startup in its environment (Bocken & Snihur 2020).

In LSM the focus is not so much on the million-dollar idea but rather on the process of refining it to get a product-market fit. This coincides with Pixar's philosophy (Levy, 2017): According to John Lasseter, Pixar does not have better ideas than competing studios. Pixar's success is based on its no holds bar cyclic review meetings were the development team gets honest feedback from the executive creative team. It is not unusual to scrap the work done if the project is not heading in the right direction and pursue a new avenue. This aligns perfectly with the LSM's Pivot Philosophy.

Some of the biggest critics, this study found of LSM, are Felin et al., (2019). They have 3 major criticisms of LSM: (1) Continuous product improvements as advocated for by the Lean Manufacturing works well in the context of incremental product innovation. Startups on the other hand typically fall in the radical innovation category so there is a mismatch.

(2) The validated learning through feedback from the customer is challenged (Felin et al., 2019). Normally Startups produce radical new business models and/or products. Here feedback from the customer often provides false positives and/or false negatives. As stated by Gladwell (2002) existing customers are often poor at identifying new products, markets or trends. This is echoed by Henry Ford's Quote "If I had asked my customer what he wanted he would have asked for a faster horse".

Some entrepreneurial ideas require more than a simple experiment to validate it. They require the entrepreneur with a contrarian vison and belief to go against the accepted norms which is hard for the existing customers to comprehend and accept. This is why Felin et al., (2019) places so much emphasis on the Starting Hypothesis: what is the problem? How is the Startup going to solve this problem and capture value at the same time?

(3) Felin criticise the lack of focus the LSM has on where to start with the initial hypothesis and what the entrepreneur should look out for. The analogy of Ries (2011) of the hypothesis being akin to a guess understates the importance of the starting hypothesis. The hypothesis is subjugated to the eagerness to experiment and iterate.

According to Felin et al., (2019) which Business Theory a Startup should use depends more on factors like technology and industry. The LSM is not a one size fits all strategy.

On the other hand, there are some researchers who see the value of LSM and decided to investigate the theoretical underpinnings aligning and supporting LSM.

Bortolini, Nogueira Cortimiglia, Danilevicz, & Ghezzi, (2021) did an extensive literature review of 963 papers. They found three main theoretical bases to explain and justify LSM: (1) Lean Philosophy (Explicit), (2) Learning School of Strategy (implicit) and (3) Bricolage & Effectuation in terms of New Venture Creation in Entrepreneurship (Implicit).

LSM was grounded on the principles of the Toyota Production System which later became known as the Lean Philosophy. The following lean principles were adopted by the LSM: seeking to eliminate or reduce waste, seek customer feedback with the goal to improve and lastly continuous improvement cycles known as Kaizen. Even the Demings Plan-Do-Check-Act Cycle was adapted to form the Build-Measure-Learn (BML) cycle in the Startup context (Bortolini et al., 2021).

LSM and in particular BML provides a practical methodology to implement the principles of the Learning School of Strategy (LSS) or Adaptive Approach. LSM principles, practices and techniques overlap with LSS dimensions in terms of experimentation, learning and managing complex projects in a volatile environment (Bortolini et al., 2021).

The strategy from the LSS initially emerges from unrelated action and this theory continuously drives organisational learning. LSM provides a critical, scientific, consolidated and structured operational tool to execute the LSS.

Bortolini et al., (2021) found, mainly Effectuation and to a lesser extent Bricolage to be the antecedent of LSM. Effectuation was the 1st theory to break away from the traditional causal model and acknowledge that the future is unknown and not causal in nature. Effectuation instead focuses on the means at hand, experiments instead of planning and is driven by the affordable losses. The strategy leverages contingencies due to the influence of roll players to create possible effects.

Bricolage focusses on combining and applying current resources in new and unique ways through experimentation and iterations in reaction to problems and opportunities to validate the Startups viability.

The LSM is not seen as the solution to all Startups' problems but an innovative methodology that was inadvertently built on other antecedent business management theories. It brings together disparate knowledge of different expertise into a coherent methodology which again forms another layer for other management theories to build on especially where the LSM is lacking. Methodologies that Bortolini et al., (2021) found synergistic and complementary include: Milestone Planning, Discovery Driven Planning (checkpoint), Critical Assumption Planning (CAP), Disciplined Entrepreneurship and Probe and Learn.

LSM is a practical process that operationalises Effectuation and Bricolage (Bortolini et al., 2021).

According to Nilsen and Ramm (2015) LSM is just a collection of previous theories and the biggest benefit of the LSM was how the theory was packaged and presented to make it more accessible to business practitioners and not just academics.

Bocken and Snihur (2020) agree with Felin on some of the limitations of LSM in the ideation phase. If the LSM can be combined with another method which is strong like Design Thinking then LSM's iterative experimentation process will reduce uncertainty, engage stakeholders and, encourage collective learning at the lowest relative cost.

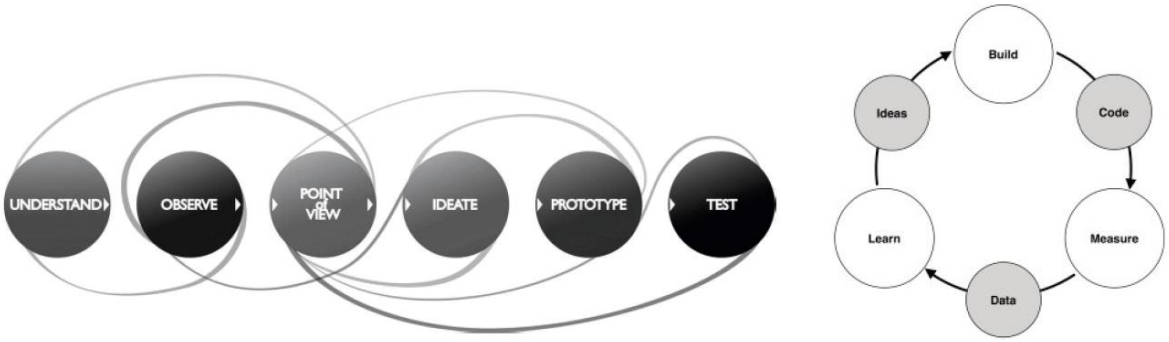
To summarise, the LSM is important for the following 3 reasons: (1) Startups need to test their assumptions before committing resources for the implementation phase. This is even more important in high novelty scenarios. (2) The main hypothesis about the value creation needs to be refined and updated together by all the relevant stakeholders especially in high novelty scenarios. (3) Experimentation in existing organisations can reduce the tendency to stick to existing ways and promote consistent innovation to drive renewal.

Next this study will critically compare the LSM with the Design Thinking methodology.

2.3.11. LSM and Design Thinking

In this section the similarities, synergies and differences of LSM and Design Thinking will be explored.

The process models of both Design Thinking (Left, Fig. 9) and LSM (Right, Fig. 9) are shown. The 1st Observation is that Design Thinking is a Linear Process whilst LSM is Circular Process. Design Thinking has a clear start where LSM has no specific start or finish (Mueller & Thoring, 2012).



Source: Mueller, R. Thoring, K. (2012). Design Thinking vs. Lean Startup: A Comparison of two User-driven Innovation Strategies. International Design Management Research Conference. pg.153.

Fig. 9: Design Thinking VS. Lean Startup

Despite the linearity stated above Design Thinking steps are iterative in nature which is similar to LSM. The following corelations are shown in Table. 1. (Mueller & Thoring, 2012):

Table. 1: Design Thinking vs LSM

Design Thinking	LSM
Understand & Point of View	Learn
Prototype	Build
Test	Measure

The “Observe” step from Design Thinking has synergies with the Get-out-of-the-Building concept from LSM.

This is where the similarities end. In the LSM the hypothesis-metric-experiment model of Build-Measure-Learn is used to achieve the goal of learning. In Design Thinking on the other hand the 1st purpose is to truly understand the problem and then through the defined process come up with a solution to the problem.

The LSM can be applied to any level of the Startup (micro or macro) where Design Thinking can only be applied at a macro level or the entire problem as all the information needs to be synthesised before attempting a solution (Mueller & Thoring, 2012).

In the Understand-Observe phase of Design Thinking the entrepreneur tries to understand the problem from the perspective of the user/customer (user experience) and empathises with them. To do this Design Thinking has many great qualitative methods, e.g. elaborated ethnographic methods, user research and observations. LSM is lacking in this area but has wonderful quantitative metric-based analysis methods to evaluate hypotheses against. Design Thinking on the other hand is lacking in these quantitative methods (Mueller & Thoring, 2012).

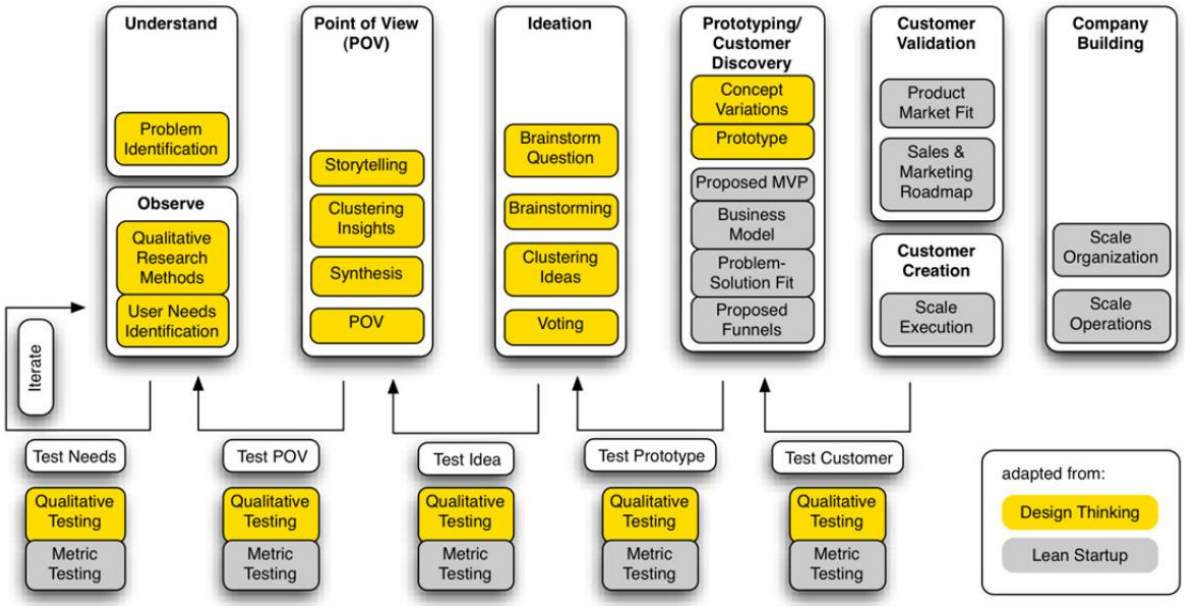
In Design Thinking, once the problem is understood the entrepreneur synthesises the information to form the Point-of-View. He/she then moves to the “Ideate” phase. In this step the proposed solutions are generated. LSM has no equivalent step. This ties in with Felin et al., (2019) criticism that LSM is lacking in generating a strong starting hypothesis.

Mueller and Thoring (2012) further explored if either method could be improved by incorporating elements of the other method. Design Thinking could be improved by adding

Pivoting which means that feedback, testing and iterative loops are done earlier before the Prototyping step. Design Thinking could also benefit from Quantitative metric-based evaluation techniques.

The LSM could on the other hand benefit from Design Thinking's qualitative methods to define the customer and his/her problems and needs i.e define a qualitative persona to better understand the customer. The entire Ideation step before beginning the iterative steps towards solutions would certainly improve the LSM and evaporate some of the criticism. Lastly qualitative methods could be included in the Customer Feedback steps to improve the quality of the feedback especially where the users struggle to articulate their needs. These qualitative methods would reinforce the existing LSM's quantitative methods.

Mueller and Thoring (2012) even came up with an alternative theory where they combined Design Thinking & LSM to form "Lean Design Thinking" (Fig. 10). This theory will not be discussed in detail in this section, but the proof of its existence indicates that the theories align and that they should rather be used together instead of being used exclusively to provide entrepreneurs with theories and tools to assist them.



Source: Mueller, R. Thoring, K. (2012). Design Thinking vs. Lean Startup: A Comparison of two User-driven Innovation Strategies. International Design Management Research Conference. pg.160.

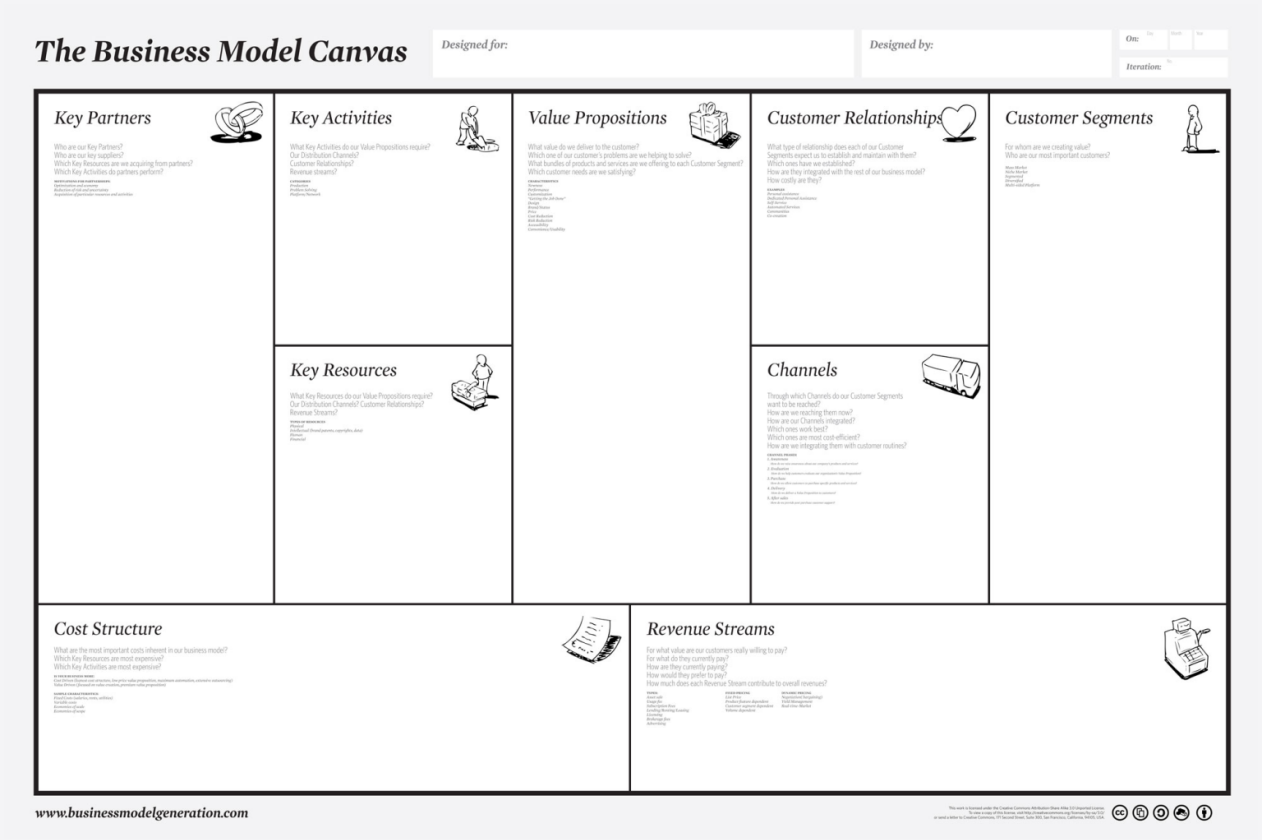
Fig. 10: Lean Design Thinking

The critical analyses of the relationship between LSM and Business Model Canvas will be dealt with in the next section.

2.3.12. LSM - Business Model Canvas (BMC)

In this section it will be shown how the LSM and BMC complement each other to provide a more holistic theory for entrepreneurs to use.

Business Model Canvas (BMC) was developed by Osterwalder & Pigneur (2005). It defines the Business Model of the Venture into nine blocks (Fig. 11). These blocks show how the venture creates, captures and delivers value.



Source: Schwery, M. (2018). Lean Startup Orientation: Empirical Evidence of Venture Success (Masters Thesis), University of Twente, The Netherlands. Technishe Universtät Berlin Germany. pg 32.

Fig. 11: Business Model Canvas

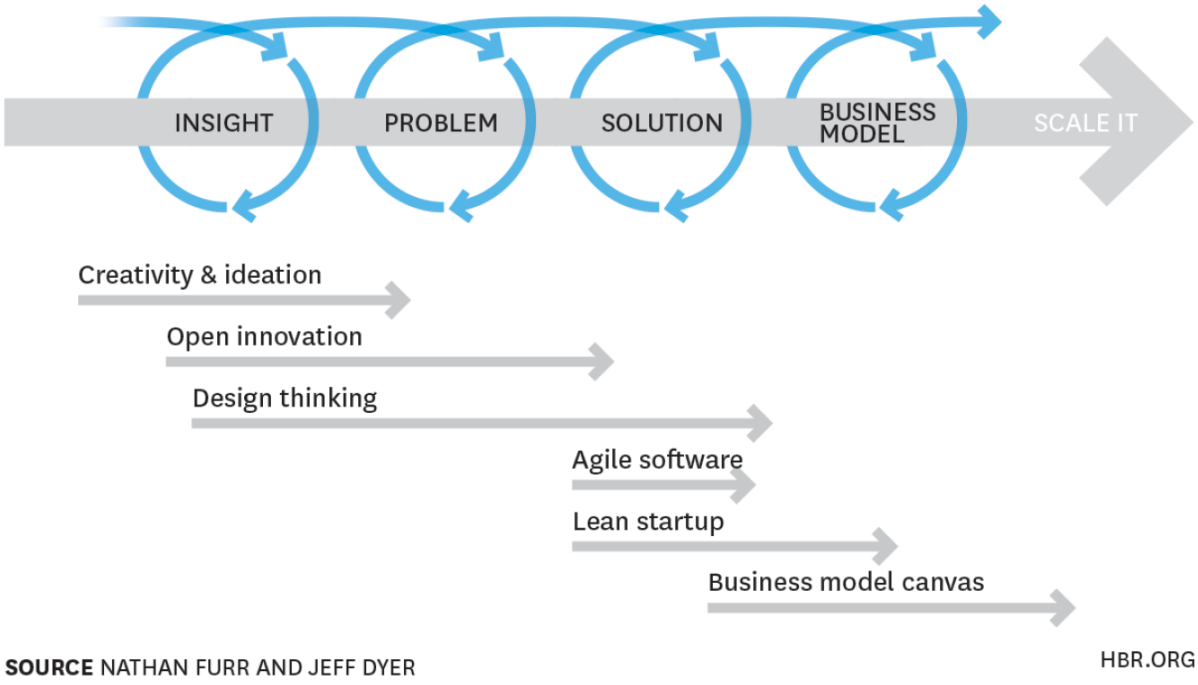
Steve Blank saw the BMC as a great way to specify hypotheses in a structured manner and conceptualizes the business model visually (Ostewalder & Pigneur, 2005). The BMC structure also allows for tracking of changes in hypotheses due to experiments thus the hypotheses can be proved or disproven (Blank & Euchner, 2018; Shepherd & Gruber, 2021)

The Business Model Canvas operates as a scorecard and a convergence tool and provides the entrepreneur with a visual encapsulation of the progress. It should not be seen as a competitor business methodology but rather as complementing methodology to LSM.

Many small and medium enterprises (SMEs) tend to focus too much internally on day-to-day activities and do not plan, even improvements are neglected in terms of planning. Successful SMEs on the other hand are more externally focussed and regularly scan the

market conditions, technology trends and even regularly analyse their competitive position (Ojasalo & Ojasalo, 2018).

Furr and Dyer (2014) consolidated the theories shown in Fig. 12 to form what they called the “End-to-end Innovation Process”. This process combines the strengths of Design Thinking upfront in understanding the Problem and then followed the by the LSM and BMC to commercialise the Innovations.



Source: Furr, N. & Dyer, J. (2014). Choose the right innovation method at a time. Harvard Business Review. pg. 4.

Fig. 12: Furr & Dyer Consolidated Theories

By applying the Business Model Canvas to SMEs it shifts their orientation from internal to external guiding the SME to understand the value from the customer’s perspective. This is then assisted by creating internal processes to support this value creation (Ojasalo & Ojasalo, 2018).

The adaptation to the BMC helps the Startup analyse and articulate what the customers problem is which aligns with the voice of the customer as articulated in Design Thinking (Koen, 2015).

This brings us to the end of the section where the LSO Construct is disseminated and the LSM is compared to other theories, how they align, diverge and even built on top of each other. Next, this study will consider the construct of the Startup Performance and how the various studies relate to this construct.

2.4. Startup Performance

A lot of research has been done on the correlations between the elements of the LSM and performance of a Startup. Below are references to the related studies.

Jaworski and Kohli (1993) did a study on the antecedents and consequences of Market Orientation. In the study Market Orientation is defined as being composed of the following:

- Generation of Market Intelligence (companywide),
- Distribution of Intelligence (across all departments),
- Responsiveness (companywide), which is further constituted by:
    - Response Design (develop plans based on market intelligence) and Response Implementation (roll out of these plans).

If we look at the antecedents of Market Orientation, they concluded that there was a correlation between Market Orientation and top management's focus on the following elements:

- Orientation (positive relation),
- Risk Aversion of top management (negative relation), interdepartmental conflict (negative relation),
- Connectedness of departments (positive relation),
- Centralised decision making (negative relation) and
- Orientation based reward system (positive relation).

Following the above mentioned, they considered the consequences of Market Orientation. Here they found correlation between Market Orientation and Business Performance, Employees Commitment, and "Esprit de Corp" (feeling of mutual loyalty and pride, shared by group members).

Market Turbulence (Uncertainty), Competitive Intensity and Technology Turbulence (Uncertainty) were defined as Moderating Variables on the Market Orientation-Business Performance Relationship. This relationship was constant thus not affected by changes in the 3 moderating variables.

Unfortunately, no correlations were indicated between the Market Turbulence/Uncertainty & Business Performance and Technology Turbulence/Uncertainty & Business Performance.

Harms and Schwery (2020), found a strong and significant relationship between Lean Startup Capability (LSC) and Startup Performance. The Performance of Startups were not affected by the Market and Technology Uncertainty.

More mature Startups perform better and according to Lose and Tengeh (2015) the entrepreneur's experience plays a vital role in the success or failure of a Startup. The Business Type affected the LSC-Performance Relationship (Harms & Schwery, 2020)

In Schwery's (2018) study the Performances of the Startups were measured according to traditional project management metrics of Time, Quality and Cost.

Ghezzi et al., (2015) on the other hand used non-financial metrics to compare the performance of mobile Startups in Italy. The metrics they used were called "Vector of Performance" that consists of 5 sub-metrics. These metrics were based on a previous study done by Delmar & Shane (2003) and are listed as follows.

2.4.1. Survival Period

Originally Ghezzi et al., (2015) used Termination of the New Venture (TNV), that is a Yes/No metric. This will not work for this study as in Ghezzi's study the answer to all active Startups was simply be "No".

This study will focus on Startups in Incubators. A more relevant metric will be how long has the Startup been operating for? This will be time based (months & years)

2.4.2. Product Development Cycle

Most Startups develops some sort of product or service which requires refinement as soon as feedback is obtained from the Build-Measure-Learn Loop. The Product Development Cycle is thus broken down into 5 sequential phases:

1. No work
2. In idea phase
3. Model/Procedure being developed
4. Been tested
5. Product/Service ready for sales/delivery

2.4.3. Venture Organizing Activity (VOA)

This metric measures the progress of activities required for the development of the physical structure of the company. It consists of 8 Yes/No Questions

1. Registered with SARS?
2. Registered with CIPC?
3. Contact with potential customers
4. Has raw materials, inventory, supplies, components been purchased?
5. Has large equipment, facilities, property been purchased/leased/rented?
6. Has patent/copyrights been obtained?
7. Licenses /Permits been obtained to operate?
8. Has Startup sought to obtain financing?
9. Has marketing/promotions been initiated?

2.4.4. Equity Funding

This metric simply measures if the business has obtained funding. Yes/No metric.

2.4.5. First Customer Acquisition (FCA)

This measures the time it has taken from the start to obtain the 1st customer. It will be measured in months & years.

Now that the LSO Construct and Startup Performance Constructs have been defined it brings us to the first hypothesis of this study that is based on the Dependent Variable - Startup Performance and Independent Variable LSO:

2.5. Hypothesis 1

From the research shown up to now it is proposed there will be correlation between Startups who apply LSM and an improvement of their performance.

H1: Lean Startup Orientation positively relates to the Startup's Performance

Next this study will consider the moderating variables for the relationship mentioned above.

2.6. Uncertain Entrepreneurial Environment

The following 6 Moderating Variables were deduced from Schwery's Study (2018). The 1st 3 are copies of Schwery's Moderating Variables and the last 3 were taken from his recommendations during his conclusion.

2.6.1. Radicalness of Innovation

For the purpose of this study, Innovation is divided into Incremental Innovation and Radical Innovation.

Radical Innovation is a new product/service that fundamentally differs from existing product/service and typically serves a market that does not yet exist. Incremental Innovation on the other hand are small changes and improvements to existing products, normally in existing markets.

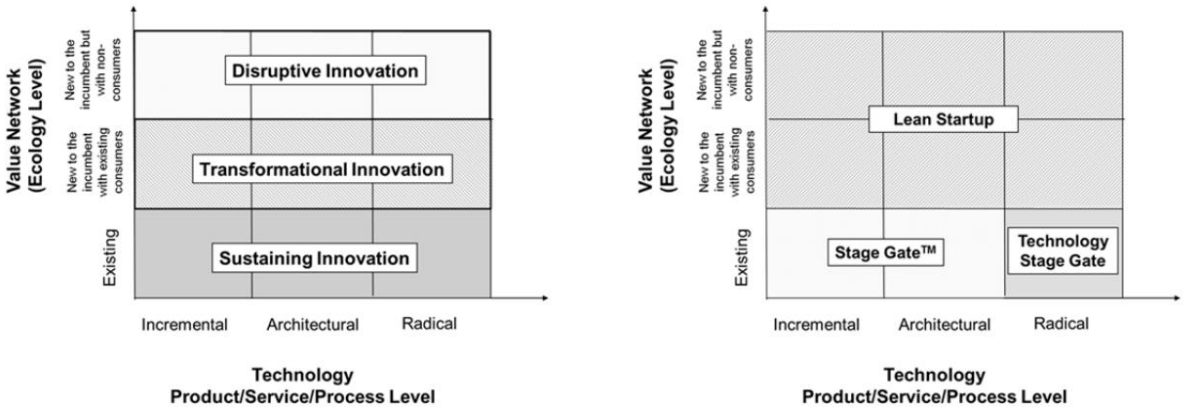
The LSM gets feedback from customers in its Build-Measure-Learn Loop. This process predisposes the LSM to incremental innovation vs radical innovation, as radical innovations are often rejected by the current market. It is only by interacting with

“Innovators” & “Early Adopters” (Gladwell, 2002) that innovators with disruptive innovations can get the product/service ready for the “Early Majority” Customers.

Getting feedback too soon from customers especially radical innovations could lead to false positives or false negatives. In essence customers in an existing market are bad at predicting new markets/products. This means LSM often leads to incremental innovation and not radical innovation (Felin et al., 2019).

Second problem with managing innovation is to link the Innovation Pipeline with the operational side of the business. This ties in with Koen’s (2015) study where he approaches Lean Startup from the corporate entrepreneurship point of view. Traditionally corporates struggle to apply innovation outside of their existing business model and into a new value network. He provides a theory to analyse the type of innovation and determine which is the best methodology to apply.

Koen et al., (2011), defined a Business Topology where they compared the relationship between Value Network (Y-Axis) and Technology (X-Axis) Fig. 13.



Source: Koen, P. A., H. Bertels, & I. R. Elsum, (2011), The three faces of business model innovation: Challenges for established firms, Research-Technology Management. Fig 4A & 4B. pg 9.

Fig. 13.A Fig. 13.B

Value Network vs Technology

The Value Network Dimension is defined as follows:

- Existing network: The existing and established suppliers, customers and channel partner.
- New to the incumbent, with existing consumers: New value network to the enterprise but with the current existing customers.
- New to the incumbent, with non-consumers: New value network to the enterprise with no customer base.

The Technology Dimension is defined as follows:

- Incremental innovation: Refinement and improvement of existing technology.
- Architectural innovation: Combining or reorganising existing components but no new technology.
- Disruptive innovation: New technology at the core.

In Fig. 13.A Koen et al., (2011), overlays the Procter and Gamble definitions of innovation: Sustaining Innovation, Transformational Innovation and Disruptive Innovation (Brown and Anthony, 2011) over the Value Network-Innovation Model. These definitions are explained below in Table. 2 and compared to Christenson et al., (2019) Definitions of Innovation which more refer to the markets they address than the net effect on the enterprise:

Table. 2: Innovation Terminology Comparison

<table>
<tr><th>Proctor & Gamble</th><th>Clayton Christenson (2019)</th></tr>
<tr><td></td><td>Efficiency Innovation

Targets existing customers, with the focus on doing more with less. Negative effect on internal jobs</td></tr>
<tr><td>Incremental Innovation

Incremental improvements to existing products (may include radical technology improvements)</td><td rowspan="2">Sustaining Innovation

Targets existing customers, whilst improving the performance. Very little effect on number of jobs</td></tr>
<tr><td>Transformational Innovation

Provides significant improvement to existing products & pulls company into adjacent new value networks</td></tr>
<tr><td>Disruptive Innovation

Complete new value network, pulls in non-consumers</td><td>Market Creating Innovation

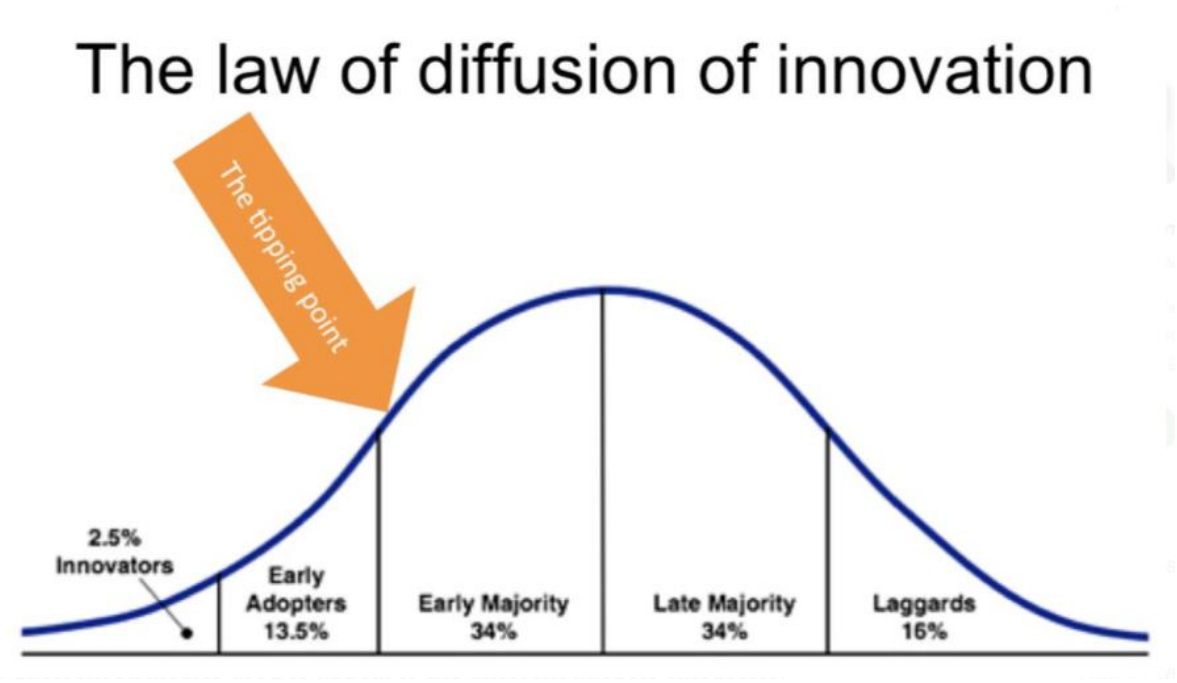
Simple & affordable, targets non-consumers, enables development. creates new jobs</td></tr>
</table>

It can be noted that there are overlaps between the definitions.

In Fig. 13.B Koen indicates the best management theories to deal with the various permutations and degrees of network-innovation variants. The stage gate approach is determined to be the best where the enterprise is focusing on the existing value network and limited Innovation. When the radicalness of the innovation increases with the same value network the technology stage gate approach is deemed best.

For all the other permutations where the existing business moves outside of its existing knowledge base of value network and innovation the Lean Startup Method with its iterative learning cycles are best to obtain new market and customer insights.

On this scale the more radical the innovation the more LSM seems applicable. Yet in Felin et al., (2019) study the LSM was deemed ineffective as the customer feedback is not valid as the mainstream users are often not good predictors or receptive of new radical innovations. According to Gladwell's (2002) Law of Diffusion (Fig. 14) the new product will first be adopted by the "Innovators" followed by the "Early Adopters". These 2 groups are willing to accept flaws or shortcoming in the "not good enough" product for other payoffs e.g. advantage in their industry or social factors like owning the "first of" in their social or professional circles. During these 2 phases the product needs to be refined based on feedback from these 2 segments to get it ready for the "Early Majority" to adopt because they are less forgiving to flaws and shortcomings as the 1st 2 groups.



Source: Gladwell, M. (2002). The Tipping Point: How Little Things Can Make a Big Difference. Fareham, England: Back Bay Books Publishers.

Fig. 14: Law of Diffusion

Entrepreneurs who are lacking in both resources and time are forced to innovate and collaborate. In this environment all the stakeholders involved collectively learn and

increase their knowledge of both the product and the market (Bocken & Snihur, 2020). By focusing their efforts and collaborating this provides fertile soil for ideas where fortuitous events often lead to radical innovations.

Next innovation is considered from a corporate entrepreneurship perspective. Large companies require a methodology to deal with new innovations that do not fit in with the current corporate structure, culture and existing market. Here the example of IBM can be considered.

IBM is a multi-national company with branches in 171 countries across the world. Like many other large companies IBM initiated a program to renew its products and processes through innovation. The Emerging Business Opportunities (EBO) initiative was established as a strategy to innovate and differentiate through new growth businesses. EBO is thus a Growth Engine (Plugge, 2004).

Most large organisation have the inherent resistance to change. The more radical the innovation the greater the structural inhibitors are and the greater the resistance to change. These Structural Inhibitors are:

- inherent expertise,
- operations,
- resources,
- regulation and
- market access.

Customer's resistance on the other hand is built on structural inhibitors inherent in usage, value, risk, tradition and image.

Large organisations often fail at innovation as the aim of the innovation often go against the current practices e.g., long term innovation is curtailed by employees being measured and rated by quarterly results which leads to incremental improvements at best.

According to Skill (2017) research is moving from exploration to exploitation which aligns with the goal of the LSM. The LSM is a good fit when applied as an innovation accelerator

model in the research context of universities. The LSM can be defined as a new process model to accelerate innovation.

Universities often neglect to consider how to build a scalable and sustainable business on innovation developed internally. From the demand side, Startups are considered as a vehicle for technology transfer.

Furr and Dyer (2014) consolidated the theory shown in Fig. 12, that combines the strengths of Design Thinking upfront in understanding the problem and then followed by the LSM and BMC to commercialise the innovations. The LSM's strength lies in refining and commercialising the radical technology through establishing a product-market fit through iterative cycles.

According to York and Danes (2014) the pressure to successfully innovate in less and less time is forcing practitioners and researchers to look for more effective theories and frameworks. Many research institutions like the NSF (I-Corps), Stanford, MIT and large corporations have adopted parts of the LSM to successfully innovate.

Customer development accelerates innovation and reduces risk of failure due to the iterative nature to achieve product-market fit before large amounts of funds are committed.

From the information above it can be seen that the LSM is useful in big corporates and research institutions to refine and commercialise radical innovation. In Startups however the LSM is more suited to incremental innovation than radical innovation as the market information obtained through validated learning is more reliable for incremental improvements than radical improvements (Harms & Schwery, 2020).

This brings us to the next hypothesis regarding the radicalness of the innovation.

2.6.1.1. Hypothesis 2.A

H2.A: Radicalness of Innovation strengthen the LSO-Performance relationship.

H0: Radicalness of Innovation does not moderate the relationship between LSO and Performance

The 2nd Moderating Variable, Technology Uncertainty, will be considered next.

2.6.2. Uncertainty (Technology & Market)

Although some scholars believe that the LSM is lacking in scholarly grounding it has a solid grounding in the process of reducing uncertainty by means of experimentation that converts assumptions to facts through validated feedback from the customer (Mansoori & Lackeus, 2019). This is echoed by Harms and Schwery (2020) that state that a Startup is an experiment, where several implied hypotheses must be tested and validated through experience.

According to Harms and Schwery (2020) learning can be divided into 2 main groups:

- Error-based Learning:
  Error-based Learning works well in scenarios where the task is well defined, clear measures for success are stated and rapid feedback is available.
- Experimental Learning:
  In Experimental Learning experiences are deliberately created to measure and observe the current scenarios or states and interrelated relationships between the elements.

Based on the above it can be deduced that Experimental Learning which is a major pillar of LSM is a good methodology for entrepreneurs to use to deal with uncertainty in their Startups.

The LSM was formulated by Ries (2011) who developed the theory through his personal experiences in starting a software company, IMVU, in Silicon Valley. The LSM is the by-

product of the theories used by a company developing an uncertain technology for a yet unknown market.

For the purpose of this study uncertainty will be divided into Technological Uncertainty and Market Uncertainty.

As mentioned previously due to Moore's Law the tempo of technology improvement is exponential. A company that finds itself with a highly uncertain technology would benefit from the application of LSM which would have an impact on the performance of the Startup.

This brings us to this study's second hypothesis.

2.6.2.1. Hypothesis 2.B

H2.B: The LSO-Performance relationship is moderated by Technology Uncertainty.

H0: Technology Uncertainty does not moderate the relationship between LSO and Performance

Market Uncertainty for the purpose of this study is constituted by the remaining environmental factors: economic, regulatory, political, legal, socio-cultural, sustainability, global and international. The Changeability and Predictability of the Market Uncertainty will gauge the dynamism of it.

In uncertain and fast-moving markets businesses require strategies that focus on experimentation and learning rather than analytical approaches (Mcgrath, 2010).

The dynamism of an uncertain market will influence the strategy the Startup uses to react to changes in the market and both of these factors will influence the performance of the Startup. This brings us to this study's 3rd hypothesis.

2.6.2.2. Hypothesis 2.C

H2.C: The LSO-Performance relationship is moderated by the Market Uncertainty.

H0: Market Uncertainty does not moderate the relationship between LSO and Performance

2.6.3. Business Industry

From the GEM 2019/2020 Report it can be seen that the entrepreneurial activity in the Early-Stage Entrepreneurial Activity (TEA) phase in South Africa is split amongst the following sectors (Fig. 15).

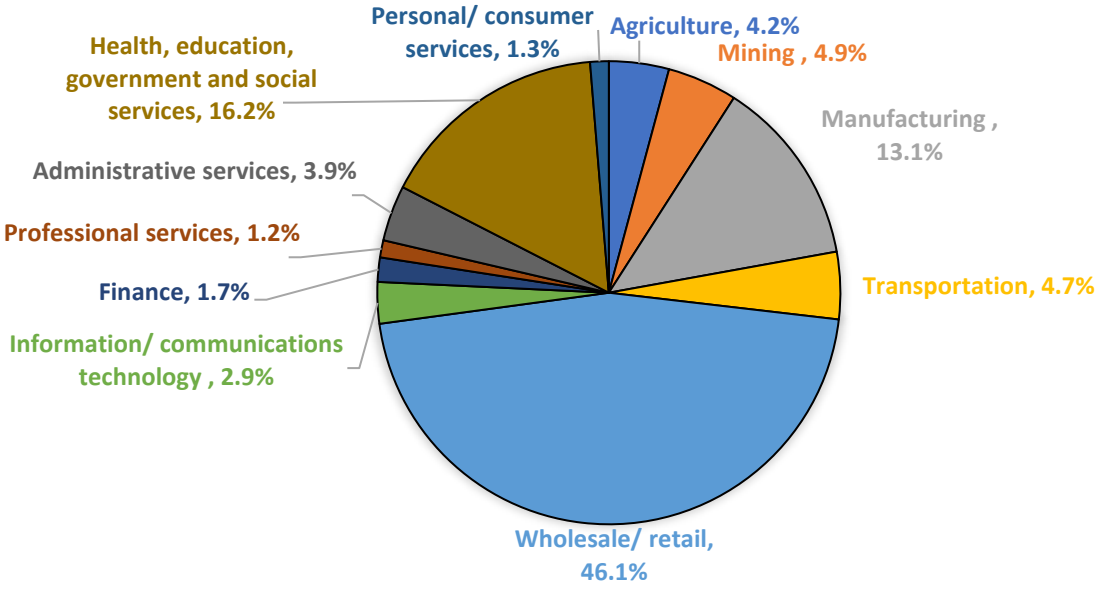


Fig. 15: Industry

The industry that the Startup operates in will affect the suitability of the LSO and the performance of the Startup. The LSO has successfully been implemented in diverse sectors like the United States Defence Force (Bitga & Pallatino, 2020) through to software development in Silicon Valley (Ries, 2011).

It is not known how the LSO would affect the performance of a Startup in a resource intensive industry like mining for example. The 4th hypothesis is stated as follows.

2.6.3.1. Hypothesis 2.D

H2.D: The LSO-Performance relationship is moderated by the Industry of Startup.

H0: Business Industry does not moderate the relationship between LSO and Performance

2.6.4. Entrepreneur Experience

The entrepreneur's experience plays a vital role in the success or failure of a Startup (Lose & Tengeh, 2015). Unfortunately, experience is not something that can be bought, it must be earned. To overcome this lack of experience incubators and accelerators make use of mentors/coaches to assist and guide entrepreneurs with improving their Startups. Ideally these mentors would be successful entrepreneurs in their own rights with qualifications, experience and tacit knowledge of the industry and market the entrepreneur wants to operate in. In reality there is a shortage of entrepreneurs (GEM 2021/2022) not to mention entrepreneurial mentors (Lose & Tengeh, 2015). Mostly the roles of mentors/coaches are fulfilled by administrators, managers and volunteers all with limited experience in entrepreneurship and no specific knowledge of the relevant industry or market.

To overcome this shortage the incubators and accelerators structure programs that take entrepreneurs through the steps required to get the Startups off the ground or accelerate their growth trajectory. A university in Sweden decided to apply the LSM to its university linked acceleratorpProgram. Mansoori, Karlson and Lundqvist (2019) did an ethnographic study to observe what effect the LSM had on the mentor-entrepreneur relationship during this program.

The LSM provided a structure for the interaction and an environment where vicarious learning took place. Previously trust was built on the foundation of mentors' position and relevant experience. LSM provided an evolutionary coaching style that helped

entrepreneurs challenge the established assumptions, even held by the mentor to make better decisions based on feedback from the customers.

This does not mean that the experience, knowledge and networks of the mentors are totally irrelevant. There is still an argument that Mentors with the above qualities could be more beneficial to an entrepreneur over a well-structured program especially where the technology readiness is immature and no customers exist to provide feedback (Mansoori et al., 2019).

From the study it was concluded that LSM directly affected the mentor-entrepreneur relationship. The LSM provided structure and content for the coaching sessions. It provided a common starting point for discussions, encouraged open and honest interaction and increased participants willingness to change their behaviour. The LSM installed trust and led to an evolutionary coaching strategy that created space for rich learning that ended in developed and transformed entrepreneurs.

The experience of the Entrepreneur has direct effect on the performance of the Startup. In South Africa, the lack of entrepreneurial experience has been identified as key problem in Startups (Lose & Tengeh, 2015). Thus the 5th hypothesis is stated as follows.

2.6.4.1. Hypothesis 2.E

H2.E: Higher Levels of Entrepreneur Experience strengthen the LSO-Performance relationship.

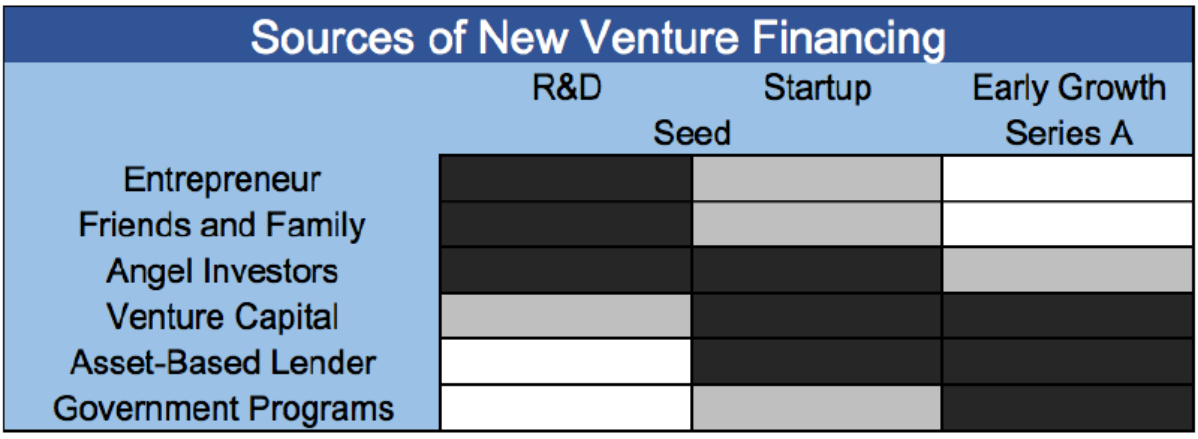
H0: The level of Entrepreneurship Experience does not moderate the relationship between LSO and Performance

2.6.5. Sources of Funding

In Garg and Shivam's (2017) study in India the majority of Startups obtained funding through Bootstrapping and Venture Capital. The latter being the preferred method of obtaining funding with a success rate of 23.6%.

According to Andenes and Pendegraft (2016) tools like LSM that have the ability to reduce capital funding required by Startups when compared to Startups two decades earlier. This is due to the reduced development time and frugal nature of the LSM.

According to Andenes and Pendegraft (2016) early-stage Startups obtain most of their funding from Angel Investors & Venture Capital (Fig. 16). This makes sense as Startups require more capital than they can bootstrap or lend from family & friends to fund business infrastructure, sales & marketing activities and develop distribution channels. At this stage there is little equity in the business to use as collateral on their balance sheet to obtain traditional loans.



Source: Andenes, S. F Pendegraft , E. 2016. Financing of Startups A Comparative Study of Norway and the USA, Pg. 22

Fig. 16: Source of Funding

The Source of Funding is not directly linked to performance but rather to the stage at which the Startup is at.

Where the Startup gets it funding from will affect how the Startup operates and how it measures its performance. A Startup funded by Ventures Capitalists will be pushed and mentored to achieve commercial success. A Startup in a Government funded program in South Africa will more likely be measured on other indices like people employed or social metrics.

This leads to the 6th and final hypothesis which is stated as follows.

2.6.5.1. Hypothesis 2.F

H2.F The LSO-Performance relationship is moderated by the Source of Funding.

H0: Source of Funding does not moderate the relationship between LSO and Performance

2.7. Literature Review

The high-level Literature Review is summarised in Table. 3.

Table. 3: Summary of relevant Lean Startup Papers

Author(s)	**Country**	**Focus (In terms if Lean Startup Methodology)**	**Relevant Entrepreneurial Theory**
Schwery 2018	Germany	LSO – Performance	Hypothesis Driven Entrepreneurship
Blank (2006)	USA	Customer Fit	Entrepreneurship Theory and Practice
Mansoori & Lackeus, 2019	USA	Comparison with other Methodologies	Business Models
Burm 2019	Netherlands	LSM in Big Corporates	Corporate Entrepreneurship, Causation, Effectuation
Çingita 2015	Turkey	LSM in Big Corporates	Corporate Entrepreneurship, Innovation
De Wet 2013	RSA	LSM in E-Retailers	Entrepreneurship
Ghezzi et al., 2015	Italy	Compare LSM with Traditional Business Model Design in Mobile Application Companies	Business Model Design
Mansoori 2019	Sweden	Entrepreneur-Coach Relationship in Incubators	Purposeful Experimentation, Effectuation

Author(s)	Country	Focus (In terms if Lean Startup Methodology)	Relevant Entrepreneurial Theory
Schwery 2018	Germany	LSO – Performance	Hypothesis Driven Entrepreneurship
Blank (2006)	USA	Customer Fit	Entrepreneurship Theory and Practice
Mansoori & Lackeus, 2019	USA	Comparison with other Methodologies	Business Models
Ries, E. 2011	USA	Originator of LSM	Opportunity Identification and Development Theory, Effectuation

The Consistency Matrix can be found in Appendix C.

The results from the Literature Study shows that there has been little study on the LSM in South Africa focussing on Startups in general.

3. RESEARCH METHODOLOGY

In the section that follows the outline of the methodology used to research how the LSM affects Startups in South Africa is described.

3.1. Research Methodology/Paradigm

Qualitative Studies are good when the information is not clear or if the relations between the variables are complex or if an exploratory study is required. As a result, many of the initial academic studies on the LSM were qualitative studies.

In this study, the hypotheses are clear and the relations between the variables are simple. e.g., if the Startups in an incubator, that applies higher degree of Lean Startup Orientation, then the performance of the Startups should show a correlation in improvement. Thus Hypotheses 1 would be true. On a secondary level this study aims to investigate how the Mediating Variables affect the relationship between Independent Variable and the Dependent Variable. Due to these factors, it was decided to pursue a quantitative study.

This study is descriptive in nature as it is trying to establish whether there is a relationship between Lean Startup Orientation and the Performance of the Startups. This study will hopefully build on the exploratory quantitative studies that were done previously (Fischer & Rassenfosse, 2011; Ghezzi et al., 2015; Schwery, 2018; Stuart & Abetti, 1990; Takata, 2016)

This study took place over +/- 3 months from December 2021 – March 2022 so it can be seen as a cross-sectional study which is a study at one point in time, a snapshot if you will, looking at multiple Startups simultaneously. The danger here would be that the results could look different 12 months later if the same study was repeated especially after the challenging times of post covid. By having enough Startups in various phases of incubation this study could compensate for the single point of view of the Cross-sectional Study.

The opposite study would be the longitudinal study which would focus on one or a few companies over a period of time. The MMENVC schedule for research does not allow for

sufficient time to attempt a longitudinal study. This choice of study is further discussed in the conclusion of this report.

The study followed a positivism paradigm where it observed Startups through empiricism objectively to support the hypotheses and either prove them or disprove them (Popper, 1963).

3.2. Research Design

It was decided to use a survey as the methodology to execute this study. A survey is easy and inexpensive to generate and distribute. It removes the bias of the researcher but unfortunately does not allow for further probing by the researcher. The response rates are normally low and the survey cannot be very long or complex.

The self-administered survey ensured relative anonymity and did not take up too much time of the participants as they are busy people. Follow up calls and messages were required to remind and compel the participants to complete the survey.

This study relied solely on the primary data collected through a questionnaire.

3.3. Population and Sample

The target population of this study is defined and demarcated from all the entrepreneurial businesses in South Africa. This is then followed by the sampling method.

3.3.1. Population

The target population for this study was Startups that are in the Startup Phase or the Early-Stage Entrepreneurial Activity (TEA, 1 – 3.5 years only in South Africa). Very few studies have been done in developing countries and even less in South Africa.

Business Incubators are ideal environments that guide Startups through the TEA phase. This seemed like the ideal environment to find Startups for this study. The sampling frame

was Startups that apply the LSO on their own accord or who are in a business incubator that apply the LSM as a framework for the participants in the incubator.

3.3.2. Sampling and Sampling Method

Due to the niche requirements of the sample frame, Probability sampling would not be advised and instead it was decided to pursue the snowball probability sampling method. Referral networking was initiated in order to connect with Startups in the required sample frame as early as September 2021.

Quantitative Studies require larger numbers when compared to qualitative studies (Wegner, 2016). Initially it was foreseen that there would be an issue with the number of available Startups using the Lean Startup Methodology and further gaining access to these Startups would be difficult. In Schwery's (2018) study he managed to get 100 Startups to participate in the study. In this study 8 variables are used in total. If a ratio of 20:1 samples to variable is applied (Hair, Black, Babin, Anderson & Tatham, 2010) then a 160 Startups in the sample set would be required.

Based on the information obtained in MMENVC Decision Science Module the aim would be to get at least 320 Startups to participate as +/- 50% of the data would be disregarded during the screening and cleaning phase.

This did not seem feasible so this study endeavoured to take a more structured approach in making contact with the incubator administrators to get targeted contact lists. Further the Startups were lobbied before sending the questionnaires and follow up emails will be sent, all with the idea of improving the overall response rate of the sample set (communication approach).

The following Incubators were identified during the initial referral networking:

- Founders Factory Africa
- GEN
- I'm In Accelerator (https://www.iminaccelerator.com/)
- Aurik Business Accelerator (https://www.aurik.co.za/)

- Plug and Play (https://www.plugandplaytechcenter.com/)
- Accelerate
- Startupbootbcamp (https://www.startupbootcamp.org/)
- Mzansi Drone Accelerator

3.4. Measuring instruments

The measuring instrument was a questionnaire that the participant completed online. The idea was to make the questionnaire simple and quick to answer and not take too much time from the participant to avoid the pitfalls of questionnaires.

To reduce ethical risks with gathering personal data it was decided to make the questionnaire anonymous.

The sources and scales used for the various variables are shown in Table. 4. below.

Table. 4: Construct, Definitions, & Sources of Scales

No	Construct	Definition	Source
Independent Variable – Lean Startup Orientation			
8.a – 8.d (4 Items)	Hypothesis Testing (LSO)	Methodology to construct, test and validate hypotheses	Schwery (2018)
9.a – 9.d (4 Items)	Customer Orientation (CO)	Inclination to communicate with the customer and understand the need/problem	Schwery (2018)
10.a – 10.d (4 Items)	Experimentation (EXP)	Methodology to test the hypotheses through trial and error	Schwery (2018)
11.a – 11d (4 Items)	Prototyping (Prot)	Prototyping as a methodology to test and learn	Schwery (2018)
12.a – 12.d (4 Items)	Validation (Val)	Methodology to use quantitative tests and measures to confirm hypotheses.	Schwery (2018)

13.a – 13.d (4 Items)	Knowledge Transfer (KT)	Methodology to use information gained throughout as input for further development	Schwery (2018)
14.a – 14.d (4 Items)	Learning (Learn)	Orientation towards organisational learning	Schwery (2018)
15.a – 15.d (4 Items)	Iterative Cycles (ITC)	Methodology to do repetitive experimental testing and working cycles to improve knowledge transfer	Schwery (2018)
Dependent Variable – Startup Success			
19.a	Survival Period	Period the Startup has survived for	My own measure based on Ghezzi et al., (2015), p 200
19.b	Product Development Cycle	Metrics of the Startup's Development Cycle	Ghezzi et al., (2015), p 200
19.c – 19.j (8 Items)	Venture Organising Activity (VOA)	Metrics of the development of the business structures	Ghezzi et al., (2015), p 200
19.k	Equity Funding (EF)	Metrics of obtaining Funds	Ghezzi et al., (2015), p 200
19.e & Follow on	First Customer Acquisition (FCA)	Metrics of the duration to obtain a customer	Ghezzi et al., (2015), p 200
Moderating Variables			
16.a - 16.f (6 Items)	Business Industry (BI)	Type of industry the Startup operates in	Takata (2016), p 5617
17.a – 17.d (4 Items)	Entrepreneur Experience	Years of experience the Entrepreneur has behind him/her	Stuart, R and Abetti, P. (1990), p 155

18.a – 18.f (6 Items)	Source of Funding (SF)	Methodology for obtaining financing	Fischer & Rassenfosse (2011), p12
20.a – 20.d (4 Items)	Radicalness of Innovation (RI)	Metric of severity of the innovation	Schwery (2018)
21.a – 21.d (4 Items)	Technology Uncertainty (TU)	Metric of advancement of the technology	Schwery (2018)
22.a – 22.d (4 Items)	Market Uncertainty (MU)	Metric of the volatility of the market	Schwery (2018)

The research instrument is an online questionnaire that can be seen in Appendix B.

3.5. Procedure for Data Collection

The questionnaire was compiled in Qualtrics XM and arranged in a phone friendly version. Qualtrics XM is a software program that collates the data through an easy to understand and use interface for participants. This meant an email containing the Introduction Letter (Appendix A) or similar condensed version on a phone via social media (WhatsApp, Facebook & LinkedIn) could easily be disseminated.

The Incubators were approached directly by liaising individually with the coordinator at each Incubator. The introductory Letter would be sent, via email or social media, to this person and they would distribute it to the Startups in the Incubators through their existing communication channels. Direct access to these Startups was not possible as the coordinators refused to provide the details of the Startups to outside parties due to the Protection of Personal Information Act 4 of 2013 (POPIA).

The participants would then complete the online questionnaire directly on their laptop or smart phone. The collected data would be saved in the cloud and be available on the Qualtrics XM website.

3.6. Data analysis and Interpretation

Once the required number of participants completed the online questionnaire on Qualtrics XM the data could be exported into IBM SPSS Statistics which is a statistical analysis program for processing.

In IBM SPSS the data cleaning process would commence. This entailed sifting through the data and removing the irrelevant parameters. Following the sifting process the missing data would be identified and the affected participants removed from the study.

Because this study followed the previous study done by Schwery (2018) it was decided to use Confirmatory Factor Analysis (CFA) statistical technique to verify the factor structure of the set of observed variables.

The multivariate techniques were considered to analyse the data because 8 variables had to be allowed for. The four of the most common multivariate techniques are multiple regression analysis, factor analysis, path analysis and multivariate analysis of variance, or MANOVA.

There are a number of moderating variables in this study and due to this, it would not be feasible to fit one model with several moderating variables using multiple regression / hierarchical regression. Further IBM SPSS can only manage 1 x Independent Variable, 1 x Dependent Variable and 1 x Moderating Variable. An alternative method and software were required.

A minimum sample of at least 200 would be required. This study managed to obtain 40. This limitation caused warnings like “nonpositive definitive” whilst doing a Factor Analysis in IBM SPSS.

Further research into alternative statistical methods and software programs were necessary.

Through research, the Structural Equation Modelling (SEM) technique was discovered which is a multivariate technique that is one of the newer linear statistical models mostly used for research that is designed to confirm a research study design rather than to explore or explain a phenomenon. This method was pursued over Regression because SEM not only incorporates measured variables but considers latent constructs and specifies the measurement error.

Due to the small sample size, of 40, SmartPLS software package was picked over IBM SPSS that typically requires a sample size of over 200.

The accuracy and repeatability of data needed to be established first.

3.7. Validity and Reliability Research

The Instrument, Scales and Construct needs to be tested for accuracy (validity) and consistency (reliability).

3.7.1. Internal Validity

Internal Validity refers to the accuracy of the data collected. This was done with a Confirmatory Factor Analysis (CFA). The biggest threat is that the construct is proved to be invalid. For the construct we want to see if it is consistent with the theoretical construct.

3.7.2. External Validity

External Validity refers to the meaningfulness and accuracy of the data. The danger is that incorrect inferences are made based on the data e.g., generalisations.

3.7.3. Reliability

The Reliability was tested with the Cronbach Alpha Coefficient that needs to be higher than 0.7.

If the study agrees with the previous studies, this would be indicative that the study is reliable. This study sets out to prove a relationship between LSO and Startup Performance.

If there is overwhelming evidence of corelation where the LSO increases the performance of the Startups, then the deduction can be made that the Hypothesis is valid.

The statistical analysis that is applicable to this study would be the Hypothesis Testing Analysis. A descriptive analysis of the sample set needs to do be done to see what the average (mean) is, the dispersion and if there is any skewness in the sample set.

Two of the hypotheses are directional hypotheses, and the remaining five hypotheses are null hypotheses.

Hypothesis Testing is an Inferential Statistical Analysis. A sample is tested, and the results are inferred on the general population.

3.8. Ethical considerations

The Participant shared their information with this study and it is the authors responsibility to keep their information as private as is reasonably possible.

To reduce the risks even further participants were not asked for sensitive information in the questionnaire e.g. people's names, ID numbers or company names thus there is very little chance of private information leaking into the public domain.

The Wits Business School Ethics Committee approved this study and awarded the following Protocol Number on 29 November 2021 - WBS/EN2252850/694.

4. PRESENTATION OF RESULTS

4.1. Introduction

In this chapter the results from this study will be presented.

4.2. Data Screening

80 Incubators in South Africa were approached, 40 respondents from the sample completed the online questionnaire. 2 respondents did not say whether they give consent so they were excluded.

All respondents with more than 10 % of the data missing were excluded (Little and Rubin, 1989). This left a final sample set of 34 respondents.

4.3. Demographic profile of respondents and Startups

In this section the demographics of the entrepreneur respondents are presented in terms of sex, age, qualifications & experience. This is followed by the Startups' demographics of age & industry.

4.3.1. Gender

22 of the respondents were male, 10 were female and 2 respondents identified as Third gender (Fig. 17). The ratio of 2.2 male to female entrepreneurs was evident.

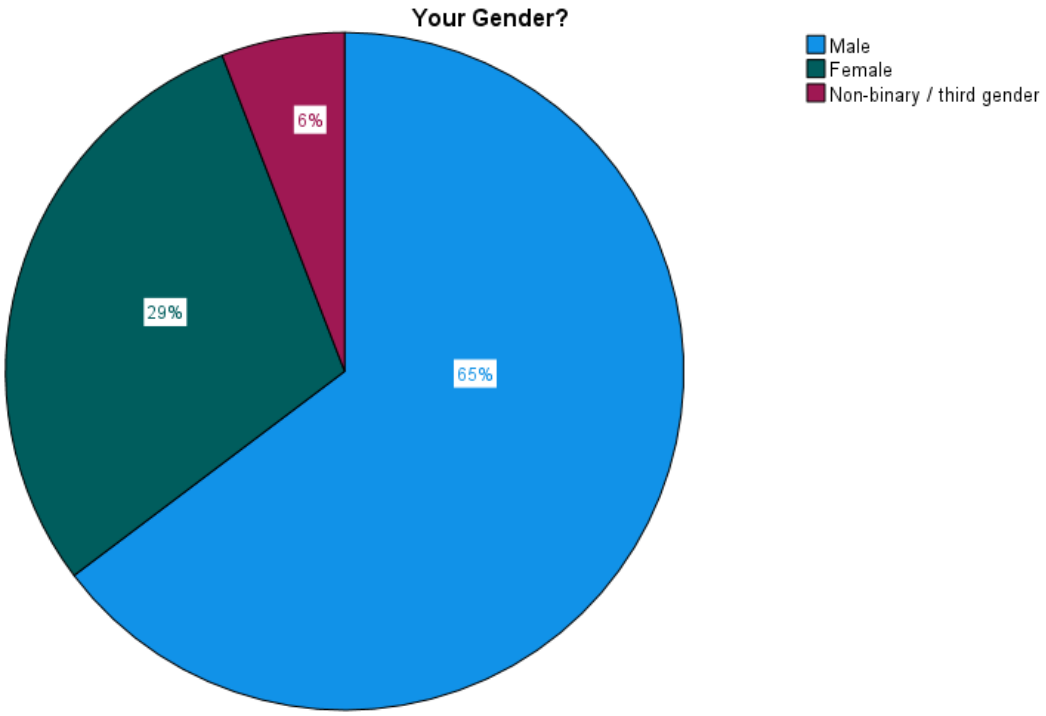


Fig. 17: Gender

In Table. 5 is a comparative of the sample's male to female ratio with the results from the GEMSA-2019.

Table. 5: Gender Ratio

	Gender Ratio (GEMSA-2019-Entrepreneur- Report)						Sample Set
Year	2005	2009	2013	2015	2017	2019	2021/2022
Male/Female Ratio	1.33	1.58	1.37	1.66	1.52	1.14	2.2

4.3.2. Age

The Control Variables were left out of the missing data analysis mentioned above. 29.4 % of the respondent did not complete their ages. This is higher than the 10 % of the data missing data threshold specified by Little and Rubin (1989). Multiple imputations were conducted to replace the missing data.

The respondents were on average 45.118 ± 8.333 years old with a range of (29, 64) as presented in Table. 6.

Table. 6: Respondent age

	N	Minimum	Maximum	Mean	Std. Deviation
Your Age (Years)?	34	29.00	64.00	45.118	8.333

From the graph in Fig. 18 it can be seen that most of the respondents were in the age group 35 – 54 years of age. This aligns with the African region as a whole in 2019 (Fig. 19).

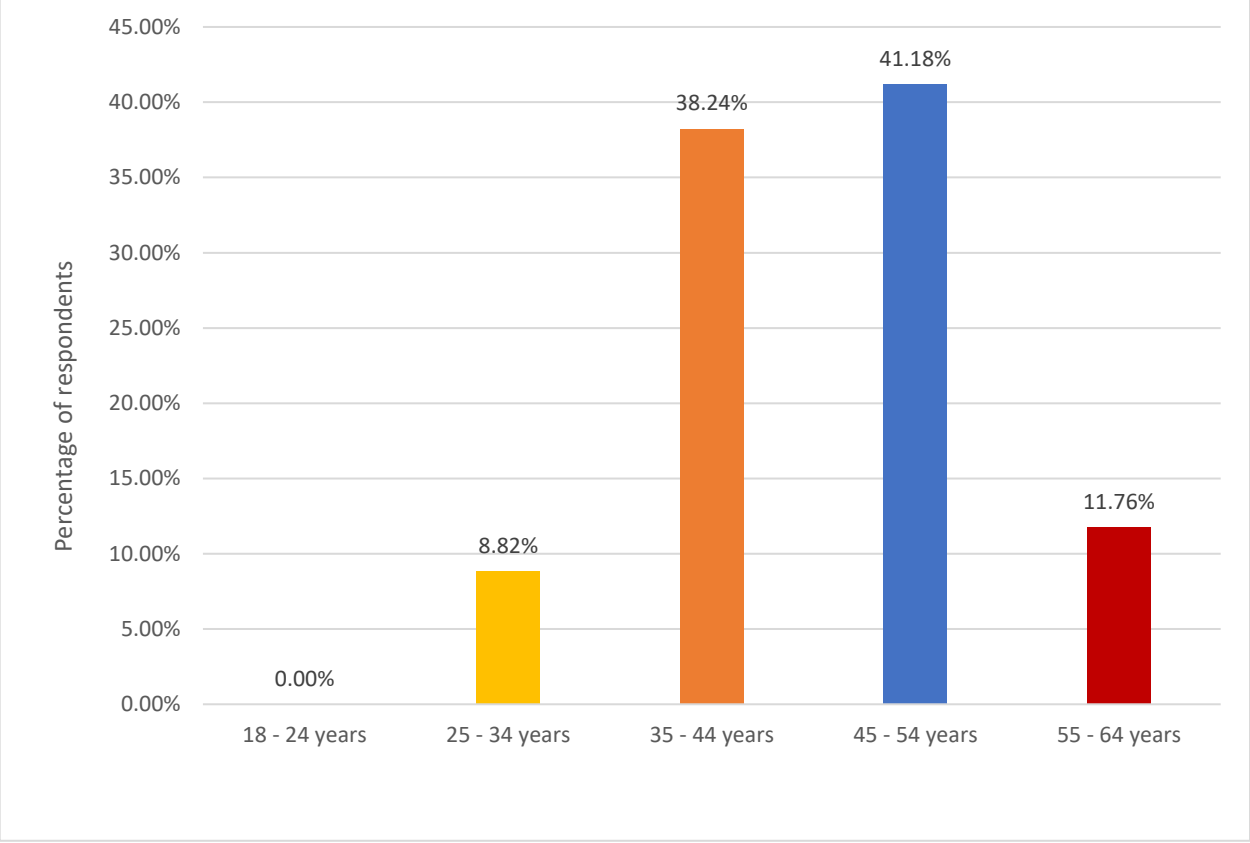
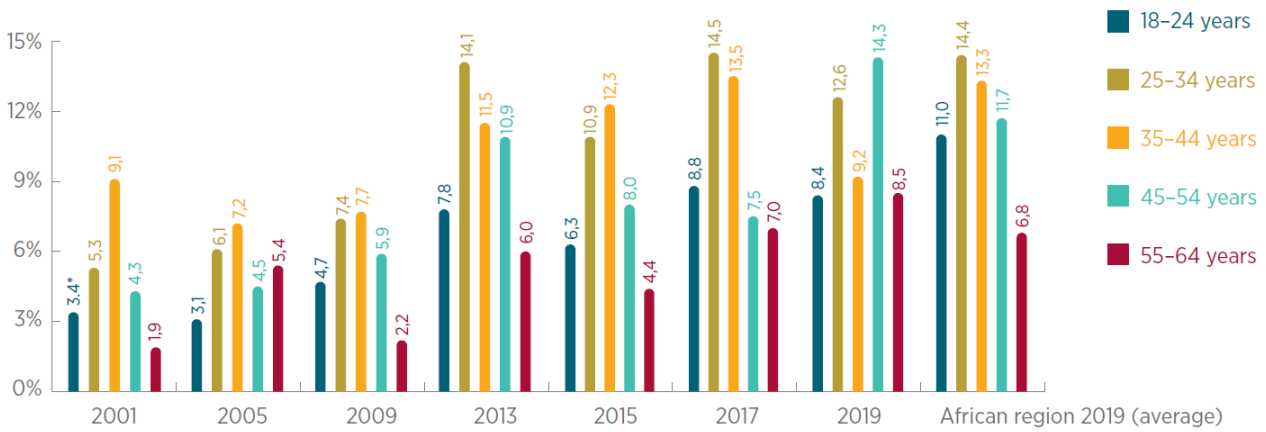


Fig. 18: Age Groups



Source: GEMSA-2019-Entrepreneurship-Report-web. Table. 8, Pg 15

Fig. 19: Age Groups - GEMSA

4.3.3. Years of Business Experience

The respondents had on average 18.029 ± 11.692 years of experience in business with a range of (1, 41) as presented in Table. 7.

Table. 7: Years of Experience in Business

	N	Minimum	Maximum	Mean	Std. Deviation
Years of experience in Business?	34	41.00	1.00	18.029	11.692

79.42 % of the Respondents had over 5 years' experience in business (Fig. 20).

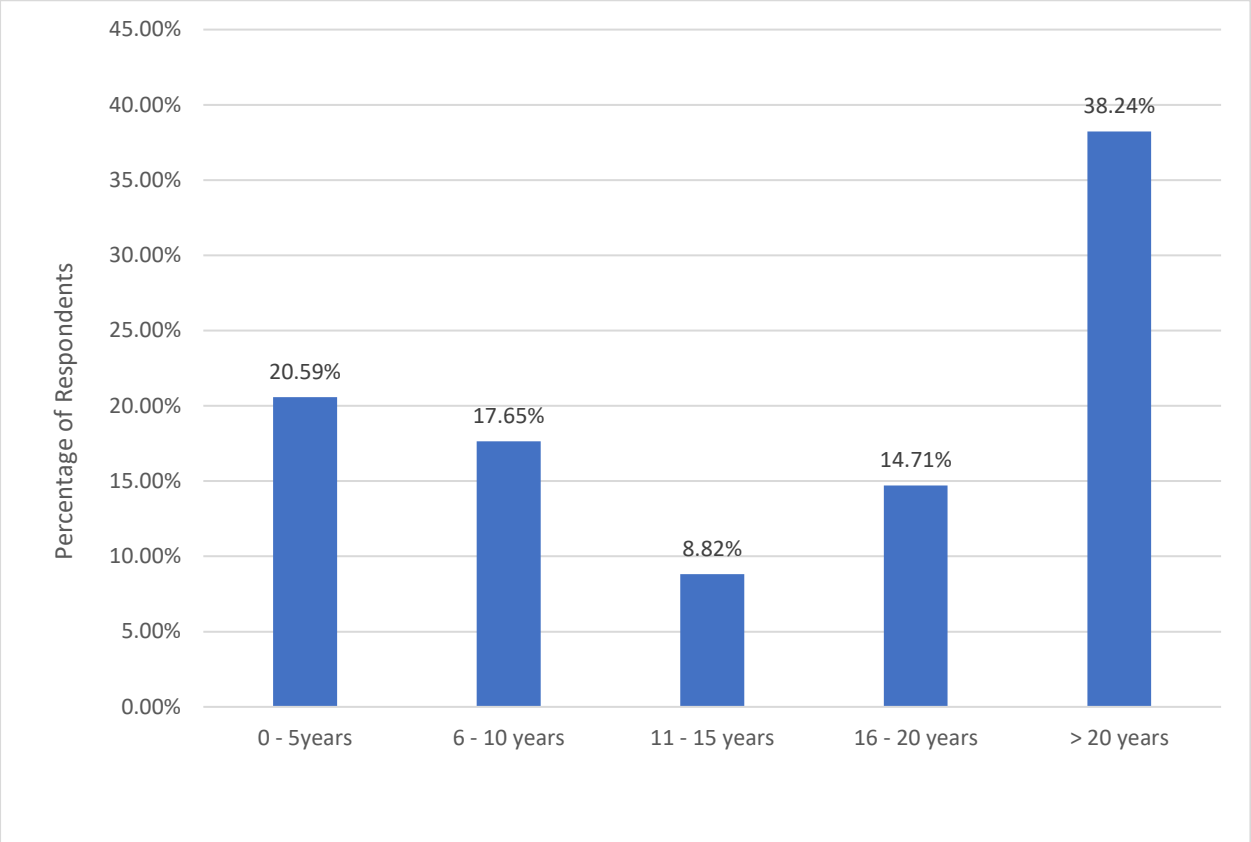


Fig. 20: Number of Years Business Experience

4.3.4. Level of education

The results illustrated in Fig. 21 indicates a proportion of 56% had a degree or higher as their highest attained qualification.

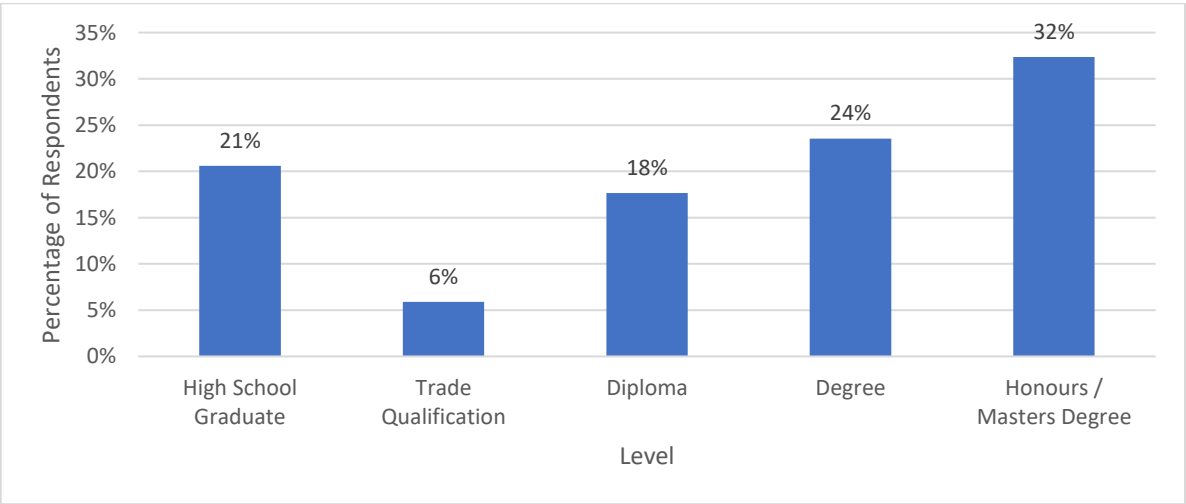


Fig. 21: Highest level of education

4.3.5. Business Age

The results presented in Fig. 22 indicate that 50 % the Startups represented in the sample were less than 6 months old, 44.11 % were between 7 Months and 26 months of age.

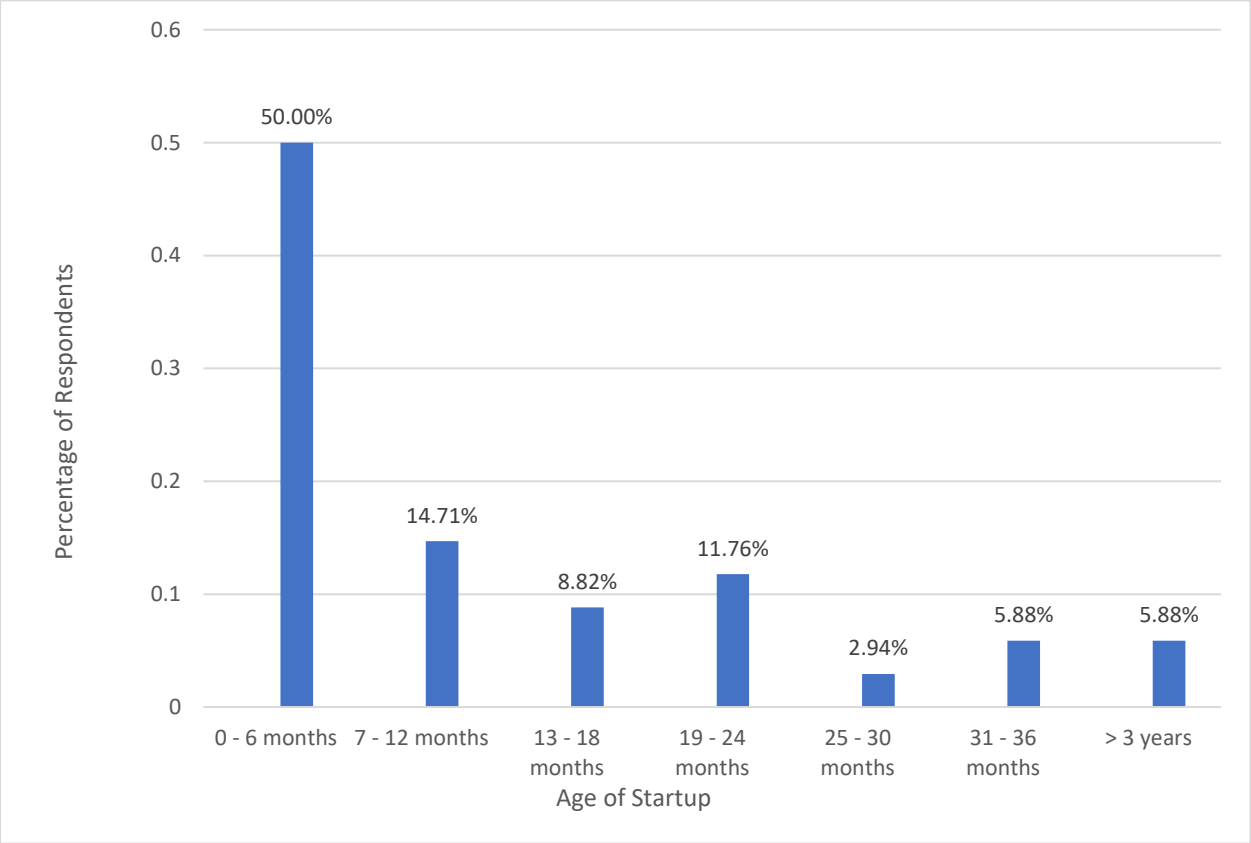


Fig. 22: Age of the Startup

4.3.6. Number Employees

The results presented in Table. 8 and Fig. 21 indicate that businesses represented in the sample employed on average 11.059 ± 14.579 persons with a range of (1, 50)

Table. 8: Number of Employees

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
How many person (s) work for your Startup full-time (including you)?	34	1.00	50.00	11.059	14.579

The 61.76 % of the Startups employed between 2 – 10 persons.

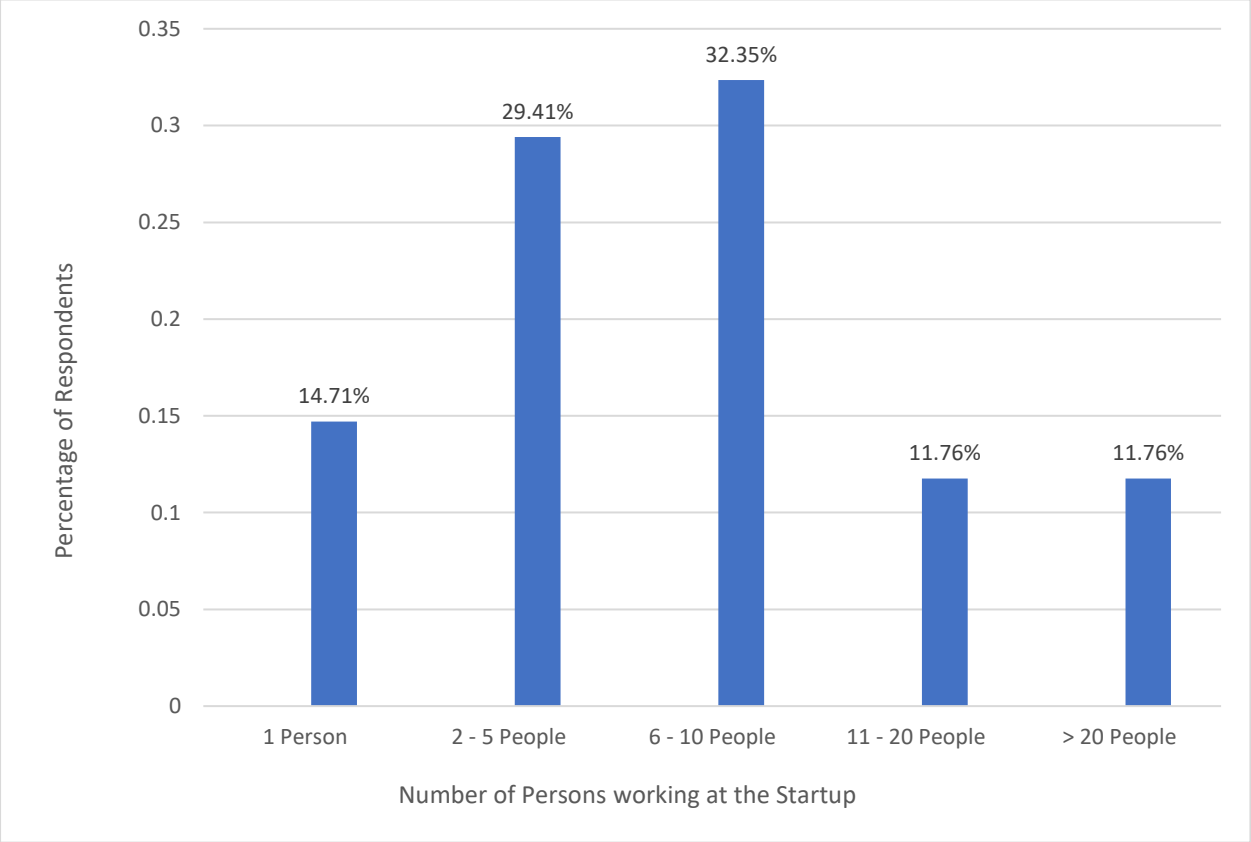


Fig. 23: Number of people working at the Startup

4.3.7. Location

53 % of the Startups represented in the sample were located in Gauteng Province (Fig. 24). Mpumalanga (12 %) and KwaZulu Natal (12 %) were the next highest reported Provinces.

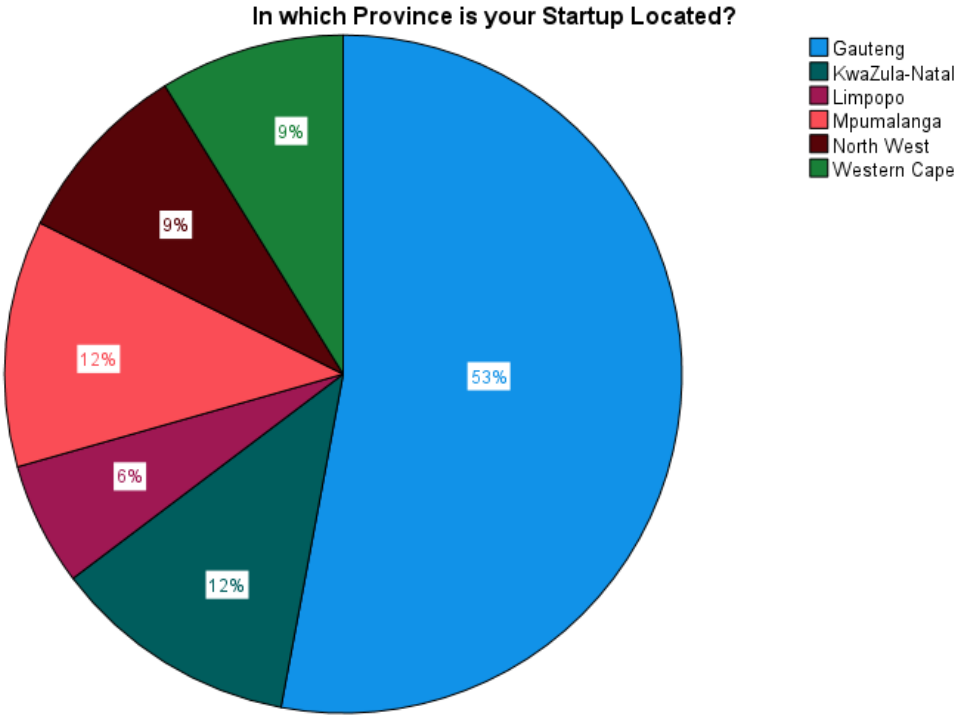


Fig. 24: Province of Startup

4.3.8. Industry

24 % of the Startups represented in the sample were in the Professional Services Industry (Fig. 25). Personal / Consumer Services (12 %) and Health, Education, Government and Social Services (12 %) were the next highest reported industries.

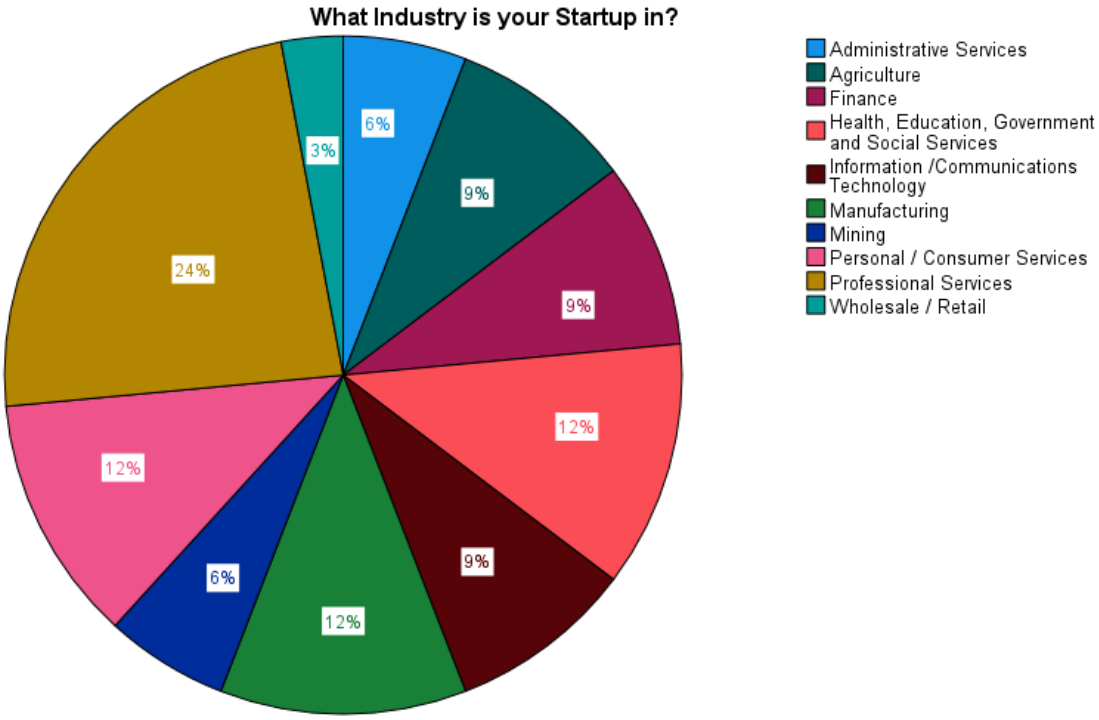


Fig. 25: Industry of Startups

This differs substantially from the data of the GEMSA (2019) report shown in Fig. 26.

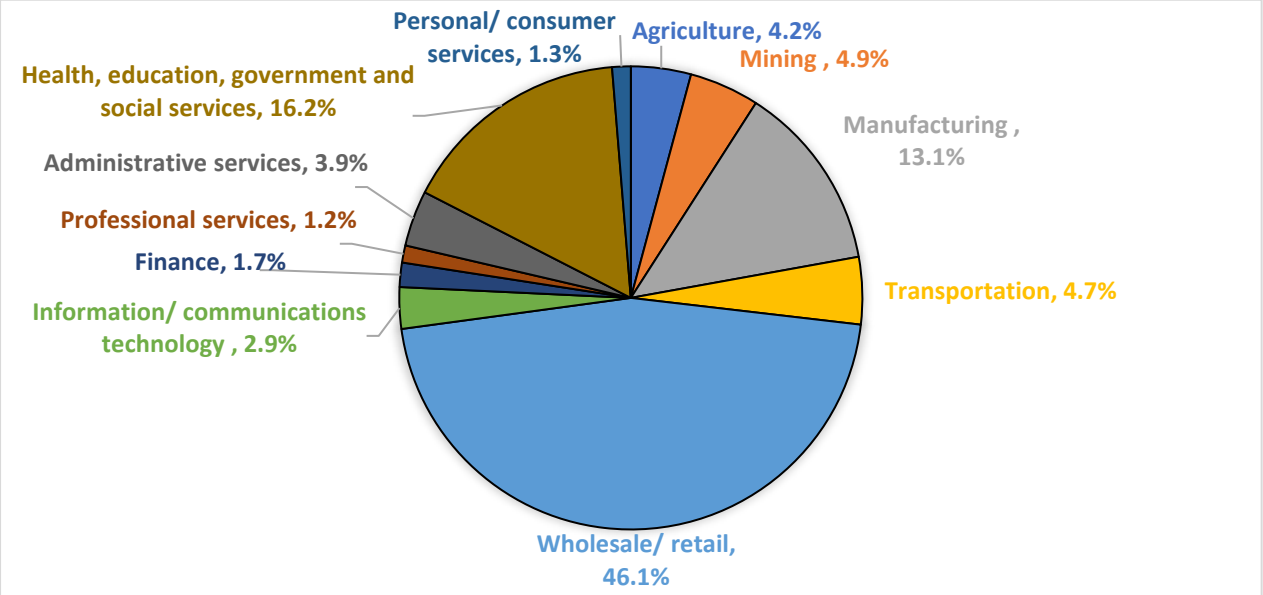


Fig 26: GEMSA (2019) Industries

4.4. Validity and Reliability

Confirmatory Factor Analysis (CFA) was conducted using SmartPLS to assess both validity and reliability.

The Path Diagram of the hypothesised model can be seen in Fig. 27

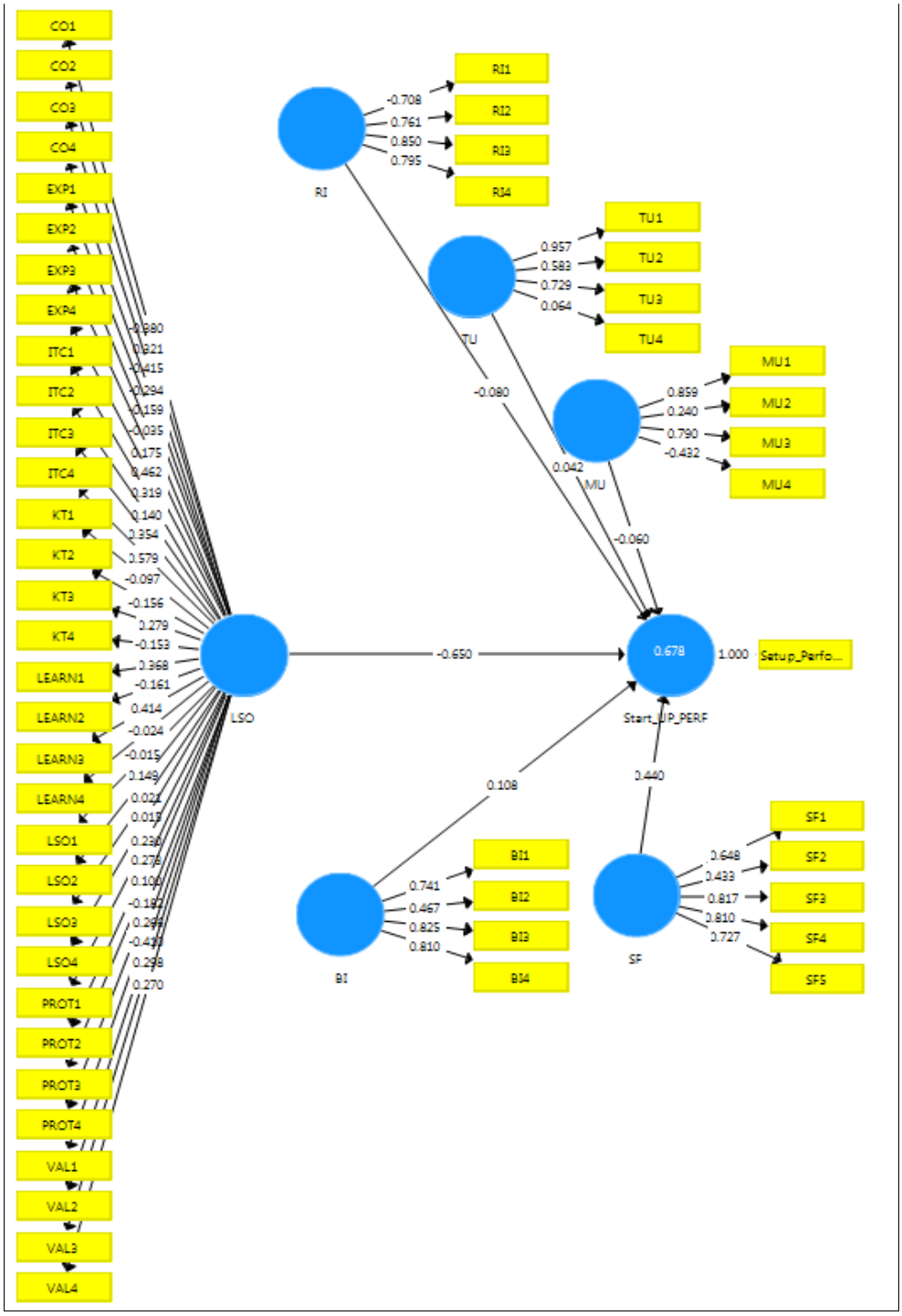


Fig. 27: Hypothesised model

The Construct Reliability and Validity results for the hypothesised model are presented in Table. 9. It can be noted that there were problems with some constructs like Market Uncertainty (MU) (α = 0.422) and Radicalness of Innovation (RI) (α = 0.474) which had Cronbach's Alpha values less than 0.5. There was no convergent validity for the LSO as the Average Variance Extracted (AVE) value was less than the minimum acceptable value of 0.4. This suggests that the model required pruning.

Table. 9: Construct Reliability and Validity - Hypothesised model

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
BI	**0.688**	**0.758**	**0.810**	**0.526**
LSO	**0.811**	**0.392**	**0.181**	**0.076**
MU	**0.422**	**0.126**	**0.470**	**0.401**
RI	**0.474**	**0.773**	**0.648**	**0.608**
SF	**0.734**	**0.767**	**0.823**	**0.492**
Start_UP_PERF	**1.000**	**1.000**	**1.000**	**1.000**
TU	**0.754**	**0.349**	**0.712**	**0.448**

Fornell-Larcker Criterion was used to assess the discriminant (divergent) validity (Table. 10). There was no divergent validity as the absolute value of the diagonal element for the LSO of the Fornell-Larcker Criterion was less than the correlation with the Startup Performance. This suggests that some of the LSO items were more correlated with the items within the Startup Performance construct than they were with the other items within the LSO construct. This also confirms that the CFA model required pruning.

Table. 10: Fornell-Larcker Criterion - Hypothesised model

	BI	LSO	MU	RI	SF	Startup_ PERF	TU
BI	0.725						
LSO	-0.016	**0.275**					
MU	0.035	0.212	0.634				
RI	-0.201	-0.144	-0.158	0.780			
SF	0.111	-0.047	-0.088	0.273	0.701		

Start_UP_PERF	0.175	-0.680	-0.214	0.137	0.474	1.000	
TU	-0.154	-0.130	0.147	0.356	0.177	0.151	0.669

Table. 11 below, shows the factor loadings for the hypothesised model and that there were a number of items that required pruning. For this study, items with a factor loading less than 0.6 were pruned.

Table. 11: Outer Loadings - Hypothesised model

	BI	LSO	MU	RI	SF	Startup_PERF	TU
BI1	**0.741**						
BI2	**0.467**						
BI3	**0.825**						
BI4	**0.810**						
CO1		**-0.380**					
CO2		**0.321**					
CO3		**-0.415**					
CO4		**-0.294**					
EXP1		**-0.159**					
EXP2		**-0.035**					
EXP3		**0.175**					
EXP4		**0.462**					
ITC1		**0.319**					
ITC2		**0.140**					
ITC3		**0.354**					
ITC4		**0.579**					
KT1		**-0.097**					
KT2		**-0.156**					
KT3		**0.279**					
KT4		**-0.153**					
LEARN1		**0.368**					
LEARN2		**-0.161**					
LEARN3		**0.414**					
LEARN4		**-0.024**					
LSO1		**-0.015**					
LSO2		**0.149**					
LSO3		**0.021**					

LSO4		0.015					
MU1			0.859				
MU2			0.240				
MU3			0.790				
MU4			-0.432				
PROT1		0.230					
PROT2		0.273					
PROT3		0.100					
PROT4		-0.182					
RI1				-0.708			
RI2				0.761			
RI3				0.850			
RI4				0.795			
SF1					0.648		
SF2					0.433		
SF3					0.817		
SF4					0.810		
SF5					0.727		
Setup_Performance						1.000	
TU1							0.957
TU2							0.583
TU3							0.729
TU4							0.064
VAL1		0.266					
VAL2		-0.410					
VAL3		0.298					
VAL4		0.270					

The pruned model after a number of pruning iterations is presented in Fig. 28. All the retained items per construct had factor loadings of at least 0.6.

There was no valid construct for Entrepreneur Experience and Market Uncertainty. The LSO construct was significantly reduced from 24 items to 4 items only.

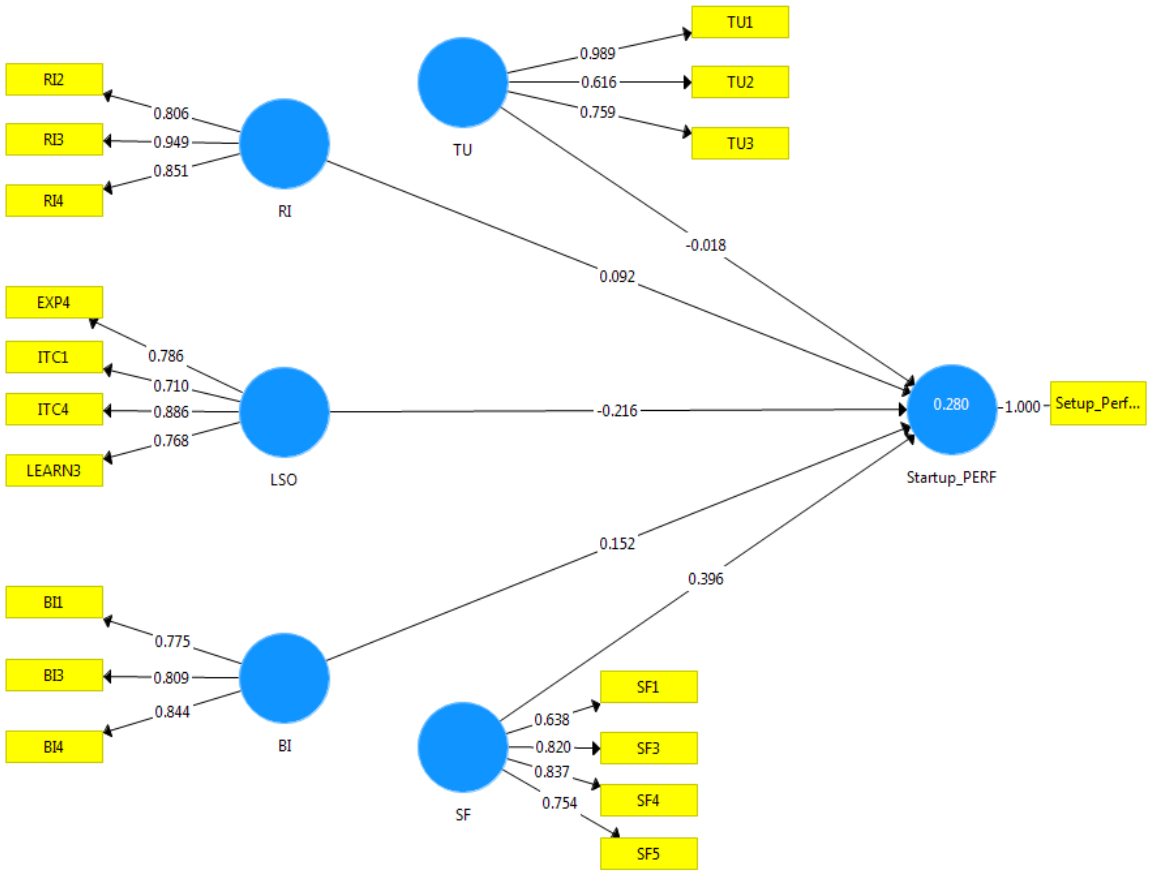


Fig. 28: CFA Model for the Pruned model

The Construct Reliability and Validity for the Pruned model shown in Table. 12 indicates that there was construct reliability for all the constructs as all the Cronbach's Alpha values were greater than 0.7. There was convergent validity as all the constructs had an AVE value greater than the minimum acceptable value of at least 0.4. This suggests that the model was a good fit for the data.

Table. 12: Construct Reliability and Validity - Pruned model

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
BI	**0.743**	**0.758**	**0.851**	**0.656**
LSO	**0.804**	**0.860**	**0.868**	**0.624**
RI	**0.874**	**1.199**	**0.904**	**0.758**
SF	**0.770**	**0.766**	**0.849**	**0.587**
Startup_PERF	**1.000**	**1.000**	**1.000**	**1.000**

TU	**0.816**	**2.660**	**0.840**	**0.645**

There was discriminant validity in the pruned model as all diagonal elements shown in Table. 13 were higher than the off-diagonal elements which shows correlations with other constructs. This indicates that the items within each construct are more strongly correlated to each other, more so than they were correlated to items within other constructs.

Table. 13: Fornell-Larcker Criterion - Pruned model

	BI	**LSO**	**RI**	**SF**	**Startup_ PERF**	**TU**
BI	0.810					
LSO	0.047	0.790				
RI	-0.163	0.130	0.871			
SF	0.116	-0.199	0.214	0.766		
Startup_PERF	0.174	-0.273	0.116	0.472	1.000	
TU	-0.102	-0.156	0.444	0.229	0.132	0.803

Table. 14 shows that all items loaded highly onto their respective factors as all the factor loadings were greater than 0.6.

Table. 14: Outer Loadings: Pruned model

	BI	**LSO**	**RI**	**SF**	**Startup_PERF**	**TU**
BI1	**0.775**					
BI3	**0.809**					
BI4	**0.844**					
EXP4		**0.786**				
ITC1		**0.710**				
ITC4		**0.886**				
LEARN3		**0.768**				
RI2			**0.806**			
RI3			**0.949**			
RI4			**0.851**			
SF1				**0.638**		
SF3				**0.820**		
SF4				**0.837**		
SF5				**0.754**		

Setup_Performance					**1.000**	
TU1						**0.989**
TU2						**0.616**
TU3						**0.759**

4.5. Hypothesis testing

Structural Equation modelling (SEM) was conducted using SmartPLS. The SEM was conducted using items that were retained within each construct from the CFA model. The SEM model is presented in Fig. 29 and Table. 15.

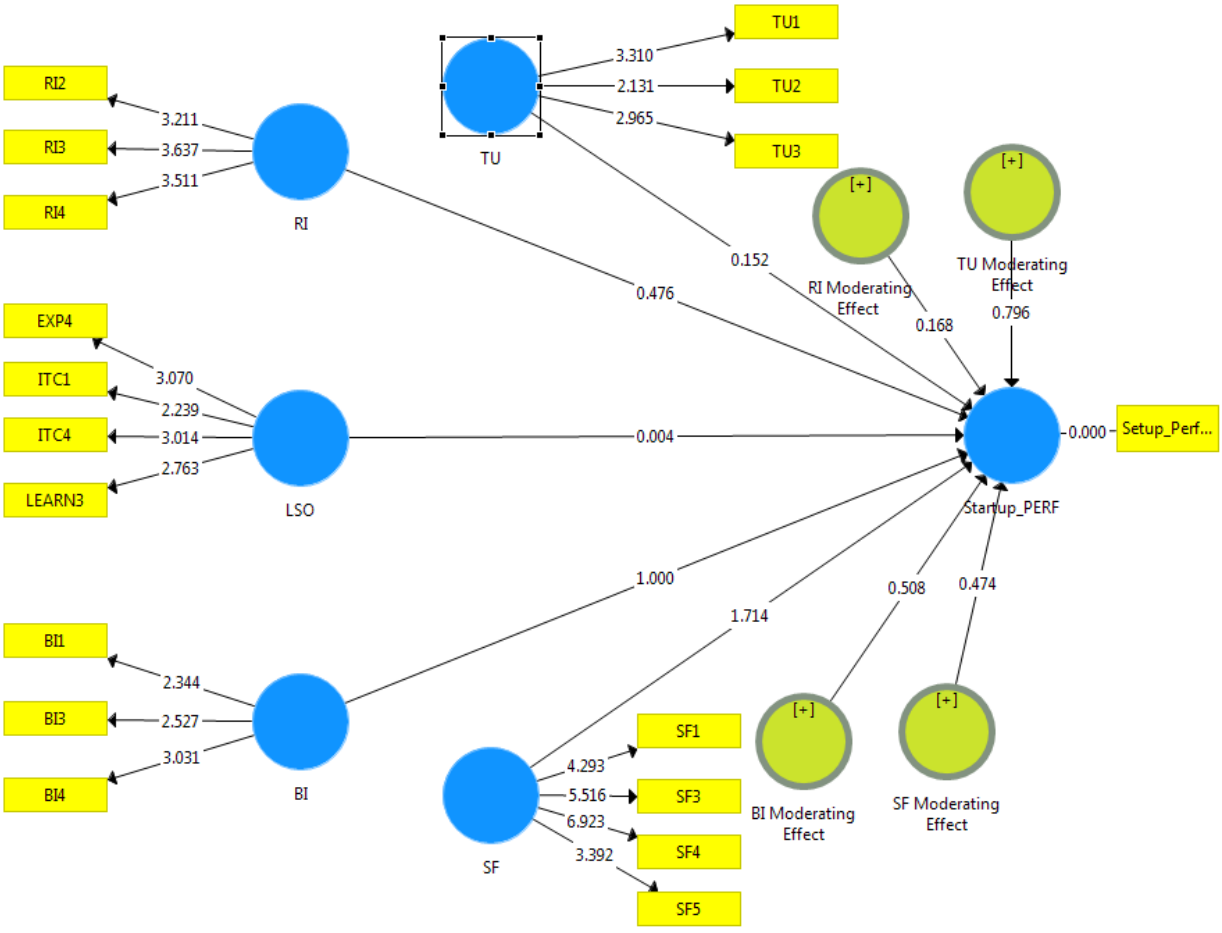


Fig. 29: SEM Model with moderating effect

Table. 15: Mean, STDEV, T-Values, P-Values

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
BI -> Startup_PERF	0.248	0.226	0.248	1.000	**0.317**
BI Moderating Effect -> Startup_PERF	-0.155	-0.141	0.305	0.508	**0.611**
LSO -> Startup_PERF	0.001	-0.015	0.281	0.004	**0.997**
RI -> Startup_PERF	0.122	0.007	0.257	0.476	**0.634**
RI Moderating Effect -> Startup_PERF	0.054	0.125	0.321	0.168	**0.867**
SF -> Startup_PERF	0.353	0.375	0.206	1.714	**0.087**
SF Moderating Effect -> Startup_PERF	0.154	0.099	0.325	0.474	**0.636**
TU -> Startup_PERF	-0.034	0.038	0.222	0.152	**0.879**
TU Moderating Effect -> Startup_PERF	0.359	0.269	0.451	0.796	**0.426**

The results of each hypothesis will be discussed next.

4.5.1. Results pertaining to Hypothesis 1

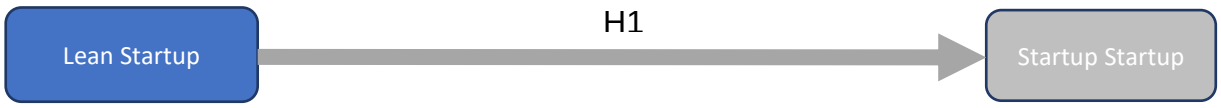


Fig. 30: Hypothesis 1

Results pertaining to Hypothesis 1: The degree of Lean Startup Orientation positively relates to the Startup's Performance.

H0: Lean Startup Orientation has no relationship with Startup Performance.

H1: Lean Startup Orientation positively relates to the Startup's Performance.

The results presented in Table. 14 indicate that the degree of Lean Startup Orientation (B = 0.001, p-value = 0.997) had a positive but insignificant effect on the Startup's Performance. The effect was positive because the path coefficient was greater than zero and not significant because the p-value (0.997) was greater than 0.05. Thus, hypothesis H1 was supported but the result was nonsignificant.

4.5.2. Results pertaining to Hypothesis 2.A



Fig. 31: Hypothesis 2.A

Results pertaining to Hypothesis 2A: Lower Levels of Radicalness of Innovation strengthen the LSO-Performance relationship.

H0: Radicalness of Innovation does not moderate the relationship between the LSO and Performance.

H2A: Radicalness of Innovation has a negative moderating effect on the relationship between the LSO and Performance relationship.

The results presented in Table. 14 indicate that the levels of Radicalness of Innovation (B = -0.054, p-value = 0.867) had a negative but insignificant moderating effect on the relationship between the LSO and the Startup's Performance. Although lower levels of Radicalness of Innovation strengthen the LSO-Performance relationship the null hypothesis could not be rejected. There is no sufficient evidence at 5% significance level to suggest that lower levels of Radicalness of Innovation strengthen the LSO and Performance relationship.

4.5.3. Results pertaining to Hypothesis 2.B

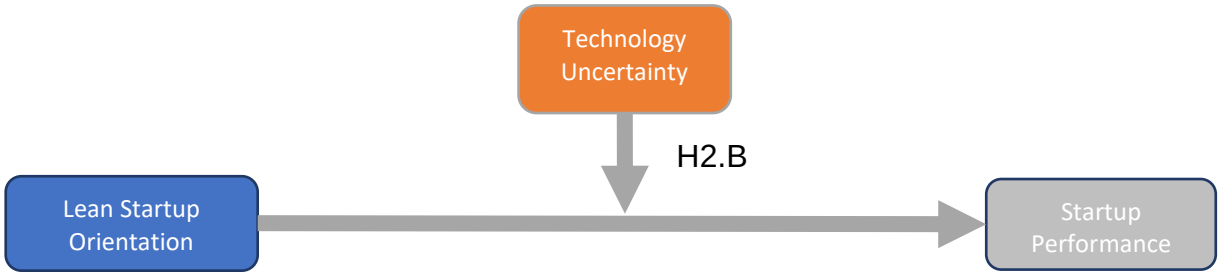


Fig. 32: Hypothesis 2.B

Results pertaining to Hypothesis 2B: The LSO-Performance relationship is moderated by the Technology Uncertainty.

H0: Technology Uncertainty does not moderate the relationship between LSO and Performance

H2B: Technology Uncertainty moderates the effect of LSO and Performance relationship

The results presented in Table. 14 indicate that Technology Uncertainty (B = 0.359, p-value = 0.426) had a positive but insignificant moderating effect on the relationship between the LSO and the Startup's Performance. Although Technology Uncertainty positively moderated the LSO-Performance relationship the null hypothesis could not be rejected. There is not sufficient evidence at a 5% significance level to suggest that the LSO-Performance relationship is moderated by the Technology Uncertainty.

4.5.4. Results pertaining to Hypothesis 2.C



Fig. 33: Hypothesis 2.C

Results pertaining to Hypothesis 2C: The LSO-Performance relationship is moderated by the Market Uncertainty.

This was not tested as there was no valid Market Uncertainty construct.

4.5.5. Results pertaining to Hypothesis 2.D

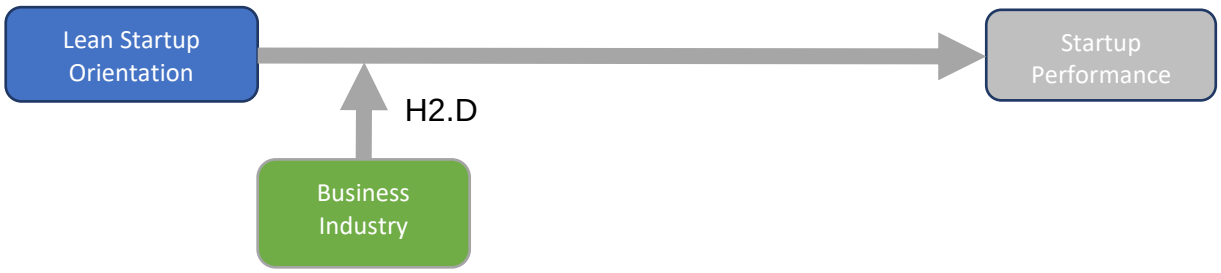


Fig. 34: Hypothesis 2.D

Results pertaining to Hypothesis 2D: The LSO-Performance relationship is moderated by the Industry of the Startup.

H0: Business Industry does not moderate the relationship between LSO and Performance

H2D: Business Industry moderates the effect of LSO and Performance relationship

The results presented in Table. 14 indicate that the Business Industry (B = -0.155, p-value = 0.611) had a negative but insignificant moderating effect on the relationship between the LSO and the Startup's Performance. Although Business Industry moderates the LSO-Performance relationship the null hypothesis could not be rejected. As a result, there is not sufficient evidence at a 5% significance level to suggest that LSO-Performance relationship is moderated by the Industry of the Startup.

4.5.6. Results pertaining to Hypothesis 2.E

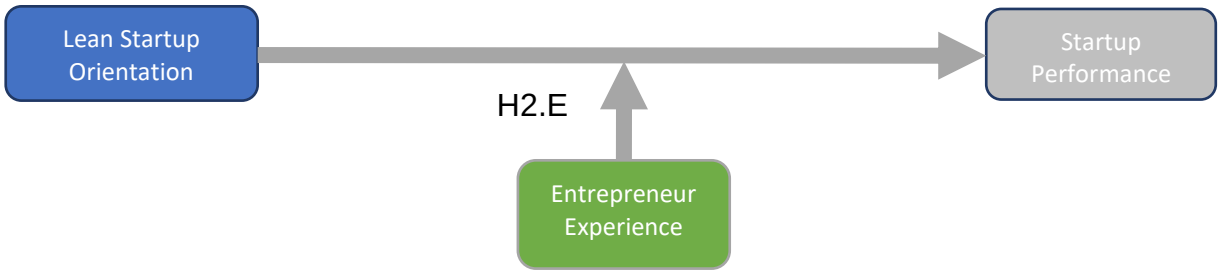


Fig. 35: Hypothesis 2.E

Results pertaining to Hypothesis 2E: Higher Levels of Entrepreneur Experience strengthen the LSO-Performance relationship.

This was not tested as there was no valid Entrepreneur Experience construct.

4.5.7. Results pertaining to Hypothesis 2.F



Fig. 36: Hypothesis 2.F

Results pertaining to Hypothesis 2F: The LSO-Performance relationship is moderated by the Source of Funding.

H0: Source of Funding does not moderate the relationship between LSO and Performance

H2F: Source of Funding moderates the effect of LSO and Performance relationship

The results presented in Table. 14 show that the Source of Funding (B = 0.154, p-value = 0.636) had a positive but insignificant moderating effect on the relationship between the LSO and the Startup's Performance. Although the Source of Funding positively moderated

the LSO-Performance relationship the null hypothesis could not be rejected. As a result there is not sufficient evidence at a 5% significance level to suggest that the LSO-Performance relationship is moderated by the Source of Funding.

5. DISCUSSION OF THE RESULTS`

5.1. Introduction

This study went at lengths to discover whether other academics have established academic grounding for LSM. From Bortolini et al., (2021) that found Effectuation to be the antecedent of LSM to LSM being a practical process that operationalises Effectuation and Bricolage. There is sufficient academic grounding for LSM.

In terms of practice this study has built on the study of Schwery (2018) and added the non-financial metrics to measure the performance of the Startups. By looking at LSM in developing countries this study encountered many hurdles that other studies can learn from and hopefully take forward in establishing the applicability of the LSM in developing countries.

Next the summary of the hypotheses will be given followed by a discussion of each individual hypothesis.

5.2. Hypothesis testing

In this section the summarised results will be shown in Table. 16 which was obtained from Chapter 4. This will be followed by an explanation of what the results mean for each hypothesis.

Table. 16: Summary of hypotheses

Hypothesis		Supported/ Not Supported	Significant/ Not Significant
H1	The degree of Lean Startup Orientation positively relates to the Startup's Performance	Unsupported	Nonsignificant
H2A	Lower Levels of Radicalness of Innovation strengthen the LSO-Performance relationship	Unsupported	Nonsignificant
H2B	The LSO-Performance relationship is moderated by the Technology Uncertainty	Unsupported	Nonsignificant
H2C	The LSO-Performance relationship is moderated by the Market Uncertainty	Not measured as there was no valid construct for Market Uncertainty	
H2D	The LSO-Performance relationship is moderated by the Industry of the Startup	Unsupported	Nonsignificant
H2E	Higher Levels of Entrepreneur Experience strengthen the LSO-Performance relationship	Not measured as there was no valid construct for Entrepreneur Experience	
H2F	Source of Funding moderates the effect of LSO and Performance relationship	Unsupported	Nonsignificant

5.2.1. Discussion of Hypothesis 1 - LSO-Startup Performance

A path coefficient of > 0.95 would be an acceptable strong, positive association between the two variables (Miles and Shevlin, 1998). The path coefficient of B = 0.001, implies a positive weak association between the Independent and Dependent Variables With the p-value (.997) > .05. the result is nonsignificant.

This indicates that there is a positive relationship between Lean Startup Orientation and the Startup's Performance but there is insufficient proof to conclude a meaningful and legitimate conclusion.

If the data from this study was significant then the Hypothesis would have been supported thus proving, in a developing country, that the application of the Lean Startup Orientation

correlated with the Performance of the Startup. This study would align with the study done by Harms and Schwery (2020). In their Quantitative Study on 2 100 active software Startups in Berlin area, Harms and Schwery (2020), found a strong and significant relationship between Lean Startup Capability (LSC) and the Startup's Performance.

If the association was negative, over 0.95 and significant (< .05) then the nul hypothesis would be supported which ties in with the study done by Nilsen and Ramm (2015) that found no correlation between Startup Success and the application of LSM. Further they stated that the application of the theory by itself is not enough to guarantee success.

5.2.2. Results pertaining to Hypothesis 2.A - Radicalness of Innovation on LSO-Performance

A path coefficient of > - 0.95 would be an acceptable strong, negative association between two variables (Miles and Shevlin, 1998). The path coefficient of B = - 0.054, implies a negative, weak association between the Moderating Variable and the relationship between the Independent and Dependent Variables. With the p-value (.867) > .05. the result is nonsignificant.

This means that there is a negative relationship between the Radicalness of Innovation and the LSO-Startup's Performance relationship but there is insufficient proof to conclude a meaningful and legitimate conclusion.

If the data from this study was significant then the hypothesis would have been supported, thus proving in a developing country that the lower the level of Radicalness of Innovation correlated with the improvement of the relationship between LSO-Startup's Performance. This study would align with study done by Felin et al., (2019) where the LSM was deemed ineffective in applying new radical innovations with feedback from mainstream users. According to Harms and Schwery (2020) the LSM is more suited to incremental innovation than radical innovation as the market information obtained through validated learning is more reliable for incremental improvements than radical improvements.

If the association was positive, over 0.95 and significant (< .05) then the nul hypothesis would be supported which aligns with the study done by Bocken and Snihur (2020) that stated that the LSM is suited to radical innovative ideas that have societal, economic and environmental impact. Koen (2015) indicated the best management theory to deal with sustaining innovation in an existing value network was stage gate approach. For all the other permutations where the existing business moves outside of its existing knowledge base of value network and the level of innovation increases (transformational & disruptive) then the Lean Startup Method with its iterative learning cycles are best to obtain new market and customer insights.

5.2.3. Results pertaining to Hypothesis 2.B - Technology Uncertainty on LSO-Performance

A path coefficient of > 0.95 would be an acceptable strong, positive association between two variables (Miles & Shevlin, 1998) The path coefficient of B = 0.359, implies a positive, weak association between the Moderating Variable and the relationship between the Independent and Dependent Variables. With the p-value (.426) > .05. the result is nonsignificant.

There is a positive relationship between the Technology Uncertainty and the LSO-Startup's Performance relationship but there is insufficient proof to conclude a meaningful and legitimate conclusion. Schwery (2018) came to similar conclusion.

In Harms and Schwery (2020) Study they found that the relationship between LSC and Startup is not affected by the Market and Technology Uncertainty or even the Degree of Innovativeness.

5.2.4. Results pertaining to Hypothesis 2.C - Market Uncertainty on LSO-Performance

The Market Uncertainty construct did not have the minimum of 3 factors required. This was not tested as there was no valid market uncertainty construct.

As stated previously, the Harms and Schwery (2020) Study found that the relationship between LSC and Startup is not affected by the Market and Technology Uncertainty.

In terms of dealing with uncertainty LSM allows entrepreneurs to stay flexible through enabling detection of early signals from the market and a fluid product development process (Harms & Schwery, 2020).

5.2.5. Results pertaining to Hypothesis 2.D - Business Industry on LSO-Performance

A path coefficient of > - 0.95 would be an acceptable strong, negative association between two variables (Miles & Shevlin, 1998). The path coefficient of B = - 0.054, implies a negative, weak association between the Moderating Variable and the relationship between the Independent and Dependent Variables with the p-value (.611) > .05. means the result is nonsignificant.

There is a negative relationship between the Business Industry and the LSO-Startup's Performance relationship but there is insufficient proof to conclude a meaningful and legitimate conclusion.

If the data from this study was significant then the hypothesis would have been supported thus proving in a developing country that the type of business industry affected the relationship between LSO-Startup's Performance. This study would align with the study done by Frederiksen and Brem (2017) where they stated their doubts about the applicability of the LSM to a wider market past software development.

5.2.6. Results pertaining to Hypothesis 2.E - Entrepreneur Experience on LSO-Performance

Results pertaining to Hypothesis 2E: Higher Levels of Entrepreneur Experience strengthen the LSO-Performance relationship.

This was not tested as there was no valid Entrepreneur Experience construct. If a valid construct was obtained and the path coefficient was > 0.95, it would mean a strong, positive association between the Moderating Variable and the relationship between the

Independent and Dependent Variables. With the p-value < .05. the result would be significant.

This would align with what Nilsen and Ramm (2015) found, a significant correlation between Startup Success and Entrepreneur Experience in Norwegian Startups. There was however no correlation between theoretical knowledge and Startup Success.

In the Western Cape in South Africa Lose and Tengeh (2015) also found that the Entrepreneur's Experience plays a crucial role in the success or failure of a Startup.

5.2.7. Results pertaining to Hypothesis 2.F - Source of Funding on LSO-Performance

A path coefficient of > 0.95 would be an acceptable strong, positive association between two variables (Miles & Shevlin, 1998) The path coefficient of B = 0.154, implies a positive, weak association between the Moderating Variable and the relationship between the Independent and Dependent Variables. With the p-value (.636) > .05. the result is nonsignificant.

There is a positive relationship between the Source of Funding and the Lean Startup Orientation-Startup's Performance relationship but there is insufficient proof to conclude a meaningful and legitimate conclusion.

According to Andenes and Pendegraft (2016) Early-Stage Startups obtain most of their funding from Angel Investors & Venture Capital.

5.2.8. Conclusion

From a statistical point of view this study has been unsuccessful. The representativeness of the data and the non-significance of most of the results does not provide any grounding to provide any opinion or conclusion.

The framework used in this study was a further development of Schwery's (2018) Study. The non-financial performance metrics were an improvement. The cross-sectional nature of this study is an impediment. It is advised that a possible future revision of this study should rather be a longitudinal study focussing on a cohort in a business incubator. A random sample can be exposed to the LSM and then upon graduation of the cohort a comparison can be drawn between the 2 groups.

6. CONCLUSION

6.1. Introduction

In this chapter the culmination of this study will be presented. It will start with the conclusion followed by the implications, recommendations, limitations and finally conclude with suggestions for further research.

6.2. Conclusion of the study

Looking back at this study it can be concluded that it was a bit ambitious to attempt 6 Moderating Variables. Even though this was the follow on to the study by Schwery (2018) the scope of this study was too broad for the allocated time.

From the data obtained, no relevant observations could be made, with any statistical relevance, that the application of the LSM correlated with performance improvements of the Startups.

What can be concluded from this study is the following:

- There is sufficient evidence that the LSM is not lacking in theoretical grounding (Mansoori, Karlson & Lundqvist, 2019; Shepherd & Gruber, 2021). The LSM is preceded by theories like Effectuation and Bricolage, according to Fisher (2012) the LSM is the materialisation of the Entrepreneur pursuing an effectuation driven paradigm towards an opportunity construct. The LSM shares many traits with theories like Design Thinking and Real Option Theory.
- The LSM has operationalised the following useful instruments and concepts: Business Model Canvas (Including Value Proposition), Minimum Viable Product (MVP), Customer Development & Validation and Pivoting (Felin et al., 2019).
- The LSM excels at addressing innovation in a corporate entrepreneurship perspective. LSM has been identified as a great theory for High Technology Startups in either university research environment or corporate diversification strategy. Frederiksen and Brem (2017) stated their doubts about the applicability of the LSM to a wider market past software development. From the evidence stated in this report it seems evident that the LSM is a practical method that can be used

by large organisations to commercialise their Innovations especially their radical innovations that do not fit into the existing framework and market.

According to Bocken and Snihur (2020) business model experimentation can assist large existing organisations in becoming unstuck from their existing entrenched ways (organisational inertia), perpetuate and reinforce renewal and encourage continuous innovation. Even failed experiments could lead to a deeper understanding and possible spill over to other areas in the organisation or even ecosystem.

A good conclusion for the LSM can be summarised as follows: LSM doesn't guarantee success, just less failures (Blank, 2013).

According to Nobel (2011) the "Launching Technology Ventures" (LTV) course presented by Prof. TR Eisenmann as part of the Harvard Business School MBA incorporated LSM back in 2011 already. This substantiates the evidence that the LSM is a very practical and applicable theory in high technology & innovation space and that it is becoming more and more intrenched in the academic lexicon and teachings.

6.3. Implications and Recommendations

Felin et al., (2019) found the LSM lacking in terms of the upfront definition of the problem and scientifically generating a hypothesis (not just a guess) on how to solve this problem. To overcome this deficiency, other theories can be introduced in the upfront phase to reinforce the LSM where it is lacking, theories like "Market Opportunity Navigator (Gruber & Tal, 2017) and Human-Centred Design Thinking (Koen, 2015).

IDEO's Human-Centred Design Thinking is the process used to establish the user's problem. This process has 2 main areas or questions: What is the right problem? Who has the problem? & What is the value to the customer in solving the problem (Koen, 2015)?

Many academics, including Felin et al., (2019), criticised LSM for a lack of structure of the methodology. This is where the Business Model Canvas (BMC) (Osterwalder & Pigneur, 2005) nicely dovetails with the LSM to achieve 2 critical outcomes: (1) It conceives the

Startup as a business model instead of just a product or solution. (2) It provides a visual representation of the elements and relationships within the Startup and enables the entrepreneurs to track their progress. The BMC + Value Proposition even aligns with Human-Centred Design methodology (Koen, 2015).

The next critique on the LSM is getting feedback too soon from customers, especially where radical innovations are applicable, could lead to false positives (Felin et al., 2019). In essence customers and role players in the existing market are bad at predicting new markets/products. This general social phenomenon can be nicely dissected in corporate environments with larger companies that are less likely to be perceptive to new radical innovative ideas or technologies. Here Human-Centred Design Thinking has the ability to overcome barriers like corporate culture, internal competition and system related barriers (Liu & Mannhardt, 2019).

By combining the LSM and Human-Centred Design Thinking, LSM will help large corporates with the following major problems experienced in commercialising new innovation (Koen, 2015):

1. Not understanding the problem
2. Mistaking solution features with the solution itself
3. Focusing on the wrong customer
4. Mistaking the prototype for the final product and not the minimum viable product to present critical features
5. Incorrect assumptions about channels, cost structures and absorption rate. This ties in with what Bertels et al,. (2015) found that the 3 elements of a Startup's business model that are most vulnerable to false assumptions are product adoption rate, cost structures & channels.

For the LSM to succeed in developing countries strategies need to be established to overcome the following challenges (Nirwan & Dhewanto, 2015): (1)

- Accessibility to customers,
- Lack of information/vocabulary,
- Methods to speed up iterations due to bureaucracy
- Educate customers on difference between MVP and the final product.

In developing markets one of the biggest challenges for Startups is whether the market is big enough to make it feasible to pursue the business (Nirwan & Dhewanto, 2015).

One alternative to the LSM could be to pursue Frugal Innovation which seems like it could be a better fit than the LSM in Developing Countries due to its 2 core underpinnings of (1) innovating with restricted means and (2) developing a simplistic robust product for developing markets (Ghorbel, 2021). Frugal Innovation and Effectuation (antecedent to LSM) share a common thread in that they both focus on what you have on hand.

In developing countries, key stakeholders often do not have the technical background and/or vocabulary to effectively articulate their needs (Nirwan & Dhewanto, 2015; Van Bossuyt, Pease & Dean, 2014;) and thus entrepreneurs need to use tools like Design Thinking to look further past they customers articulated problem. By combining quantitative and qualitative design methods to provide quick and economical insights from the customer and supply chain which then feeds into product development, validated learning and decision-making iterative loop could be a plausible solution.

Lastly in developing countries like South Africa Incubators are struggling to survive. Most of the incubators are government funded and as such are run by administrators. Based on the accelerator program run by the university in Sweden (Mansoori et al., 2019) the LSM can provide a structure, learning environment and evolutionary coaching style to help both administrators and entrepreneurs succeed.

6.4. Limitations

After the target sample of 320 Startups in incubators was established, it was decided to see how many Incubators were actively operating in South Africa. From the initial research a list of 80 incubators in South Africa was compiled. Based on the assumption that only 50 % of the incubators would reply, this study would thus require 8 Startups from each incubator.

Unfortunately, the reality of Incubators in South Africa is that many of them are struggling to survive and many of the Incubators on the list have been discontinued e.g., Standard Bank Incubator Programme.

Due to the Covid lockdown most of the incubator managers and administrators were further working remotely making it exceedingly difficult to make contact as emails were never read or replied to and repeated phone calls were almost never returned.

Two incubators agreed to participate in this study: “Founders Factory Africa” and “Propella” Business Incubator. They distributed the introductory letter (Appendix A) to their cohorts and the replies were dismal to say the least. To overcome this lack in response requests were made to follow up directly with the particular cohorts but access was denied to the cohort information stating the POPIA.

This is where this research study discovered first-hand, Fritsch’s (1997) comments that Startups are notoriously difficult to study and thus all the more reason to pursue these types of studies. The lived experiences mentioned above made it extremely difficult to obtain respondents from the target population. Many other MMENC cohort researchers complained about the similar problems and through consultative process with the faculty instructions were given on 13 December 2022 that a minimum of 40 respondents would be acceptable to complete the research.

To improve the response rate the Sample was opened up to any Startup from South Africa in the TEA phase (0 – 3.5 years). The results and the discussions in this report are based on the 40 respondents’ questionnaires received.

Startup Success is a complex metric and can be influenced by many factors. In this study an attempt was made to establish a correlation between the presence of LSM and the success of the Startup. It could be that there are other factors that not only correlate significantly more than the evidence produced here but are in fact causal in nature too.

Due to the lack of respondents, this study was opened up to any entrepreneur even if they weren’t in a business incubator. The snowball sampling method was used and there was

no auditing mechanism to determine if the respondents were actually representing real Startups.

The low number of respondents, in other words sample size, brings the representativeness of the sample into question.

Due to the cross-sectional nature of this study, it could be that the results obtained are skewed as the progress of a Startup at the beginning of the TEA phase and one towards the end of the 3.5 years TEA phase are not comparable.

This study did not succeed in its goal of proving a correlation between the application of the LSO and the performance of the Startups in a developing country. Instead, what was achieved was to show that there is enough academic support and justification for the LSM to warrant further study and development.

The framework developed by Schwery (2018) was improved upon by the addition of the non-financial metrics. Further improvement to this framework is possible through future studies especially in developing countries.

6.5. Suggestions for further research

If there is sufficient interest in the LSM then it would be advisable for the Wits Business School to partner up with several Incubators and for a reasonable time frame so that several cohorts can be studied over multiple years. This partnership will break down the barriers of information sharing and would provide a mechanism to break the encompassing construct of 6 dependent variables into more manageable +/- 3 variables for a master's thesis. If several students apply limited study over several cohorts the study could develop, gain momentum and be refined.

The 2 constructs, Market Uncertainty and Entrepreneur Experience, that failed need to be re-evaluated.

Despite the reluctance of the WBS to use financial incentives according to Schwery (2018) using a competition with prize money really incentivised Startups who are always cash strapped to participate in the study.

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APPENDIX A: COVER LETTER

Hi Leana

Is it possible for you to assist me with my request below with your Launchlab Business Incubator?

I am hoping your Startups in your Incubator can help me with my study below.....



Calling all Entrepreneurs in Startups – Give something back

I want to see if the **Lean Startup Methodology** from Silicon Valley can help Startups in South Africa perform better.

Please take the anonymous **Online Questionnaire** (10 – 15 min) by **clicking on the image above** and give something back to the industry.

Regards

Fritz van Eeden
Masters in Management (Entrepreneurship & New Venture Creation)

APPENDIX B: QUESTIONNAIRE

MMENVC - LSO-Performance

Start of Block: Introduction

Q1
Dear Reader

My name is Fredrick (Fritz) van Eeden, Masters Student at Wits Business School, Student Number 2252850.

I am currently busy with my Thesis which is on the topic of:

"The effect of the Lean Startup Orientation on the Startup's Performance in South Africa?"

For this study I request that you complete the online Questionnaire which should take no more than 15 minutes.

We endeavor to protect your anonymity as far as possible and guarantee that your neither your personal information or company information will be published in any way. Your input will form part of the data required for this study.

Thank you for taking the time to complete the questionnaire and for your valued input.

Regards

Fritz van Eeden

- ○ I consent, begin the study (1)
- ○ I do not consent, I wish not to participate in the study (2)

End of Block: Introduction

Start of Block: Control Variables

Q2 Lead Entrepreneur - Age (Years)

0 10 20 30 40 50 60 70 80 90 100

Click to write Choice 1 ()



Q3 Lead Entrepreneur - Gender

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- Prefer not to say (4)

Q4 Lead Entrepreneur - Highest Level of Education

- No Formal Education (including Primary School) (1)
- High School Graduate (2)
- Trade Qualification (3)
- Diploma (4)
- Degree (5)
- Past Graduate Qualification (Masters, Doctorate) (6)
- Other (7)

Q5 Lead Entrepreneur - Number of years of Entrepreneurial Experience?

0 5 10 15 20 25 30 35 40 45 50

Click to write Choice 1 ()



Q6 Business Founding Year

Click to write Label 1 Click to write Label 2 Click to write Label 3

2000 2002 2004 2006 2008 2011 2013 2015 2017 2019 2021

Click to write Choice 1 ()	

Q7
Size of the Business:

(How many persons work for your venture full-time equivalent (including you)?

1 6 11 16 21 26 30 35 40 45 50

Click to write Choice 1 ()	

Q8 Which Province is your Business Located in?

- Free State (1)
- Gauteng (2)
- KwaZula-Natal (3)
- Limpopo (4)
- Mpumalanga (5)
- North West (6)
- Eastern Cape (7)
- Northern Cape (8)
- Western Cape (9)

End of Block: Control Variables

Start of Block: Industry

Q9 What Industry is your Business is in?

- Administrative Services (1)
- Agriculture (2)
- Finance (3)
- Health, Education, Government and Social Services (4)
- Information /Communications Technology (5)
- Manufacturing (6)
- Mining (7)
- Personal / Consumer Services (8)
- Professional Services (9)
- Transportation (10)
- Wholesale / Retail (11)

End of Block: Industry

Start of Block: Startup Performance

Q10 How long has the Business been running for (Years)

(Survival Period)

	More than 5 Years 0 1 2 3 4 5
Click to write Choice 1 ()	

Q11
Where is your Business on the Scale below in terms of Product

Development?

(Product Development Cycle)

- ○ No Work (1)
- ○ In Idea Phase (2)
- ○ Model/Procedure being Developed (3)
- ○ Been Tested (4)
- ○ Product/Service Ready for Sales/Delivery (5)

Q12
Is your Business registered with SARS?
Venture Organizing Activity (VOA)

- ○ No (1)
- ○ Yes (2)

Q13
Is your Business registered with CIPC?
Venture Organizing Activity (VOA)

- ○ No (1)
- ○ Yes (2)

Q14
Is your Business in contact with Potential Customers?
Venture Organizing Activity (VOA)

- ○ No (1)
- ○ Yes (2)

Q15
Has Raw Materials, Inventory, supplies, components been purchased?
Venture Organizing Activity (VOA)

- ○ Yes (1)
- ○ No (2)

Q16
Has Large Equipment, Facilities, Property been purchased/leased/rented?
Venture Organizing Activity (VOA)

- No (1)
- Yes (2)

Q17
Has Patent/Copyrights been obtained?
Venture Organizing Activity (VOA)

- No (1)
- Yes (2)

Q18
Licenses /Permits been obtained to operate?
Venture Organizing Activity (VOA)

- No (1)
- Yes (2)

Q19
Has Startup sought to obtain Financing?
Venture Organizing Activity (VOA)

- No (1)
- Yes (2)

Q20
Has Venture Marketing/Promotions Organizing been Activity initiated? (VOA)

- Yes (1)
- No (2)

End of Block: Startup Performance

Start of Block: Source of Funding

Q21 Has Funding been obtained?

- Yes (1)
- No (2)

Q22
Where and what percentage of Funding has been obtained?
Total must add up to 100 %
(Source Of Funding)

Personal Investment (Personal Savings)	_____ (1)
Love Money (Friends, Families & …..)	_____ (2)
Bank Loans	_____ (3)
Venture Capital	_____ (4)
Angel Investors	_____ (5)
Business Incubator	_____ (6)
Government Grants & Subsidies	_____ (7)
Micro Financing	_____ (8)
Enterprise Development	_____ (9)
Crowd Funding	_____ (10)
Other	_____ (11)
Total	_____

Q23 How Much Funding has been raised in total? ZAR (R)

> R 20 000 000

0 4000000 8000000 12000000 16000000 20000000

ZAR (R) ()	

End of Block: Source of Funding

Start of Block: LSO-Uncertainty

Q24.A
Our product/service was a minor improvement over the previous technology. (RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q24.B Our product/service was a breakthrough innovation.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q24.C Our newly developed product/service was difficult to replace with a substitute using older technology.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q24.D Our product/service represented a major technological advance.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q25.A In our kind of business, customers' product/service preferences change quite a bit over time.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q25.B Our customers tend to look for new products/services all the time.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Page Break

Q25.C New customers tend to different have product/service-related needs that our existing customers.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q25.D
It is very easy to predict any changes in our marketplace. (RC).

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q26.A
What was the level of ‘newness’ or uncertainty of the technology involved in this new product / service development?

- Well established, known Technology (1)
- . (2)
- . (3)
- . (4)
- Very New Technology (5)

Q26.B
What was the level of complexity of the technology involved in this new product / service development?

- ○ Relatively Simple Technology (1)
- ○ . (2)
- ○ . (3)
- ○ . (4)
- ○ Very Complex Technology (5)

Q26.C
How would you describe the technology shifts for the technologies used in this new product / service development project?

- ○ Very Stable / Predictable (1)
- ○ . (2)
- ○ . (3)
- ○ . (4)
- ○ Very rapid change and Uncertain (5)

Q26.D
Technological changes in our industry are frequent.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q27.A
We formulated a series of hypotheses about what the market needs and how best to deliver it.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q27.B
We translated the vision about our product / service and its value proposition into falsifiable hypotheses.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q27.C
Among all the hypotheses in our business model, we tested and validated the riskiest assumptions first.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q27.D
We frequently design experiments to test hypotheses on our business model.

(RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q28.A
It is important to gain deep market insight (= talking directly to customers) to better understand our customer's problem.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q28.B
When we developed the solution we never had the customer in mind. (RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q28.C
We invested significant effort in understanding of the problem and learning about the user and its social

context.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q28.D
It is important to gain a deep insight (= talking directly to customers) into how our solution solves the customer problem.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q29.A
We tested assumptions about our new product/service from the beginning with potential customers.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q29.B
We took an experimental approach that relied on frequent trial and error to find the right product solution.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q29.C
We didn't test our product/service with potential customers before commercializing to the market. (RC)

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q29.D
We frequently design and run experiments on elements of our business model.

- ○ Strongly disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q30.A
We used prototyping to test key assumptions about technical viability.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q30.B
Our customers rarely interacted with prototypes during the development process. (RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q30.C
We used prototypes to validate specific product/service features and business model specifications.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q30.D
In developing the product/service we aim to use the simplest way to build and test our requested product

features.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q31.A
We used metrics to measure the impact of product/service improvements on customer behavior.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q31.B
We didn't use data driven tests to improve our human judgement and overall decision making. (RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q31.C
We validated as many assumptions as possible about the viability of the product/service before expending

enormous effort and financial resources.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q31.D
We have metrics available to test the product/service acceptance by customers and the sales performance.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q32.A
We used information about our gained real customers' needs in the development of the new product/service.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q32.B
We actively transferred information gathered from real customers to the development team.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q32.C
The transfer of information about customers' needs and preferences took place rarely. (RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q32.D
We have specific mechanisms for sharing lessons learned in our venture.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q33.A
The organisation's ability to learn is not considered as key to our competitive advantage.

(RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q33.B
The basic values of our organisation include learning as key to improvement.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q33.C
Venture learning is an investment, not an expense.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q33.D
Learning in our organisation is key commodity necessary to guarantee organisational survival.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q34.A
We viewed new product/service development as cycles of experiments, learning and additional experiments.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q34.B
We didn't try many different product/service solutions before we found the right one. (RC)

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q34.C
We engaged in many trial and error processes in product/service development before we had a complete

understanding of the market and technology.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q34.D
We repeated the process of testing until all the key business model hypotheses have been validated

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

End of Block: LSO-Uncertainty

APPENDIX C: CONSISTANCY MATRIX

Title: The effect of the Lean Startup Orientation on the Startup's Performance in South Africa.							
Problem : In an uncertain Entrepreneurial Environment such as in South Africa the majority of Startups dismally fail or fail to perform sufficiently to remain self sustaining.							
Main Objective Here : To investigate the effect the Lean Startup Orientation (LSO) has on the Non Financial Performance of Startups in South Africa.							
Sub-Objectives	**Literature Review**	**Research questions**	**Hypotheses /Propositions**	**Variables(Independent & Dependent)**	**Source of data**	**Type of data**	**Analysis**
To investigate the effect the Lean Startup Orientation has on Startup's Performance	Schwery, M. (2018) & Ghezzi, A. (2015)	To what extent does the Lean Startup Orientation affect the Startup's Performance	The degree of Lean Startup Orientation positively relates to the Performance of Startups (Hypothesis 1)	IV1 = Lean Startup Orientation DP1 = Performance	Questionnaire Q8.a - Q15.d Q19.a - Q19.e	Ordinal Data (5 Likert Scale), Interval Data (Multiple Rating List Scale) & Nominal Data (Simple Category Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
To investigate the extent to which Radicalness of Innovation moderates the LSO-Performance relationship in Startups.	Schwery, M. (2018)	To what extent does Radicalness of Innovation moderate the LSO-Performance relationship in Startups.	Lower Levels of Radicalness of Innovation strengthen the LSO-Performance relationship in Startups. (Hypothesis 2.A)	IV1 = Lean Startup Orientation MV1 = Radicalness of Innovation	Questionnaire Q20.a - Q20.d	Ordinal Data (5 Likert Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
To investigate the extent to which Technology Uncertainty moderates the LSO-Performance relationship in Startups.	Schwery, M. (2018)	To what extent does Technology Uncertainty moderate the LSO-Performance relationship in Startups.	Technology Uncertainty moderates the LSO-Performance relationship in Startups. (Hypothesis 2.B)	IV1 = Lean Startup Orientation MV3 = Technology Uncertainty	Questionnaire Q21.a - Q21.d	Interval Data (Staple Scale) & Ordinal Data (5 Likert Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
To investigate the extent to which Market Uncertainty moderates the LSO-Performance relationship in Startups.	Schwery, M. (2018)	To what extent does Market Uncertainty moderate the LSO-Performance relationship in Startups.	Market Uncertainty moderates the LSO-Performance relationship in Startups. (Hypothesis 2.C)	IV1 = Lean Startup Orientation MV2 = Market Uncertainty	Questionnaire Q22.a - Q22.d	Ordinal Data (5 Likert Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
To investigate the extent to which Business Industry moderates the LSO-Performance relationship in Startups.	Takata (2016)	To what extent does Business Industry moderate the LSO-Performance relationship in Startups.	Business Industry moderates the LSO-Performance relationship in Startups. (Hypothesis 2.D)	IV1 = Lean Startup Orientation MV4 = Business Industry	Questionnaire Q16.a - Q16.f	Ordinal Data (5 Likert Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
To investigate the extent to which Entrepreneur Experience moderates the LSO-Performance relationship in Startups.	Stuart, R and Abetti, P. (1990)	To what extent does Entrepreneur Experience moderate the LSO-Performance relationship in Startups.	Higher Levels of Entrepreneur Experience strengthen the LSO-Performance relationship in Startups. (Hypothesis 2.E)	IV1 = Lean Startup Orientation MV5 = Business Industry	Questionnaire Q17.a - Q17.d	Ordinal Data (Multiple Rating List Scale) , Ratio Data (Numerical Scale) & Nominal Data (Simple Category Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
To investigate the extent to which Source of Funding moderates the LSO-Performance relationship in Startups.	Fischer & Rassenfosse (2011)	To what extent does Source of Funding moderate the LSO-Performance relationship in Startups.	Source of Funding moderates the LSO-Performance relationship in Startups. (Hypothesis 2.F)	IV1 = Lean Startup Orientation MV6 = Source of Funding	Questionnaire Q18.a - Q18.f	Interval Data (Multiple Rating List Scale) & Ratio Data (Constant Sum Scale)	1. Descriptives 2.Correlation 3. Structural Equation Modeling
KEYWORDS - Lean Startup Methodology Economic Growth							