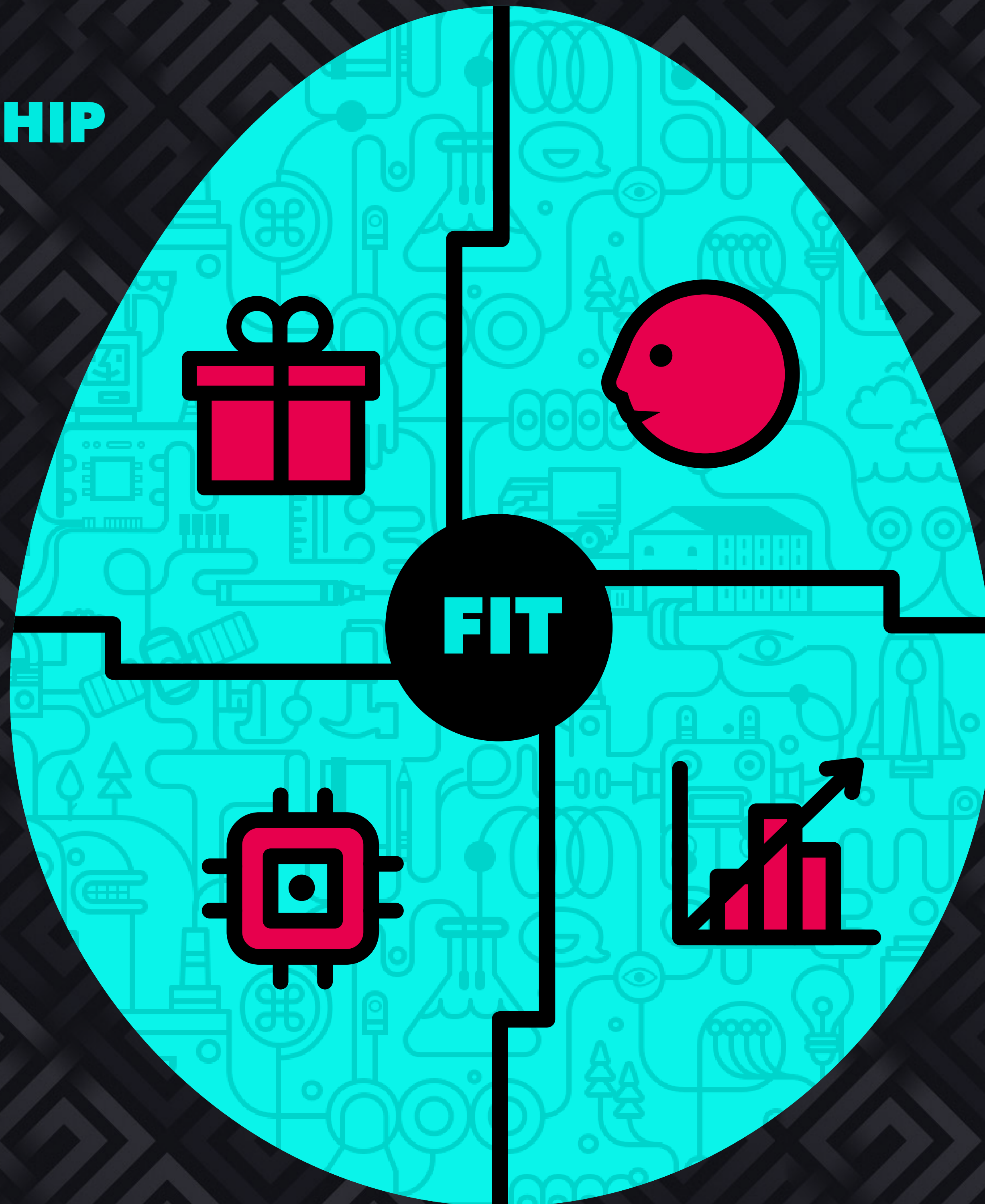


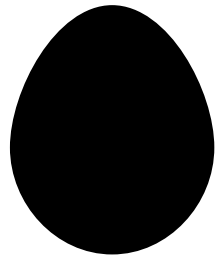
**SHELL FOR
SCIENTIFIC
ENTREPRENEURSHIP**
PLAYBOOK



*AN APPLICATION
OF SCIENTIFIC
ENTREPRENEURSHIP TO
EARLY STAGE STARTUPS*

**SHELL FOR
SCIENTIFIC
ENTREPRENEURSHIP**
PLAYBOOK





Brazil and other developing countries are experiencing an entrepreneurial boom that is changing industries such as finance, education, health, and logistics, among others. The growth of the entrepreneurial ecosystem rests on two pillars: the expansion of new venture finance and the creation of large numbers of promising startups. One depends on the other: startups need capital to scale, and investors seek promising opportunities offered by a deep pool of qualified startups.

Entrepreneurship education plays an important role in expanding the pool of promising startups by training entrepreneurs on how to evaluate business opportunities, how to design scalable business models, and how to accelerate the process of customer discovery and business model validation. Entrepreneurial education programs can also inspire new generations of entrepreneurs in schools, universities, incubators, and local communities.

Entrepreneurial education has undergone a revolution over the past ten years. In the past, entrepreneurship was taught using methods that were more appropriate for large or mature companies: business plans, case studies, financial analysis, and so on. However, the main objective of an early stage venture is quite different: to identify a scalable business model that addresses a fundamental customer need. This requires very different methods: experimentation, hypothesis testing, and customer discovery. The Lean Startup approach provides structured processes and frameworks for this kind of experimentation.

Expanding on the Lean Startup methodology and best practices, the Scientific Entrepreneurship Playbook provides a comprehensive framework for training new entrepreneurs, centered on the most fundamental aspect of science: hypothesis testing and experimentation. To develop the Scientific Entrepreneurship Playbook, the team draws from their extensive experience in entrepreneurial education, startup creation, and engineering. The program is also anchored at the University of São Paulo Polytechnic School (Poli-USP), one of the centers of excellence in Latin America for engineering and entrepreneurship, and located within the most important entrepreneurial hub in the region.

I'm honored by the invitation to introduce the program, which builds on many of the pedagogical principles developed here at the University of California, Berkeley. The Scientific Entrepreneurship Playbook will train and inspire a new generation of entrepreneurs, contributing to the continued growth of entrepreneurial ecosystems in Brazil and elsewhere.

Flavio Feferman

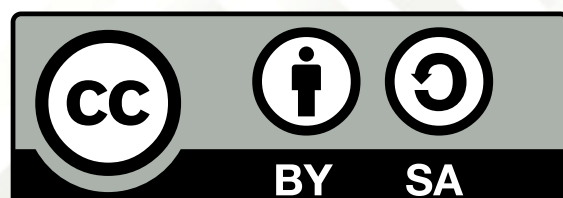
Lecturer and Distinguished Teaching Fellow

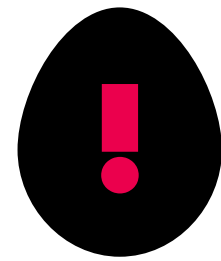
University of California, Berkeley

Haas School of Business

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1 .MANIFESTO

Scientific entrepreneurship¹ is what directs, motivates and moves us. Taking this idea to the university is our strategy of choice.

WHY?

Entrepreneurship because our ultimate dream is to see more and more technologies transformed into companies. Companies with real customers willing to pay for the products and services offered. We do not discuss theories of innovation or design. At most, we borrow some results from those disciplines. Not because we consider them less important, but because our approach is different.

We approach entrepreneurship as a science because we have constructed a methodological foundation to support our project. We did not find this foundation in the classical scientific methods of deduction and induction. The deductive method moves from a general statement or hypothesis to particular cases. The inductive method derives general conclusions from the study of specific cases. Did you see the word “new” in either of the last two sentences? No! Entrepreneurship and innovation have to do with iterative processes whose conclusions emerge from cycles of testing and learning. In this context it is worth

1. Scientific entrepreneurship means continuous learning based on hypothesis testing.

mentioning the abductive method developed by C.S. Peirce, a framework that anchors the construction of our methodology. Like Peirce, we believe there are no primordial certainties but only hypotheses to be tested experimentally. Also like Peirce, we believe the chain of hypotheses evolves as the experiments proceed and hence is not born fixed, immutable or predetermined. The hypothesis and the chain of experiments change as the experiments go on. New ideas flow as a possible and welcome result of the process. Change is a natural thing.

Spanish poet Antonio Machado* puts a similar view:

Wanderer, your footsteps are
the road, and nothing more;

**wanderer, there is no road,
the road is made by walking.**

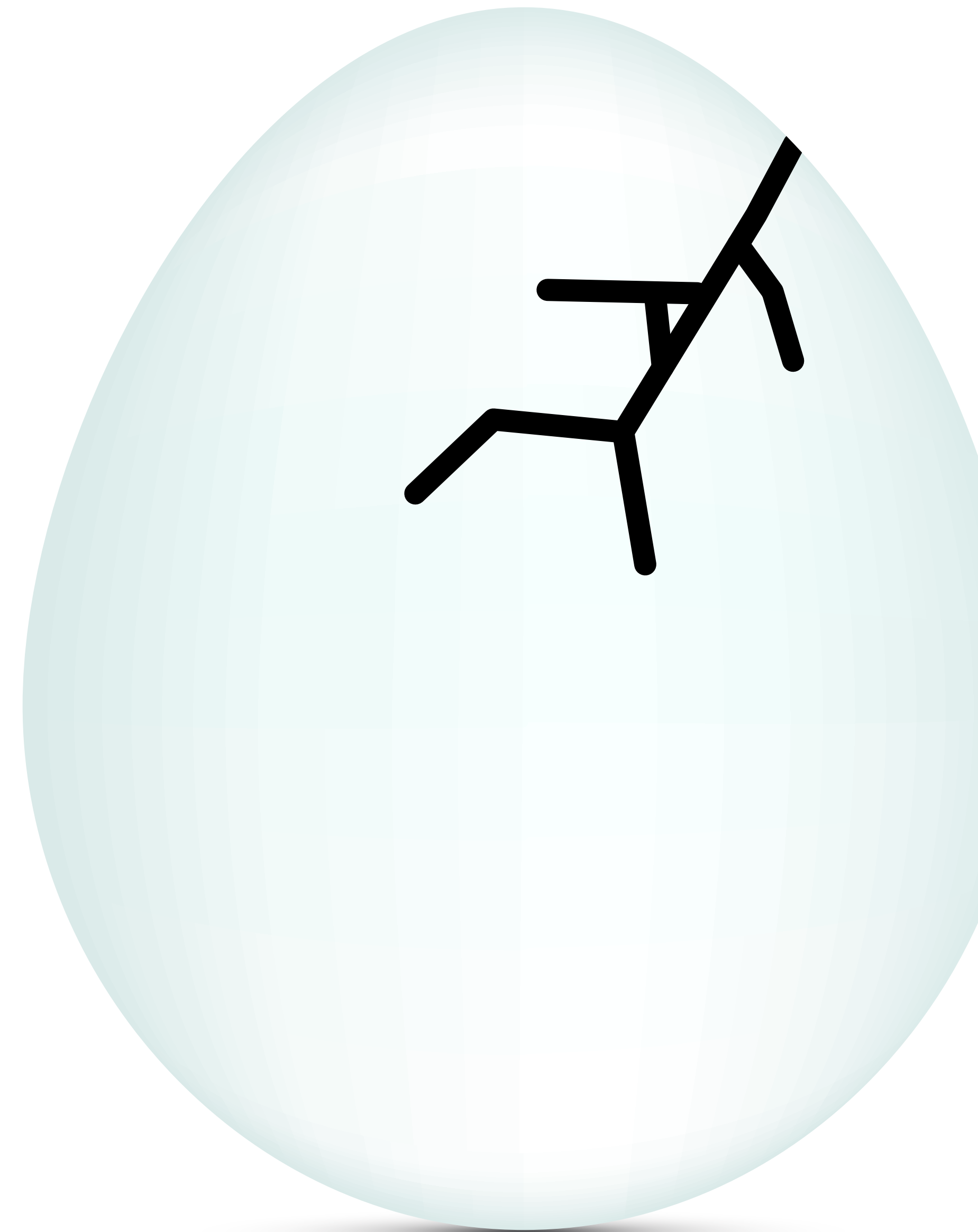
Walking makes the road,
and turning to look behind
you see the path that you
will never tread again.
Wanderer, there is no road,
only foam trails on the sea.

Antonio Machado (1875-1939), from “Provérbios y cantares” in Campos de Castilla.

1 .MANIFESTO

We have chosen the university base as our strategy. Not only because it is close to us but also as a way of giving back: we are what we are thanks to the huge amount we learned during our time at university, specifically the University of São Paulo. We understand that in the twenty-first century it is the duty of universities to train people holistically, imparting scientific and technical knowledge, a broad comprehension of society, and development to find a place in that society. This latter aspect is our focus: preparing entrepreneurs and helping them find their place in society. This approach is very different from the kind of teaching required in content-centered education. Instead of teachers/facilitators, we need coaches. And much of this book is devoted to them.

***WE HOPE OUR PASSION
INSPIRES YOU!***





2 .WHAT IS THE PLAYBOOK? WHO IS IT FOR?

Entrepreneurship is a way of life for the authors. Marcos began his first business venture in 1988, Artur in 2011, and Diogo in 2010. Experience is invaluable!

Together or separately, over the last 20 years the authors have followed the evolution of methodologies, techniques and tools that support the establishment of new business ventures. The evolution that occurred in this period has been particularly important for technology initiatives, and even more so for those involving physical products. This playbook is the outcome of the authors' thinking and practice in the past five years, as leaders of undergraduate and graduate courses at the University of São Paulo (USP), as participants in the program Academic Working Capital (AWC)², at USP's Center for Entrepreneurship (NEU), and in the venture builder CAOS Focado.

We dare to call this organized process a methodology. This playbook, then, was born from the opportunity to “codify and operationalize practices practices and support the training of new coaches who follow the Scientific Entrepreneurship approach. Everything that exists needs a name, so we chose Shell for Scientific Entrepreneurship. Or S4S for short! Our inspiration came first from Professor Steve Blank and his Lean

2. A pre-acceleration program maintained by TIM Institute to build tech startups on the basis of final year projects. For more information, visit: awc.institutotim.org.br.

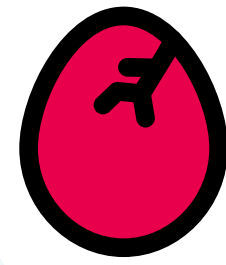
NB. ALL THE TOOLS DESCRIBED IN THIS BOOK HAVE BEEN TESTED IN PRACTICE

LaunchPad method, as applied by him at the US National Science Foundation's Innovation Corps (NSF I-Corps). No less important were contributions from the work of Paul Graham and Sam Altman at the accelerator Y Combinator, and Professor Bill Aulet at MIT.

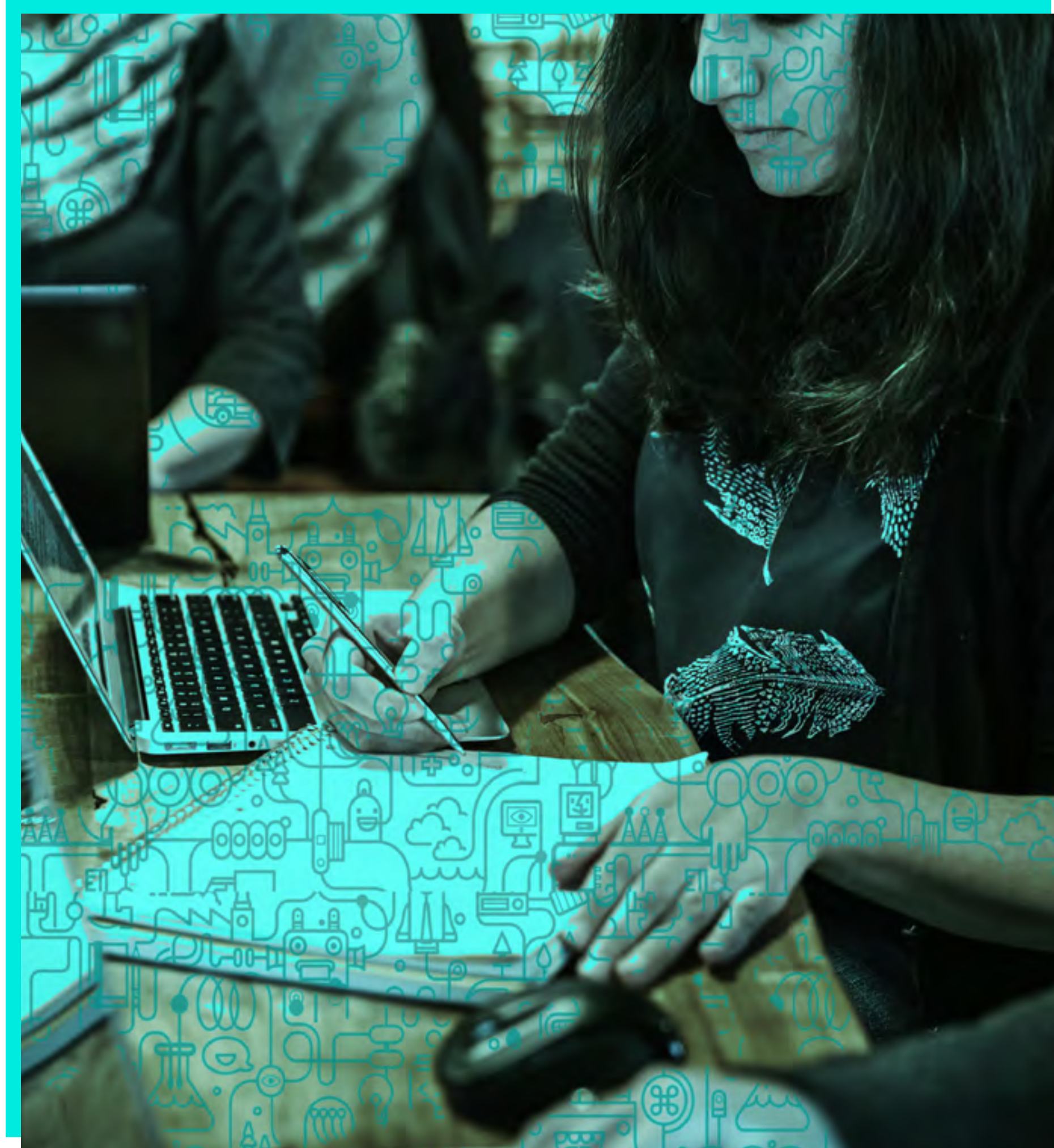
Because we know that the development of a new business venture is a counterintuitive process in which real learning happens in the practice of real entrepreneurship, we believe in the need for a coach who can act as a guide throughout the learning process. Entrepreneurs do not have to be experts in entrepreneurship in order to move their initiatives forward. In addition to a methodology, it is also necessary to have a pedagogic framework that supports the coaches and accelerates the entrepreneurs as they travel the learning curve.

AND WHY RESTRICT ACCESS TO KNOWLEDGE? HERE'S THE ANSWER: A PUBLIC PLAYBOOK!

This playbook is for coaches, mentors and educators to find out about our thinking on this topic. It is also for investors, especially in the initial stages, so that they can extend their involvement beyond injecting financial capital.



3 .WHERE DOES THIS FIT?



Technology-based entrepreneurship focuses on the exponential curve of a startup, which typically goes through the following phases: (i) zero stage/ideation, in which a relevant problem is discovered with an interesting solution to the need identified; (ii) validation/establishment, when the first solutions start making sense, and the first efforts are made to sell the product and adapt its initial versions to actual demand; (iii) growth, in which the product is better elaborated and the startup begins to lubricate its marketing process and build a larger team; (iv) maturity, when processes and technologies are scaled up, policies to attract and retain talent are implemented, and strategies are put in place for scenarios of more intense competition.

Scientific entrepreneurship as originally created by Steve Blank, who called it evidence-based entrepreneurship, focused on early-stage startups, embryonic ventures corresponding to phases (i) and (ii) above. At this stage the focus is on understanding the market's "pain" and formulating a suitable solution. "Make something people want" is Y Combinator's motto. Understanding the user's needs in depth, and developing the best solution for those needs – the famous goal of "problem-solution fit".

To achieve problem-solution fit, it is usually necessary to execute an iterative process that presupposes both an understanding of the user's needs (Customer Discovery)³ and the development of quick prototypes for value validation (Agile Development)⁴. A startup that has paying

3 .ONDE ISSO SE ENCAIXA?

users is considered to have achieved a “fit”, and hence to have completed its crossing of startup “death valley” (also known as the chasm)⁵. When the number of paying users is large enough, product-market fit has been achieved.

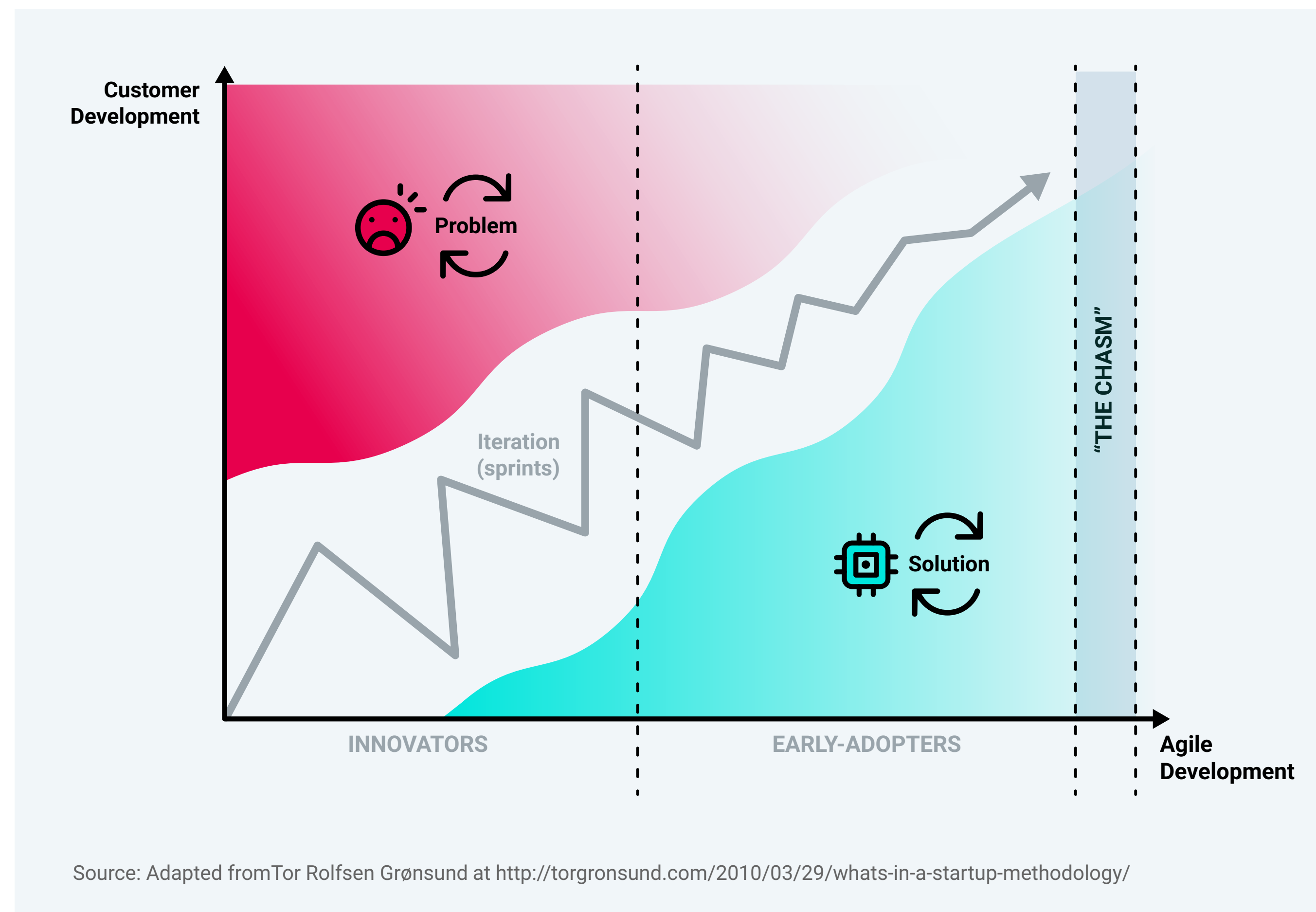
The Shell for Scientific Entrepreneurship is designed for early-stage entrepreneurs in this sense. Its main thrust is special attention to discovery processes based on exploration.

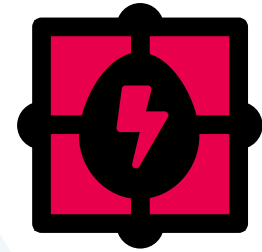
Exploration is fundamental owing to the extreme uncertainty that prevails at the beginning of the journey. Will the market really want this? Is the technology viable? Is a good structure of partnerships in place to assure adequate distribution of the solution? Is there enough money on the table? All these questions are addressed by our method. They are essential to get past the gaps in the early stages.

3. <https://steveblank.com/tag/customer-discovery/>

4. https://en.wikipedia.org/wiki/Agile_software_development

5. https://en.wikipedia.org/wiki/Crossing_the_Chasm





4 .HOW IS IT APPLIED?

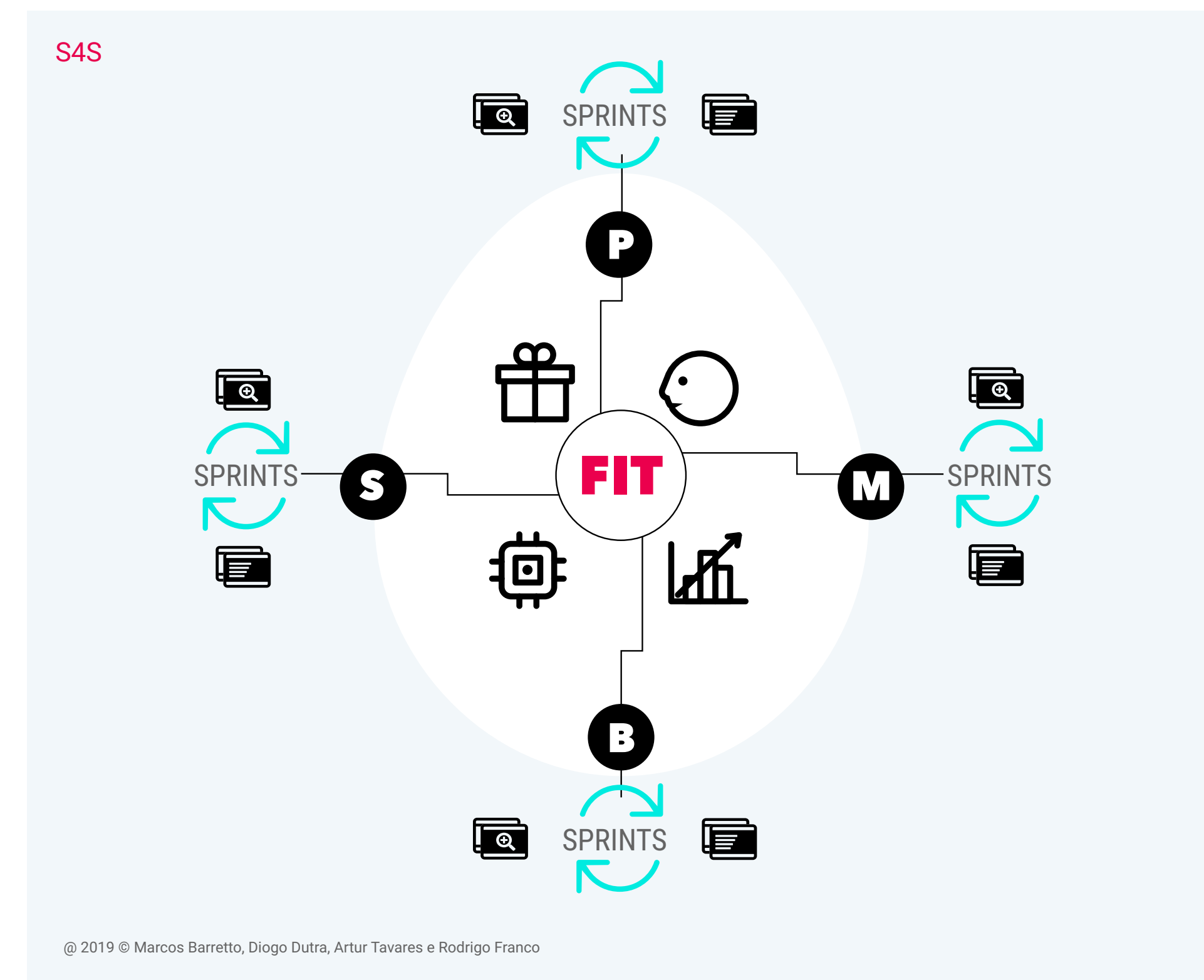
S4S: Shell for Startups

The S4S as an application of the principles of Scientific Entrepreneurship is based on iterative processes of hypothesis formulation and validation, like C.S. Peirce’s abductive method⁶. The S4S proposes to find a fit between a well-defined problem and a solution that demonstrably solves the problem and is also financially sustainable (problem-solution fit). Thus the S4S consists of a circuit of real experiments designed to validate the solution in terms of four pillars: (i) a specific customer segment with clear pain points; (ii) an objective value proposition; (iii) a set of functionalities that make the value proposition tangible; and (iv) a minimum of economics that can stay on its feet.

Why do we call it a shell? Instead of suggesting a single path or sequence of phases, as traditional methodologies do, we prefer to emphasize the multiple processes that occur in parallel and can be sequenced in different ways. This is what we mean by a shell. The inspiration came from computing, a universe in which the term is defined as a user interface that permits access to the services of an operating system.

6. Veja mais nas referências, pág. 25

The shell comprises four processes that guide the development of early-stage startups: **P** discovering customers and their main pain points; **S** iteratively validating the product with users until a clear-cut use case is reached; **B** understanding and planning expectations regarding sales, costs and capital requirements; and **M** closing the first sales.



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4 .HOW IS IT APPLIED?

S4S: SHELL for Startups

The processes are developed in iterative cycles or sprints. A set of tools has been created to guide and support recording and learning. The four main elements of the process of discovering and validating problem-solution fit are in the center of the diagram: Customer Segment (CS), Value Proposition (VP), Function & Engineering (FE) and Operations & Economics (OE). We represent the different test-validation cycles with their respective hypothesis/lesson recording tools (Decks and Records). Execution of the cycles allows for alteration of the four central elements, which are modified with each discovery/validation, but must be kept consistent at all times.

The Problem Test cycle **P** focuses on discovering a customer with a relevant pain point. The challenge is to find a beachhead market⁷ through a series of interviews and small experiments. By the end, the entrepreneurs must have collected enough facts and evidence to prove that customer segments have bought into their value proposition by deciding to “persevere or pivot”. In other words, can a rough assessment show that enough profit can be earned in the chosen market segment to meet the entrepreneurs’ expectations for financial return?

In the Solution Test cycle **S**, the entrepreneurs have to perform several experiments focusing on validation of the value proposition (VP) and a direct link to the product requirements (FE). The validated requirements

must be consolidated into a solution that at least matches the critical functionalities identified.

The purpose of the Business Model test cycle **B** is to define a structure of operations that supports the sales vision for an initial horizon and the capital requirement to sustain the plan. This entails an effort to achieve a deeper understanding of all aspects of the business model and sales process, through the transformation of qualitative into quantitative elements, which we call economics.

Lastly, the Market Test cycle **M** is the sales process simplified to acquire the first customers. All of our early-stage cycle aims to consolidate validation of the problem-solution fit, and this is actualized by the first sales. We call this phase “zero to one” (from zero customers to one customer). The distinctive feature of this sales cycle is that it offers risks while confirming that it is not part of the traditional sales

7. In his book *Disciplined Entrepreneurship: 24 Steps to a Successful Startup*, Bill Aulet, Managing Director of the Martin Trust Center for MIT Entrepreneurship, introduces the concept of beachhead market as central to any market entry strategy. In military parlance, a beachhead is a position on an enemy shoreline captured by troops in advance of an invading force. For Aulet, the beachhead market is the most important place from which to launch an invasion of the market because it is where the paying customers are to be found. It is normally a niche market but offers the possibility of expansion via entry into other adjacent markets.

4 .HOW IS IT APPLIED?

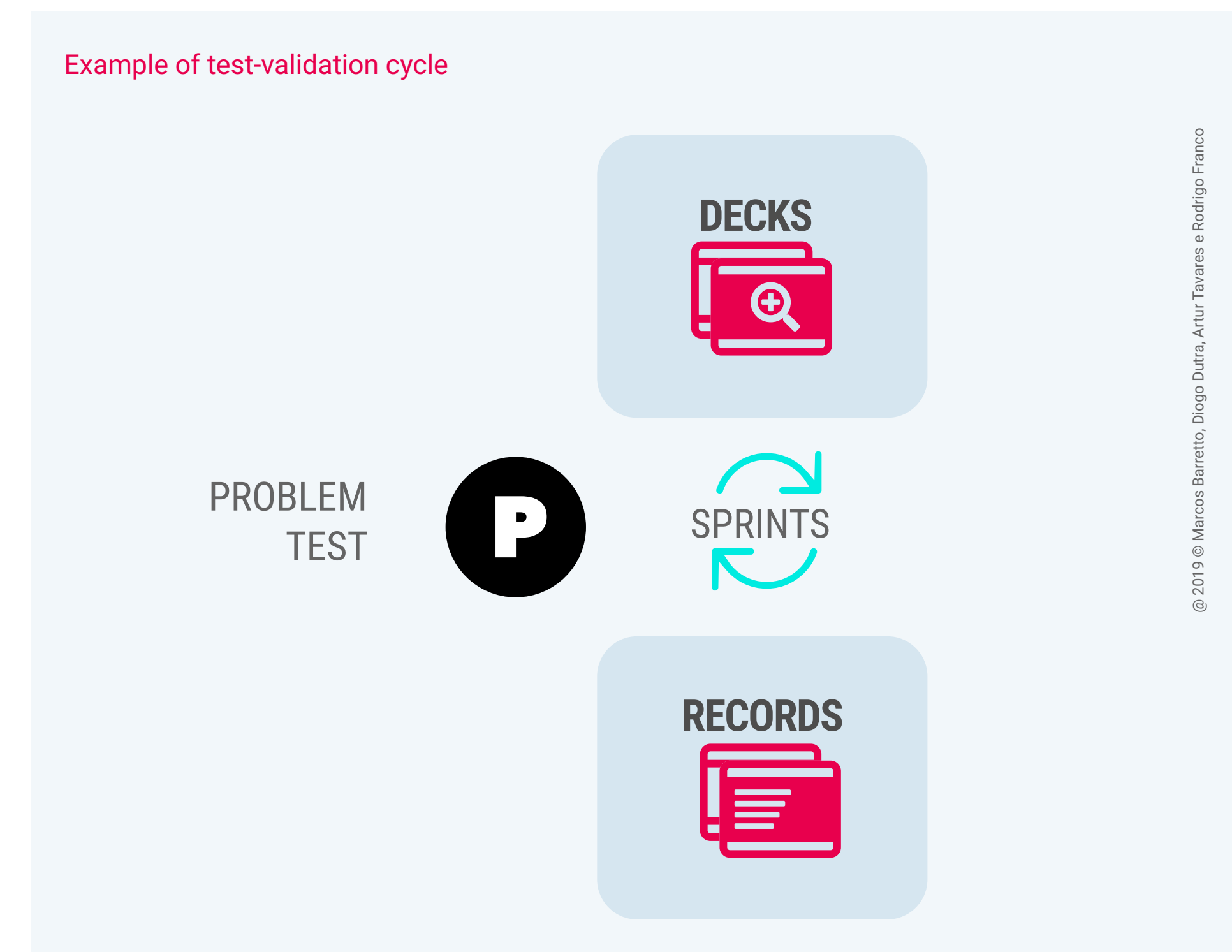
structure but a sales approach proper to innovative solutions unknown to the consumer.

Using a set of Decks, the entrepreneurs are prompted to organize their hypotheses and discoveries. The Records are a second collection of tools for use in planning and recording incursions, interviews and experiments with users/customers. The cycles consist of weekly or fortnightly sprints with intensive field activities to validate the hypotheses. Just as Agile methodologies, from which the term sprint is borrowed, propose the figure of an Agile coach, the Scientific Entrepreneurship methodology also relies on the figure of a coach, who considerably speeds up the process of learning and convergence by the entrepreneurs compared with autodidactic processes using a standard canvas⁸.

Sprint rituals, therefore, are supported by Decks and Records, which are evaluated and restructured in sprint review sessions, sprint planning sessions, and coaching sessions. In principle the cycles can be executed in any order or even skipped. The natural sequence of execution is **P** > **S** > **B** > **M**.

8. The combination of this methodology with the figure of the coach also entails the structuring of a pedagogy to prepare this key participant in the process.

However, not a few successful startups perform the **P** cycle in a shortened version, especially when their focus is on problems that have already been solved in other environments belonging to the **S** cycle. The **B** and **M** cycles are often executed in parallel



4 .HOW IS IT APPLIED?

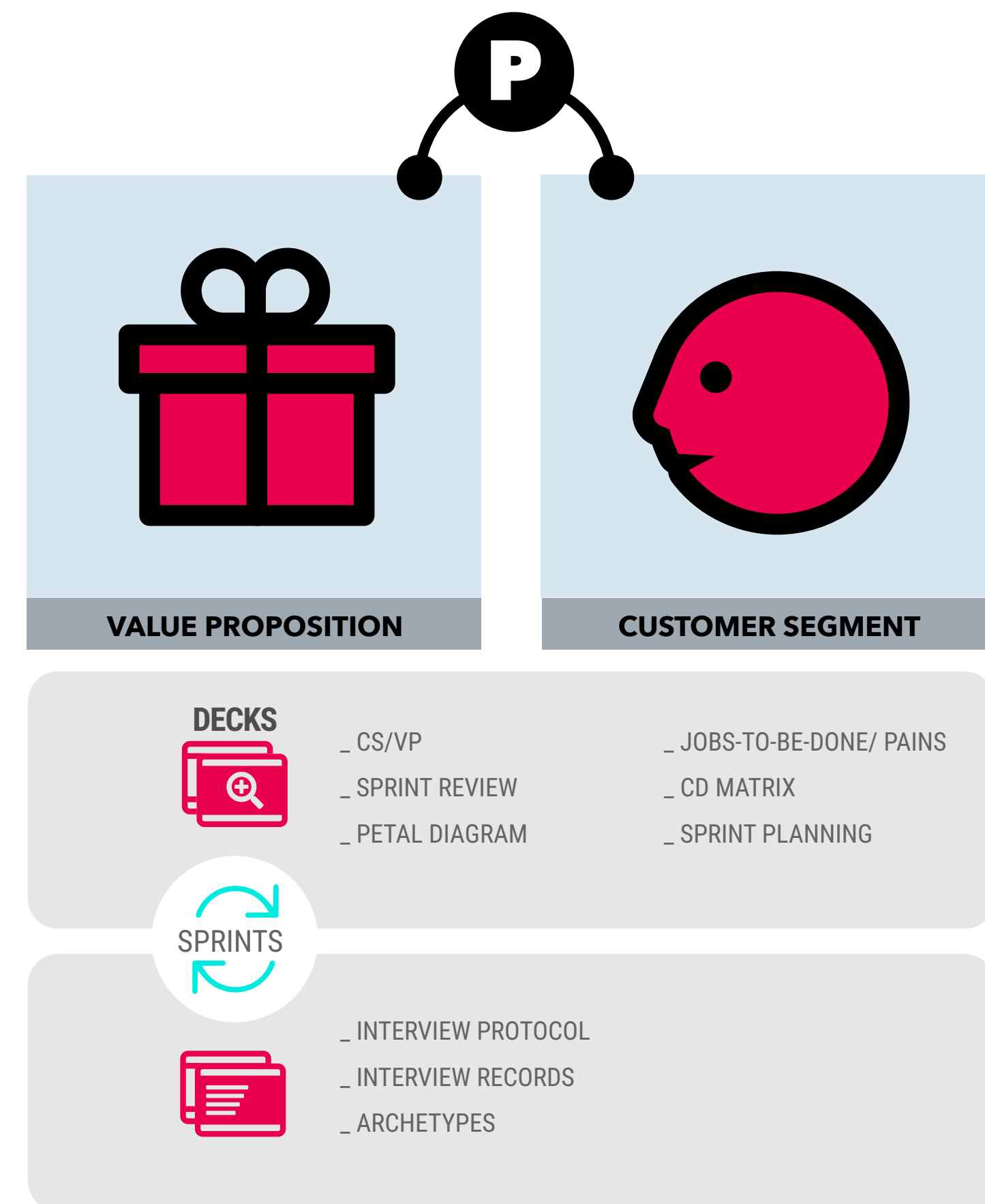
4.1 Problem Test Cycle **P**

This is a stage involving many interviews, in which the entrepreneurs go out into the field to investigate their hypotheses by talking to the people they think have a relevant pain to be resolved. The core idea is organizing and discovering a beachhead market, i.e. a market that is relatively easy to enter, normally one with a glaringly unsolved problem. The guidance provided during this cycle helps the entrepreneurs both investigate other markets and possibilities, and focus on finding a niche market with potential customers willing to pay for an innovation.

Here we introduce the concept of “hair on fire”, an idiomatic expression used in the startup context by investing partners at Sequoia Capital. The idea is that if you give a brick to someone whose hair is on fire, they will use it to put the flames out even if they have to hit themselves on the head. In other words, the focus is on finding such a relevant pain that the customer will pay even for a half-baked (unfinished) version.

In this cycle the Deck contains six frameworks that help the organization maintain the founders’ focus: (i) value proposition x customer segment canvas; (ii) sprint review; (iii) petal diagram; (iv) jobs-to-be-done framework; (v) CD matrix; and (vi) sprint planning.

The Records in this phase consist of three tools to support the interviews and learning records: (i) interview protocol; (ii) interview record canvas; and (iii) archetypes.



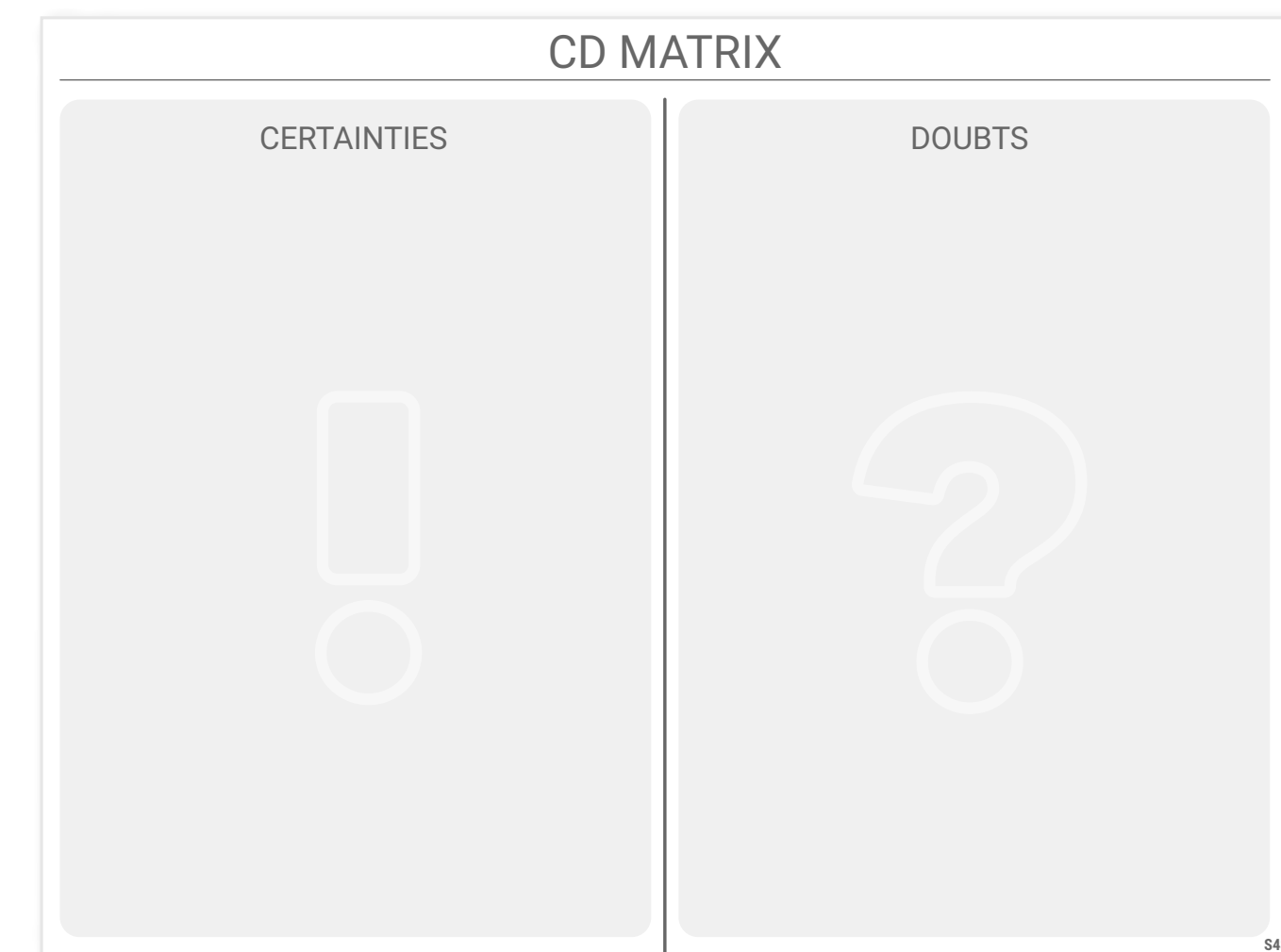
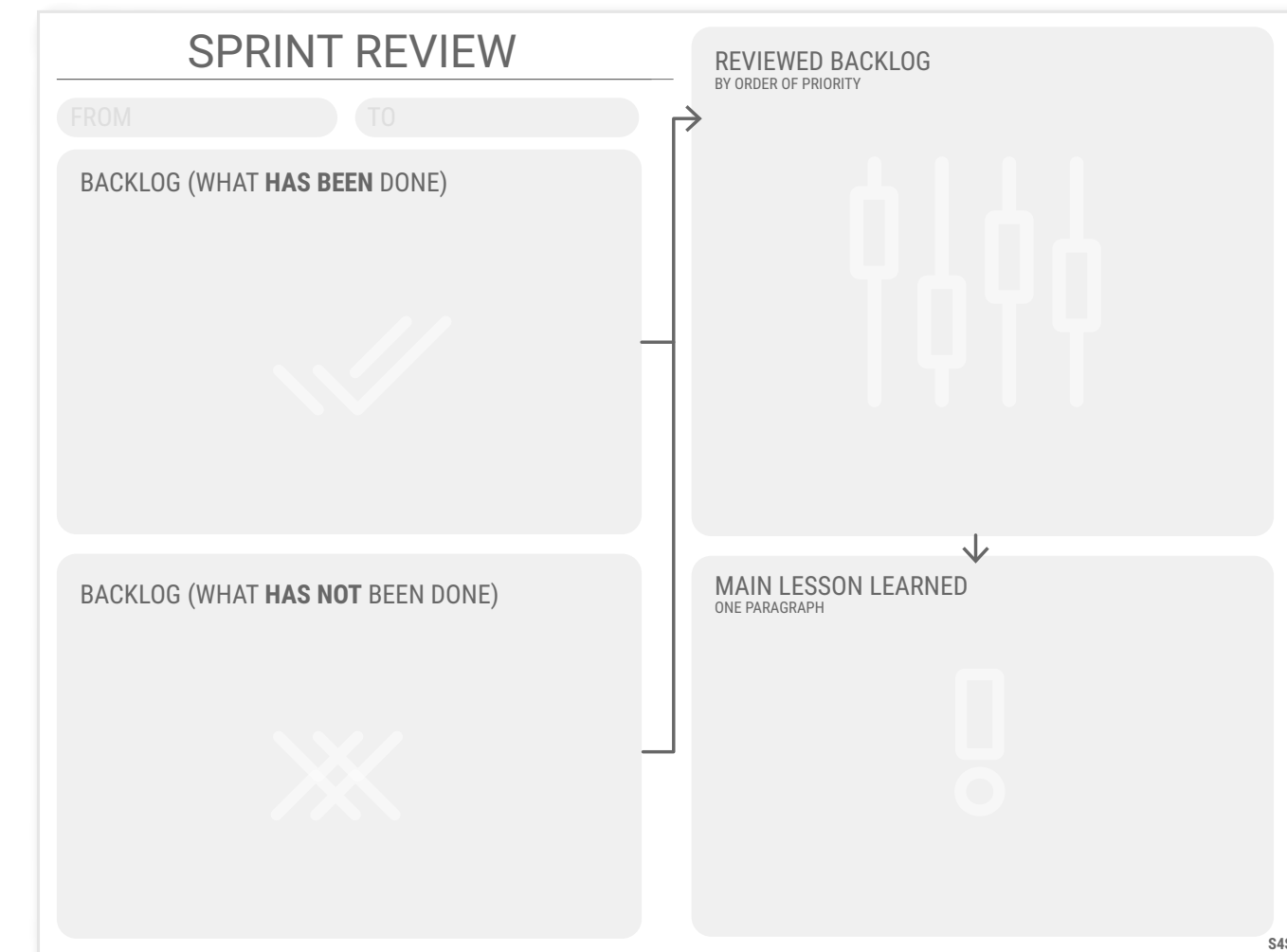
4 .HOW IS IT APPLIED?

4.1 Problem Test Cycle

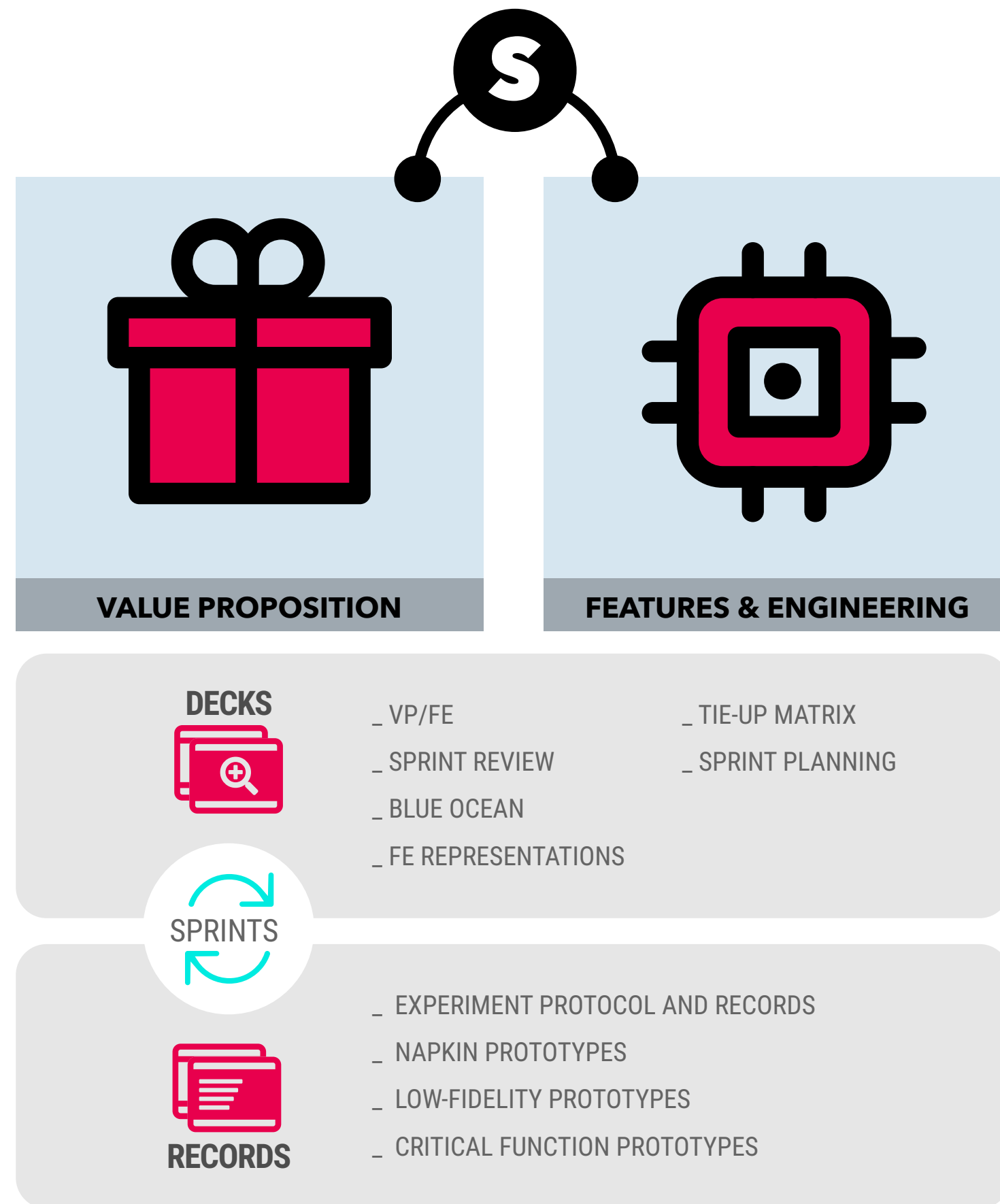
CASE STUDY • ROAD LABS

RoadLabs is an example of a proposal that makes experienced Brazilian entrepreneurs and investors turn up their noses: a solution for customers in the public sector. The founders developed a technology to detect potholes on roads and said to themselves, “Why not sell it to governments and cities?” When we heard, we were horrified! Selling to the public sector in Brazil is a complex undertaking full of uncertainty. However, we have a rule that says we do not dictate what should be done; we offer guidance. Here it is worth stressing that a good coach makes sure the entrepreneurs (i) talk to the right people, (ii) ask the right questions, and (iii) learn as they go. With the petal diagram, the group was advised to explore other markets and do a lot of interviews. A major insight popped up from one of the interviews: they discovered that toll road operators pay heavy fines for potholes. This is very painful. The fines pile up. They cost millions, and the customer is a private-sector company or consortium, subject to competitive bidding procedures like any player in a B2B market. So they decided to take the plunge. After several interviews they had acquired a detailed understanding of the toll road operators’ expectations. Before they even produced a prototype, they were already making progress on the negotiation of paid contracts. It is interesting that even now RoadLabs still does problem test exercises as part of the product development process. It continues to grow and innovate in a market with a shortage of technological solutions.

EXAMPLES OF TOOLS



4 .HOW IS IT APPLIED?



4.2 Solution Test Cycle **S**

In this cycle, real experiments are conducted in which the entrepreneurs have to validate the main functionalities and value propositions required by prospective customers. They test various minimum viable products (MVPs), which can range from solving the problem manually using an Excel spreadsheet to building hardware for initial testing.

In addition, throughout the validation process the entrepreneurs begin choosing the requirements and engineering designs to be implemented at the end of the cycle. This is the first version of the solution, which we call the Critical Function Prototype.

In this phase of the cycle the Deck also contains six frameworks: (i) value proposition x function & engineering canvas; (ii) sprint review; (iii) blue ocean framework; (iv) calculation records and representations/ engineering designs; (v) tie-up matrix; and (vi) sprint planning. The Records in this phase consist of three tools to support the experiment/prototype creation process: (i) experiment protocol and records, (ii) napkin prototypes, (iii) low-fidelity prototypes, and (iv) critical function prototypes.

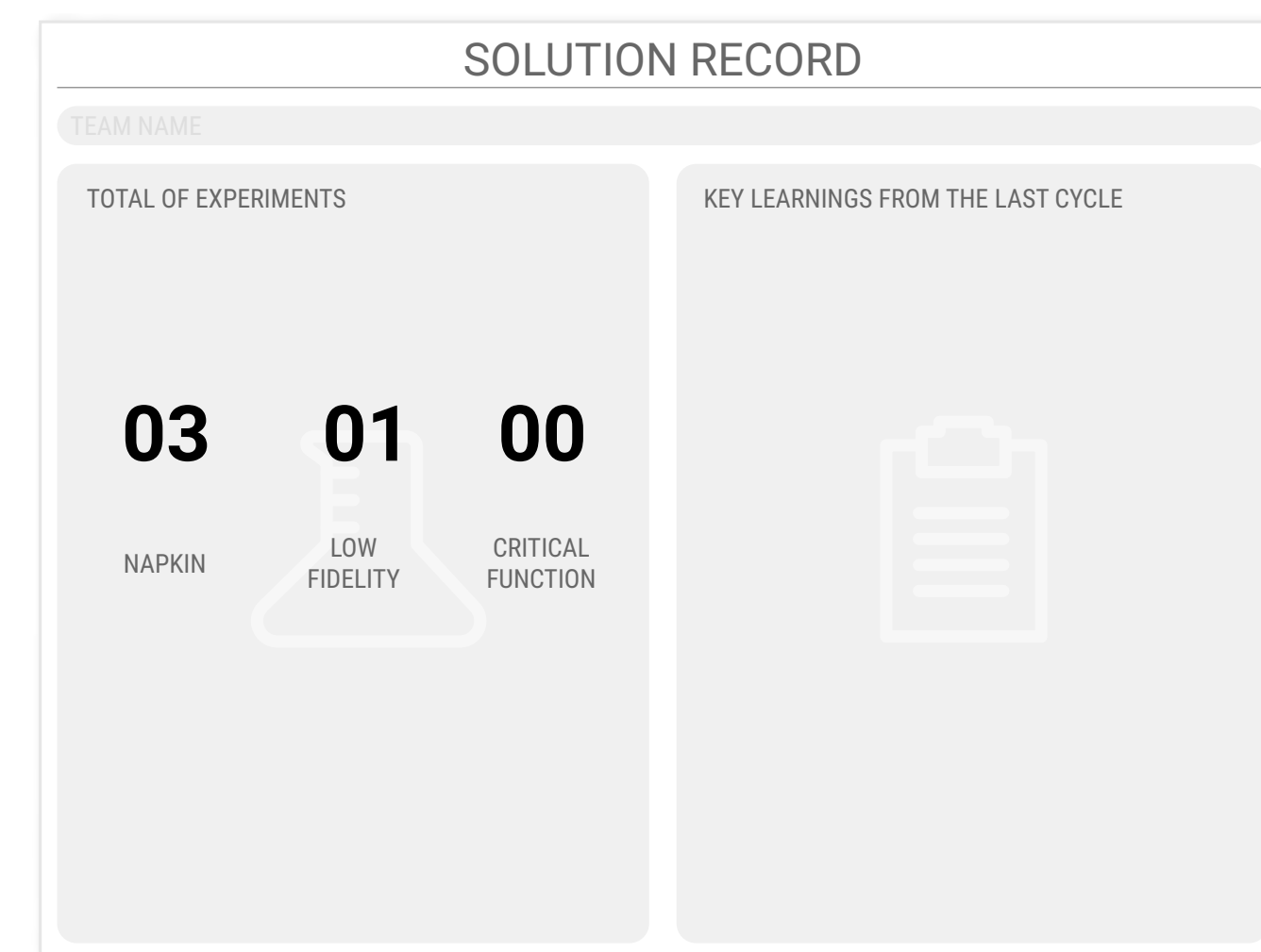
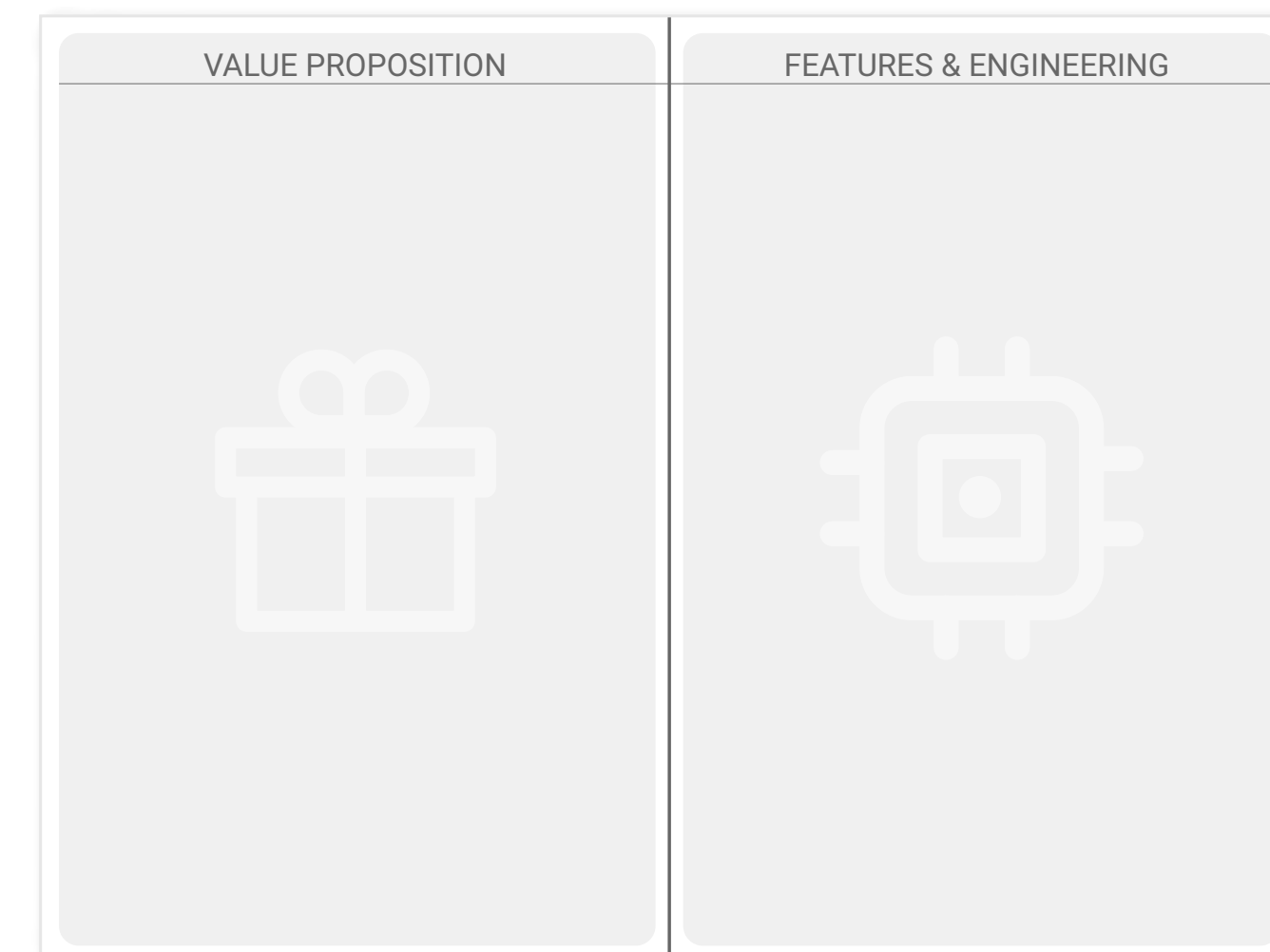
4 .HOW IS IT APPLIED?

4.2 Solution Test Cycle

CASE STUDY • E-SPORTSE

The E-sportse project was born as a hardware device designed to guarantee accuracy in timing runners on street races. After the problem test phase, the group perceived a more significant pain point in the judgment of race results for competitive examinations, which have to be even more accurate. Having located a customer “with hair on fire”, the entrepreneurs moved on to the Solution Test phase, in which they planned the largest possible number of experiments. The first and cheapest experiment consisted of a PowerPoint presentation of the solution. This produced feedback on the solution then used by the market and the indicators that should be added to measure results in an actual competitive exam. Next they built a low-fidelity prototype, which was installed on a bike and tested in an open sports court. They took the prototype to a prospective customer and showed on a computer screen the accuracy, precision and numbers the customer expected to see – the same as those discovered in the first experiment using PowerPoint. The customer was excited by this performance and called in the firm’s senior management to take a look. Until then the entrepreneurs had not dared to present such a raw prototype for fear of spoiling their chances with the customer. This is the most important lesson of this cycle: the customer “with hair on fire” accepts half-baked versions, so take the plunge! They then moved on to prototype development, producing a pilot batch under contract with the customer: ten devices to be fitted to the runners’ race bibs. The secret of this phase lies in going into the street without fear, always thinking up the smallest possible experiment or trial, and knowing what needs to be learned from it. With this in mind, the experiments steadily mature until you reach real tests and pilots with paying customers. Some months later the group closed a contract for a good price to implement the solution on a larger scale. The solution is now used in various parts of Brazil, and is being constantly improved.

EXAMPLES OF TOOLS



4 .HOW IS IT APPLIED?

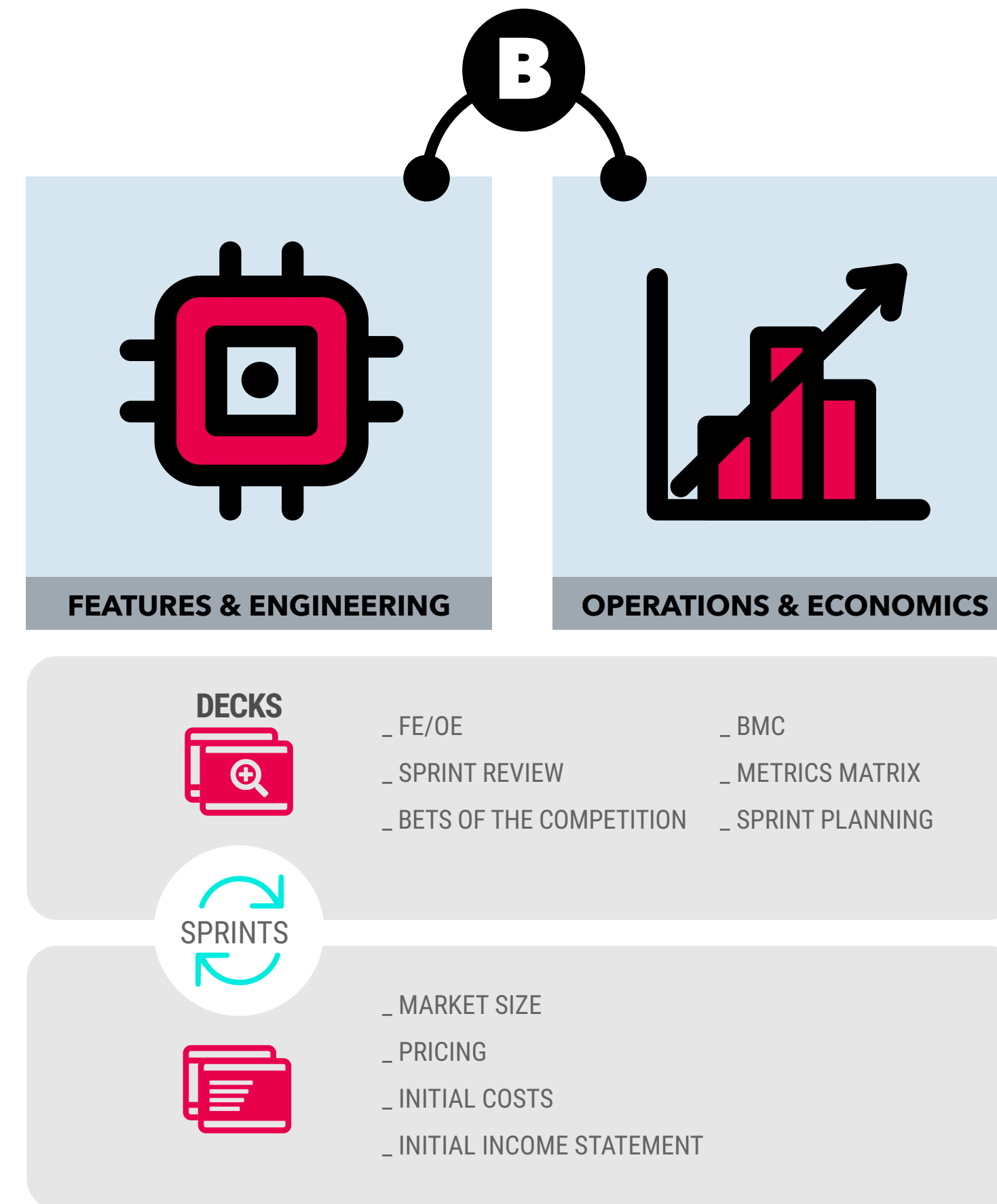
4.3 Business Model Test Cycle **B**

In this cycle the goal is to validate the main elements of the business model, such as pricing, cost structure and financial planning for the first few months of operations.

This phase requires a more in-depth and quantitative analysis as part of the discussion of the business venture. The logic of growth and the numbers must be properly aligned over time. To this end, the entrepreneurs are encouraged to test and validate the business model with experts, and to perform a painstaking evaluation of pricing with customers. It is most important to study competitors and suppliers in great detail in this phase, both to compare cost structures and to work on pricing.

The Deck for this cycle contains the following frameworks: (i) features & engineering x operations & economics canvas; (ii) sprint review; (iii) bets of the competition; (iv) Business Model Canvas (BMC); (v) metrics matrix; and (vi) sprint planning.

The Records for this cycle contain a financial modeling spreadsheet with: (i) market size calculation; (ii) basic pricing study; (iii) initial cost structure; and (iv) financial flow (revenue and expenditure) projected for the next six months.



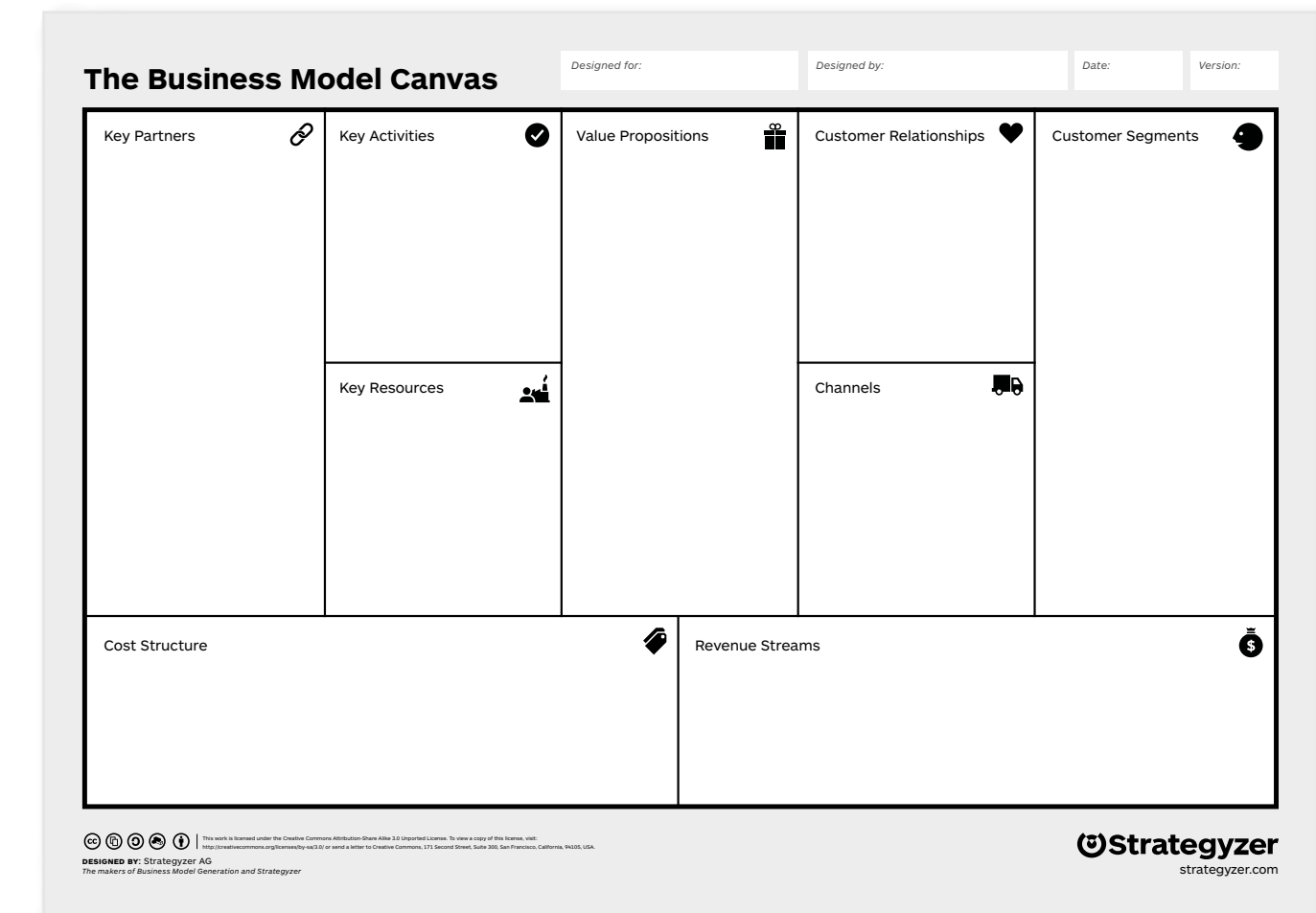
4 .HOW IS IT APPLIED?

4.3 Business Model Test Cycle

CASE STUDY • MVISIA

Particularly for high-tech markets, the context of the business model is most important. Not only is it necessary to think about the value proposition and customer segment, but each decision on distribution channels, partners, key resources and key activities can affect the future of the organization. Tech entrepreneurs are often found to have an excellent understanding of the solution but no idea how to pay their bills at the end of the month, how to build healthy relationships with suppliers, or how to finance the business over time without neglecting new product development. The case of MVISIA is a good illustration of the usefulness of a systemic approach to **designing the business**. The entrepreneurs began with the understanding that machine learning and computer vision could be used to select agricultural products in an automated manner with conveyor belts and smart cameras. At the time this selection was done manually by workers, with low productivity and occupational health problems. Given the obvious benefits to be gained from automation, it was not hard to find customers. But how can the creation of such a robust technology be made viable if the entrepreneurs lack financial resources? MVISIA performed several exercises in this phase, exploring possible markets for expansion to boost revenue, validating the development of the solution with multiple suppliers to optimize costs, machining and manufacturing, producing plans to develop the solution, and presenting its proposals in many competitions for access to funding. As a result their understanding of the distribution chain matured, they gained detailed insights into costing and pricing, and they built a network of partners and strategic supporters. The result? They won the 2015 Santander Prize, the 2016 Odebrecht Prize and the 2017 Inovacana Price. They also won grants from the São Paulo State Research Agency (FAPESP) via its Innovative Research in Small Business program (PIPE), and from the Brazilian government via its innovation agency (FINEP). The prizes and funding guaranteed hundreds of thousands of dollars for the development of new technologies and expansion into larger markets.

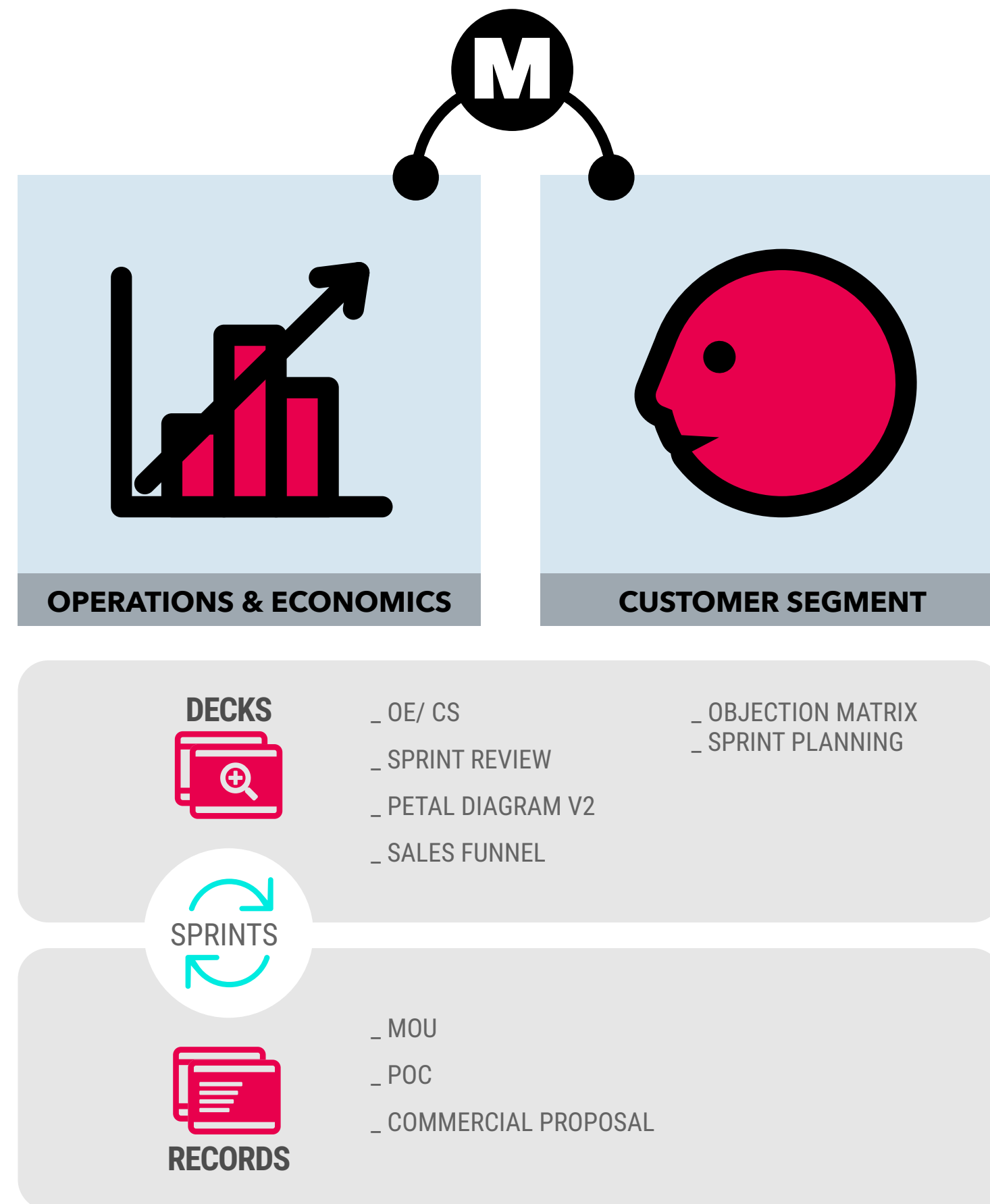
EXAMPLES OF TOOLS



Source: <https://www.strategyzer.com/canvas/business-model-canvas>



4 .HOW IS IT APPLIED?



4.4 Market Test Cycle **M**

The focus is on closing at least one sale. This process ends up being intensive once the team has put energy and discipline into a minimum sales funnel. Here the entrepreneurs are introduced to the concept of commercial follow-up and its importance in this phase of the innovation. Closing a sale, a pilot program or a co-development are goals to be pursued, as the venture gains traction with its first customer, helping the founders avoid losing energy and giving up too soon.

Closing the first sale requires the development of credibility and a growing commitment by both parties. Many risks are involved for both the first buyer and the nascent startup, and the objections that arise during the process need to be addressed and surmounted.

The Deck for this cycle contains the following frameworks: (i) customer segment x operations & economics canvas; (ii) sprint review; (iii) petal diagram v2; (iv) sales funnel; (v) objection matrix; and (vi) sprint planning.

The Records present a basic framework for organization of the first proposals: (i) memorandum of understanding (MoU); (ii) proof of concept proposal (PoC); and (iii) commercial proposal.

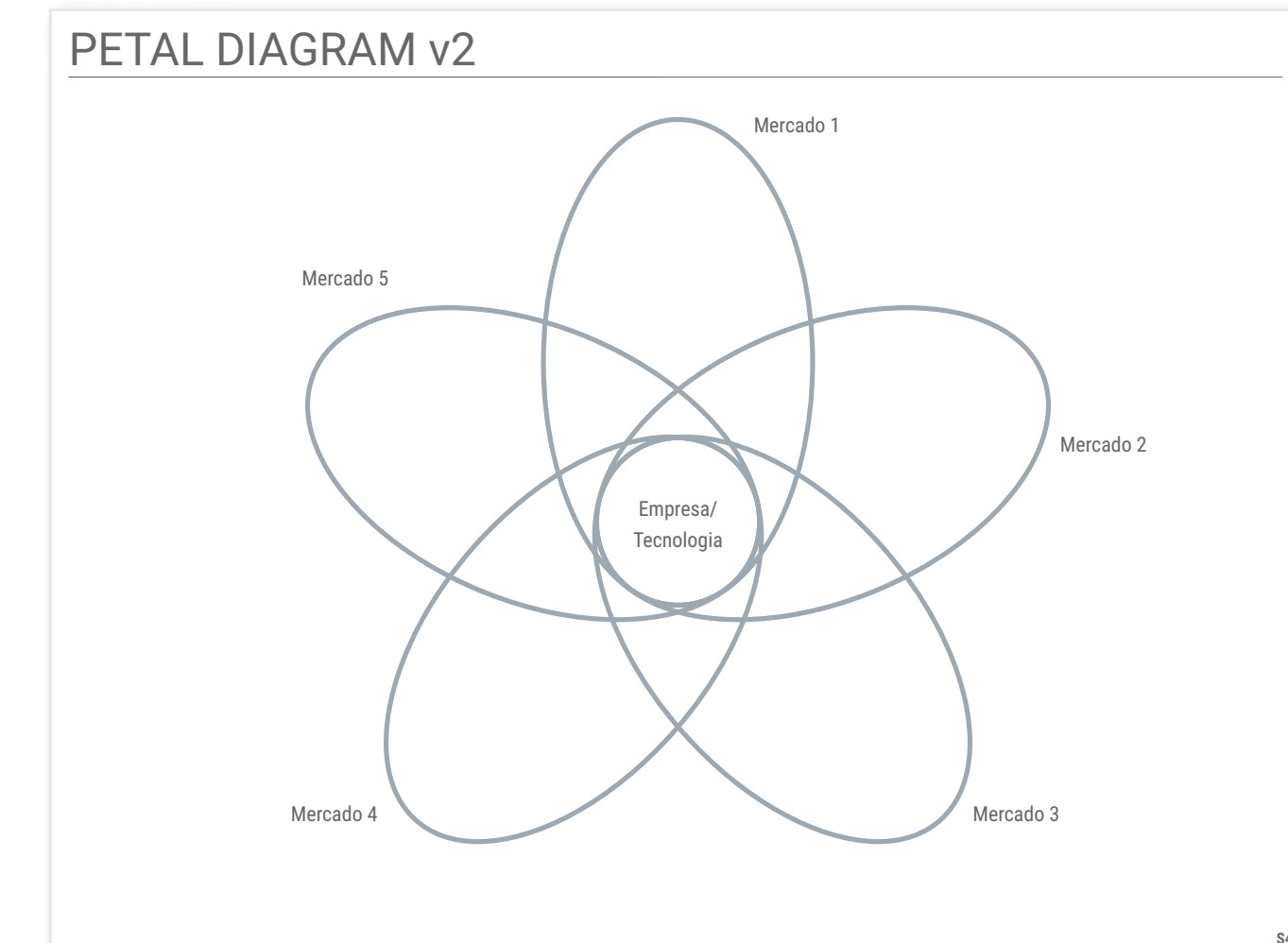
4 .HOW IS IT APPLIED?

4.4 Market Test Cycle

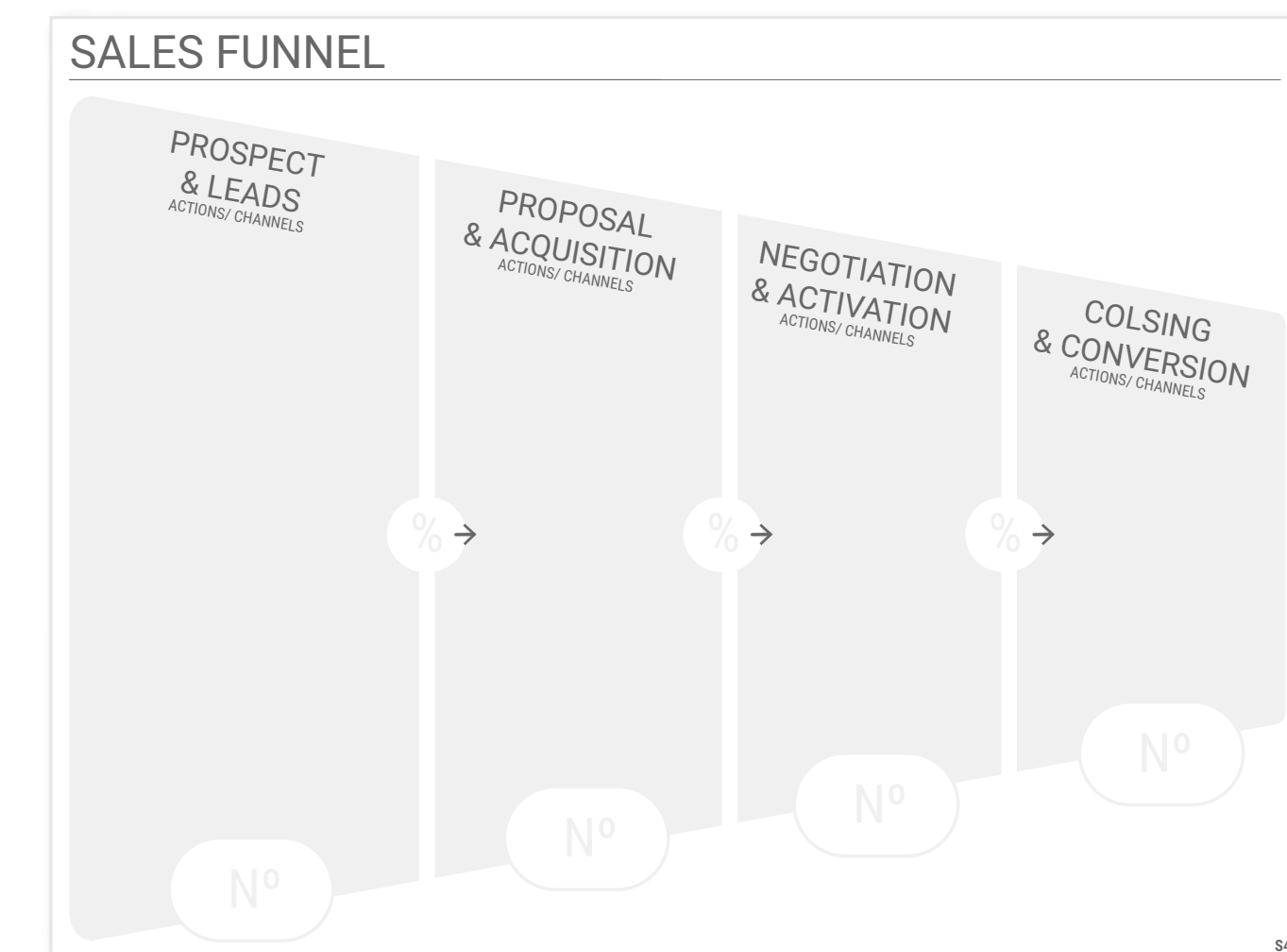
CASO STUDY • CENTRICS

Centrics is a good case to illustrate the importance of the Market Test. The startup identified an opportunity in the difficulty of adopting after-sales management solutions in traditional markets (Customer Success concept). The entrepreneurs wanted to give offline companies a chance to obtain the same customer satisfaction performance as software companies, which use data-based tools. After the maturation period they went out and tried to sell, and rather than waiting for the technology to be entirely ready, they produced the first reports for the first customers manually, completing Excel spreadsheets on their computers and delivering value to those who were willing to pay. In this cycle, Centrics set out to understand the main obstacles that were stopping new customers from buying its solution, and designed a sales funnel to guide its efforts. The tool was updated with each iteration. The phase of focusing on sales is also important for the team to mature: the involvement of everyone with exclusive dedication shows who is really on the ball and who is going to drop out. Centrics now has a more mature product that evolves with each new customer. This has helped the leaders of the venture understand a truth learned by few: product-market fit happens only when sales are recurring and predictable. The challenges continue, and the firm seeks to extract data on how to keep existing customers active, which is helping the team prioritize activities, concentrating only on what is important and avoiding “scope creep” – many functions the customer does not want – and it is also helping them understand the customer profile that will drive recurring sales.

EXAMPLES OF TOOLS



Source: <https://steveblank.com/2013/11/08/a-new-way-to-look-at-competitors/>





_ tools for synthesis and organization of learning and sprint planning



_ tools for recording and archiving data collected and results achieved

PROBLEM TEST

DECKS

- _ CS/VP
- _ SPRINT REVIEW
- _ PETAL DIAGRAM
- _ JOBS-TO-BE-DONE/ PAINS
- _ CD MATRIX
- _ SPRINT PLANNING

SPRINTS

RECORDS

- INTERVIEW PROTOCOL _
- INTERVIEW RECORDS _
- ARCHETYPES _

SOLUTION TEST

DECKS

- _ VP/FE
- _ SPRINT REVIEW
- _ BLUE OCEAN
- _ FE REPRESENTATIONS
- _ TIE-UP MATRIX
- _ SPRINT PLANNING

SPRINTS

RECORDS

- _ EXPERIMENT PROT. & REC.
- _ EXPERIMENTS
- _ NAPKIN PROTOTYPES
- _ LOW-FIDELITY PROTOTYPES
- _ CRITICAL FUNCT. PROTOTYPES

MARKET TEST

DECKS

- _ OE/CS
- _ SPRINT REVIEW
- _ PETAL DIAGRAM V2
- _ SALES FUNNEL
- _ OBJECTION MATRIX
- _ SPRINT PLANNING

SPRINTS

RECORDS

- _ COMMERCIAL PROPOSAL
- _ MOU
- _ POC

BUSINESS MODEL TEST

DECKS

- _ FE/OE
- _ SPRINT REVIEW
- _ BETS OF THE COMPETITION
- _ BMC
- _ METRICS MATRIX
- _ SPRINT PLANNING

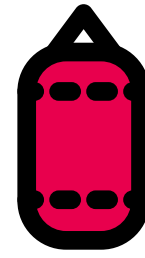
SPRINTS

RECORDS

- MARKET SIZE _
- PRICING _
- INITIAL COSTS _
- INITIAL INCOME STATEMENT _



_ Iterative search / development process with a period of 1 to 2 weeks



5 .WHO SUPPORTS IT ALL? HOW?

The role of the coach

The coach plays a central part in the fast learning process for entrepreneurs. His or her role consists basically of the following:

- (i) as an expert on the process, **helping the entrepreneurs understand** the main errors and pitfalls of each phase;
- (ii) **being a major motivator**, challenging them to take the next steps and encouraging them to continue with the process;
- (iii) creating a climate in which the leaders of the project **ask the right questions, talk to the right people and learn as they go**.

Like the shell concept inspired by computing, the cycles use the idea of sprints imported from Agile development methodologies. The Agile coach also encompasses the role of Scrum Master, whose mission is to ensure that the development team follows the process. In Scientific Entrepreneurship the coach performs a similar role. The premise is that the entrepreneur is not – and should not be! – an expert in entrepreneurship. That is the coach’s role. The coach offers important feedback without “telling anyone what to do”.

More practically, the coach is responsible for managing the recurring interactions with the entrepreneurs. This involves holding sessions,

at least once a month, and managing engagement throughout the application of the S4S.

The coach is responsible for oral and written assessments to facilitate absorption of the principles of the methodology during each interaction. The entrepreneur’s evolution happens throughout the process proposed by the S4S, but above all by means of feedback loops: the entrepreneur experiments in a confused manner, receives advice, and resumes experimentation with the coach’s comments in mind. As the cycle repeats, the process becomes consolidated as an entrepreneurial mindset based on data and real-world experiments.

The coach acts in two contexts: development of single teams, or development of teams in batches (as in accelerator and similar programs).

The Scientific Entrepreneurship pedagogy is even stronger when executed by batches of teams. Managing the framework is more complex but the collective learning process is greatly enhanced. We recommend that a coach should work with at most five to seven teams, devoting about 20 hours per month to this batch.

In addition to one-on-one sessions, coaches (i) collectively mentor

5 .WHO SUPPORTS IT ALL? HOW?

The role of the coach

their teams (in the flipped classroom format); (ii) develop a collective assessment and feedback for the batch; and (iii) assure an open communication system for batch teams to exchange information. All this enables the entrepreneurs to achieve a significant increase in the number of feedback loops. It also injects a social effect that positively impacts performance. The coach performs several assessments during the program: (i) live in the flipped classroom; (ii) in writing after it; (iii) formal feedback after collective assessments, producing a comparative perception between themselves and the other teams in the batch.

Reinforcing collective assessment, the coaches meet once a month to analyze the status of each team, align the overall maturing of the teams and produce a ranking of the teams according to the degree of maturity reached during application of the methodology. This ranking can be based on a qualitative discussion or on the scores awarded to the teams at the end of each flipped class. The assessments have two main elements: dedication and performance. Dedication reflects indicators specific to each cycle, such as the number of interviews, for example, or the willingness to chase after new people or information. Performance relates to the coach's degree of confidence in the team's potential success. This division exists because highly dedicated teams sometimes fail to find a relevant opportunity, while there are also cases

in which teams that are not so dedicated do find an opportunity and get things right. These are exceptions, as teams with relatively little dedication do not usually perform very well.

As investor David Frankel said: “whenever I invest because I’m more excited about the opportunity than the entrepreneur, it’s always a mistake.”

The methodological support provided by the **S4S** framework combined with the figure of the coach leads to the need for a pedagogy that supports the activity of the coach.

5 .WHO SUPPORTS IT ALL? HOW?

Pedagogy

Coaches are not mentors, or experts on specific markets. They are experts on the method. Their main job is to keep participants in the method, learning as much and as fast as possible from their potential customers. A very common mistake is wanting to make entrepreneurs experts on the method. No! They need to be experts on their customers. Supplying a load of literature, presenting multiple frameworks and requiring the founder to master all these techniques leads to a lack of focus on what really matters: building something useful for a real customer.

The pedagogy that emerges from Scientific Entrepreneurship combines three main elements: (i) experiential learning, (ii) team-based learning, and (iii) flipped classroom.

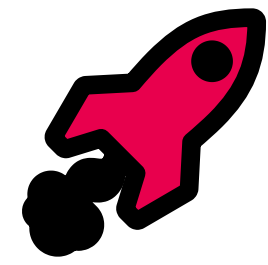
Experiential learning is a pillar that emphasizes the real entrepreneurial process, including experience with actual people in validations performed out of the office and classroom. In accordance with this pedagogical principle, the coach should intensively instigate the entrepreneurs to go out and get concrete real-world evidence that proves their business hypotheses.

EXPERIENTIAL LEARNING, TEAM-BASED LEARNING, AND FLIPPED CLASSROOM.

The pedagogical principle of team-based learning presupposes that the coach constantly stimulates the entrepreneurs to think. In this case, as business partners the founders should reflect, analyze the data and think about their conclusions before sharing them with the coach or with a mentor. In the case of the methodology applied as a program, this effect is even greater as it creates cross-learning between teams with different markets and challenges.

Lastly, the pedagogical element embodied in the flipped classroom format, especially when the methodology is applied as a program, assures a leading role for the entrepreneur who presents the project and is the central focus for the interactions, not the coach. The role of the coach in the flipped classroom is to understand the group's progress in the last sprint and provide feedback to help them move forward faster. In the program format, all the teams of a single coach participate together, and the teams are encouraged to exchange information, sharing the lessons learned at different stages of maturity.

The shell must be very clear to the coaches, and the basic principles of the pedagogy must be mastered in practice. If so, the Scientific Entrepreneurship methodology will effectively convert more and more technologies into startups by means of a clear process of crossing the early-stage chasm.



6 .WHAT NEXT?

The vision behind the S4S is shaped by the early phases of the startup life cycle, particularly (i) ideation and (ii) validation/establishment. Ideally the first customer (preferably a paying customer) has been involved and there is an initial validation of the solution. What next? The exponential growth curve points to the stages of (iii) growth and (iv) maturity.

For growth to happen, there typically has to be a major strengthening of customer attraction via advertising, structuring of the sales team and processes etc. if the solution involves physical products, there will normally also be a restructuring of sourcing, manufacturing and distribution activities. As a rule this growth requires proper team structuring and a corresponding increase in the workforce. To support all this growth, a capital injection is probably needed, involving additional investment rounds.

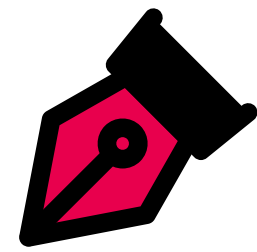
The maturity stage comes close to traditional corporate management, on one hand, with the establishment of departments and well-structured business processes. However, it is desirable for the startup to hold on to its primordial characteristic, the unremitting pursuit of innovation, so that it does not become a dinosaur heading for extinction.

Playbook

Most of the frameworks and tools in this document can easily be found on the internet.

More information about the tools is provided in the section **DEEP INTO**.





7 .ABOUT THE AUTHORS & CREDITS



MARCOS BARRETTO: graduated in electrical engineering from the University of São Paulo's Engineering School (POLI-USP) in 1983. He holds a master's degree (1988) and PhD (1993) from the same institution. He has taught there for over 30 years. He has published more than 100 articles in Brazilian and international journals and

newspapers, as well as several book chapters. During his academic career he has undertaken at least five entrepreneurial ventures of his own in the field of technology. The latest one is a fintech.



ARTUR VILAS BOAS: Holds a master's degree in entrepreneurship and innovation from the University of São Paulo's School of Economics & Business Administration (FEA-USP). Currently preparing a PhD in administration. Coordinator of the university's Center for Entrepreneurship (NEU-USP) and a researcher in its Center for Technology Policy & Management (NPGT-USP).

Author of articles published in Brazilian and international journals. Teaches entrepreneurship, innovation and management at POLI-USP and the university's Medical School (FM-USP), as well as MBA programs at Fundação Vanzolini and the Federal University of São Carlos (UFSCar). As a leader of AWC, NEU and other programs, he has been directly involved in the acceleration of hundreds of startups in various parts of Brazil.



DIOGO DUTRA: Graduated in mechatronic engineering from POLI-USP and holds a master's degree in engineering design from the same institution. Studied engineering design at Mines ParisTech (France). Specialist in design-based innovation. Founding partner, venture builder CAOS Focado, with a leading role in developing

a startup in a current portfolio of three startups in the segments edtech, agtech and healthtech. Lead coordinator of TIM Institute's AWC entrepreneurship education program since its inception in 2015.



RODRIGO FRANCO: Communicator and specialist in Strategic Design by ESPM, and Master's student in entrepreneurship and innovation by FEA-USP. Worked for more than a decade with graphic, service, process and systems design, creativity, innovation and startups from technology-based to creative economy, helping in the initial stages of dozens of innovative businesses. Was part of

the lead team at AWC program since 2018. Also works as a researcher, professor and mentor as well as head of design at the venture builder CAOS Focado.

7 .ABOUT THE AUTHORS & CREDITS

Acknowledgments and credits

Our thanks to TIM Institute, which for the past five years has maintained the AWC program, our inspiration in developing and applying early-stage startup methodologies. We also want to pay tribute to all our partners in this initiative, especially the University of São Paulo's Center for Entrepreneurship (NEU-USP) and CAOS Focado, for their extremely important contributions to the university's ecosystem, enabling us to offer more cutting-edge technology to society. We are grateful to the entire team who participated in the various programs and projects we have conducted over the years. They all bought into our dream of impacting early-stage entrepreneurship and contributed enormously to the thinking that has produced this methodology. We also thank all the students, mentors, entrepreneurs and board members with whom we have crossed paths and who have helped us develop the ideas, concepts and practices set out here to maturity. Finally, special thanks to Rodrigo Franco, who revised and designed this playbook, and brilliantly developed the structure of the shell presented here.





8 .FURTHER READING

Glossary

AGILE COACH

Agile coaches help to train teams in the Agile methodology and supervise the development of Agile teams to guarantee effective results. They are responsible for guiding teams during the implementation process. The coach serves as an objective player to help teams navigate common blockages and problematical points in the adoption process.

AGILE DEVELOPMENT

Agile development is the set of methodologies used to develop engineering projects within a conceptual framework called Agile development. An Agile project seeks the capacity to implement a new version of the solution at the end of each iteration, or Sprint, the stage in which the team re-assesses the priorities for the project and plans the next delivery. The fundamental idea behind it is minimizing risk through development.

BEACHHEAD MARKET

In his book *Disciplined Entrepreneurship: 24 Steps to a Successful Startup*, Bill Aulet, Managing Director of the Martin Trust Center for MIT Entrepreneurship, introduces the Beachhead Market concept as key to

any market entry strategy. In military parlance, a beachhead is a position on an enemy shoreline captured by troops in advance of an invading force. For Aulet, the Beachhead Market is the most important place from which to launch an invasion of the market because it is where the paying customers are to be found. It is normally a niche market but offers the possibility of expansion via entry into other adjacent markets.

BLUE OCEAN FRAMEWORK

The concepts of Blue Ocean Framework and Value Curve were first presented in three articles in *Harvard Business Review* by W. Chan Kim and Renee Mauborgne, and expanded in their book *Blue Ocean Strategy* (2005). A Value Curve is a tool that enables executives to visualize how their strategy is working in comparison with close competitors.

BUSINESS MODEL CANVAS (BMC)

The Business Model Canvas was proposed by Alexander Osterwalder, based on his earlier book, *Business Model Ontology*. It consists of nine segments that form the building blocks for the business model in a one-page canvas. A detailed explanation can be found in Osterwalder's *Business Model Generation*.

8 .FURTHER READING

Glossary

CUSTOMER DEVELOPMENT

The Customer Development methodology is a cornerstone of the Lean Startup movement and was a driver of the movement at its inception. US entrepreneur and academic Steve Blank was the main creative force in the development of this methodology.

CUSTOMER SEGMENT

A Customer Segment is a community of customers or companies to which the startup plans to sell products or services. Customer segments are one of the most important building blocks in the Business Model Canvas, and are usually the first block to be identified.

FLIPPED CLASSROOM

The Flipped Classroom is a pedagogical model that reverses the traditional model of classroom-based learning with a teacher and elements to be done for homework. Participants first watch short videos on the class content at home, and then meet in the classroom to do exercises and discuss projects with the instructor.

JOBS-TO-BE-DONE

The theory of Jobs-to-be-Done was developed in part as a complement to the theory of disruptive innovation, proposed by Clayton Christensen in his famous book, *The Innovator's Dilemma*. It is a tool used to evaluate the circumstances that arise during customers' lives and to investigate the problems they want or need to solve.

LEAN LAUNCHPAD

Lean LaunchPad is a methodology created by Steve Blank to test and develop business models based on intensive contact with customers. It is grounded in the scientific method and combines experiential learning with the three building blocks of the Lean Startup movement: Alexander Osterwalder's Business Model Canvas, Steve Blank's Customer Development Model, and Agile Engineering.

MINIMUM VIABLE PRODUCT (MVP)

The MVP is the version of the product that enables a full turn of the Build-Measure-Learn loop with a minimum amount of effort and the least amount of development time.

8 .FURTHER READING

Glossary

OBJECTION MATRIX

The Objection Matrix is a tool that maps all the strong objection points that may arise during a negotiation. Sellers can use it to prepare to surmount the objections mapped when they come up in conversation.

PRODUCT-MARKET FIT

Product-Market Fit simply means having a product that satisfies a real need of the market in which you operate. The term was coined by Marc Andreessen, founder of Netscape, among other companies, and currently working as an investor in Silicon Valley.

PROOF OF CONCEPT (PoC)

PoC refers to a practical model created to prove the theoretical concept established by a research project or technical article. It can also be considered an implementation, typically summarized or incomplete, of a method or idea executed to verify that the concept or theory in question can be profitably and usefully developed.

SALES FUNNEL

A representation of the stages a prospective customer goes through between making first contact with the company and making a first purchase. A sales funnel (or pipeline) is usually divided into three stages: top of funnel, middle of funnel and bottom of funnel.

SPRINT

Scrum is an Agile methodology for managing and planning software projects. In Scrum, projects are divided into typically monthly cycles called Sprints. A Sprint represents a Time Box in which a set of activities is to be completed. Agile methodologies of software development are iterative, meaning the work is divided into iterations, which are called Sprints in the case of Scrum.

SPRINT PLANNING

Sprint Planning is a Scrum meeting at which a Sprint is planned. It is usually divided into two parts: the first is concerned with what is to be developed, and the second with defining how this will be done.

8 .FURTHER READING

Glossary

SPRINT REVIEW

At the end of each Sprint, a Sprint Review Meeting is held for the team to show what they have accomplished during the Sprint. The meeting evaluates the project against the goals set for the Sprint at the Sprint Planning Meeting. Ideally the team will have achieved all the items in the Product Backlog included in the scope of the Sprint, but what really matters is achieving the overall objective of the Sprint.

VALUE PROPOSITION

The Value Proposition is one of the main building blocks in the Business Model Canvas. It describes what the solution offers the market in terms of gains and benefits for customers.

ZERO TO ONE

In *Zero to One: Notes on Startups, or How to Build the Future*, US entrepreneur and investor Peter Thiel recounts the business lessons learned by and from Silicon Valley startups. The hardest step for a startup, according to Thiel, is going from zero customers to customer number one.

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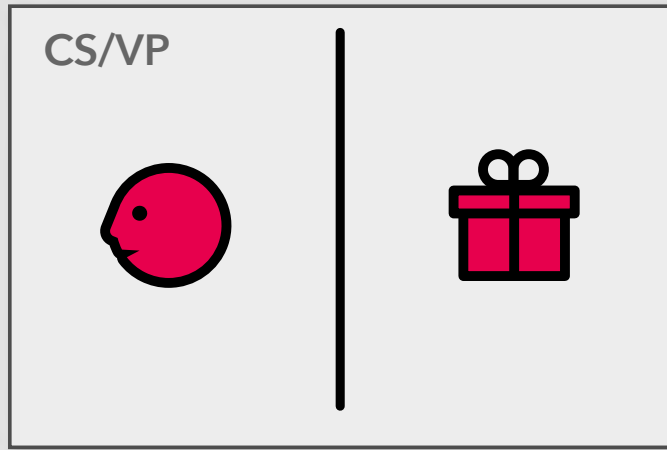
! 9. EXTRA

This extra material explores the structure of Decks and Records in each phase in greater depth, for readers interested in details of the tools and frameworks used in the method presented.

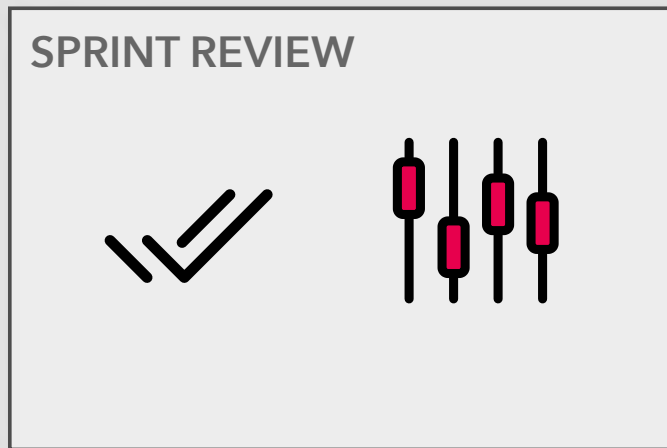
DEEP INTO

LET'S DO IT!

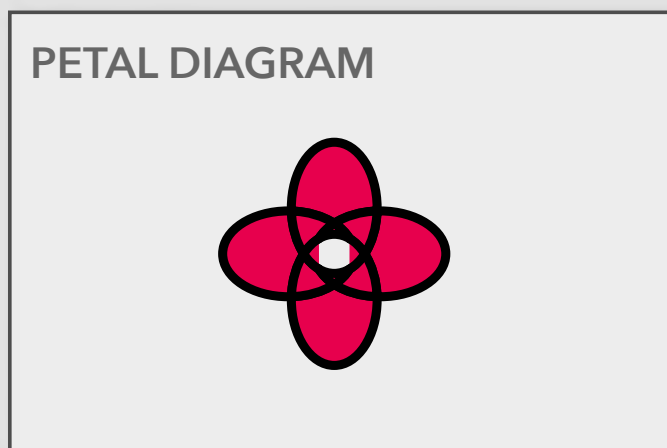
P PROBLEM TEST



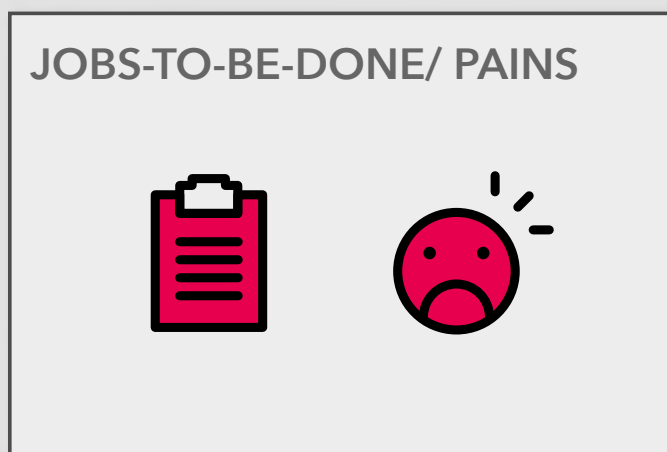
(i) **Customer Segment x Value Proposition Canvas:** A framework with two columns, one for the Customer Segment and the other for the Value Proposition. The founders are to list, add and remove elements from both columns. The more specific and lean they can be, the better the validation and focus on the Beachhead Market. It is important for the information in the Customer Segment column to be ranked in the same order as the information in the Value Proposition column.



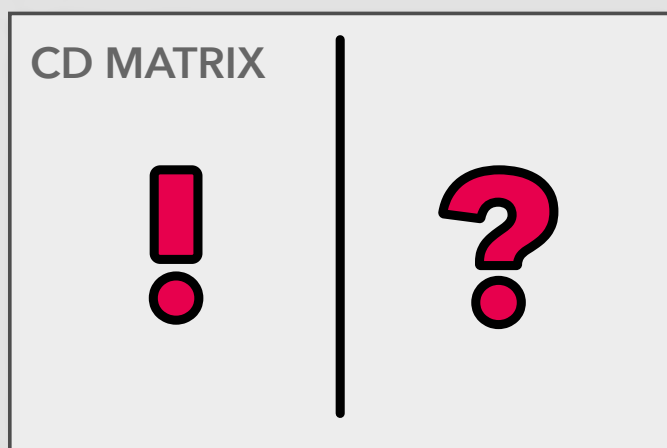
(ii) **Sprint Review:** A compilation of the most important activities and lessons of the latest Sprint.



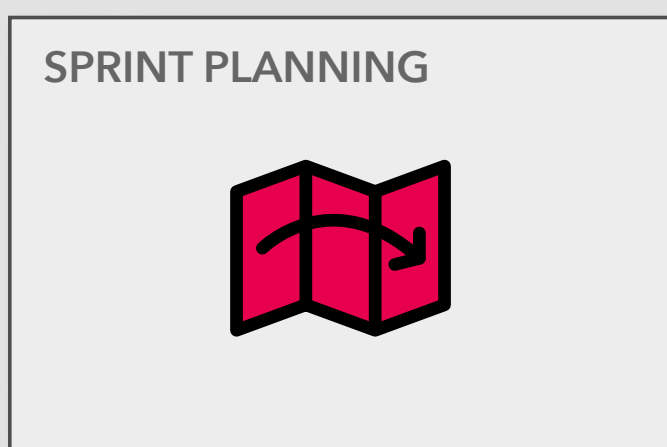
(iii) **Petal Diagram:** A multi-dimensional diagram showing all competitors in the same market.



(iv) **Jobs-to-be-done framework:** A framework showing the main jobs-to-be-done and pains in each customer segment identified. Its main function is to analyze non-superficially the real pains of the customer segment and validate them in each interview.



(v) **CD Matrix:** A two-column matrix for Certainties and Doubts. This matrix is central to the scientific analysis of the process. The flow of interviews should help convert doubts into certainties. Each interview also creates new doubts. The flow gradually builds up to the Beachhead Market.



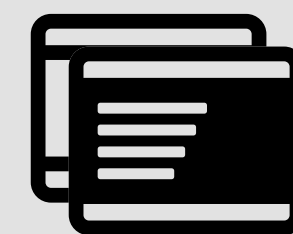
(vi) **Sprint Planning:** A space devoted to proposals for activities to be performed in the next Sprint.



DECKS

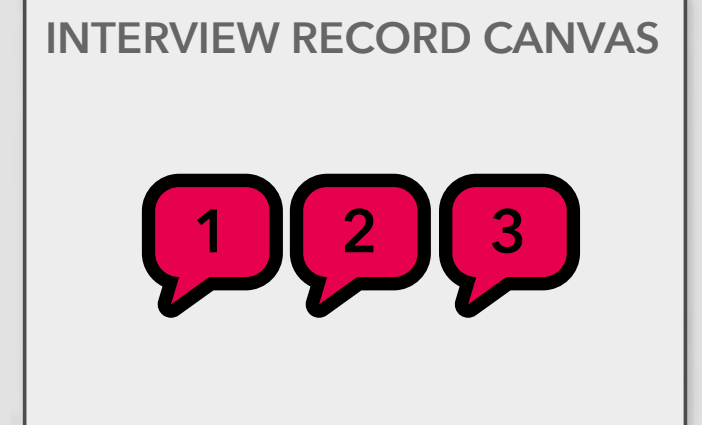


SPRINTS



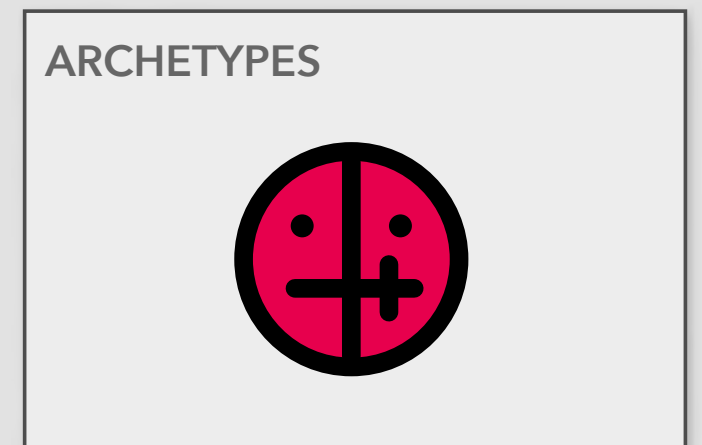
RECORDS

(i) **Interview Protocol:** A minimal structure containing hypotheses to be tested and doubts to be resolved in connection with a primary structure of questions to be put in a standard interview with a specific customer segment.



(ii) **Interview Record Canvas:** Each interview is to be recorded, with a minimum of information plus insights and the lessons learned from the conversation.

(iii) **Archetypes:** Idealized representations of customers, updated with each cycle and Sprint. The final Archetype should represent the customer "with hair on fire".





SOLUTION TEST

VP/FE

(i) Value Proposition x Function & Engineering Canvas: A framework with two columns, one for the Value Proposition and the other for Function & Engineering. The founders are to list, add and remove elements from both columns. The more specific and lean they can be, the better the experiments and the faster they will achieve convergence to a Critical Function Prototype. The information in the Value Proposition column should be ranked in the same order as the information in the F&E column.

SPRINT REVIEW

(ii) Sprint Review: A compilation of the most important activities and lessons of the latest Sprint.

BLUE OCEAN FRAMEWORK

(iii) Blue Ocean Framework: A chart comparing the startup's Value Proposition and features with those of its competitors. The point is to find an opportunity to maximize Value Propositions or features not offered adequately by the competition.

REPRESENTATIONS & PROJECTS

(iv) Representações/Projetos de Funcionalidades & Engenharia: Input for technical representation and materialization of prototypes that relates to value propositions. Here, technical choices and images of engineering projects are also presented.

TIE-UP MATRIX

(v) Tie-up Matrix: Matrix that ties hypotheses to experiments and validation metrics. The founders should use it to keep the focus on Scientific Entrepreneurship, organizing hypotheses and crafting experiments designed to validate or refute them.

SPRINT PLANNING

(vi) Sprint Planning: A space devoted to proposals for activities to be performed in the next Sprint.



DECKS



SPRINTS



RECORDS

(i) Experiment Protocol & Records: Tools that support experiment planning and recording in line with the Tie-up Matrix. "Ask/try/do" suggestions are part of the framework.

EXPERIMENT PROTOCOL & RECORDS

(ii) Napkin Solution: A set of flows and simple non-scalable technical drawings. A simple enough solution to be executed in under 24 hours.

NAPKIN PROTOTYPE

(iii) Low-Fidelity Solution: A set of flows and technical drawings for primary solutions that permit small builds using fast prototyping techniques to validate relational aspects with the user. May include evidence of the prototype's evolution, such as photographs and other information.

LOW-FIDELITY PROTOTYPE

(iv) Critical Function Solution: A set of flows and technical drawings representing the first version of the product. Not a "finished" solution but a solution with a minimum of features the customer is already willing to pay for. These records should comprise technical drawings with components and engineering designs duly organized to deliver the value(s) validated in previous phases. May include evidence of the prototype's evolution, such as photographs and other information.

CRITICAL FUNCTION PROTOTYPE

FE/EF

(i) Features & Engineering x Operations & Economics Canvas: A two-column framework with a column for Function & Engineering and a column for Operations & Economics. The founders are to list, add and remove elements from both columns. The more specific and lean they can be, the simpler the business model and the less overall uncertainty there will be about the project.

SPRINT REVIEW

(ii) Sprint Review: A compilation of the most important activities and lessons of the latest Sprint.

BETS OF THE COMPETITION

(iii) Bets of the competition: A matrix analyzing market bets in which each competitor is analyzed by a good choice and a wrong choice.

SPRINT PLANNING

(iv) BMC: A simplified version of the Business Model Canvas in which relationships are expanded into channels and a value delivery operation.

METRICS MATRIX

(v) Metrics Matrix: A mapping of experiments to validate quantitative financial metrics, such as price, cost and total addressable market (TAM).

BUSINESS MODEL CANVAS

(vi) Sprint Planning: A space devoted to proposals for activities to be performed in the next Sprint.



DECKS



SPRINTS



RECORDS

B

BUSINESS MODEL TEST

(i) Market Size Calculation: A spreadsheet with hypotheses and estimates that represent the size of the market attacked. Calculation of total addressable market (TAM), serviceable available market (SAM) and target market.

MARKET SIZE

(ii) Basic Pricing Study: Comparisons of what people pay now with wallet size in customer segments, and pricing tests conducted previously by the founders.

PRICING

(iii) Initial Cost Structure: A list of fixed and variable costs in the startup's first few months. It is important to include everything that is extremely necessary to get up and running. Fat of all kinds should be cut.

INITIAL COSTS

(iv) Initial income statement: Consolidated income statement for the first six months of operations, including sales estimates and minimum cost operation. Helps decide whether a fresh capital injection should be pursued.

INITIAL INCOME STATEMENT

M

MARKET TEST

FE/EF

(i) Operations & Economics x Customer Segment Canvas: A framework with two columns, one for Operations & Economics and the other for Customer Segment. The founders are to list, add and remove elements from both columns. The more specific and lean they can be, the simpler the business model and the less the overall uncertainty about the project.

SPRINT REVIEW

(ii) Sprint Review: A compilation of the most important activities and lessons of the latest Sprint.

PETAL DIAGRAM v2

(iii) Petal Diagram v2: The same diagram as in cycle P but with dimensions focusing on competitors as adjacent solutions that can attract customers to the startup's solution. Finding the adjacent solutions' customers means finding potential customers for this solution.

SALES FUNNEL

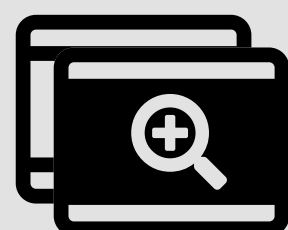
(iv) Sales Funnel: A chart with a minimum of three phases – prospecting, qualifying and closing. The purpose is to keep track of funnel progress and conversion.

OBJECTION MATRIX

(v) Objection Matrix: Survey of hypotheses, confirmations and strategies to address objections during sales.

SPRINT PLANNING

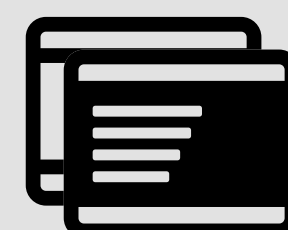
(vi) Sprint Planning: A space devoted to proposals for activities to be performed in the next Sprint.



DECKS



SPRINTS



RECORDS

(i) Memorandum of Understanding (MoU):

A minimal structure to present a document that shows a real intent to buy the product or service within a specified timeframe. It is possible to enter into a MoU for the execution of a PoC (proof of concept).

MoU



(ii) Proof of Concept Proposal (PoC):

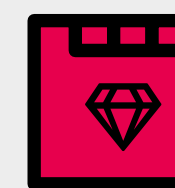
A contract to execute an initial project that proves the credibility of the promise to deliver the Value Proposition. Low value that sustains the initial costs.

PoC CONTRACT



(iii) Commercial Proposal: Proposing a pilot project and including a timetable and success metrics. It may be important to include a clause offering a discount aligned to the real value of the solution shortly after the pilot.

COMMERCIAL PROPOSAL



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