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Hypothesis-Driven Entrepreneurship: The Lean Startup

Startups are new organizations created by entrepreneurs to launch new products. A startup's founders typically confront significant resource constraints and considerable uncertainty about the viability of their proposed business model.

A hypothesis-driven approach to entrepreneurship maximizes, per unit of resources expended, the amount of information gained for resolving such uncertainty. When following this approach, an entrepreneur translates her vision into falsifiable business model hypotheses, and then tests those hypotheses using a series of **minimum viable products** (MVPs). Each MVP represents the smallest set of activities needed to disprove a hypothesis.

Based on test feedback, an entrepreneur must decide whether to *persevere* with her proposed business model; **pivot** to a revised model that changes some model elements while retaining others; or simply *perish,* abandoning the new venture. She repeats this process until all of the key business model hypotheses have been validated through MVP tests. At this point, the startup has achieved **product-market fit**: it has a product that profitably meets the needs of the target market's customers, and can commence scaling.

A hypothesis-driven approach helps reduce the biggest risk facing entrepreneurs: offering a product that no one wants. Many startups fail because their founders waste resources building and marketing products before they have resolved business model uncertainty. By contrast, early-stage entrepreneurs who follow a hypothesis-driven approach do not view growth as their primary objective. Instead, their goal is to learn how to build a sustainable business. By bounding uncertainty before scaling, the hypothesis-driven approach optimizes use of a startup's scarce resources.

Entrepreneur Eric Ries coined the term **lean startup** to describe organizations that follow the principles of hypothesis-driven entrepreneurship.[1] In this context, "lean" is often misinterpreted as meaning that a startup is bootstrapping, keeping costs to a bare minimum and relying only on its founders' personal resources. Rather, lean startups espouse the same objective as firms that embrace lean manufacturing: avoiding waste. A lean startup may eventually invest enormous amounts of capital in customer acquisition or operational infrastructure—but only after its business model has been validated through fast and frugal tests.

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Time is often an entrepreneur's scarcest resource; *speed matters.* Like lean manufacturing, the lean startup method and its intellectual antecedents—entrepreneur Steve Blank's customer development process, agile software development, and design thinking—accelerate the tempo of innovation by relying on rapid iteration, small batches and short cycle times.[2]

This note's next section explains, step-by-step, the process of formulating hypotheses, testing them, and then acting on test feedback. The note's final section asks what settings are best suited for hypothesis-driven entrepreneurship. Several appendices on special topics follow, along with a glossary of key terms (each introduced in the note's main text in **bold italics**) and suggestions for further reading.

Hypothesis-Driven Entrepreneurship: Process Steps

In this section, we examine the process of hypothesis-driven entrepreneurship and explore the rationale for lean startup practices. **Figure 1** depicts the process steps. **Appendix A** contrasts the lean startup method with three other approaches often used to launch startups:

- **Build-It-And-They-Will-Come** bypasses customer feedback and demand validation, relying solely on a founder's vision for initial guidance, and then focusing an engineering-dominated team's energy on turning the founder's vision into reality.

- **Waterfall Planning** divides product development work into phases (e.g., design, coding, testing) that are completed in sequence by different organizational units, with each new phase commencing only when the prior phase's work passes a formal review.

- **Just Do It!** eschews a strong product vision or detailed plan, relying instead upon an improvisational approach that adapts a startup's product and business model based on feedback from resource providers and customers.
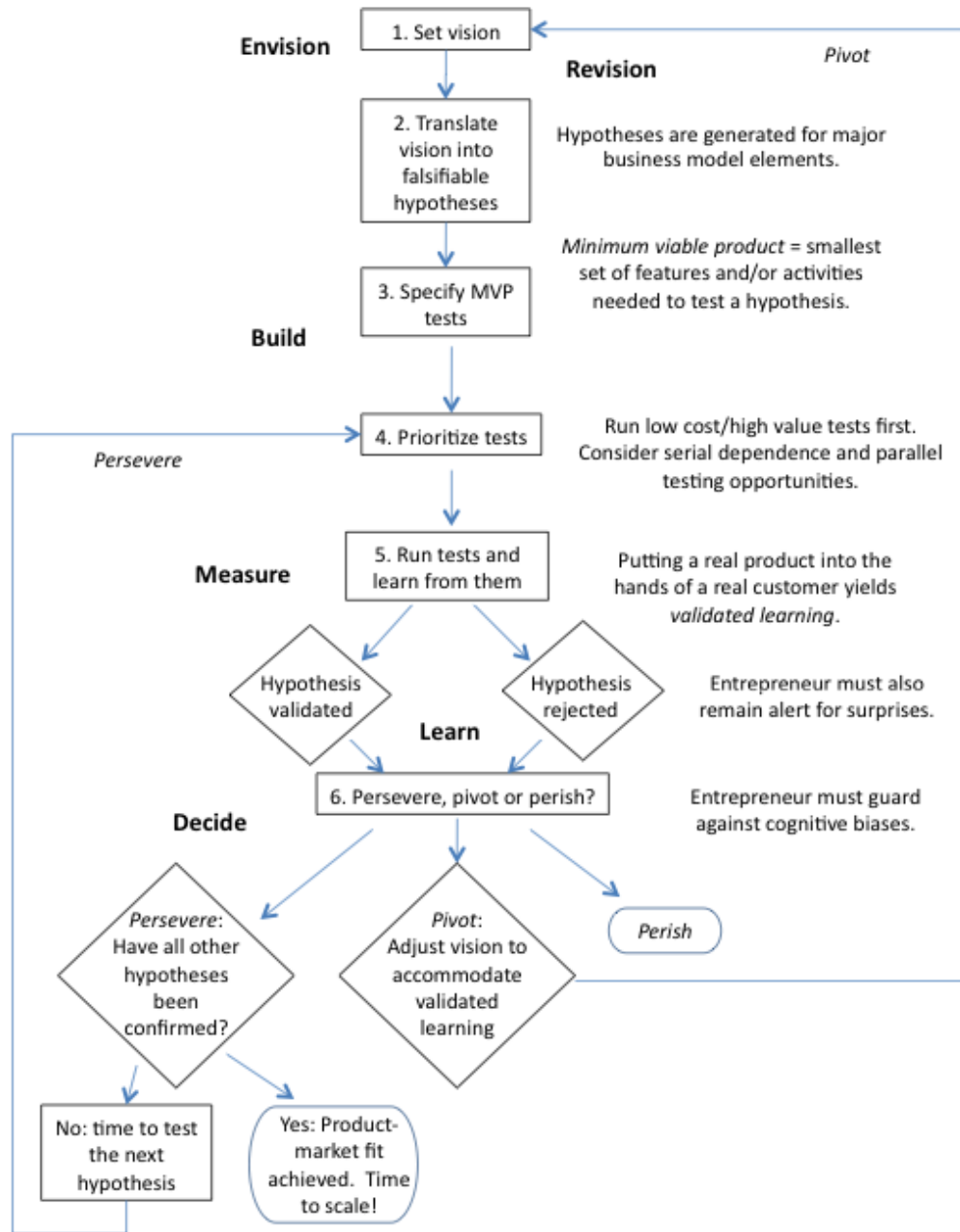
The Build-It-And-They-Will-Come and waterfall planning approaches both provide initial direction, but make limited use of feedback to subsequently correct course. By contrast, the Just-Do-It! approach embraces feedback, but a lack of initial direction means that some adaptations may turn out to be costly and time-consuming detours. The lean startup approach, by testing a comprehensive set of business model hypotheses, helps ensure that pivots—feedback-induced adaptations—are efficient and effective.

Step 1: Develop a Vision

Before an entrepreneur can generate business model hypotheses, he must have a vision for the problem that his startup will address and a potential solution for that problem. This initial step of developing a vision, also called *ideation,* is less subject to "by-the-book" instruction than the other stages in the lean startup launch process. Ideation is a broad topic, beyond the scope of this note, but we offer a few guidelines for generating an entrepreneurial vision in **Appendix B**.

Step 2: Translate the Vision into Hypotheses

Next, having developed a vision, the entrepreneur translates it into falsifiable business model hypotheses. A **business model** is an integrated array of distinctive choices specifying a new venture's unique customer value proposition and how it will configure activities to deliver that value and earn sustainable profits.[3] These choices, summarized in **Figure 2**, can be grouped into four elements that

Figure 1: Hypothesis-Driven Entrepreneurship Process Steps

Envision

1. Set vision

Revision *Pivot*

2. Translate vision into falsifiable hypotheses

Hypotheses are generated for major business model elements.

3. Specify MVP tests

Build

Minimum viable product = smallest set of features and/or activities needed to test a hypothesis.

4. Prioritize tests

Persevere

Run low cost/high value tests first. Consider serial dependence and parallel testing opportunities.

5. Run tests and learn from them

Measure

Putting a real product into the hands of a real customer yields *validated learning*.

Hypothesis validated

Hypothesis rejected

Learn

Entrepreneur must also remain alert for surprises.

6. Persevere, pivot or perish?

Decide

Entrepreneur must guard against cognitive biases.

Persevere: Have all other hypotheses been confirmed?

Pivot: Adjust vision to accommodate validated learning

Perish

No: time to test the next hypothesis

Yes: Product-market fit achieved. Time to scale!

Source: Casewriters.

Figure 2: Summary of Business Model Questions

Customer Value Proposition	**Go-To-Market Plan**
• What *unmet needs* will the venture serve? • Which *customer segments* will it target? • Will it emphasize *differentiation* or *low cost?* • Will it serve a *new* or *existing* market? • What will be the *minimum viable product* at launch? The *roadmap* for adding features? • Who will provide *complements* required for a *whole product solution?* On what terms? • How will the product be priced? Does *skimming* or *penetration pricing* make sense? • Can the venture leverage *price discrimination* methods? *Bundling? Network effects?* • What *switching costs* will customers incur? What is the expected *life of a customer relationship*? • Relative to rivals' products, how will customers' *willingness to pay* compare to their *total cost of ownership*?	• What mix of *direct* and *indirect channels* will the venture employ? What margin and/or exclusive rights will channel partners require? • Given expected customer *lifetime value* (LTV), what *customer acquisition cost* (CAC) will the venture target? • What mix of free and paid *demand generation methods* will the venture employ? What will be the shape of its *customer conversion funnel*? The CAC for each paid method? • If the venture relies on free demand generation methods, what will be its *viral coefficient?* • Will the venture confront a *chasm* between early adopter and early mainstream segments? If so, what is the plan for crossing the chasm? • Does the venture have strong incentives to race for scale due to network effects, high switching costs, or other first mover advantages? Do scalability constraints and late mover advantages offset these incentives?
Technology & Operations Management	**Cash Flow Formula**
• What activities are required to develop and produce the venture's product? • Which activities will the venture perform in-house and which will it *outsource*? • Who will perform outsourced activities, and under what terms? • What are the *cost drivers* for key activities? Can the venture exploit *scale economies* in production by substituting fixed for variable costs? • Will the venture create any valuable *intellectual property*? If so, how will it be kept proprietary? • Are there other *first mover advantages* in technology & operations (e.g., preemption of scarce inputs)? *Late mover advantages* (e.g., reverse engineering)? • Given capacity and hiring constrains, can the venture scale operations rapidly?	• What *contribution margin* will the venture earn? • What *fixed costs* will the venture incur, and what *breakeven capacity utilization and sales volume* does this imply? • What share of the *total addressable market* does breakeven sales volume represent? • How much *investment* in working capital and property, plant & equipment will be required per dollar of revenue? • How will contribution margins, fixed costs, and investment/revenue ratios change over time? • Given projected growth, will be the profile of the venture's *cash flow curve*? How deep is the curve's trough, and when will it be reached?

Source: Eisenmann, "Business Model Analysis for Entrepreneurs," HBS 812-096.

define the new venture's customer value proposition, technology and operations plan, go-to-market strategy, and cash flow formula.

Falsifiability. For each business model element, an entrepreneur formulates a set of falsifiable hypotheses. As with the scientific method, a hypothesis is *falsifiable* when it can be rejected through a decisive experiment. According to Ries, absent a falsifiable hypothesis, "if the plan is to see what happens, a team is guaranteed to succeed—at seeing what happens—but won't necessarily gain validated learning. This is one of the most important lessons of the scientific method: if you cannot fail, you cannot learn."[4]

For instance, it is almost impossible to fail with a go-to-market hypothesis that says, "Our product will spread through word-of-mouth." As long as marketing trials reveal any non-zero rate of word-of-mouth referrals, then this vaguely worded statement will prove true, whether the rate is very low or very high. By contrast, "Our viral coefficient over the next twelve months will exceed 0.5" is a much better hypothesis—one that could be rejected.

Whenever possible, entrepreneurs should generate hypotheses that require quantitative metrics for validation. Appropriate metrics will depend on the hypothesis to be tested, but entrepreneurs who follow the lean startup approach invariably monitor their customer *conversion funnel* closely. A conversion funnel represents a multi-step process through which a prospect may eventually be converted into a loyal customer. The process resembles a funnel, in the sense that fractions of prospects/customers fail to pass through each sequential step (e.g., only X% of prospects exposed to marketing programs become new customers; only Y% of new customers become repeat purchasers; etc.). Entrepreneurs combine conversion funnel data with other metrics to estimate the average lifetime value (LTV) of variable contribution margin earned from a typical customer of a given type, net of the average customer acquisition cost (CAC) for that type.

Entrepreneurs often use *cohort analysis* to track trends in LTV/CAC, conversion funnel performance, and other metrics. A cohort encompasses a set of customers acquired during a specific period of time, often through the same marketing method (e.g., customers acquired in June 2013 via Google AdWords). Analyzing metrics for successive similar cohorts (e.g., 60-day subscriber retention rates for cohorts acquired via telesales in March, April, and May) indicates whether hypotheses about actions to improve performance are valid. Likewise, *A/B testing* is frequently employed to facilitate rigorous hypothesis testing. A/B tests divide a set of similar prospects or customers into a *control group* that experiences a status quo product and a *treatment group* that experiences a product with at least one modified element. A/B testing is used to determine whether modifications yield statistically significant performance improvements.

Comprehensiveness. At a venture's outset, its founder need not develop detailed hypotheses for all elements of her business model. Business model analysis is an iterative and ongoing process. Due to serial dependence between business model elements, some assumptions simply cannot be analyzed unless others are addressed first. For example, until a team has formulated hypotheses regarding what customer segments they will target, they cannot generate falsifiable hypotheses regarding customer acquisition costs.

While entrepreneurs should avoid over-investing in detailed analysis of downstream topics, they nevertheless should make a quick pass through all elements of their business model early in the process of evaluating an opportunity. Back-of-the-envelope analysis is adequate at this stage. The goal is to surface potential "deal-breaker" issues early—in particular, any lack of internal consistency between model elements—and to stimulate a search for ways to address them.

Step 3: Specify MVP Tests

For an entrepreneur confronted with uncertainty and controlling limited capital and team resources, it is essential to maximize learning per unit of time and effort expended. The best way to accelerate learning is, in the words of investor and Y Combinator founder Paul Graham, to "launch early and often."[5] Uncertainty can be resolved to some extent through traditional market research techniques such as focus groups and customer surveys.[6] However, entrepreneurs get far more reliable feedback when they put a real product in the hands of real customers in a real world context.

How can one launch early and often? By specifying a ***minimum viable product*** (MVP): the smallest set of features and/or activities needed to complete what Ries calls a "Build-Measure-Learn" cycle and thereby test a business model hypothesis.[7] By launching a series of MVPs, an entrepreneur reduces product development batch sizes and cycle times, yielding two benefits.[8] First, short product development cycles accelerate feedback: entrepreneurs learn about customer requirements before investing too much time in building features no one will use. Second, releasing feature revisions in small batches makes it easier to interpret test results and to diagnose problems. If only a few aspects of a product have changed, it is easier to find bugs.

Minimum viable products may be "minimal" in one or both of two ways, compared to the product an entrepreneur might expect to eventually offer when scaling aggressively. MVPs may constrain *product functionality* and/or *operational capability*. With constrained product functionality, customers experience only a subset of the features envisioned for subsequent versions of the product. With constrained operational capability, a startup relies on temporary and makeshift technology to deliver the MVP's functionality. The simplest MVPs take the form of ***smoke tests*** that radically constrain both functionality and operations, testing demand for a product that does not yet exist. **Appendix C** offers some guidance on how and when to use web landing pages, letters of intent, and other smoke tests.

Constrained Functionality. IMVU, a startup whose users socialize in a 3D virtual world, tested its concept with an MVP that constrained functionality. IMVU's team did not initially provide early adopters with the ability to have their avatars walk from place to place, which would have required extensive programming. Instead, they tested an MVP that permitted instantaneous "teleporting" between locations—an easier programming task. This allowed the team to more quickly test demand for what they perceived to be IMVU's core functionality: social communications.[9]

In general, entrepreneurs should constrain MVP product functionality when:

- Early adopters are expected to be willing to buy a product that offers "need to have" features (e.g., social communication for IMVU), despite that product's lack of costly-to-develop "nice to have" features (e.g., ambulation for IMVU).

- Some segments of early adopters (e.g., Group A) would never use certain costly-to-develop features that might be deemed "need to have" by other early adopter segments (e.g., Group B). Intuit, for example, tested its smartphone application for income tax preparation, SnapTax, by initially offering a version that met the needs only of California residents with one-page 1040EZ returns (Group A), eschewing the functionality required to serve all other states' residents and Californians with more complex returns (collectively, Group B).[10]

Specifying MVP functionality poses a special challenge when the long-term viability of an innovative new product's business model requires widespread adoption by mainstream customers.

Such products are often initially targeted to potential early adopter segments whose needs may differ from those of mainstream customers.[11] Likely early adopters may be "power users" who desire advanced features. To ensure sales to early adopters, it can be tempting to specify MVPs that include sophisticated features that might be deemed irrelevant by mainstream customers—or worse, might confuse mainstream customers and position the new product in their minds as "not for me."

Dropbox's team avoided this temptation. Relentlessly focused on preserving product simplicity to facilitate mass-market penetration over the longer term, they conducted usability tests to make sure that mainstream consumers could download and configure Dropbox, even though such consumers were not likely to be early adopters. The team also decided to forego features that were frequently requested by power users, such as the ability to automatically synchronize a PC's entire "My Documents" folder. Including such advanced features might have compromised ease-of-use, making it more difficult to attract mainstream customers in the future.[12]

Constrained Operations.   The technology used to deliver the MVP's functionality is often temporary and makeshift relative to the operational capabilities required for scaling. For example, when they were investigating demand for an online social question-and-answer service, Aardvark's founders relied on human operators rather than computer algorithms to identify individuals in a user's social network best able to answer questions.[13] With Aardvark's "mechanical Turk" MVP, users posed questions using an SMS interface, and then received SMS answers minutes or hours later from people in their extended social network. Users had no way of knowing that Aardvark employees—not computers—had routed questions to the right people. With this temporary, ersatz solution, Aardvark's team was able to test demand and learn a great deal about customer needs *before* spending time and money developing routing algorithms. The team avoided waste, because algorithms they might have built before conducting consumer tests would almost certainly have required extensive revision once consumer preferences were better understood.

Operational requirements are dictated by product functionality. Consequently, entrepreneurs should generally employ MVPs with constrained operational capability whenever they are still defining their product's core functionality. Likewise, entrepreneurs should constrain operational capability when it would be costly to acquire such capability and when relying on a temporary, makeshift solution does not unduly impact customers' ability to provide useful feedback. Aardvark's MVP, for example, met these criteria: due to the time required for respondents to receive a question and compose an answer, users would naturally expect some delay in receiving an response, even when using the finished, algorithmically-driven product. Hence, the extra time required to have human operators route questions through Aardvark's MVP had little impact on test subjects' experiences.

Using a Series of MVPs. Rent the Runway (RTR), an online service that rents designer dresses, illustrates how entrepreneurs can use a series of MVPs to improve their product and validate key business model assumptions in an iterative manner. For their first MVP tests, RTR's founders borrowed dresses and invited female undergraduates to two events—"trunk shows"—where they could rent the dresses. At the first trunk show, about one-third of 125 attendees rented dresses. From this test, the founders learned that women would rent previously worn dresses and would return them on time and undamaged. They also collected information about which brands, sizes, styles, colors and price points were popular with early adopters.

However, the first test had not addressed a key uncertainty: would women rent dresses without being able to try them on, a requirement with online rental? At their second campus trunk show, women could view but not try on the dresses. About three-quarters rented in this trial, which offered more of the styles that had been popular in the first test.

While RTR's first two MVP tests had validated several important hypotheses, they had done so by putting women in a social setting that was unlike the solitary experience they would have when renting online. To address this concern, the founders devised a third MVP test to validate demand under more realistic conditions. They emailed PDFs of dresses to a sample of women who had asked to be notified about RTR's launch by registering on the site's landing page. This PDF trial garnered a 5% rental rate—far lower than earlier tests, but above the predetermined threshold required for a viable business model.

Constraining Customer Sets. Whether they constrain functionality or operations, MVPs are typically tested with a greatly reduced customer set, when compared to the pool of prospects that a scaling startup would target. Acquiring a large numbers of customers before validating business model hypotheses can be expensive and can exacerbate damage to a startup's brand if a subsequent pivot confuses and alienates the early adopters. Instead, MVPs should be tested with just enough customers to provide reliable feedback. In the case of quantitative tests, this implies samples that are large enough to yield statistically significant results, but no larger.

False Positive and Negative Results. When specifying MVPs, entrepreneurs should consider the risk that their test design may yield either a *false positive* or a *false negative* result. A false positive indicates that a hypothesis has been confirmed when in reality it is not valid. When evaluating demand, false positive results are sometimes observed when entrepreneurs recruit enthusiasts—individuals with an unusual level of passion for the product category—as test subjects. If test subjects' preferences are not representative of those of the bulk of prospects who will be targeted as a startup scales, then high rates of engagement observed in an MVP test may not be meaningful indicators of demand.

A false negative indicates that a hypothesis has been disconfirmed when in reality it is valid. False negative results regarding demand for a new product are more likely to occur with a badly built MVP or a poorly executed test. For example, if test subjects expect web pages to load quickly, they might abandon a sluggish, badly built MVP, even if they perceived the new product's value proposition to be otherwise appealing.

Using a series of MVPs allows an entrepreneur to iterate and improve a new product's design in response to early test results, and thereby reduces the odds of false negative results in later tests. For example, if Rent the Runway's founders had proceeded directly to the PDF test mentioned above, instead of conducting two trunk show trials first, it is possible that they would have offered the wrong dress assortment in the PDF test. In this counterfactual scenario, RTR's team might have observed a false negative from the PDF test: a low rental rate representing an indifferent reaction to the dress selection offered, rather than rejection of the basic concept of online dress rental.

Concerns About MVPs. Entrepreneurs often express two concerns about "launching early and often" with MVPs:

- **Exposure to Idea Theft.** Some entrepreneurs worry that an early launch will exacerbate the risk of competitors stealing their concept. In most instances, however, the value of early feedback greatly outweighs any risk of accelerating rivals' entry. Furthermore, ideas are worthless unless executed, and the iterative MVP methodology helps a startup improve its execution and time-to-market performance. In general, both entrepreneurs and corporate managers spend too much time worrying about competitors and not enough time understanding potential customers.

- **Reputational Risk.** Other entrepreneurs cite the reputational risk of launching an MVP that may have limited features and/or have bugs. The MVP testing approach deliberately limits the target customer base to the minimum scale necessary to rigorously validate hypotheses, and thereby mitigates the reputational impact of any quality problems. Using a different brand name for MVP tests can sometimes also diminish reputational risks.

Step 4: Prioritize Tests

After generating business model hypotheses and specifying MVPs to test them, an entrepreneur must prioritize the tests, deciding how to sequence them.

As a general principle, an entrepreneur should give priority to tests that can eliminate considerable risk at a low cost. An example would be a patent search, which often costs less than $2,000. Litigation over alleged patent infringement can shut down a startup. If a lawsuit is a real possibility, then it makes no sense to start building and marketing a product until a patent search is completed. Likewise, when business model elements are serially dependent, then an entrepreneur will have little choice about how to sequence experiments. For example, hypotheses about a go-to-market plan or a technology sourcing strategy usually will depend on a startup's customer value proposition.

Parallel Testing. Sometimes, however, entrepreneurs will have the option to pursue tests in parallel, because the relevant hypotheses are not serially dependent. For example, the founders of Rent the Runway had to confirm not only that women would rent dresses, but also that designers would make inventory available to RTR. It was by no means obvious that designers would support rentals, since they could conceivably cannibalize retail sales. In response to this concern and in parallel with the trunk show tests of consumer demand mentioned above, RTR's founders conducted a series of interviews to understand designers' priorities.[14] After a negative initial reception from many designers, the founders were able to craft a value proposition that focused on the marketing benefits of exposing designers' brands to young women who could not yet afford retail purchases.

There are tradeoffs involved with parallel testing. On the one hand, if an entrepreneur tests hypotheses A and B simultaneously, and A is decisively rejected in ways that render B irrelevant, then the effort expended on testing B has been wasted. On the other hand, if both hypotheses are validated, then the startup can gain a time-to-market edge by testing A and B in parallel, rather than in series. When a startup faces a threat of competitive preemption—especially in a winner-take-all market—parallel testing can confer benefits.

Step 5: Learn from MVP Tests

In the next stage of the lean startup process, entrepreneurs evaluate feedback gained from MVP tests. As noted above, they should ask whether the result might be a false positive or false negative. Entrepreneurs also should be on guard against two other potential sources of error. The first comes from customers, whose stated preferences do not always correspond to their true preferences. Consider the experience of Facebook in launching two new features: Beacon, which posted information about users' purchase transactions (e.g., their Netflix rentals) and News Feed.[15] Both features generated protests from Facebook users. Yet, the former was dropped while the latter was retained. Why? Because Facebook had data to show that users were engaging with News Feed but not Beacon. Facebook's management acted on users' *revealed* rather than *stated* preferences.

The second source of potential error in interpreting test feedback comes from the entrepreneur herself. Extensive psychological research shows that humans are vulnerable to cognitive biases: they

see what they *want* to see, and they see what they *expect* to see. In **Appendix D**, we describe several cognitive biases and how they can lead an entrepreneur to misinterpret MVP test results.

In addition to collecting the data required to confirm or disprove hypotheses, entrepreneurs should be on the lookout for surprises as they conduct MVP tests. Surprises come in two forms:

- **Unexpected test results**. When using a new product, customers frequently behave in unanticipated ways. PayPal, for example, was initially designed to allow Palm Pilot users to exchange money electronically. To generate interest for this application, the PayPal team built a demonstration website. The website quickly became far more popular than the Palm Pilot application. In response, PayPal's team abandoned its Palm Pilot product and focused exclusively on the website.[16] Unexpected insights about customer behavior may come from tracking quantitative measures, or they may come from qualitative interactions with early adopters. For example, soon after PayPal launched its website, many eBay users contacted PayPal customer service asking if they could display the PayPal logo on their eBay auction listings. PayPal's managers pivoted to this opportunity.[17]

- **Information not derived from testing**. An entrepreneur may also revise business model hypotheses based on other sources of unexpected information, beyond test results. Such sources include competitors' announcements, regulators' actions, and news about new technologies. Soon after PayPal's launch, for example, executives at banks and credit card companies told PayPal's team that fraud was going "to eat them for lunch."[18] This primed technical co-founder Max Levchin to keep tabs on fraudulent transaction rates.

As illustrated by the PayPal example, entrepreneurs should savor surprises. If they mechanically monitor only the data generated to test hypotheses, then founders may miss opportunities or get blindsided by unforeseen threats.

Step 6: Persevere, Pivot, or Perish

After evaluating MVP test results and other market feedback, an entrepreneur must decide whether to persevere, pivot, or perish.

Persevere. If the MVP validates the business model hypothesis and other feedback does not prompt a shift in direction, then the entrepreneur perseveres on his current path, either testing remaining hypotheses or—if all hypotheses have been validated—preparing to scale.

Pivot. If the MVP test rejects the business model hypothesis or if it validates the hypothesis, but other feedback indicates that greater opportunity lies elsewhere, then the entrepreneur may elect to *pivot*. In basketball, a pivoting player keeps one foot planted while moving the other. For startups, the same principle holds: a pivot changes some business model elements while retaining others (see **Appendix E** for a typology of pivots and examples of each type). In particular, core aspects of the startup's original vision are typically retained, for example, a commitment to solving a broad problem, to serving a certain customer segment, or to employing a proprietary technology. Consistent with this, Ries defines a pivot as changing strategy while retaining one's original vision.[19]

Pivoting is neither a goal nor something to be avoided. While pivoting can be costly and disruptive, failing to pivot when assumptions are known to be flawed can be fatal.

Perish. If an MVP test decisively rejects a crucial business model hypothesis, and the entrepreneur cannot identify a plausible pivot, then she should shut down her business.

Step 7: Scaling and Ongoing Optimization

If an entrepreneur has validated all key business model hypotheses, then he has achieved **product-market fit**.[20] Product-market fit means that the venture has the right product for the market: one with demonstrated demand from early adopters and with solid profit potential. This in turn implies that the venture can deliver adequate value to all relevant parties: employees will join; customers will buy the product at the price being offered; partners will be motivated to provide technology and distribution; and investors will be able to earn adequate returns. It is time to scale, to invest aggressively in customer acquisition and to amass the additional resources required—staff and infrastructure—to serve a rapidly growing customer base.[21] **Appendix F** explains why startups should avoid premature scaling.

Entrepreneurs should continue to utilize hypothesis-testing methods even after confirming their business model assumptions. The purpose of these tests shifts from business model *validation* to business model *optimization*. In the spirit of kaizen—continuous improvement—optimization through rigorous experimentation never ends.

Of course, startups may still need to—or choose to—pivot after they have achieved product-market fit. However, because the costs of doing so are much greater with a scaled-up organization, entrepreneurs are only likely to pivot in response to major and unexpected environmental changes that either disrupt business model elements or present unusually attractive new opportunities.

Limits to Lean Startup Methods

As a process that avoids waste and speeds time-to-market, the hypothesis-driven approach is broadly applicable to many types of new ventures—even those for which resources are readily available, such as units of deep-pocketed large corporations (see **Appendix G** for a discussion of such settings). There are, however, some situations in which the lean startup process yields fewer advantages, in particular: when mistakes must be limited; when uncertainty about customer demand is low; and when long product development cycles preclude launching early and often. In these situations an entrepreneur should modify lean techniques or seek an alternate development path.

When Mistakes Must be Limited

A hypothesis-driven approach relies on the ability to make and learn from mistakes. However, new ventures do not always operate in environments where mistakes are tolerable. Three such situations are especially salient: when there is no post-launch ability to correct mistakes; when mistakes would impact customers' mission-critical activities; and when there is limited societal tolerance for mistakes.

For example, once an unmanned interplanetary mission is launched, its planners have no way to correct hardware design mistakes. As a consequence, a greater focus on contingent planning is required, not the "launch early and often" approach employed by lean startups.

Launching early and often can also pose problems when customers use a new product in mission-critical activities. It is not acceptable for Gmail to lose 1% of user's email or for Dropbox to be out of service for a few minutes. With new products like these, a firm may elect to get feedback through a smoke test, as Dropbox did by creating an online video demonstration of product features once it had a working, but not fully debugged, prototype.

Finally, society may legally limit a firm's ability to make mistakes when testing new products. Such is the case with the development of new pharmaceuticals, where clinical trials must follow strict protocols that prohibit experiments with unproven compounds on human subjects. Efforts to evade such constraints and to learn faster by "launching early and often" raise ethical issues, for example, when moving early pharmaceutical trials to less regulated overseas markets.

When Demand Uncertainty is Low

With strong unmet demand for a new product, there is less need to seek feedback about customers' needs. This would be the case for a low-cost cancer cure that produced no adverse side effects. Similarly, there would be strong demand from utilities for a low cost, reliable, "green" solution for generating electricity that did not produce unpredictable, off-peak spikes in output requiring expensive power storage facilities—a limitation of solar and wind energy. With such new products, entrepreneurs should still follow a hypothesis-driven approach to testing alternative engineering approaches, but it is not imperative to launch early and often to get feedback about customer demand.

When Demand Uncertainty is High but Development Cycles are Long

Intrinsically long product development cycles, which are endemic to entrepreneurial projects that require engineering breakthroughs or massive infrastructure deployment, make it impossible to launch early and often. If demand uncertainty is low, this doesn't pose a major problem. But what if development cycles are intrinsically long for a radically innovative product for which there *is* considerable uncertainty about customer demand? Consider the case of Segway.[22] Until the company had a working prototype of its two-wheeled "personal transportation system," could anyone accurately predict how early adopters would react to the product?

In this context, there is no possibility of putting a real product in the hands of real customers, early in the product development process. But the entrepreneur should still use hypothesis-testing methods whenever possible to gain insight on target customers' needs. And he must remain especially vigilant about cognitive biases. Research shows that decision makers who must make big and ongoing investments before outcomes are known are vulnerable to a phenomenon called "escalation of commitment"—a tendency to ignore disconfirming data in such settings and to continue investing. Escalation of commitment follows from the cognitive traps described in **Appendix D**: optimism bias, the planning fallacy, confirmation bias, and the sunk cost fallacy.[23]

Conclusion

Some experienced entrepreneurs might regard the lean startup approach as "old wine in a new bottle." Indeed, the core concept behind hypothesis-driven entrepreneurship—*test then invest*—has been practiced in well-run new ventures for decades. Likewise, product development professionals have long recognized the value of small batches and rapid prototyping.

The lean startup approach builds on these ideas, but in our view, it goes several steps further. First, the lean startup approach evaluates an early stage startup's entire business model, whereas most of its intellectual antecedents focus more narrowly on a startup's product. Second, the lean startup approach introduces two new concepts: *minimum viable products* that efficiently test business model hypotheses, and *pivots* that change certain business model elements in response to failed hypothesis tests. Finally, unlike other methods for managing an early-stage venture, the lean startup approach balances the strong direction that comes from a founder's vision with the need for redirection that follows from market feedback.

Appendix A: Alternative Approaches for Launching Startups

To understand the logic behind hypothesis-driven entrepreneurship, consider three other approaches that entrepreneurs may employ when developing and launching a new product.

Build It And They Will Come

Entrepreneurs sometimes do cursory research on an opportunity and then focus all of their energy on product development. These entrepreneurs are driven by their vision of a perfect product. Their engineering-dominated team works furiously to turn that vision into reality; the team does not stop until the product is ready for launch. The entrepreneur's vision burns brightly, so she does not feel any need to test business model hypotheses. Like the farmer in the film *Field of Dreams*, who builds a baseball diamond in his fields after hearing voices in his head saying, "build it, and they will come," the entrepreneur makes a leap of faith.

Sometimes, a Build-It-and-They-Will-Come approach results from an ego-defensive avoidance pattern. An entrepreneur's ego is heavily invested in her venture's success. One way to limit ego damage is to avoid feedback showing that the venture is off track. In other instances, a deep dive into product development is a comfortable excuse for hiding in one's office. Introverted entrepreneurs may be too timid to solicit reactions from strangers.

A Build-It-and-They-Will-Come approach is risky. The team receives no customer feedback until the product is built and launched. If uncertainty about demand is high, then the odds of inventing the right product through a purely vision-driven approach are low.

Waterfall Planning

Other entrepreneurs translate their vision into a plan, and then methodically execute that plan. Work is completed in sequential stages. Effort on a downstream stage only commences when the preceding stage is completed and successfully passes through the "gate" of a formal review — hence the name "stage-gate planning."[24] This approach is also called "waterfall" planning because a graphical depiction of how stages are completed over time cascades from top left to bottom right. Stages typically include:

1. Concept exploration, culminating in a business plan that describes product features, target customers, technical challenges, competitors, financial projections, etc.

2. Product specification, captured in a Product Requirements Document that — at least in theory — provides sufficient guidance on proposed product functionality to allow engineers to begin design work.

3. Product design.

4. Product development.

5. Internal testing.

6. Alpha launch with pilot customers to validate technical performance.

These steps represent the plan for the engineering team. The complete plan includes stages to be completed in parallel by other functions. For example, marketing will develop sales collateral material once product specifications are complete, then it will formulate a public relations plan, etc.

Waterfall planning is sometimes introduced to startups by entrepreneurs who learned the technique in big corporations, where it can work well when launching line extensions that require coordinated effort across separate organizational units. For startups developing and launching radically new products, however, rigid adherence to waterfall plans often causes problems. After the concept exploration stage, a team employing waterfall planning typically will not receive much customer feedback until it commences an alpha test. Likewise, when work is completed in big batches, errors introduced early in a stage may not be discovered until additional work has been completed, requiring rework. Also, when the external environment is rapidly changing, assumptions are bound to become outmoded by the time all stages are completed.

Just Do It!

Some founders respond to the dysfunctions of planning—and indulge their penchant for entrepreneurial action—by embracing an improvisational approach when launching their new product. They jump into the startup process with imagination and aspirations, but without a strong product vision or a detailed plan. These founders rely heavily on the ongoing feedback and assistance that they get from people they know and meet. They adapt their offering frequently to fit this input from potential resource providers and customers and to respond to surprises that they inevitably encounter.

This Just-Do-It! approach to entrepreneurship has advantages: it leverages scarce resources by tailoring an offering to suit resource providers' capabilities and preferences.[25] Also, improvisation may successfully steer a new venture, step-wise, toward opportunity. Without a strong vision, clear plan, or hypotheses, however, it can be difficult to know when to make course corrections, or what direction they should take. The decision rule guiding adaptations is vague: "If outcomes seem to be improving, keep doing what you are doing, and consider taking a few more steps down this path; if outcomes are deteriorating, stop doing what you are doing and try a new path." But what new path should the entrepreneur follow? And what is the performance threshold that dictates when to change direction, versus waiting for more input or simply trying harder?

Without a clear initial sense of direction, searching for opportunity through incremental adaptation can pose significant problems when entrepreneurs fail to foresee serial dependence between decision outcomes. Consider these examples of how product design decisions that rely on early market feedback can misfire if they are not integrated with an overall strategy:

- After receiving positive feedback from early adopters, a startup may design its product to meet the needs of power users, only to discover later that its offering is over-engineered—too costly and too complex—for mainstream users whose support is essential to harness scale economies.

- After getting encouraging face-to-face feedback from target customers, a startup might launch a product that solves a serious problem for small businesses. However, if the entrepreneur does not anticipate that: 1) direct customer contact will be required to explain the product's benefits, and 2) the product will not yield enough gross margin to support direct sales, then the entrepreneur may be surprised to discover that his business model is not viable.

Comparing these three approaches for launching a startup, we can see that Build-It-and-They-Will-Come and waterfall planning suffer from a similar flaw: both provide strong initial direction, but make little use of feedback to change direction. By contrast, the Just-Do-It! approach embraces feedback, but the absence of initial direction means that some feedback-induced adaptations may turn out to be mistakes, due to serial dependence between decisions. Hypothesis-driven

entrepreneurship avoids these pitfalls. This is supported by research which shows that startups that pivot once or twice are half as likely to scale prematurely—a leading cause of failure for startups—than startups that pivot more than two times or not at all.[26] An entrepreneur doesn't need a perfect hunch, but she does need a good one, along with a way to receive and incorporate feedback. Sequentially testing a comprehensive set of business model hypotheses ensures that pivots—feedback-induced adaptations—take serial dependence into account.

Appendix B: Guidelines for Entrepreneurial Ideation

The following guidelines for entrepreneurial ideation are gleaned from insights shared by entrepreneurs, design thinking principles, and academic research on creativity and innovation.[27]

- **Immersion.** Creativity usually follows from deep immersion in a problem. For some problems, especially in consumer markets, an entrepreneur's own interests and life experiences are adequate guides for ideation. To identify unmet needs and potential solutions for business-to-business markets, however, an entrepreneur typically must tap the domain knowledge that follows from years of industry experience. If she lacks such experience, the entrepreneur will benefit from closely observing and interacting with customers and/or domain experts, playing the role of anthropologist.

- **Obsession.** Creative individuals become obsessed with the problems on which they are working. They are not, however, unduly devoted to provisional solutions that they conceive during the ideation process; they remain open to new ideas, willing to reconsider their assumptions and prepared to abandon flawed concepts—no matter how much effort they have invested in them. Those that succeed know that early solutions are likely to be wrong or incomplete and that failure is a natural part of the process.

- **Incubation.** Inventors often spend years on a problem before they get an epiphany about a solution; the subconscious remains engaged in problem solving even when inventors—frustrated by barriers or distracted by other priorities—set their work aside for long periods. The notion that solutions may come into focus slowly can be difficult to accept for aspiring entrepreneurs, especially those who commit to launching a startup before they have a vision for what it will do.

- **Recombination.** New ideas often result from connecting seemingly unrelated concepts. Creative individuals are curious; they put themselves in situations of planned serendipity where they will be exposed to diverse ideas in order to harness their associative thinking abilities. They may do this through the variety of contacts they keep in the real world or through the subject matter experts they follow online.

- **Clarification.** Many inventors employ processes to keep track of and refine their ideas. Design thinkers often rely on journals and Post-It notes, but some entrepreneurs find that writing blog posts not only forces them to integrate and sharpen their ideas but also invites helpful responses. Some founders also find that group "white boarding" sessions provide a helpful way to generate, clarify, and prioritize their ideas.

- **Collaboration.** Researchers have dispelled the myth of the lone genius inventor. The prolific American inventor Thomas Edison, for example, surrounded himself with brilliant and determined collaborators in his Menlo Park, New Jersey laboratory. Most great creative work is done in small teams: think of Lennon and McCartney, Jobs and Wozniak, or Brin and Page. One collaborator will say something that triggers another's ideas, and cofounders will support each other emotionally when the creative process stalls.

Experts on creativity reject the notion of a playbook for innovation, but entrepreneurs engaged in ideation would be wise to copy two practices of design thinkers. First, entrepreneurs should learn how to run a good brainstorming session. This entails generating as many ideas as possible, in particular, wild ones; building connections between ideas; and avoiding negative evaluation of ideas. Second, entrepreneurs should familiarize themselves with the ways in which design thinkers use crude prototypes.[28]

Appendix C: Smoke Testing

The simplest MVPs take the form of *smoke tests:* products that are truly minimal because they do not yet exist. "Smoke testing" has its origins in the ancient Roman practice of forcing smoke through new plumbing to look for leaks. By extension, modern electrical engineers use the term to describe the first test after initial assembly of a system to see if its circuits will literally "go up in smoke." In the same spirit, the lean startup community has adapted the term to describe MVPs for products not yet developed—MVPs made from nothing but "smoke and mirrors."

Before they develop any product features or assemble any operational capabilities, web startups often conduct smoke tests using landing pages that provide a brief description of a planned online service. They ask page visitors to leave an email address if they wish to be contacted when the service launches. In the context of direct selling to enterprises, an equivalent smoke test asks a potential customer to sign a legally non-binding *letter of intent* to purchase an as-yet-unfinished new product.[29]

If a substantial fraction of visitors register after viewing the landing page, then an entrepreneur can infer that there is some interest in the proposed service. Of course, simply registering doesn't require a purchase commitment, so the test cannot conclusively validate demand—but it can provide enough evidence to warrant proceeding with additional tests of higher fidelity MVPs. Conversely, if almost no one registers upon viewing a landing page, then the entrepreneur must take stock of her situation. Did the test fail because there is little demand for the proposed product? Or because the entrepreneur doesn't yet know enough about the problem to describe potential solutions that appeal to prospective customers?

Video MVPs. Startups can improve the reliability of landing page tests by providing more detailed product descriptions. For example, Drew Houston, cofounder of the online file storage/sharing service Dropbox, was able to gauge demand by posting a three-minute online video.[30] The video demonstrated Dropbox's proposed product features, using a working but not fully debugged prototype, and then asked people to register to beta test the product. Houston's video MVP illustrates another situation in which smoke testing makes sense: if a product is used in a mission critical activity—like backing up all of a user's computer files—then it would be irresponsible for an entrepreneur to ask an unwitting customer to field test an early product version that might have serious flaws.

Charging for Smoke Tests. Startups can also get more reliable data about demand by asking landing page visitors to make a purchase commitment after viewing a product description. Magazine publishers have done this for decades, sending direct mail solicitations for new magazines that have not yet been produced—called a *dry test* by direct marketers. In the same spirit, Kickstarter, an online funding platform for creative projects, asks potential project sponsors to make a funding commitment after viewing a video MVP. In a typical Kickstarter proposal, an artist shows images of her past work, explains the goals for her next project, and then requests a specific level of funding for that project. The project can proceed only if it attracts a threshold level of funding commitments; if it does not, then sponsors do not disburse funds.

As a general rule, entrepreneurs should charge smoke test customers whenever they can. Of course, this is not possible with a product that is intended to be free to end users, as with an ad-supported media site. Likewise, it may not be feasible to ask customers for payment when it is obvious to customers that the startup might not actually be able to build the proposed new product, due to technical challenges.

Appendix D: Lean Startup Psychology

The human brain is subject to many well-documented cognitive biases that impair our ability to make reasoned judgments about feedback we receive.[31] While we cannot eliminate these biases, we can mitigate their impact by understanding them and employing strategies to combat them. Four cognitive biases are especially relevant for early-stage entrepreneurs: optimism bias, the planning fallacy, confirmation bias, and the sunk cost fallacy. Below, we describe these biases and discuss how the lean startup approach helps limit their impact.

Optimism Bias

Optimism bias reflects our systematic tendency to overestimate the likelihood of positive events and underestimate that of negative ones. As psychologist and Nobel Prize-winning economist Daniel Kahneman writes, "The evidence suggests that an optimistic bias plays a role—sometimes the dominant role—whenever individuals or institutions voluntarily take on significant risks."[32]

This bias can fuel an entrepreneur's "reality distortion field," a term coined to describe Steve Jobs's ability to mesmerize through charisma and riveting rhetoric, inspiring people to advance his vision by changing their views of benefits and barriers. As Kahneman writes of entrepreneurs, "Their confidence in their future success sustains a positive mood that helps them obtain resources from others, raise the morale of their employees, and enhance their prospects of prevailing." [33]

However, a reality distortion field can also warp its propagator's perceptions. An entrepreneur may come to believe in her vision so fervently that reality—in the form of disconfirming data—cannot enter the field. For example, in a study of almost 300 inventions that the Inventor's Assistance Program (IAP) rated as likely to fail, almost half of founders continued working on them after receiving negative feedback from the IAP.[34] This was advice that the inventors had paid for but subsequently disregarded. Of these negatively rated inventions, only five were ever commercialized and none were successful.

An entrepreneur can guard against optimism bias by generating falsifiable hypotheses and tracking performance against them. A *pre-mortem* may also help his team look more objectively at disconfirming data.[35] In a pre-mortem, a founding team envisions a world where their plan has been implemented faithfully but the venture has failed. Team members each take a few minutes to write an imagined history of why the venture failed. This process provides an open forum for a team to surface and seriously consider doubts and threats.

Planning Fallacy

The planning fallacy is a manifestation of the optimism bias. It reflects our tendency to overestimate the benefits of a task and to underestimate its duration, costs, and risks—even when we have past experience with similar tasks.

Research indicates that it takes web startups, on average, 2-3 times longer than their founders' had originally estimated to validate their market.[36] Dropbox founder Drew Houston took even longer. In his Y Combinator application, he projected that it would take him eight weeks to ship a paid version of his product. It took eighteen months to do so.[37]

Entrepreneurs can mitigate the planning fallacy's impact by (a) being conscious of the fallacy when making intuitive estimates and (b) selecting a reference class of comparable projects for assessing estimates.[38] While reference class data might not be readily available for startup teams

working on fundamentally new products, the lean startup approach should nevertheless improve the reliability of entrepreneurs' estimates. By creating a minimum viable product to rigorously test falsifiable hypotheses, an entrepreneur is making a prediction and then correcting it based on feedback.

Confirmation Bias

Confirmation bias reflects our tendency to disproportionately look for, interpret, and remember information in ways that validate rather than reject our beliefs. This bias can diminish decision-making effectiveness when contrary evidence is neglected.

The lean startup approach can help a founder develop a more realistic view of the evidence supporting his business model. But even if MVP tests are interpreted with "eyes wide open," confirmation bias can creep in earlier in the process, when specifying tests. The founder may unwittingly design tests that return *false positives*—that is, tests that validate a hypothesis when it is actually wrong—for example, by sampling only enthusiastic early adopters and then extrapolating their characteristics to the mainstream market. When specifying tests, an entrepreneur should explicitly consider ways in which a proposed test might return false positive or false negative results and should keep communicating with skeptics (e.g., with investors who declined to invest). Assigning the role of devil's advocate to a team member can also ensure that all sides of an argument are presented.

Sunk Cost Fallacy

Sunk costs—expenses that have already been incurred and cannot be recovered (e.g., assets that have no salvage value)—should not be considered when making decisions. Nevertheless, people often fall prey to a sunk cost fallacy, in effect saying, "It would be wasteful to discard all this work, so we should persist." This is flawed logic: a rational decision maker should focus *only* on a project's future expected benefits and future expected costs. But research shows that humans are averse to losses, especially when they are responsible for decisions that led to them. This can make it psychologically difficult for entrepreneurs to pivot to a new business model.

By launching early and avoiding premature scaling, an entrepreneur's sunk costs are limited and thus less likely to affect her judgment. She may also be less inclined to view sunk costs as losses if she views pivoting as a natural part of the entrepreneurial process and recruits employees and investors based on a vision of the future that includes, ex ante, the possibility of pivots.

Appendix E: Typology of Pivots

An entrepreneur may choose to pivot along one or more of the following dimensions of a business model:

- **Customer Value Proposition: Feature Set**. A new venture may pivot to a new customer value proposition by expanding, contracting, or entirely changing its feature set. TiVo, for example, originally intended to sell home media servers; the venture contracted its feature set to focus solely on digital video recording, while still retaining its focus on the home entertainment sector.[39] Chegg changed its feature set entirely while retaining its focus on college students: it pivoted from being a Craigslist-style marketplace for university communities to renting textbooks.[40]

- **Customer Value Proposition: Customer Set.** A startup may also pivot to a new customer value proposition by expanding, contracting, or entirely changing its customer set. Zipcar, for example, broadened its target market beyond environmentally conscious young urbanites to include young urban professionals, offering BMWs and similar brands to the latter segment—cars that had little appeal for its initial customers.[41]

- **Technology and Operations Management Strategy**. An entrepreneur may choose to expand, contract, or shift the scope of activities that are performed internally, rather than externally by partners. For example, Keurig, after abortive efforts to develop the in-house capability to manufacture packaging line equipment and brewers and to develop its own brand of coffee, outsourced all of these activities to partners.[42]

- **Go-To-Market Plan**. A startup may change its main methods for acquiring customers. Dropbox, for example, initially expected to rely on a combination of search engine marketing and distribution by partners such as PC security software vendors. When these methods proved uneconomical and infeasible, respectively, Dropbox shifted to viral marketing.[43]

- **Cash Flow Formula**. A startup may pivot by changing its monetization approach. Google, for example, initially tried to license its search technology to online portals and other websites before shifting to paid search advertising.[44]

Appendix F: Premature Scaling

A core lean startup principle is that entrepreneurs should not scale until they have achieved product-market fit. Premature scaling can hurt a startup in three ways. First, it relinquishes one of the primary advantages of an early-stage venture: its agility. Unlike established corporations, an early-stage venture can quickly change direction based on new information because it has not committed resources that must be redeployed. Once a startup has started scaling, pivots become more difficult and expensive.

Second, premature scaling risks alienating and confusing large numbers of customers if a startup subsequently must pivot to a new value proposition. If early adopters who have been sold on one premise are told that their purchase was wasted, the backlash can be strong and the reputational consequences for a startup can be severe.

Finally, premature scaling shortens a venture's runway and thus the number of build-measure-learn cycles its team can complete. As investor and Y Combinator founder Paul Graham notes, "The slower you burn through your funding, the more time you have to learn."[45] "Runway" is conventionally defined as the number of months required to exhaust a startup's cash balance based on its expected "burn rate," that is, negative cash flow per month. Ries has redefined runway as the number of pivots a startup can complete with available resources. Once a startup starts scaling, its burn rate increases and its runway shortens, unless it can raise more capital. Startups that have not resolved business model uncertainty—or put another way, that have not achieved product-market fit—typically find it difficult to raise capital to fund scaling.

Scaling Early With Network Effects. The rule "no premature scaling" can be misconstrued to mean, "no scaling until a product earns profit." The latter guideline may not make sense for platforms that facilitate user interactions and leverage strong network effects.[46] Consider Facebook, YouTube, and Twitter. These platforms all launched with at best fuzzy plans for making money. Did it make sense for their founders to defer scaling until they had validated a hypothesis about how they would earn profit? No: these firms all relied on ecosystem partners to help experiment with ways to monetize a big platform. Partners simply wouldn't emerge and couldn't commence experiments until each platform had a big user base. For example, Zynga, whose social games have become a huge source of revenue and profits for Facebook, was not founded until 2007, three years after Facebook launched. It is often impossible for such platforms to fully validate their business models *until* they have a critical mass of platform users.

While Facebook, YouTube and Twitter lacked an initial theory about how to make money, other platforms may have such a theory but nevertheless choose to defer monetization for strategic reasons. Due to network effects, the value of a platform increases with the scale of its user base. It often makes sense for platform owners to offer their service free-of-charge in order to amass a bigger user base. PayPal, for example, did not introduce fees until after it became the dominant online auction payment service.[47]

Appendix G: Using Lean Startup Methods in Resource-Rich New Ventures

At least initially, most startups face significant resource constraints. But not all early-stage ventures face such limits. On rare occasions, startups—especially those launched by successful serial entrepreneurs—are born "fat": upon founding, they are able to raise huge rounds of venture capital. Other new ventures are spawned within deep-pocketed large corporations. In theory, resource-rich new ventures—both fat startups and units of established corporations—should embrace a hypothesis-driven approach. Doing so can speed their time-to-market and improve the odds that their new products will meet customer needs. In practice, however, it can be more difficult for such ventures to stick to lean startup discipline.

"Fat" Startups. Research suggests that fat startups are prone to over-spending. Eisenmann, for example, showed that during the late-1990s dot com boom, Internet startups that raised substantially more capital than otherwise similar peers earned lower long-term returns than those peers.[48] We can speculate why it is difficult for fat startups' founders to follow lean startup precepts. Firms that raise big initial venture capital rounds are often funded during valuation bubbles, when investors typically favor ventures that show strong growth in their user bases or revenues, rather than profits. This puts pressure on fat startups to scale prematurely, which in turn can lead to wasteful spending on product development and marketing while the startup is still pivoting toward product-market fit.

Corporate Ventures. Intuit, General Electric and many other large corporations have been training their managers to use lean startup methods.[49] However, new ventures nested inside big companies often find it difficult to follow lean startup principles due to the nature of their budgeting and product planning processes. In most large corporations, managers crave predictability. Stage-gate planning, which delivers predictable results for incremental product line extensions, is often imposed on radically innovative products for which it is not well suited. Stage-gate planning means that work is completed in big batches, which raises the stakes with each new round of product development. Due to escalation of commitment, a new venture can become too big to fail.

Likewise, innovative new products are usually funded through the calendar rhythms of an annual budgeting process designed to promote predictability in the core business. Managers submit new product proposals once a year; they ask for enough funding to cover a year's worth of expected expenditures. Expectations for predictability make it awkward for managers to diverge from plan, so they may keep a zombie venture alive, awaiting year-end review by superiors, even after hypothesis testing has shown that the concept should be abandoned.

Key Terms

A/B testing: Divides a set of similar prospects or customers into a *control group* that experiences a status quo product and a *treatment group* that experiences a product with at least one modified element. Used to determine whether modifications yield statistically significant performance improvements.

Business model: An integrated array of distinctive choices specifying a new venture's unique customer value proposition and how it will configure activities to deliver that value and earn sustainable profits. These choices, summarized in **Figure 2**, can be grouped into four elements that define the new venture's customer value proposition, technology and operations plan, go-to-market strategy, and cash flow formula.

Cohort analysis: Tracks trends in performance metrics (e.g., customer retention rates) using sets of customers who were acquired during successive periods of time, typically via the same marketing method.

Conversion funnel: Represents a multi-step process through which prospects may eventually be converted into loyal customers. The process resembles a funnel in the sense that fractions of prospects/customers fail to pass through each sequential step.

False negative: A test result that indicates a hypothesis has been disconfirmed when in reality it is valid.

False positive: A test result that fails to disconfirm a hypothesis that in reality is not valid.

Falsifiable hypothesis: A hypothesis is falsifiable when it can be disconfirmed through a decisive experiment.

Lean startup: A new venture that tests business model hypotheses using Minimum Viable Product tests. "Lean" does not necessarily imply "low cost"; rather, it refers to an imperative to "avoid waste."

Minimum Viable Product: The smallest set of activities needed to rigorously disprove a hypothesis.

Pivot: Changing some business model elements while retaining others; see **Appendix E** for a typology.

Product-market fit: Occurs when the venture has the right product for the market: one with demonstrated demand from early adopters and with solid profit potential. Lean startups do not commence scaling until they achieve product-market fit

Smoke test: A test that gauges demand for a product that does not yet exist, for example, a web landing page that describes a planned product/service and invites a page visitor to register to be notified when the product is launched.

Further Reading

Steve Blank & Bob Dorf, *The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company,* K&S Ranch: 2012

Steven Blank, *Four Steps to the Epiphany,* Cafepress.com: 2005.

Steven Blank, "Why the Lean Start-Up Changes Everything," *Harvard Business Review,* May 2013.

Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business:* 2009.

Frank Cespedes, "Customer Visits for Entrepreneurs," HBS technical note 812-098.

Frank Cespedes, Thomas Eisenmann & Steven Blank, "Customer Discovery and Validation for Entrepreneurs," HBS technical note 812-097.

Brant Cooper & Patrick Vlaskovits, *The Lean Entrepreneur: How Visionaries Create Products, Innovate with New Ventures, and Disrupt Markets,* Wiley: 2013.

Alastair Croll & Benjamin Yoskovitz, *Lean Analytics: Use Data to Build a Better Startup Faster,* O'Reilly: 2013.

Thomas Eisenmann, "Business Model Analysis for Entrepreneurs," HBS technical note 812-096.

Clark Gilbert & Matthew Eyring, "Beating the Odds When You Launch a New Venture," *Harvard Business Review,* May 2010.

Tom Kelley, *The Art of Innovation,* Doubleday Currency: 2001.

Laura Klein, *UX for Lean Startups: Faster, Smarter User Experience Research and Design,* O'Reilly: 2013.

Ash Maurya, *Running Lean: Iterate from Plan A to a Plan That Works,* O'Reilly: 2012.

John Mullins & Randy Komisar, *Getting to Plan B: Breaking Through to a Better Business Model,* Harvard Business Press: 2009.

Alexander Osterwalder & Yves Pigneur, *Business Model Generation,* Wiley: 2010.

Donald Reinertsen, *The Principles of Product Development Flow: Second Generation Lean Product Development,* Celeritas: 2009

Eric Ries, *The Lean Startup,* Crown: 2011.

Donald Sull, "Disciplined Entrepreneurship," *Sloan Management Review,* October 2004.

Stefan Thomke, *Experimentation Matters: Unlocking the Potential of New Technologies for Innovation,* Harvard Business Press: 2003.

References

[1] Eric Ries, *The Lean Startup,* Crown Business, 2011.

[2] For a description of customer development processes, see Steve Blank, *Four Steps to the Epiphany,* Cafepress.com, 2005; for a description of agile software development methods, see Kent Beck, *Extreme Programming Explained,* Addison-Wesley, 2004; for overviews of design thinking principles, see Tim Brown, *Change by Design,* HarperBusiness, 2009 and Jeanne Liedtke & Tim Ogilivie, *Designing for Growth,* Columbia Business School Publishing, 2011.

[3] For more background, see T. Eisenmann, "Business Model Analysis for Entrepreneurs," HBS technical note 812-096. For other definitions and descriptions of business models, see H. Chesbrough & R. Rosenbloom, 2002, "The role of the business model in capturing value from innovations: Evidence from Xerox Corporation's technology spinoff companies," *Industrial and Corporate Change* 11: 529-555; J. Magretta, "Why business models matter," *Harvard Business Review,* May 2002; T. Malone et al., 2006, "Do some business models perform better than others?" MIT Sloan working paper 4615-06; L. Applegate, "Crafting business models," HBS technical note 808-705; M. Johnson, C. Christensen, & H. Kagermann, "Reinventing your business model," *Harvard Business Review,* Dec. 2008; J. Mullins & R. Komisar, 2009, *Getting to Plan B: Breaking Through to a Better Business Model,* Harvard Business Press; A. Osterwalder, 2010, *Business Model Generation,* Wiley; and R. Casadesus-Masanell & J. Ricart, "How to design a winning business model," *Harvard Business Review,* Jan.-Feb. 2011.

[4] Ries, p. 57

[5] Essays on startup management by Paul Graham are available at http://www.paulgraham.com/articles.html.

[6] For an overview of research techniques suited for early-stage startups, see F. Cespedes, T. Eisenmann & S. Blank, "Customer Discovery and Validation for Entrepreneurs, HBS technical note 812-097

[7] Ries, p. 22.

[8] For deeper analysis of the benefits of small batches and short cycles in product development, see Donald Reinertsen, *The Principles of Product Development Flow,* Celeritas Publishing, 2009.

[9] Ries, p. 108.

[10] Ries, pp. 29-31.

[11] For a discussion of the differences between early adopters and mainstream customers, see Geoffrey Moore, *Crossing the Chasm,* Harper, 2002.

[12] See Ries, pp. 97-99 and Eisenmann, Pao & Barley, "Dropbox: It Just Works," HBS case 811-065.

[13] See Ries, pp. 103-106 and Eisenmann, Wagonfeld, & Barley, "Aardvark," HBS case 811-064.

[14] Eisenmann & Winig, "Rent the Runway," HBS case 812-077.

[15] Ries, HBS class visit, Launching Technology Ventures, Jan. 26, 2011.

[16] Chapter 1: Max Levchin, PayPal in Jessica Livingston, *Founders at Work,* Apress, 2008.

[17] Eric Jackson, *The PayPal Wars,* World Ahead Publishing, 2010.

[18] Max Levchin interview in *Founders at Work.*

[19] Ries, Innovation Lab presentation at Harvard Business School, September 21, 2011.

[20] For a discussion of why product-market fit is important for startups, see Marc Andreessen, "The Only Thing That Matters," Oct. 12, 2009 blog post, accessed at http://pmarca-archive.posterous.com/the-pmarca-guide-to-startups-part-4-the-only on Nov. 13, 2011.

[21] The challenges of scaling a startup are covered in T. Eisenmann, "Scaling: Pacing Issues," HBS technical note 812-099 and T. Eisenmann & A. Wagonfeld, "Scaling: People and Organizational Issues," HBS technical note 812-100.

[22] For a history of Segway, see Steve Kemper, *Reinventing the Wheel,* HarperBusiness, 2005.

[23] Barry Staw, "The Escalation of Commitment to a Course of Action," *Academy of Management Review,* Oct. 1981.

[24] The principles of stage-gate planning are explained in Robert Cooper, *Winning at New Products,* Basic Books, 2001.

[25] For a more detailed explanation of this style of entrepreneurial management and its advantages, see Saras Sarasvathy, *Effectuation: Elements of Entrepreneurial Expertise,* Edward Elgar Publishing, 2009.

[26] Max Marmer, et al., "Startup Genome Project Extra on Premature Scaling," accessible at http://startupgenome.cc/pages/startup-genome-report-extra-on-premature-scal.

[27] For an overview of research on innovation, see Scott Berkun, *The Myths of Innovation,* O'Rielly Media, 2010.

[28] In addition to the books on design thinking cited above, see *The Art of Innovation,* Doubleday, 2001, by IDEO founder Tim Kelley.

[29] See Cespedes, "Customer Discovery and Validation," HBS technical note 812-097, for a discussion of letters of intent.

[30] See Ries, pp. 97-99 and Eisenmann, Pao & Barley, "Dropbox: It Just Works," HBS case 811-065.

[31] For an overview of cognitive biases, see Daniel Kahneman, *Thinking, Fast and Slow,* Farrar Straus, 2011

[32] Kahneman, p. 256.

[33] Kahneman, p. 256.

[34] Kahneman, p. 257.

[35] Kahneman, pp. 264-265.

[36] Max Marmer, et al., "Startup Genome Project Extra on Premature Scaling," p. 9, accessible at http://startupgenome.cc/pages/startup-genome-report-extra-on-premature-scal.

[37] Eisenmann, Pao & Barley, "Dropbox: It Just Works."

[38] Daniel Lovallo & Daniel Kahneman, "Delusions of Success: How Optimism Undermines Executives' Decisions" 18 Aug 2003, *Harvard Business Review.*

[39] Livingston. *Founders at Work,* Chapter 14: Mike Ramsay, TiVo.

[40] Eisenmann, Sahlman & Richardson, "Chegg: Textbook Rental Takes Flight," HBS case 811-077.

[41] Mark Levine, "Share My Ride," *New York Times Magazine,* March 5, 2009.

[42] Marshall & Dann, "Keurig," HBS case 899-180.

[43] Eisenmann, Pao, & Barley, "Dropbox: It Just Works."

[44] Edelman & Eisenmann, "Google Inc.," HBS case 910-036.

[45] Paul Graham, "How to Start a Startup," March 2005, accessed at http://www.paulgraham.com/start.html on Nov. 13, 2011.

[46] For an overview of platforms, see Eisenmann, "Platform-Mediated Networks: Definitions and Core Concept," HBS technical note 807-049.

[47] Jackson, *The PayPal Wars.*

[48] Thomas Eisenmann, "Internet Companies Growth Strategies," *Strategic Management Journal,* Dec. 2006.

[49] Ries, pp. 32-36; 88-89.