

## CORE CURRICULUM



### Entrepreneurship

Lynda M. Applegate, Series Editor

**READING** + INTERACTIVE ILLUSTRATIONS

# Experimenting in the Entrepreneurial Venture

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**THOMAS R. EISENMANN**  
HARVARD BUSINESS SCHOOL

**ERIC RIES**

**SARAH DILLARD**  
.....

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## Table of Contents

<b>1 Introduction</b>	<b>3</b>
<b>2 Essential Reading</b>	<b>3</b>
2.1 The Hypothesis-Driven Approach	3
2.2 Other Approaches for Managing Early-Stage Startups	4
2.3 Hypothesis-Driven Entrepreneurship: Seven Steps	5
Step 1: Develop a Vision for Your Venture	5
Step 2: Translate the Vision into Hypotheses About Your Business Model	6
Step 3: Specify MVP Tests	8
Step 4: Prioritize Tests	13
Step 5: Learn from MVP Tests	14
Step 6: Persevere, Pivot, or Perish	15
Step 7: Scale the Business and Optimize the Business Model	16
2.4 Limits to the Hypothesis-Driven Approach	17
When Mistakes Must Be Limited	18
When Demand Uncertainty Is Low	18
When Demand Uncertainty Is High but Development Cycles Are Long	18
When Resources Are Plentiful	19
<b>3 Supplemental Reading</b>	<b>20</b>
3.1 Alternative Approaches for Launching Startups	20
Build It and They Will Come	20
Waterfall Planning	20
Just Do It!	21
3.2 Guidelines for Entrepreneurial Ideation	22
3.3 Cognitive Biases	23
Optimism Bias	23
Planning Fallacy	24
Confirmation Bias	24
Sunk-Cost Fallacy	24
<b>4 Key Terms</b>	<b>25</b>
<b>5 For Further Reading</b>	<b>26</b>
<b>6 Endnotes</b>	<b>27</b>
<b>7 Index</b>	<b>30</b>



This reading contains links to online video and interactive illustrations, denoted by the icons above. To access these exercises, you will need a broadband Internet connection. Verify that your browser meets the minimum technical requirements by visiting <http://hbsp.harvard.edu/list/tech-specs>.

Thomas R. Eisenmann, Howard H. Stevenson Professor of Business Administration, Harvard Business School; Eric Ries, Rock Center Entrepreneur-in-Residence; and Research Associate Sarah Dillard (Harvard MBA/MPP 2011) developed this Core Reading.

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# 1 INTRODUCTION

The founders of an early-stage startup typically confront considerable uncertainty about the viability of their venture's business model—in particular, about demand for their proposed product. If they develop and market the product before resolving this uncertainty, they may waste resources on a product that no one wants. Since most startups are severely resource-constrained, such waste can be fatal for a new venture.<sup>1</sup>

A hypothesis-driven approach to entrepreneurship—an approach that employs rigorous experiments and the logic of the scientific method—helps reduce this risk. To apply this approach, entrepreneurs translate their vision into hypotheses about their business model. They then test those hypotheses using a series of minimum viable products (MVPs). Each MVP represents, with respect to product functionality and the operational capabilities needed to deliver that functionality, the simplest possible offering required to disprove a hypothesis. (Note that in this reading we use *product* to refer both to physical offerings and to services.)

Using feedback from the tests, a venture's founders decide whether to *persevere* with their proposed business model; *pivot* to a revised model; or *perish* by abandoning the new venture. They repeat this process until they have validated all key business model hypotheses through MVP tests. At this point, the startup has achieved **product-market fit**: It has an offering that profitably meets the needs of the target market's customers, and it can begin **scaling**—aggressively acquiring customers and stepping up operational capacity.

This reading contrasts the hypothesis-driven entrepreneurship approach with other methods. It then explains, step-by-step, how to formulate business model hypotheses, test them, and then act on test feedback. In the final section, we consider what settings are best suited for hypothesis-driven entrepreneurship. Supplemental Readings on special topics follow. “Alternative Approaches for Launching Startups” describes three other common methods; “Guidelines for Entrepreneurial Ideation” shares methods to enhance creativity and innovation; and “Cognitive Biases” explores some of the biases that can impair judgment.

## 2 ESSENTIAL READING

### 2.1 The Hypothesis-Driven Approach

Entrepreneur Eric Ries coined the term **lean startup** to describe organizations that follow the principles of hypothesis-driven entrepreneurship.<sup>2</sup> In this context, many people mistakenly interpret the word “lean” as meaning that a startup is bootstrapping—keeping costs to a bare minimum and relying only on its founders' personal resources. A more accurate interpretation is that lean startups have the same objective as firms that embrace lean manufacturing: to avoid waste. Indeed, such a startup may eventually invest enormous amounts of capital in customer acquisition or operational infrastructure. However, this will happen only after the founders have validated their business model through fast and frugal experiments.

Founders of a lean startup also know that time is among the scarcest of resources; simply put, *speed matters*. Like lean manufacturing, the lean startup method and its intellectual

antecedents (such as entrepreneur Steve Blank's customer development process, agile software development, and design thinking) accelerate the tempo of innovation by using rapid iteration, small batches, and short cycle times.<sup>3</sup> The lean startup method is especially well suited for software-based businesses, owing to the relative ease of revising and testing new product versions. However, with the advent of 3D printing and other rapid prototyping tools, short product development cycles are becoming prevalent in many manufacturing businesses as well.

Some experienced entrepreneurs might view the lean startup approach as “old wine in a new bottle.” To be sure, 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 goes several steps further. First, it evaluates an early-stage startup's entire business model, while most of its intellectual antecedents focus more narrowly on the product offered by the startup. Second, it provides a rigorous framework for entrepreneurial experimentation, offering guidance on how to use MVPs to efficiently test business model hypotheses and on the best time for an entrepreneur to pivot. Third, 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.

## 2.2 Other Approaches for Managing Early-Stage Startups

The hypothesis-driven approach contrasts with three other approaches often used to launch new ventures:

- *Build It and They Will Come.* The startup's founders bypass customer feedback and demand validation, relying solely on their vision for initial guidance. An engineering-dominated team focuses on turning the founders' vision into reality.
- *Waterfall Planning.* The entrepreneurs divide product development work into phases (e.g., design, coding, testing) that different organizational units complete in sequence. Each new phase begins only when the work of the prior phase passes a formal review.
- *Just Do It!* The founders eschew a strong product vision or detailed plan. Instead, they rely on an improvisational approach that adapts the venture's offering and business model using feedback from customers, investors, employees, and other resource providers.

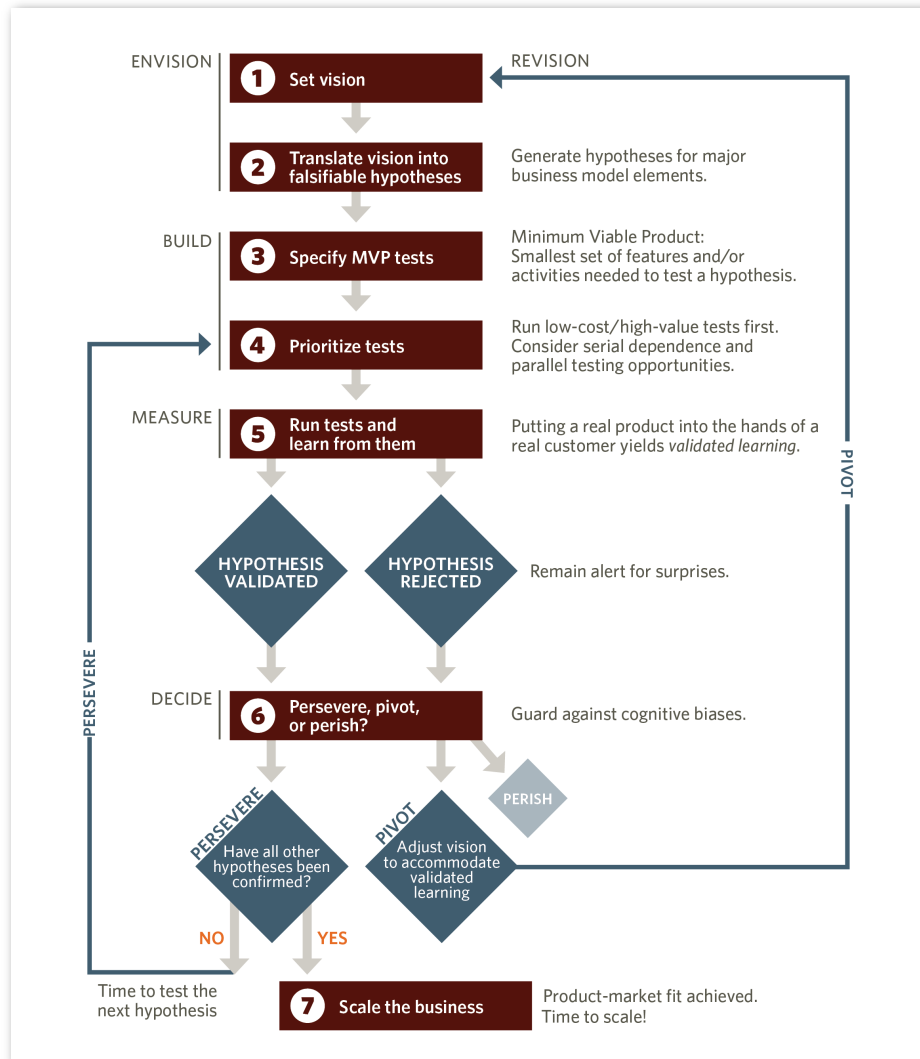
The “build it and they will come” and “waterfall planning” approaches provide initial direction, but they make limited use of feedback to subsequently change course. By contrast, the “just do it!” approach embraces feedback, but because it lacks strong initial direction, founders using this approach may make some business model adaptations that 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 to the business model) are efficient and effective. (See Supplemental Reading 3.1 to learn more about these other approaches.)

## 2.3 Hypothesis-Driven Entrepreneurship: Seven Steps

In this section, we examine the steps in the hypothesis-driven entrepreneurship process (see Exhibit 1).

**EXHIBIT 1** Hypothesis-Driven Entrepreneurship Process Steps



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### Step 1: Develop a Vision for Your Venture

Before entrepreneurs can generate hypotheses about their business model, they must have a vision. A **vision** is a high-level description of a potential solution for a prospective customer's unmet need, reflecting the founders' beliefs about the future. The vision for Zipcar's launch, for example, might have been expressed this way: "Zipcar will enable urban consumers who don't own automobiles to rent cars from nearby locations for hourly or daily use, avoiding the high costs of long taxi trips and the hassles of traditional car rental services." Founders should state their vision explicitly; this helps in determining whether any subsequent pivots are consistent with the original vision.

Developing a vision, also called *ideation*, is less subject to by-the-book instruction than the other steps in the process. (Ideation is a broad topic, beyond the scope of this reading. See Supplemental Reading 3.2 to learn more about how to generate an entrepreneurial vision.)

## Step 2: Translate the Vision into Hypotheses About Your Business Model

After developing their vision, entrepreneurs translate it into business model hypotheses. A **business model** is an integrated array of distinctive choices specifying a new venture's unique customer value proposition and how the venture will configure activities to deliver that value and earn sustainable profits.<sup>4</sup> These choices, summarized in **Exhibit 2**, can be grouped into four categories: customer value proposition, technology and operations management, go-to-market plan, and cash flow formula.

### EXHIBIT 2 Summary of Business Model Questions

#### Customer Value Proposition

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 the *minimum viable product* at launch be? What *road map* will be used 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*?

#### Go-to-Market Plan

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 the shape of its *customer conversion funnel* be? The CAC for each paid method?  
If the venture relies on free demand generation methods, what will its *viral coefficient* be? That is, how many new customers will each existing customer bring to you on average?  
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 owing to network effects, high switching costs, or other first-mover advantages? Do scalability constraints and late-mover advantages offset these incentives?

#### Technology and Operations Management

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 and operations (e.g., preemption of scarce inputs)? *Late-mover advantages* (e.g., reverse engineering)?  
Given capacity and hiring constraints, can the venture scale operations rapidly?

#### Cash Flow Formula

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, and equipment will be required per dollar of revenue?  
How will contribution margins, fixed costs, and investment/revenue ratios change over time?  
Given projected growth, what will the profile of the venture's *cash flow curve* be? How deep is the curve's trough, and when will it be reached?

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Falsifiability and comprehensiveness are two keys to translating a vision into business model hypotheses.

## Falsifiability

For each business model element, an entrepreneur formulates a set of falsifiable hypotheses. As with the scientific method, a *falsifiable hypothesis* is one that can be rejected through a decisive experiment. Ries makes the following point about the importance of falsifiability: “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.”<sup>5</sup>

For instance, it’s almost impossible to reject a go-to-market hypothesis that says, “Our product will spread through word-of-mouth.” As long as marketing trials reveal that any word-of-mouth referrals have been made, then this vaguely worded statement will prove true, whether the number of referrals is very low or very high. By contrast, a much stronger hypothesis would be one that says, “Our viral coefficient over the next 12 months will exceed 0.5”—because it could be proved wrong. Here’s another hypothesis that could be falsified: “At least ten CIOs in companies matching our early-adopter criteria—and at least 50% of such CIOs whom we approach—will sign a legally nonbinding letter of intent saying they will purchase our product if it is delivered on time and meets our proposed specifications.” As these examples suggest, expressing a hypothesis in specific, quantifiable terms is critical for making it falsifiable.

Of course, entrepreneurs in early-stage ventures confront considerable uncertainty about the problem that their venture’s offering aims to address and potential solutions for solving that problem. So how are they supposed to articulate specific hypotheses in the early stages of evaluating an opportunity? Benchmarks from similar ventures can often provide guidelines. However, relevant data are less likely to be available when someone is launching a radical new innovation. In such situations, entrepreneurs can sometimes derive the threshold performance levels required to pass a test from a preliminary financial model. For example, given anticipated gross margins, a viral coefficient greater than 0.5 might be necessary to keep customer acquisition costs low enough to achieve positive net income.

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 multistep process through which a prospect may eventually be converted into a loyal customer. The process resembles a funnel, in the sense that smaller fractions of prospects/customers pass through each sequential step. To illustrate, only X% of prospects exposed to marketing programs become new customers, and only Y% of new customers become repeat purchasers. 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 also 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, often through the same marketing method (for instance, customers acquired in June 2013 through Google AdWords). Analyzing metrics for successive similar cohorts (e.g., 60-day subscriber retention rates for cohorts acquired through telesales in March, April, and May) indicates whether hypotheses about actions to improve performance are valid.

Likewise, many entrepreneurs use *A/B testing* 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

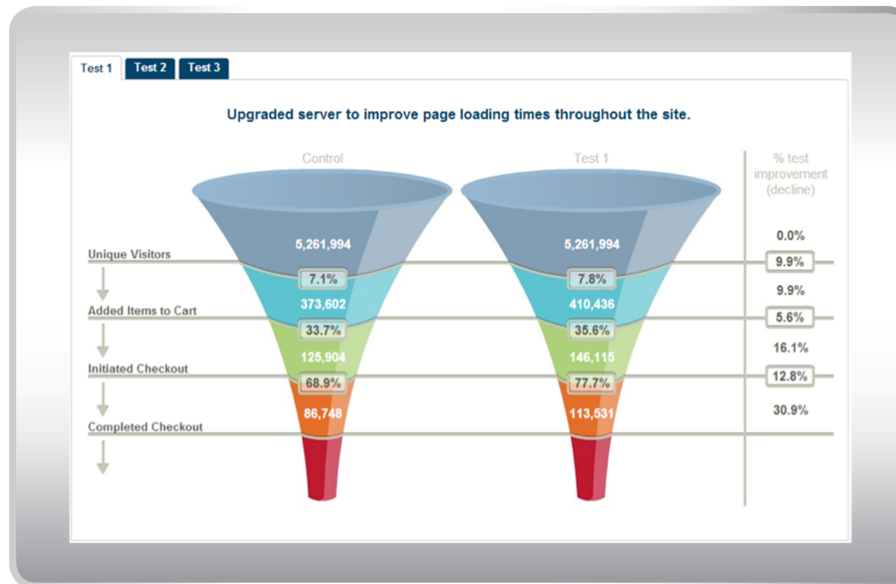
element. Startup founders can use A/B testing to determine whether modifications to their offering yield statistically significant performance improvements. **Interactive Illustration 1** shows how an e-commerce company used A/B testing to evaluate potential improvements to its website and operations. As you click through the screens, notice how the modification described in each test affects the treatment group's conversion funnel. These effects are summarized as percent changed, in the rightmost column. Which modification(s) would you implement permanently?



### INTERACTIVE ILLUSTRATION 1 A/B Testing with Conversion Funnels



Scan this QR code, click the image, or use this link to access the interactive illustration: [bit.ly/hbspFae34F03](https://bit.ly/hbspFae34F03)



## Comprehensiveness

At a venture's outset, its founders do not need to develop detailed hypotheses for all elements of their business model. Business model analysis is an iterative and ongoing process. Owing to serial dependence between business model elements, however, entrepreneurs can't analyze some assumptions without addressing others first. For example, until a new venture's founders have formulated hypotheses regarding which customer segments they will target, they cannot generate falsifiable hypotheses regarding customer acquisition costs.

Thus, early in the process of evaluating an opportunity, entrepreneurs should avoid overinvesting in detailed analysis of assumptions that are serially dependent on other business model elements. Instead, they should make a quick review through all elements of their business model. Back-of-the-envelope analysis is adequate at this stage. The goal now is to surface potential "deal-breaker" issues early—in particular, any conflicts between elements of the business model—and to find ways to address them.

## Step 3: Specify MVP Tests

As we've noted, entrepreneurs face significant uncertainty about their business model and have limited capital and resources, including time, at hand. Thus, it's essential that they extract maximum learning from every unit of time and effort they expend. In the words of Paul Graham, investor and founder of Y Combinator (a startup incubator and accelerator), the best



way to accelerate learning is to “launch early and often.”<sup>6</sup> Traditional market-research techniques such as focus groups and customer surveys can help a venture’s founders resolve uncertainty to some extent.<sup>7</sup> However, entrepreneurs get far more reliable feedback when they put a real product in the hands of real customers in a real-world setting.

Entrepreneurs can launch early and often by specifying a *minimum viable product* (MVP). This is the simplest possible offering required to disprove a business model hypothesis, with respect to the offering’s functionality and the operational capabilities needed to deliver it. MVPs may include early product versions, prototypes, summary descriptions of envisioned offerings (e.g., landing-page tests to assess potential interest), or preliminary plans for proposed products or services. Following the conventions of the entrepreneurial community, we can thus apply the label “minimum viable product” to items that are not actually functional *products*, but rather *simulacra*—representations of proposed products that entrepreneurs can use to solicit feedback from prospective customers. Likewise, engineering plans may be sufficient to test a hypothesis and thus can constitute an MVP.

By launching a series of MVPs, entrepreneurs are able not only to test their business model hypotheses, but also to reduce product development batch sizes and cycle times—activities that deliver two benefits.<sup>8</sup> First, short product development cycles accelerate feedback: Entrepreneurs learn about customers’ requirements before investing too much time in building features that 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 flaws.

MVPs may be “minimal” (constrained) in one or both of two ways, compared with the product an entrepreneur might expect to offer after aggressively scaling the business. Specifically, MVPs may constrain *product functionality*, *operational capability*, or both.

## Constrained Product Functionality

With constrained product functionality, customers experience only a subset of the features envisioned for subsequent versions of the product. IMVU, an online social entertainment startup whose users socialize in a 3D virtual world, is an apt example. IMVU’s team did not initially provide early adopters with the ability to have their avatars walk from place to place in the virtual world, because that would have required extensive programming. Instead, they tested an MVP that permitted instantaneous “teleporting” between locations, which was an easier programming task. This enabled the team to gauge demand more quickly for what they saw as IMVU’s core functionality: social communication.<sup>9</sup>

In general, entrepreneurs should constrain MVP product functionality under the following conditions:

- Early adopters are expected to be willing to buy a product that offers “need-to-have” features (such as social communication for IMVU), even though the product lacks “nice-to-have” features that are costly to develop (for example, ambulation for IMVU).
- Some segments of early adopters would never use certain costly-to-develop features that other segments might deem “need to have.” 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 who had one-page 1040EZ returns. The initial version lacked the functionality required to serve all other states’ residents and Californians who had more complex returns.<sup>10</sup>

Specifying MVP product functionality poses a special challenge when the business model of an innovative new offering requires widespread adoption by mainstream customers to be viable in the long term. Such products are often initially targeted to potential early adopter segments whose needs may differ from those of mainstream customers.<sup>11</sup> For instance, likely

early adopters may be “power users” who want advanced features. To ensure sales to early adopters, entrepreneurs may be tempted to specify MVPs that include sophisticated features that mainstream customers might deem irrelevant—or, worse, might find confusing. As a result, mainstream customers could end up dismissing the new product as “not for me.”

Dropbox’s team resisted this temptation to appeal only to early adopters. Members of the team were determined to keep the product simple to facilitate mass-market penetration over the long term. Thus, 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 forgo features that many power users asked for, 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 for Dropbox to attract mainstream customers in the future.<sup>12</sup>

### Constrained Operational Capability

With constrained operational capability, 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 Aardvark’s founders were investigating demand for an online social question-and-answer service, they relied on human operators rather than computer algorithms to identify individuals in a user’s social network who would be best able to answer questions.<sup>13</sup> 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. Thanks to this temporary, ersatz solution, Aardvark’s team was able to test demand and to learn a great deal about customer needs *before* spending significant amounts of time and money developing routing algorithms. The Aardvark team avoided waste, because the algorithms they might have built before conducting consumer tests would almost certainly have required extensive revision after the team gained a better understanding of consumer preferences.

Operational requirements are dictated by product functionality. Thus, entrepreneurs should generally use MVPs with constrained operational capability under the following conditions:

- They are still defining their product’s core functionality.
- It would be costly to acquire full operational capability.
- Relying on a temporary, makeshift solution does not unduly limit customers’ ability to provide useful feedback.

Aardvark’s MVP met these criteria. Owing to the time required for respondents to receive a question and compose an answer, users would naturally expect some delay in receiving a 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.

### Smoke Tests: Constrained Product Functionality and Operational Capability

The simplest MVPs take the form of *smoke tests*: products that do not yet exist and therefore are constrained in terms of both product functionality and operational capability. Smoke testing has its origins in the practice of forcing smoke through new plumbing to detect leaks. By extension, modern electrical engineers use the term to describe the first test after the initial assembly of a system to see if the system’s 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.”

Landing-page tests are a common form of smoke testing. Before web startups develop any product features or assemble any operational capabilities, they often conduct landing-page tests that provide a brief description of a planned online service. They ask page visitors to leave an e-mail address if they wish to be contacted when the service launches. (In the world of direct selling between businesses, an equivalent test asks a potential client company to sign a legally nonbinding **letter of intent** to purchase an as-yet-unfinished new product.<sup>14</sup>)

If a substantial number of visitors register after viewing a trial 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. However, it can provide enough evidence to warrant proceeding with additional tests of more sophisticated MVPs. Conversely, if almost no one registers after viewing a landing page, then the entrepreneur must take stock of the situation. Did the test fail because the entrepreneur has not identified a strong unmet need? Or did it fail because the entrepreneur doesn’t yet know enough about the problem to describe potential solutions that would appeal to prospective customers?

Web startups can improve the reliability of landing-page tests by providing more detailed product descriptions. For example, Drew Houston, Dropbox’s cofounder, was able to gauge demand by posting a three-minute online video on a landing page.<sup>15</sup> 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 version of a working product that might have serious flaws.

Web 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 used a similar tactic for decades, sending direct-mail solicitations for new magazines that have not yet been produced—called *dry tests* by direct marketers. In the same spirit, Kickstarter, an online crowdfunding platform, asks potential project sponsors to make a funding commitment after viewing a video MVP. The video typically shows the project creator’s past work and demonstrates a prototype for the proposed project. The project can proceed only if it attracts a threshold level of funding commitments; if it fails to do so, then sponsors do not disburse funds. (See **Video 1** for an example of a Kickstarter campaign page for Tiggly, a startup that offered tablet learning toys for toddlers.)



#### **VIDEO 1** Tiggly’s Kickstarter Campaign

Source: Video courtesy of Phyl Georgiou and Steven Miller. Kickstarter landing page courtesy of Kickstarter, Inc.



Scan this QR code, click the icon, or use this link to access the video: [bit.ly/hbsp2G3sbem](https://bit.ly/hbsp2G3sbem)

### **Constraining Customer Sets**

Whether they constrain product functionality, operational capability, or both, MVPs are typically tested with a greatly reduced customer set compared with the pool of prospects that a scaling startup would target. Acquiring a large number of customers before validating business model hypotheses can be expensive, and it can damage a startup’s brand if a subsequent pivot confuses and alienates the early adopters. Instead, entrepreneurs should test MVPs 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.

In addition to making decisions about MVP constraints on product functionality, operational capability, and customer sets, entrepreneurs must consider the possibility of getting false positive or false negative results from their test design. Using a series of MVPs can help them avoid either scenario. In addition, entrepreneurs need to weigh how they will address two common concerns about MVPs.

### Dealing with False Positive and False 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, entrepreneurs may get false positive results if they recruit enthusiasts—individuals with unusually intense passion for the product category—as test subjects. Recruiting sympathetic friends and family to test a product can also yield a false positive result. 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 perceive the new product's value proposition to be otherwise appealing.

### Using a Series of MVPs

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. The founders of Rent the Runway (RTR), an online service that rents designer dresses, discovered this firsthand. These entrepreneurs used 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 "trunk show" events where the women 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. The founders also collected information about which brands, sizes, styles, colors, and price points were popular with these 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 proved most popular in the first test.

RTR's first two MVP tests had validated several important hypotheses. But 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. This rate was far lower than the results of earlier tests, but it was above the threshold that the founders had determined would be required to make their business model viable.

When it came to false positive and false negative results, if Rent the Runway's founders had proceeded directly to the PDF test instead of first conducting two trunk show trials, they might have offered the wrong dress assortment in the PDF test. As such, they 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

Many entrepreneurs express two concerns about “launching early and often” with MVPs:

- *Idea theft.* Some entrepreneurs worry that if they conduct an early launch through an MVP, competitors will steal their business concept. In most instances, though, the value of early feedback greatly outweighs any risk of idea theft. Furthermore, ideas are worthless unless they’re executed, and the iterative MVP methodology helps a startup improve its execution and time-to-market performance. In general, both entrepreneurs and corporate managers can benefit by spending more time understanding potential customers and less time worrying about competitors stealing their ideas.
- *Reputational risk.* Other entrepreneurs cite the reputational risk of launching an MVP that may have limited features and/or problems. The MVP testing approach deliberately limits the target customer base to the minimum scale necessary to rigorously validate hypotheses. This approach thereby mitigates the reputational impact of any quality problems. Using a different brand name for MVP tests can sometimes further help diminish reputational risks.

### Step 4: Prioritize Tests

After generating business model hypotheses and specifying MVPs for testing the hypotheses, entrepreneurs must prioritize the tests; that is, they must decide how to sequence them. In general, a new venture’s founders should give priority to tests that can eliminate considerable risk at a low cost. An example would be a patent search, which may cost just a few thousand dollars. 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 instance, hypotheses about a go-to-market plan or a technology sourcing strategy usually will depend on a startup’s customer value proposition.

Sometimes, however, entrepreneurs will have the option to pursue tests in parallel, because the relevant hypotheses are not serially dependent. To illustrate, 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 rentals could conceivably cannibalize retail sales. In response to this concern and in parallel with the trunk show tests of consumer demand previously mentioned, RTR’s founders sought supply agreements—letters of intent—from designers.<sup>16</sup> Initially, this got a negative reception from many designers. But then RTR’s founders crafted a value proposition that focused on the marketing benefits of exposing designers’ brands to young women who could not yet afford to buy the dresses, but who might be able to do so later in their lives.

However, parallel testing comes with tradeoffs. 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 be a wise choice.

## Step 5: Learn from MVP Tests

In this step, entrepreneurs evaluate feedback gained from their MVP tests. As noted above, it is imperative that they ask whether the result might be a false positive or a 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 (such as their Netflix rentals) and News Feed.<sup>17</sup> Both features generated protests from Facebook users. Yet Facebook dropped the former while retaining the latter. Why? Most likely, Facebook had data to show that users were engaging with News Feed but not with Beacon. In this scenario, Facebook's management would have been acting on users' *revealed* rather than *stated* preferences.

The second source of potential error in interpreting test feedback comes from entrepreneurs themselves. 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. For instance, entrepreneurs may believe in their vision so fervently that reality—in the form of disconfirming data from MVP tests—cannot enter their field of vision. (See Supplemental Reading 3.3 for more on cognitive biases that can lead entrepreneurs 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 and can generate valuable insights into how a new venture's founders might revise their business model to capture unexpected opportunities or parry unanticipated threats:

- *Unexpected test results.* When using a new product, customers frequently behave in unanticipated ways that may cause an entrepreneur to alter the venture's business model. PayPal, for example, was initially designed to enable PalmPilot users to exchange money electronically. To generate interest for this application, the PayPal team built an MVP in the form of a demonstration website. The website quickly became far more popular than the PalmPilot application. In response, PayPal's team abandoned its PalmPilot product and focused exclusively on its website.<sup>18</sup> Moreover, entrepreneurs may gain unexpected insights about customer behavior by tracking quantitative measures or analyzing 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.<sup>19</sup>
- *Information not derived from testing.* A new venture's founders may also revise their business model hypotheses using 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."<sup>20</sup> This primed technical cofounder Max Levchin to keep tabs on fraudulent transaction rates.

As illustrated by the PayPal example, entrepreneurs should savor surprises. If they monitor only the data generated from their MVP tests, then they may miss opportunities or get blindsided by unforeseen threats.



## Step 6: Persevere, Pivot, or Perish

After evaluating MVP test results and other market feedback, entrepreneurs must decide whether to persevere with their original business model, pivot to a new or revised model, or perish (i.e., give up the venture).

### Persevere

If MVP test results validate a business model hypothesis and other feedback does not prompt a shift in direction, then the entrepreneur perseveres on the current path. He or she may test the remaining hypotheses. Or—if all hypotheses have been validated—the entrepreneur may prepare to scale the business.

### Pivot

If an MVP test rejects or validates a business model 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. In particular, core aspects of the startup's original vision are typically retained, such as commitments to solving a broad problem, serving a certain customer segment, or employing a proprietary technology. Consistent with this, Ries defines a pivot as changing strategy while retaining one's original vision.<sup>21</sup>

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

- *Customer value proposition: Feature set.* An early-stage 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. After determining that consumers' unmet needs were stronger around the management of videos than of music or photo libraries, the venture narrowed down its feature set to focus solely on digital video recording, while still retaining its focus on the home entertainment sector.<sup>22</sup> Similarly, Chegg changed its feature set entirely while retaining its focus on college students: It pivoted from a marketplace for university communities modeled on Craigslist to an online company renting textbooks—the product category that had generated the most marketplace transactions.<sup>23</sup>
- *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 by offering BMWs and similar brands to the latter segment—cars that had little appeal for its initial customers.<sup>24</sup>
- *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 some abortive efforts to develop an in-house capability to manufacture packaging line equipment and brewers and to develop its own brand of coffee—decided to outsource all of these activities to partners.<sup>25</sup>
- *Go-to-market plan.* A startup may change its main methods for acquiring customers. Dropbox, for instance, 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.<sup>26</sup>

- *Cash flow formula.* A startup may pivot by changing its monetization approach. To illustrate, Google initially tried to license its search technology to online portals and other websites, but then it shifted to paid search advertising through its own search engine, which offered vastly greater revenue potential.<sup>27</sup>

Pivoting is neither inherently good nor bad. While it can be costly and disruptive, failing to pivot when an entrepreneur knows that his or her business model assumptions are flawed can prove fatal to a fledgling business.

## Perish

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

## Step 7: Scale the Business and Optimize the Business Model

Entrepreneurs who have validated all their key business model hypotheses have achieved product-market fit.<sup>28</sup> 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 stakeholders: Employees will want to come work for the company; 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 acquiring customers and amassing the additional resources (such as staff and infrastructure) needed to serve a fast-growing customer base.<sup>29</sup>

During this step, entrepreneurs can benefit by asking themselves three questions: Am I scaling prematurely? Can I use network effects to successfully scale early? Should I use ongoing experimentation and pivoting to optimize my business model?

## Dangers of Premature Scaling

That entrepreneurs should *not* scale until they have achieved product-market fit is a core lean startup principle. 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 on the basis of new information because it has not yet committed resources that must be redeployed. Once a startup has begun 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 the startup severe.

Third, premature scaling shortens a venture's *runway*—the number of months required to exhaust a startup's cash balance based on its expected "burn rate," or negative cash flow per month. A shorter runway means a team can complete fewer experimentation cycles. As investor and Y Combinator founder Paul Graham notes, "The slower you burn through your funding, the more time you have to learn."<sup>30</sup> Eric Ries has redefined "runway" as the number of pivots a startup can complete with available resources. Once a new venture starts scaling, its burn rate increases and its runway shortens, unless it can raise more capital. Startups that have not resolved business model uncertainty—meaning they haven't achieved product-market fit—typically find it difficult to raise capital to fund scaling.



## Scaling Early with Network Effects

Some observers may misconstrue the rule “No premature scaling” to mean, “No scaling until a product earns a profit.” The latter guideline may not make sense for platforms that facilitate user interactions and leverage strong network effects.<sup>31</sup> 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 a profit? It did not, because these three companies all relied on ecosystem partners to help them experiment with ways to monetize a big platform. Partners simply wouldn’t emerge and couldn’t begin experiments until each platform had achieved a big user base. For example, Zynga, whose social games eventually became a big 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 users.

While Facebook, YouTube, and Twitter lacked an initial theory about how to make money, other platforms may have such a theory. Nevertheless, they may choose to defer monetization for strategic reasons. Owing to network effects, the value of a platform increases with the scale of its user base. Indeed, 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.<sup>32</sup>

## Ongoing Experimentation and Pivoting

Entrepreneurs should continue to test their business model hypotheses even after confirming them. The purpose of these tests shifts from *validating* their business model to *optimizing* it. In the spirit of *kaizen*—continuous improvement—optimization through rigorous experimentation never ends, as is evident at firms such as Amazon and Netflix, where almost every aspect of the customer experience is subject to constant A/B testing.

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 in a scaled-up organization, entrepreneurs will likely pivot only in response to major and unexpected changes that disrupt elements of their business model or that present unusually attractive new opportunities. Zynga, for example, has launched an effort to aggregate gamers at its own website in an effort to reduce its costly dependence on Facebook as the main distribution channel for Zynga’s social games.

## 2.4 Limits to the Hypothesis-Driven Approach

As a process that avoids waste and speeds time-to-market, the hypothesis-driven approach is broadly applicable to many types of new ventures. These include even ventures for which resources are readily available, such as units within deep-pocketed large corporations, as noted in this section. Yet the process yields fewer advantages under a specific set of circumstances: 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 the hypothesis-driven approach or seek an alternative development path.

Let’s examine each of these conditions in greater detail.

## 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. 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 used 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 a user’s e-mail or for Dropbox to be out of service for a few minutes. Before launching new products like these, a company may elect to get feedback through a smoke test. As we’ve seen, Dropbox did this 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, as would be the case when companies move 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, which is a current limitation of solar and wind energy.

With such new products, entrepreneurs should still follow a hypothesis-driven approach to testing alternative engineering approaches. However, they don’t need 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 are endemic to entrepreneurial projects that require engineering breakthroughs or massive infrastructure deployment. Such cycles therefore make it impossible to launch early and often. Low demand uncertainty 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.<sup>33</sup> Until the company had a working prototype of its two-wheeled “personal transportation system,” could anyone accurately predict how early adopters would respond to the product?

In such a situation, there is no possibility of putting a real product in the hands of real customers early in the product development process. However, entrepreneurs should still use hypothesis-testing methods whenever possible to gain insight on target customers’ needs, and they must remain especially vigilant about cognitive biases. Research shows that decision makers who have to make big and ongoing investments before they can know the outcomes are vulnerable to a phenomenon called “escalation of commitment”: They tend to ignore disconfirming data and to continue investing. Escalation of commitment follows from the

cognitive traps described in Supplemental Reading 3.3: optimism bias, the planning fallacy, confirmation bias, and the sunk-cost fallacy.<sup>34</sup>

## When Resources Are Plentiful

As noted earlier, most startups face significant resource constraints, at least initially, although not all early-stage ventures experience such limits. On rare occasions, startups—especially those launched by successful serial entrepreneurs—are born “fat.” That is, upon their founding, they are able to raise huge amounts of venture capital. Other new ventures are spawned within deep-pocketed large corporations. In theory, resource-rich new ventures—both fat startups and units in established corporations—should still embrace a hypothesis-driven approach. Doing so can speed their time-to-market and sweeten the odds that their new products will meet customer needs. In practice, however, such ventures can find it difficult to act like lean startups.

### “Fat” Startups

Research suggests that fat startups are prone to overspending. Eisenmann, for example, showed that during the late-1990s dot-com boom, Internet startups that raised substantially more capital than similar peers earned lower long-term returns than those peers.<sup>35</sup> It is difficult for fat startups’ founders to follow lean startup precepts, because firms that raise big initial venture capital rounds are often funded during valuation bubbles. During bubbles, 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. Scaling too early can, in turn, 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.<sup>36</sup> However, new ventures nested inside big companies often find it difficult to follow lean startup principles because of the nature of the organization’s budgeting and product planning processes. In most large corporations, managers crave predictability. Executives often impose waterfall planning—which delivers predictable results for incremental product-line extensions—on radically innovative products for which such planning isn’t well suited. For instance, waterfall planning calls for development work to be completed in big batches. This raises the stakes with each new round of product development, making managers ever more reluctant to pull the plug on the project. Owing to escalation of commitment, a new venture can become “too big to fail.”

Likewise, innovative new products within a large corporation 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, when they ask for enough funding to cover a year’s worth of anticipated expenditures. Expectations for predictability make it awkward for managers to diverge from this plan. As a result, 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.

## 3 SUPPLEMENTAL READING

### 3.1 Alternative Approaches for Launching Startups

To understand the logic behind hypothesis-driven entrepreneurship, consider three other approaches that entrepreneurs may use 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 teams work furiously to turn that vision into reality, and do not stop until the product is ready for launch. The entrepreneurs' vision burns brightly, so they feel no 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 is the result of an ego-defensive avoidance pattern. In this situation, the entrepreneur's ego is heavily invested in the success of his or her venture. One way for the entrepreneur 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 very risky. The team receives no customer feedback until the product is built and launched. If uncertainty about demand is high, then the odds of successfully 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 begins only after the preceding stage is completed and successfully passes through the "gate" of a formal review—hence the name "stage-gate planning," a term that is also used to describe this approach.<sup>37</sup> The word "waterfall" comes from a graphical depiction of stages being completed over time and cascading 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 designers and engineers to begin 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 function teams. For example, marketing will develop sales

collateral material once product specifications are complete, then it will formulate a public relations plan, and so forth.

Waterfall planning is sometimes introduced to startups by entrepreneurs who learned the technique in big corporations. This approach 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. For instance, after the concept exploration stage, the team won't receive much customer feedback until it conducts an alpha test. Likewise, when work is completed in big batches, entrepreneurs may not discover errors introduced early in a stage until additional work has been completed, which results in 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 new venture founders respond to the dysfunctions of planning—and indulge their penchant for entrepreneurial action—by embracing an improvisational approach to launch 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 ongoing feedback and assistance that they get from people they know and meet. They adapt their product or service 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, because it leverages scarce resources by tailoring an offering to suit resource providers' capabilities and preferences.<sup>38</sup> Improvisation may also successfully steer a new venture, stepwise, toward opportunity. But without a strong vision, clear plan, or hypotheses, it can be difficult to know when to make course corrections or what direction such changes should take. The decision rule guiding adaptations is vague and runs something like this: "If outcomes seem to be improving, keep doing what you're doing, and consider taking a few more steps down this path; if outcomes are deteriorating, stop doing what you're 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're 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. It then discovers 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, 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. Surprise: The 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, since they 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 strong initial direction means that

some feedback-induced adaptations may turn out to be mistakes, owing to serial dependence between decisions.

Hypothesis-driven entrepreneurship avoids these pitfalls. This is supported by research that shows that startups that pivot once or twice are half as likely to scale prematurely—a leading cause of failure—than startups that pivot more than two times or not at all.<sup>39</sup> Entrepreneurs don't need a perfect hunch, but they do need a good one—along with a way to gather and use feedback. Sequentially testing a comprehensive set of business model hypotheses ensures that pivots—feedback-induced adaptations—take serial dependence into account.

### 3.2 Guidelines for Entrepreneurial Ideation

The following guidelines for entrepreneurial ideation are gleaned from insights from entrepreneurs, design thinking principles, and academic research on creativity and innovation.<sup>40</sup>

- *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. However, to identify unmet needs and potential solutions for business-to-business (B2B) markets, entrepreneurs typically must tap the domain knowledge that follows from years of industry experience. If they lack such experience, they will benefit from closely observing and interacting with customers and/or domain experts, playing the role of anthropologist.
- *Obsession.* While creative individuals become obsessed with the problems they're working on, they are not 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 who 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 mind 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 subject matter experts they follow online.
- *Clarification.* Many inventors use disciplined processes and tools to keep track of and to refine their ideas. Design thinkers often rely on journals and sticky notes, but some entrepreneurs find that writing blog posts forces them to integrate and sharpen their ideas while at the same time inviting valuable responses from readers. Some founders also find that group “whiteboarding” sessions can help their teams generate, clarify, and prioritize 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, such as The Beatles' Lennon and McCartney, Apple's Jobs and Wozniak, or Google's Brin and Page. One collaborator will say something that triggers another's ideas, and co-founders 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; forging connections between ideas; and avoiding negative evaluation of ideas. Second, entrepreneurs should familiarize themselves with the ways in which design thinkers use crude prototypes.<sup>41</sup>

### 3.3 Cognitive Biases

The human brain is subject to many well-documented cognitive biases that impair our ability to make reasoned judgments about feedback we receive.<sup>42</sup> While we cannot eliminate these biases, we can mitigate their impact by understanding them and deploying 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 hypothesis-driven entrepreneurship approach helps limit their impact.

#### Optimism Bias

Optimism bias reflects our systematic tendency to overestimate the likelihood of positive events and to 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.”<sup>43</sup>

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. For example, his ability inspired people to sign on to the legendarily stressful and demanding product development effort that resulted in the revolutionary Macintosh computer. 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.”<sup>44</sup>

However, a reality distortion field can also warp its propagator’s perceptions. Entrepreneurs may come to believe in their vision so fervently that they refuse to accept the reality of disconfirming data. For example, in a study of almost 300 inventions that the Inventor’s Assistance Program (IAP) rated as likely to fail, almost half the founders continued working on them after receiving this negative feedback—advice that the inventors had paid for but subsequently disregarded.<sup>45</sup> Of these negatively rated inventions, only five were ever commercialized, and none were successful.

Entrepreneurs can guard against optimism bias by generating falsifiable hypotheses and tracking performance against them. A “premortem” may also help a founding team look more objectively at disconfirming data.<sup>46</sup> In a premortem, the team envisions a world where its 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 members 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, two to three times longer than their founders had originally estimated to validate their market.<sup>47</sup> Dropbox founder Drew Houston took even longer. For his Y Combinator application, he projected that it would take him eight weeks to ship a paid version of his product, but it actually took 18 months to do so.<sup>48</sup>

Entrepreneurs can mitigate the planning fallacy's impact by (1) being conscious of the fallacy when making intuitive estimates and (2) selecting a reference class of comparable projects for assessing estimates.<sup>49</sup> While reference-class data might not be readily available for startup teams working on fundamentally new products, the hypothesis-driven 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 in response to 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 our decision-making effectiveness when we ignore contrary evidence.

The hypothesis-driven approach can help founders develop a more realistic view of the evidence supporting their business model. But even if entrepreneurs interpret MVP tests with “eyes wide open,” confirmation bias can creep in earlier in the process when founders specify tests. Founders may unwittingly design tests that return false positives—that is, tests that validate a hypothesis when that hypothesis is actually wrong. For example, they may sample only enthusiastic early adopters and then extrapolate their characteristics to the mainstream market. When specifying tests, entrepreneurs should explicitly consider ways in which a proposed test might return false positive or false negative results and they should keep communicating with skeptics (such as investors who declined to invest). Assigning the role of devil's advocate to a team member can also help ensure that all sides of an argument are presented.

## Sunk-Cost Fallacy

Entrepreneurs should not consider sunk costs—expenses that have already been incurred and that can't be recovered (such as assets that have no salvage value)—when making decisions. Nevertheless, they often fall prey to the sunk-cost fallacy. In effect, they say, “It would be wasteful to discard all this work, so we should persist.” This is flawed logic, because a rational decision maker focuses *only* on a project's future expected benefits and future expected costs. But research shows that we humans are averse to losses, especially when we're 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, entrepreneurs limit their sunk costs. Therefore, concerns about such costs are less likely to affect their judgment. They may also be less inclined to view sunk costs as losses if they view pivoting as a natural part of the entrepreneurial process and they recruit employees and investors with a vision of the future that includes the possibility of pivots.



## 4 KEY TERMS

**A/B testing** Divides a set of similar prospects or customers into two groups: 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.

**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 multistep process through which prospects may eventually be converted into loyal customers. The process resembles a funnel in the sense that only a fraction of prospects/customers 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 that 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.

**letter of intent** A commitment, often legally nonbinding, to take a future action, such as purchasing a product under development. Letters of intent can be used as MVP tests in business-to-business settings.

**minimum viable product (MVP)** The simplest possible offering, in terms of product functionality and operational capabilities needed to deliver the product's functionality, required to rigorously disprove a business model hypothesis.

**pivot** Responding to feedback by changing some business model elements while retaining others.

**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.

**runway** The number of months required to exhaust a startup's cash balance based on its expected "burn rate," or negative cash flow per month.

**scaling** Aggressively acquiring customers and stepping up operational capacity.

**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.

**vision** A high-level description of a potential solution for a prospective customer's unmet need, reflecting founders' beliefs about the future.

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## 6 ENDNOTES

- 1 This Core Curriculum reading is largely adapted and reprinted from Harvard Business School, “Hypothesis-Driven Entrepreneurship: The Lean Startup,” HBS No. 812-095, by Thomas R. Eisenmann, Eric Ries, and Sarah Dillard. Copyright © 2013 by the President and Fellows of Harvard College; all rights reserved.
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## 7 INDEX

- Aardvark social search service, 10
- A/B testing, 7–8, 17, 25
- alpha launch, 20
- Amazon, 17
- biases, 14, 18–19, 23–24
- bootstrapping, 3
- brainstorming, 23
- build-it-and-they-will-come approach, 4, 20, 21
- business model, 3, 4, 9–10, 12, 14, 15–16, 17, 21, 24, 25
- business model hypotheses testing, 3, 4, 5, 6–7, 11, 13, 14, 15, 16, 17, 20, 22, 25
- business model optimization, 17
- business model validation, 3, 11, 12, 15, 16, 17, 24
- business plan, 20
- cash flow formula, 6, 16
- Chegg, Inc., 15
- clarification, 22
- cognitive biases, 14, 18–19, 23–24
- cohort analysis, 7, 25
- collaboration, 22
- comprehensiveness, 8
- confirmation bias, 24
- constrained operational capability, 9, 10
- constrained product functionality, 9–10
- continuous improvement, 17
- control group, 7
- conversion funnel, 7, 8, 25
- Craigslist, Inc., 15
- customer value proposition, 6, 13, 15
- demand evaluation, 3, 4, 9, 10, 11, 12, 16
- demand uncertainty, 18–19
- design thinking, 4, 22, 23
- development cycles, 4, 9, 17, 18–19
- Dropbox, Inc., 10, 11, 15, 18, 24
- dry tests, 11
- early adopters, 9–10, 11, 12, 14, 16, 18, 21, 24
- escalation of commitment, 18–19
- evaluating test feedback, 14
- experiments, 3, 4, 13, 16, 17
- Facebook, Inc., 14, 17
- false negative, 12, 14, 24, 25
- false positive, 12, 14, 24, 25
- falsifiable hypothesis (falsifiability), 7–8, 25
- fat startups, 19
- feedback, evaluating, 14
- focus groups, 9
- General Electric Company, 19
- Google, Inc., 7, 16, 23
- go-to-market plan, 6, 7, 13, 15
- hypothesis-driven entrepreneurship, description, 3–4
- hypothesis-driven entrepreneurship, limits, 17–19
- hypothesis-driven entrepreneurship, steps, 5–17
- idea theft, 13
- ideation, 5, 22–23
- immersion, 22
- incubation, 22
- Intuit, Inc., 9, 19
- just-do-it! approach, 4, 21
- kaizen, 17
- Keurig Green Mountain, Inc., 15
- landing-page tests, 9, 11, 25
- launch-early-and-often approach, 9, 18
- lean startups, 3–4, 7, 11, 16, 18, 19, 25
- letters of intent, 7, 11, 13, 25
- minimum viable product (MVP), 3, 9, 25
- minimum viable product (MVP) tests, 8–9
- mistakes, limits on, 18
- “need to have” features, 9
- Netflix, Inc., 17
- networks, 17
- obsession, 22
- operational capability, 3, 9, 10–11
- optimism bias, 23–24
- optimization, of business model, 17

parallel testing, 13  
patent searches, 13  
PayPal, Inc., 14, 17  
perish, 3, 16  
persevere, 3, 15  
pivot, 3, 4, 14, 15–16, 25  
planning fallacy, 24  
power users, 10, 21  
premature scaling, 16  
premortems, 23–24  
prioritizing tests, 13  
product design, 20  
product development, 4, 9, 17, 18–19, 20, 23  
product functionality, 3, 9–10, 20  
product-market fit, 3, 16, 19, 25  
product specifications, 7, 20  
prototypes, 4, 9, 11, 18, 23  
  
rapid prototyping, 4  
recombination, 22  
Rent the Runway (RTR) online service,  
    12–13  
reputational risk, 13  
runway, 16, 25  
  
scaling, 3, 9, 10, 16–17, 22, 25  
Segway, Inc., 18  
sequencing tests, 13  
simulacra, 9  
smoke tests, 10–11, 18, 25  
SnapTax application, 9  
speed, in lean startup approach, 3–4  
stage-gate planning, 20–21  
sunk-cost fallacy, 24  
surveys, 9  
  
technology and operations management,  
    6, 15  
test results, unexpected, 14, 17  
Tiggly (startup), 11  
TiVo, Inc., 15  
treatment group, 7–8  
Twitter, 17  
  
unexpected test results, 14, 17  
  
validation, of business model, 3, 11, 12, 15, 16,  
    17, 24  
vision, 3, 4, 5–6, 14, 15, 20, 21, 23, 25  
  
waterfall planning, 4, 20–21  
whiteboarding, 22  
  
Y Combinator (startup), 8, 16, 24  
YouTube, 17  
  
Zipcar, Inc., 4, 16  
Zynga, Inc., 17