LEAN STARTUP IN LARGE ENTERPRISES USING HUMAN-CENTERED DESIGN THINKING: A NEW APPROACH FOR DEVELOPING TRANSFORMATIONAL AND DISRUPTIVE INNOVATIONS

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INTRODUCTION

Delivering true breakthrough innovations often requires companies to reach beyond the technology itself to rethink the business model using an iterative or probe and learn approach which represents a key tenet of design thinking. Corning's optical fiber program, General Electric's development of computerized axial tomography, Motorola's development of cellular phones, and Searle's development of NutraSweet (Lynn, Morone, and Paulson, 1996) created entirely new markets; to achieve success. The initial concepts needed to be tested in the market to build insight into what markets to pursue and what features and benefits provided value to customers. The technical innovation in each of these cases, was accompanied by a new business model, as these new products required different operational competencies, vendors, and customer channels than the companies' existing offerings.

However, large enterprises, which are particularly adroit at exploiting their existing business models, often have considerable difficulty in developing new business models. For example, Sony developed the Walkman audio player, establishing the market for portable music devices. But Apple displaced it in the portable audio space with a new business model that included a new delivery channel—iTunes. Similarly, Knight Ridder, one of the largest newspaper publishers in the United States and a pioneer in the digital news market, clung to its traditional ad-based business model and failed to capitalize on the potential of new revenue streams exploited by monster.com, autotrader.com, and realtor.com. Kodak, which dominated the film photography market, failed to embrace the business models needed to support digital photography and ultimately ceded the market to companies such as Canon and Nikon.

The lean startup process, with its iterative learning cycles, is particularly suited to breakthrough innovations that require an iterative process and a new business model. Sustaining innovations, which represent the majority of product development activities in large companies, don't require

a lean startup process since customer needs are well understood and companies are able to exploit their current business model. Most large companies have a well-honed process and a formal Stage-Gate process that comprises a set of serial activities (i.e., stages) and decision points (i.e., gates). A go/no-go decision is made at each gate based on the overall risk and value of the project given the data available at the gate. An iterative process, embraced by the lean startup process, could be counterproductive to the sequential Stage-Gate process.

The lean startup process is beginning to be used at enterprises (Blank, 2013a), such as GE and Intuit. The methodology has some unique features that are congruent with both the probe-and-learn process as well as design thinking, but its most important contribution is its focus on the business model. This is an artifact of its origins in entrepreneurial startups, which all need to create business models to support their technical innovations. In contrast, enterprises already have business models for their sustaining business, but those sustaining business models may not be appropriate for breakthrough innovations. Thus, the lean startup process provides a needed focus on business model development as well as a structure for the probe-and-learn process.

The objective of this chapter is to introduce the lean startup process, integrate it with key concepts in human centered design and show how it can be used for developing breakthrough innovations. The chapter is broken into five sections: In the first section, the principles and methodology of the lean startup approach, as it is currently being used in entrepreneurial startups, are explained, and corollaries to enterprises are discussed. In the second section, breakthrough innovation is defined within the context of sustaining, transformational, and disruptive innovation, and the lean startup methodology's particular value for transformational and disruptive innovation is illustrated. The third section provides a definition of what a business model is and demonstrates how the lean startup approach makes the business model a key outcome. The fourth section discusses the lean startup approach through the lens of human-centered design principles and evaluates the attributes of different business model canvases. The final section offers a discussion of lessons learned from implementing the lean startup approach in enterprises.

LEAN STARTUP

The lean startup movement was begun by Steve Blank, a serial entrepreneur, based on his experiences in eight startups—two that failed badly, several that had some success, and one "dot.com bubble home run" (Blank, 2013b, p. 370). Blank came to believe that there was something fundamentally wrong with the accepted serial entrepreneurship process, in which startups would write a business plan, get funding, assemble a team, introduce the product, and then start selling it as hard as it could. Under this process, by some measures over 75 percent of startups failed (Gage, 2012). Shane (2008) found, based on a study of all new businesses founded in the United States in 1992, "only 45% of [new businesses] last five years and only 30% last ten years" (p. 98). Lean startup seeks to address these high failure rates by rethinking the entrepreneurship model.

The Principles of the Lean Startup Methodology

The lean startup methodology developed by Blank (2014) relies on three principles:
- Search and execution are different.
- Startups are not smaller versions of large companies.
- Search requires a temporary organization designed to search for a repeatable, scalable business model.

Each of these principles can be reframed to fit the context of innovation in enterprises.

Search and execution are different. Most startups try to execute on their plan once they obtain funding, never realizing that search and execution are different. In contrast, large companies have long understood that the initial stages, the FEI, are different from the product development process. In the FEI, a concept is developed, which is scaled for production in the second part of the innovation process and then commercialized in the third stage. For sustaining innovations, a business plan is typically written at the close of the FEI, as the concept moves into development and commercialization. That plan describes the execution steps for product development and maps the overall value proposition of the innovation.

Thus, the principle remains unchanged, whether the method is implemented in a startup or in an enterprise:

Search and execution associated with innovation require different activities.

Startups are not smaller versions of large companies. Most startups begin by envisioning themselves as having customers, sales, and a complete business model, that is then developed into a business plan that guides the search for startup funding. The business plan describes the execution process needed to develop the envisioned business. However, it relies on lots of assumptions, which are usually found to be mostly incorrect when the startup team visits its first set of customers. In a similar way, most enterprises envision the FEI process for breakthrough innovations as simply a different version of the FEI process for sustaining innovations, and assume that breakthrough innovations will use a comparable business model as sustaining business - only requiring minor adjustments. In reality, however, breakthrough innovations often require a new business model, with different customers, channels, and partners. Thus,

the search for breakthrough innovations in enterprises is not an expanded version of the search for sustaining innovations.

Search requires a temporary organization designed to search for a repeatable, scalable business model. The real output of the search activity is a repeatable, scalable business model that can serve as a guide for sales and commercialization. Christensen and Raynor (2003) posit that large enterprises also require a different organization to search for and, in many cases, execute on breakthrough innovation. While these authors advocate a probe-and-learn approach to developing breakthrough innovation, they are silent with regard to a process for developing the new business model these innovations usually require. But the same principle applies to business model as to search, for both startups and large enterprises:

Breakthrough innovations require a temporary organization, managed separately within the current business unit or an entirely different organization, designed to search for a scalable, repeatable business models.

The Lean Startup Process

The lean startup process, schematized in Figure 1, involves four parts. Three were described by Blank in his explication of the model: the business model, customer development, and agile

development; the fourth element, the minimum viable prototype (MVP),[1] is added here since it is the main experimental tool used by lean startup teams to validate their hypotheses. The process involves continuous iterations of customer development, MVP, and business model changes, repeating until a scalable, repeatable business model emerges. The value of the lean startup approach is that the business model, which is schematized using the business model canvases, is the principle convergence point of the process.
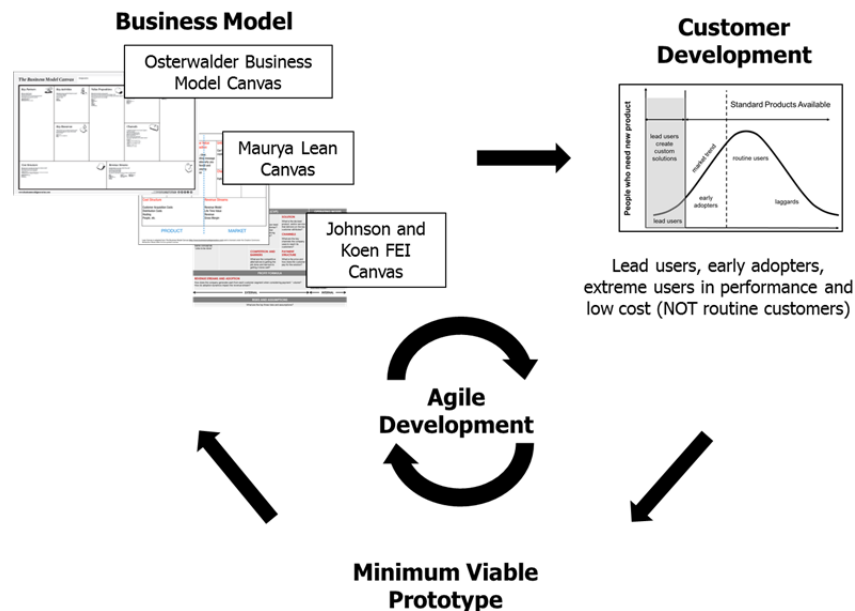

Figure 1. Schematic showing the four elements of the lean startup approach: the business model, customer development, the minimum viable prototype (MVP), and agile development.

In the customer development stage, the team validates its business model through ethnographic studies of customers in relation to their environments. Visiting customers is a central theme of both the lean startup approach and human centered design. Understanding a person's thoughts, emotions and motivations represents a critical part of the process and requires well-tuned listening and observing skills to be able to empathize and understand the real needs of the customer. Tom Kelly (2005) advocates that the people doing the interview need to act as anthropologists to understand how people interact both physically and emotionally with the new

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[1] The lean startup movement defines MVP as "minimum viable product." I prefer "minimum viable prototype" because the term *product* implies something that can be sold. In contrast, a prototype incorporates only the feature set necessary to get a response from the customer and often is not a full, saleable product.

concepts. Graduate classes taught by Blank and others require teams to visit at least 125 customers during the course. Which customers are visited is as important as how many.

Startups often make the mistake of visiting "routine users" (Figure 2). These customers are often satisfied with the current solutions and product offerings, and thus provide limited insight. Lead users or early adopters who are not satisfied with current solutions offer far more potential for real insight and learning. Lead users (von Hippel, 1986) and early adopters are different from other customers because they are at the leading edge of an emerging product or process need and have a high incentive to find original solutions to meet their own needs. For example, a team developing new farm irrigation systems would benefit from spending time with farmers who are in the midst of a drought or who operate in areas where irrigation costs are high, rather than farmers who have access to sufficient affordable irrigation using current solutions. Lead makers, with the advent of inexpensive 3D printing, as a form of lead users may also be valuable to study.
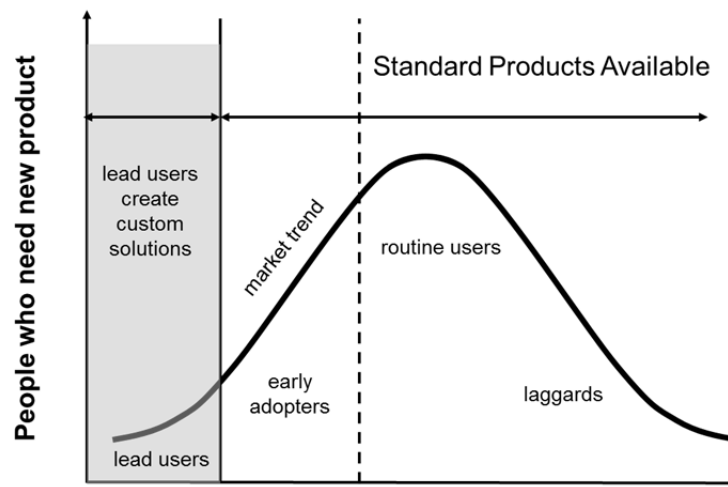

Figure 2. Schematic of the differences between lead users, early adopters, routine users, and laggards; lean startup teams should focus on lead users and early adopters.

The third part of the lean startup approach is the development of an MVP. There is frequently confusion around what exactly constitutes an MVP. Most, when first confronted by the concept, believe that the MVP is actually a minimal-featured version of the final product. This is not the case. Rather, *the MVP incorporates the minimum set of features necessary to get early customer validation that the company's long-term vision makes sense.* MVPs may take many forms, depending on the stage of development and the information the prototype needs to yield.

For example, the MVP shown in Figure 3a illustrates only the basic design features for a new nasal debrider, the final version of which is shown in Figure 3b.

Figure 3a   Figure 3b

Figure 3. Example of an MVP. Figure 3a shows a very rough prototype, constructed to demonstrate the minimum feature set in terms of look and design needed to get rapid, candid feedback from ENT surgeons. Figure 3b is a picture of the final Gyrus ENT debrider.

Blank (2013c) offers another illustrative example demonstrating the need to focus the MVP on the customer needs. A California-based startup planned to develop a series of unmanned serial drones to carry hyperspectral imaging cameras that could tell famers where their land required more fertilizer or water. The team envisioned the MVP as a drone equipped with a hyperspectral camera. Their business model was to build a fleet of drones with hyper spectral imaging cameras. But in fact the farmer didn't really care how the data was collected. Thus the MVP was the data. The team confused the MVP in trying to develop an early working prototype of their envisioned product as a drone with a hyperspectral camera. But in fact the farmers didn't really care how the data was collected—the MVP, for this customer set, was the data. In the end, the team rented a hyperspectral camera and flew over fields with it to collect data, which they then showed to the farmers in their target market.

The final component of the lean startup process is the iterative cycle of developing and testing MVPs, which can be described either as agile development or as build-measure-learn feedback loop (Reis, 2011). A key metric for this process is how quickly the team loops through the process, developing successive MVPs.

TRANSFORMATIONAL AND DISRUPTIVE INNOVATION: DEFINING THE DOMAIN WHERE THE LEAN STARTUP PROCESS SHOULD BE USED

In order to see where the lean startup approach can be most productively implemented in enterprises, it is important to develop a common framework and typology. Not every radical innovation will benefit from a lean startup approach. For example, Intel's dual-core processer doubles performance while reducing power consumption. This is a radical innovation, but it doesn't require a new business model: Intel can leveraging its current business model since the product is sold to its current customers using the company's existing channels. Technology project management tools designed for high-risk projects, such as Technology Stage Gate (Ajamian and Koen, 2002), are more appropriate to manage these kinds of innovations. In contrast, Intel might have found the lean startup methodology to be valuable in its failed attempt to get into the mobile phone market, with chips built using existing technology but sold through a new channel to new customers based on a new value proposition.

Innovating outside an existing business model has always been difficult for large companies. In a study of 154 companies, Bain and company found that the odds of success dropped as low as 10 percent when large companies tried to develop products two steps from their core, where one step was a single change in the business model—that is, a new customer, new technology competence, or new channel (Edwards, 2012). With iTunes and iPod, for example, Apple succeeded with a new business model several steps outside of its core as a computer company.

The principle area that causes problems for large enterprises is innovating into a new value network. Many schematics of the innovation space map two dimensions, with newness of the market and of the technology as the two critical axes. However, Christensen and Raynor (2003) and Koen, Bertels, and Elsum (2011) suggest a value network dimension that is more encompassing than the traditional market dimension, capturing the unique relationships enterprises build with both its upstream (supplier) and downstream (distributor and customer) channels.

Koen, Bertels, and Elsum (2011) suggest a three-dimensional innovation typology that captures value network, newness of the technology, and the financial hurdle rate; Figure 4a shows the value network and technology dimensions of this model. Within the technology dimension, incremental, architectural, and radical innovation are demarcated. Incremental innovation involves the refinement and improvement of existing technology. Architectural innovation involves new ways of integrating existing components into a system, but no new technology.

The iPod, for instance, incorporated no new technology but provided an entirely new design. Finally, radical innovation, exemplified by Intel's dual-core processor, incorporates new core technology.
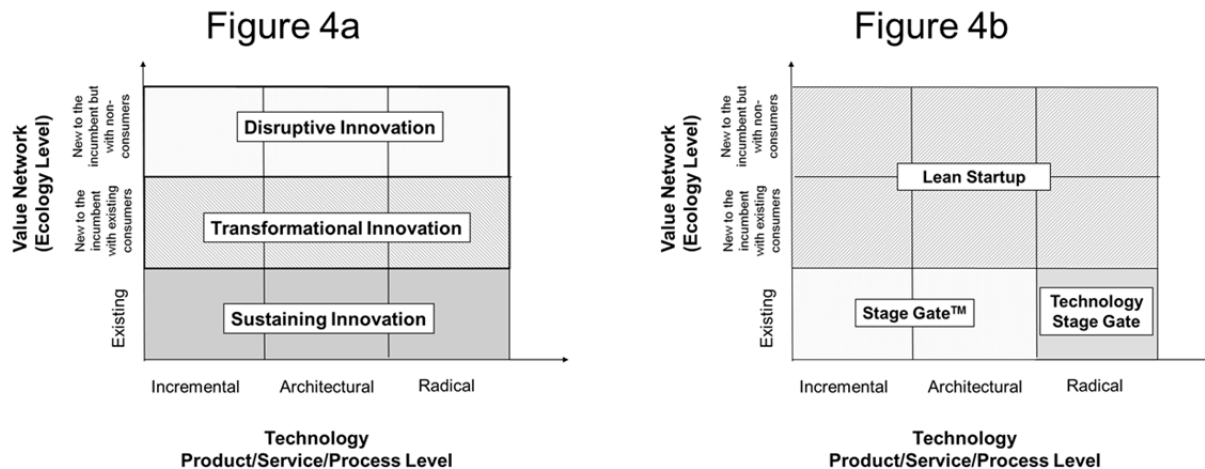

Figure 4. Business model typology showing the relationship between sustaining, transformational, and disruptive innovation (Figure 4a) and where the lean startup methodology may best be used in (Figure 4b).

Koen and colleagues (2011) also distinguish between three types of value networks. The first is the existing network—the suppliers, customers, and channel partners with whom the company already has established relationships. The second type is a value network that is new to the company, but that engages with existing customers. Intel's new phone chip engaged with a new value network for Intel, but one for which it already had channels and customers. The third type of value network is also new the incumbent, but has no customers. Classic examples of this are the first personal computer and Sony's first battery-powered transistor pocket radio. The initial set of customers for these products were non-consumers—meaning that they had not owned or used earlier generations of the product.

Procter & Gamble developed its own definitions for the different types of innovation: sustaining, transformational and disruptive (Brown and Anthony, 2011); these are overlaid on Koen et al.'s model in Figure 4a.

- *Sustaining innovations* bring incremental improvements to existing products; they may include radical technology innovations, as in the case of the dual-core microprocessor chip.

- *Transformational innovations*, sometimes called *adjacencies*, bring a significant improvement to the existing product line and often draw the company into new value networks. An example is Nespresso, developed by Nestlé, which engaged Nestlé's coffee business into a new value network focused on young urban professionals willing to pay a premium price for fine coffee.

- *Disruptive innovations* establish an entirely new value network that involves nonconsumers—customers who have not entered the market. Sony's Walkman is an example of an architectural innovation focused on a market, teenagers, who had not previously owned audio playing devices.

Different combinations of innovation and value network require different project management tools, as shown in Figure 4b. Stage-Gate and Technology Stage Gate should be used for projects in the sustaining space, as the company already has intimate knowledge of the value network and the iteration required by lean startup or probe-and-learn approaches will add costs and time to the process. In contrast, a lean startup approach should be used for the transformational and disruptive innovation, where a probe-and-learn approach is required to glean needed market and customer insight.

WHY IS A BUSINESS MODEL A VALUABLE PART OF THE LEAN STARTUP PROCESS?

The concept of a business model was first mentioned in an academic article in 1957 (Bellman et al.,) in the context of building business games for training purposes. The term continues to confuse academics and practitioners alike. Wirtz (2011), reviewing the academic literature around business models, showed that there was little, if any, agreement in the academic literature with regard to what constitutes a business model. Despite the concept's lack of theoretical grounding, however, it continues to gain prominence among academic and business communities.

The Business Model Canvas (Figure 5), introduced by Osterwalder and Pigneur (2010), addresses this confusion by providing a much-needed visual encapsulation of the business model and a clear vernacular, which facilitates discussion and debate without sacrificing the complexities of the business. As it is explicated by Osterwalder and Pigneur, the Business

Key Partners

who are our key Partners?
who are our key suppliers?
which key resources are we acquiring from partners?
which key Activities do partners perform?

MOTIVATIONS FOR PARTNERSHIPS
Optimization and economy
Reduction of risk and uncertainty
Acquisition of particular resources and activities

Key Activities

what key Activities do our value Propositions require?
our distribution channels?
customer relationships?
revenue streams?

CATEGORIES
Production
Problem Solving
Platform/Network

Key Resources

what key resources do our value Propositions require?
our distribution channels? customer relationships?
revenue Streams?

TYPES OF RESOURCES
Physical
Intellectual (brand patents, copyrights, data)
Human
Financial

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

CHARACTERISTICS
Newness
Performance
Customization
"Getting the Job Done"
Design
Brand/Status
Price
Cost Reduction
Risk Reduction
Accessibility
Convenience/Usability

Customer Relationships

What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
Which ones have we established?
How are they integrated with the rest of our business model?
How costly are they?

EXAMPLES
Personal assistance
Dedicated Personal Assistance
Self Service
Automated Services
Communities
Co-creation

Channels

through which channels do our customer Segments want to be reached?
How are we reaching them now?
How are our channels integrated?
which ones work best?
which ones are most cost-efficient?
How are we integrating them with customer routines?

CHANNEL PHASES
1. Awareness
   How do we raise awareness about our company's products and services?
2. Evaluation
   How do we help customers evaluate our organization's Value Proposition?
3. Purchase
   How do we allow customers to purchase specific products and services?
4. Delivery
   How do we deliver a Value Proposition to customers?
5. After sales
   How do we provide post-purchase customer support?

Customer Segments

For whom are we creating value?
who are our most important customers?

Mass Market
Niche Market
Segmented
Diversified
Multi-sided Platform

Cost Structure

what are the most important costs inherent in our business model?
which key Resources are most expensive?
which key Activities are most expensive?

IS YOUR BUSINESS MORE
Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing)
Value Driven (focused on value creation, premium value proposition)

SAMPLE CHARACTERISTICS
Fixed Costs (salaries, rents, utilities)
Variable costs
Economies of scale
Economies of scope

Revenue Streams

For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each revenue Stream contribute to overall revenues?

TYPES
Asset sale
Usage fee
Subscription Fees
Lending/Renting/Leasing
Licensing
Brokerage fees
Advertising

FIXED PRICING
List Price
Product feature dependent
Customer segment dependent
Volume dependent

DYNAMIC PRICING
Negotiation (bargaining)
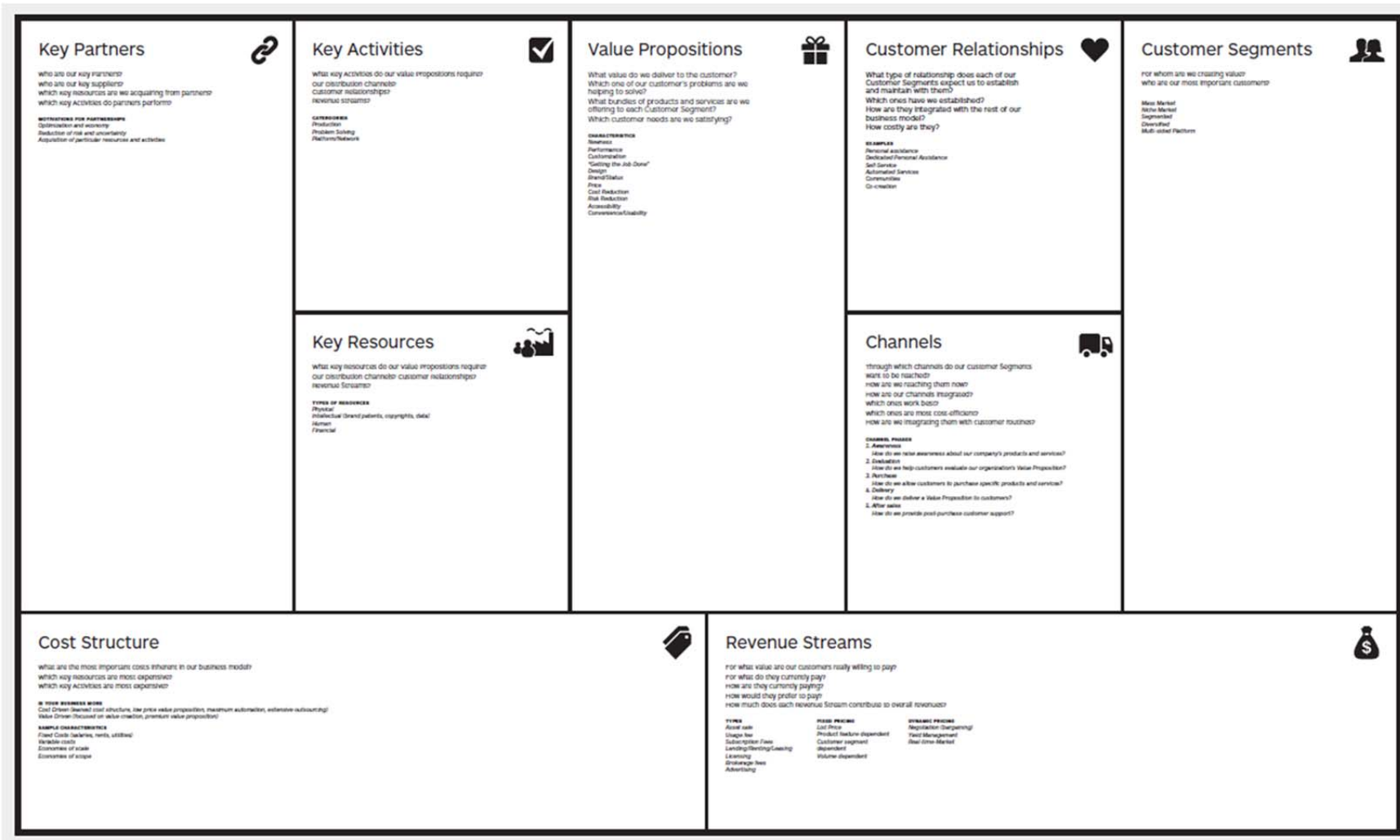Yield Management
Real-time-Market

Figure 5. Business model canvas (Osterwalder and Pigneur, 2010)

Model Canvas breaks the business model into nine building blocks: key partners, key activities, key resources, value propositions, customer segments, customer relationships, channels, cost structure, and revenue streams. The Business Model Canvas allows the development team to evaluate all nine elements first separately and then together, thereby facilitating new insights that would not have been possible without this holistic perspective. As part of a lean startup approach, the Business Model Canvas helps the team validate business model hypotheses until it finds one that is repeatable and scalable. The layout of the canvas helps make sure the team is not overlooking key elements. Most startups, for instance, tend to focus too much on the solution and the customers, neglecting channels, the value proposition, and the resources they need.

Edward Tufte (1997), a renowned scholar in the area of information design and visual literacy, encourages the use of data-rich illustrations and emphasizes the importance of being able to see all of the key data "in one common eye span."[2] Exploring the decisions leading up to the 1986 explosion of the space shuttle Challenger, in which seven astronauts died because of leaking O-rings, Tufte posits that the disaster could have been predicted had the critical information all been plotted in one descriptive illustration that could be surveyed within a single eye span (Tufte, 1997, p. 49). The Business Model Canvas provides just such a layout for the team, capturing all the data needed to visualize the business within one easily viewable graphic.

Because the Business Model Canvas functions as a convergence tool for the project team, it is a critical element of the lean startup process. But most teams, in the beginning, fail to understand its value, feeling that the canvas contains no new insights and replicates what they already know. Academics can also be particularly harsh when they are exposed to the canvas for the first time, indicating that it captures only very elementary business information. Teams quickly come to understand its value when they begin to use it as a tool to organize and test hypotheses while simultaneously accounting for the linkages that connect the different elements of the business model.

Even with the Business Model Canvas, the concept of the business model remains both murky and confusing. Just filling out the boxes of the canvas neither creates value nor assures success as the quality and depth of the information collected remains the critical commodity. In the end, the Business Model Canvas accomplishes two critical goals in the lean startup process:

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[2] Email communication between Tufte and the author, January 10, 2014.

1. It conceptualizes the startup as a business model, rather than as a product or solution. The true output of the lean startup approach is a repeatable and scalable business model.

2. It provides the team with a visual encapsulation of progress that captures the complexities of the different elements and their relationships as various hypotheses are tested.

LEAN STARTUP THROUGH THE LENS OF HUMAN-CENTERED DESIGN

Lean startup codifies many elements of the human-centered design process, which solves problems by matching people's needs with what is technologically feasible by developing simple prototypes and then iterating them until a viable business strategy emerges that can be converted into customer value—and hence a business opportunity.

To accomplish this goal, the human-centered design process always begins with a focus on the central question, What is the business problem? This approach helps teams avoid the typical error of focusing too quickly on the idea or solution. Many innovations fail not because of a fatal flaw in the solution, but because the company fails to understand what problem it is solving. The team developing Newton, Apple's PDA, was so enamored with the technology underlying the concept that they failed to consider the unique set of problems that the mobile user needed to solve. Segway failed because its development process was focused on transportation for everyone and not on particular jobs to be done for specific users; the company built a huge plant at the outset—based on the idea of transportation for everyone—and ended up with significant overcapacity. Sony's Betamax videotape format failed, despite its superior technical quality, coming in second to VHS. Sony was focused on higher quality, while VHS's creators focused on the early adopter's need for a two-hour capacity so they could record an entire football game. Betamax failed, in other words, because Sony was not focused on the problem users wanted to solve.

Getting to the right problem represents the pinnacle of the design process used by the iconic design firm IDEO. IDEO's methodology consists of three critical questions:

1. *What is the right problem?* As indicated in the discussion above Apple's Newton and Sony's Betamax failed since they did not understand the problem they were solving. A great quote from Einstein further emphasizes the importance of understanding the problem:

   > *"If I had only one hour to save the world I would spend 55 minutes defining the problem and only 5 minutes finding the solution."*

2. *Who has the problem?*
   The heart of the human-centered design process is a focus on human values and a deep empathy with users. Thus, it is necessary to identify early on which customers the team plans to spend time with.

3. *What is the value to the user in solving the problem?*
   The value of a solution for the customer is determined by observing what people do, how they think, what they need, and what they want. These determine the attributes of the solution (as opposed to the solution itself). Christensen, Cook, and Hall (2005) illustrate this critical point with a vivid example: The morning customer in their narrative faces a long ride to work and needs something to both satisfy hunger and bring some excitement to the boring commute. Staving off hunger and bringing excitement are the attributes of the solution, or the customer value needed to solve the problem. The solution itself could take any of several forms—a milkshake, a bagel, a doughnut, or even a candy bar.

In IDEO's process, the project team continuously iterates answers to these questions until it converges on the right problem that brings real value to a set of customers.

The Business Model Canvas plays a role in this development, allowing teams to track the interactions between the various elements of the emerging business model. When the Business Model Canvas is used in the context of a human-centered design method, it is extremely valuable to separately evaluate these three core questions and the solution, so that the solution attributes are not confused with the solution. Keeping the problem, the customer, the solution

attributes, and the solution separate in the canvas allows the lean startup team to build on the key tenets of the human-centered design process.

Unfortunately, Osterwalder and Pigneur's (2010) canvas does not allow for this extension to the extent that Maurya's (2012) Lean Canvas and the FEI Canvas[3] do. The Lean Canvas, shown in Figure 6, was specifically developed for the startup entrepreneur and is intended to better capture the uncertainty and risk of the startup (Maurya, 2111). The FEI canvas, shown in Figure 7, was developed to support the front end of innovation in large enterprises. The framework for the FEI Canvas was the four-box business model developed by Johnson (2010, p. 25), which has four key elements: the value proposition, key resources, key processes, and the profit formula. In this way, the FEI Canvas embeds an accepted concept for a business model in a large enterprise.

Figure 6. The Lean Canvas (Maurya, 2012)

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[3] http://www.frontendinnovation.com/media/default/pdfs/fei-canvas.pdf

FEI Canvas©

Figure 7. FEI Canvas (http://www.frontendinnovation.com/media/default/pdfs/fei-canvas.pdf)
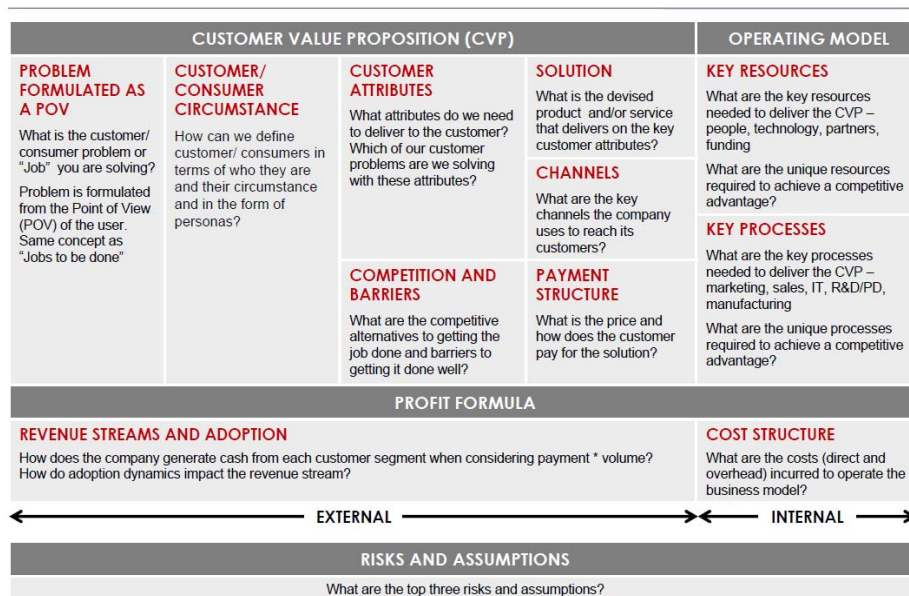
The attributes of the three canvases are compared in Table 1. The Lean and FEI Canvases share five attributes with the Osterwalder and Pigneur canvas, but also encompass a number of other attributes. These differences reflect the different intents of the three canvases. For example, the Lean Startup canvas does not have a box for external resources, as Maurya (2011) believes that entrepreneurial startups should focus on customers before looking at developing partnerships. In a similar vein, the FEI Canvas includes additional boxes intended to capture the particular context of front-end innovation in a large corporation. For example, there are separate boxes to capture key processes and resources that are often principal enablers for competitive advantage for large companies. Osterwalder and colleagues (2014) recently published the Value Proposition Canvas (Figure 8), which fill many of the gaps in the original version.

Each of the three canvases aligns with the human-centered design approach to varying degrees, as illustrated in Table 2. In the original Business Model Canvas, three of the four building blocks of human-centered design are not accounted for, although the Value Proposition Canvas addresses all of these shortcomings. For instance, the problem definition is included in the customer segment portion of the Value Proposition canvas using "jobs to done" language and the value to users in solving the problem, captured only generically in the original Business

Model Canvas, is expanded with its own box in the Value Proposition Canvas. The solution is also missing from the original canvas, but detailed in the Value Proposition canvas, although the need to pair the original Business Model Canvas with the Value Proposition Canvas violates Tufte's (1997) insistence that effective tools must capture all critical information in a single eye span.

The Lean Canvas separates the problem, which customers have the problem, and the solution into separate boxes. Solution attributes are not assigned to a particular box; presumably, they should be included in the value proposition box, which calls for a "single, clear, compelling message that states why you are different and worth paying for" (Maurya, 2012, p. 5). The FEI Canvas, which was designed with the human-centered design perspective in mind, has separate boxes for all four of the core design principles.

In summary, the human-centered design approach evaluates the project through the lens of the problem, asking the development team to define the problem, identify who has the problem (i.e., who the customer is), and map the value proposition or the attributes required in the solution. Osterwalder and Pigneur's original Business Model Canvas was designed to be used in a sustaining business, where it is less important to define the problem. This could limit its use as a brainstorming tool in transformational and disruptive innovations, where it is critical for teams to be able to work on problem, the customer, the solution attributes, and the solution separately. In contrast, the Lean Canvas, which was designed for startups, specifically separates out three of the four human-centered design attributes, and the FEI Canvas, which was constructed to support the FEI in enterprises, offers separate spaces for all four elements.

IMPLEMENTING THE LEAN STARTUP APPROACH IN ENTERPRISES

Based on the author's experience implementing a lean startup approach in three Fortune 100 companies and teaching lean startup as part of a 14-week executive MBA course, companies consistently stumble in five ways: by misunderstanding the problem, by confusing solution attributes with the solution itself, by focusing on the wrong customer, by envisioning the prototype as a fully featured solution rather than a minimum threshold to demonstrate critical features, and by making incorrect assumptions about channels, cost structures, and adoption rates.
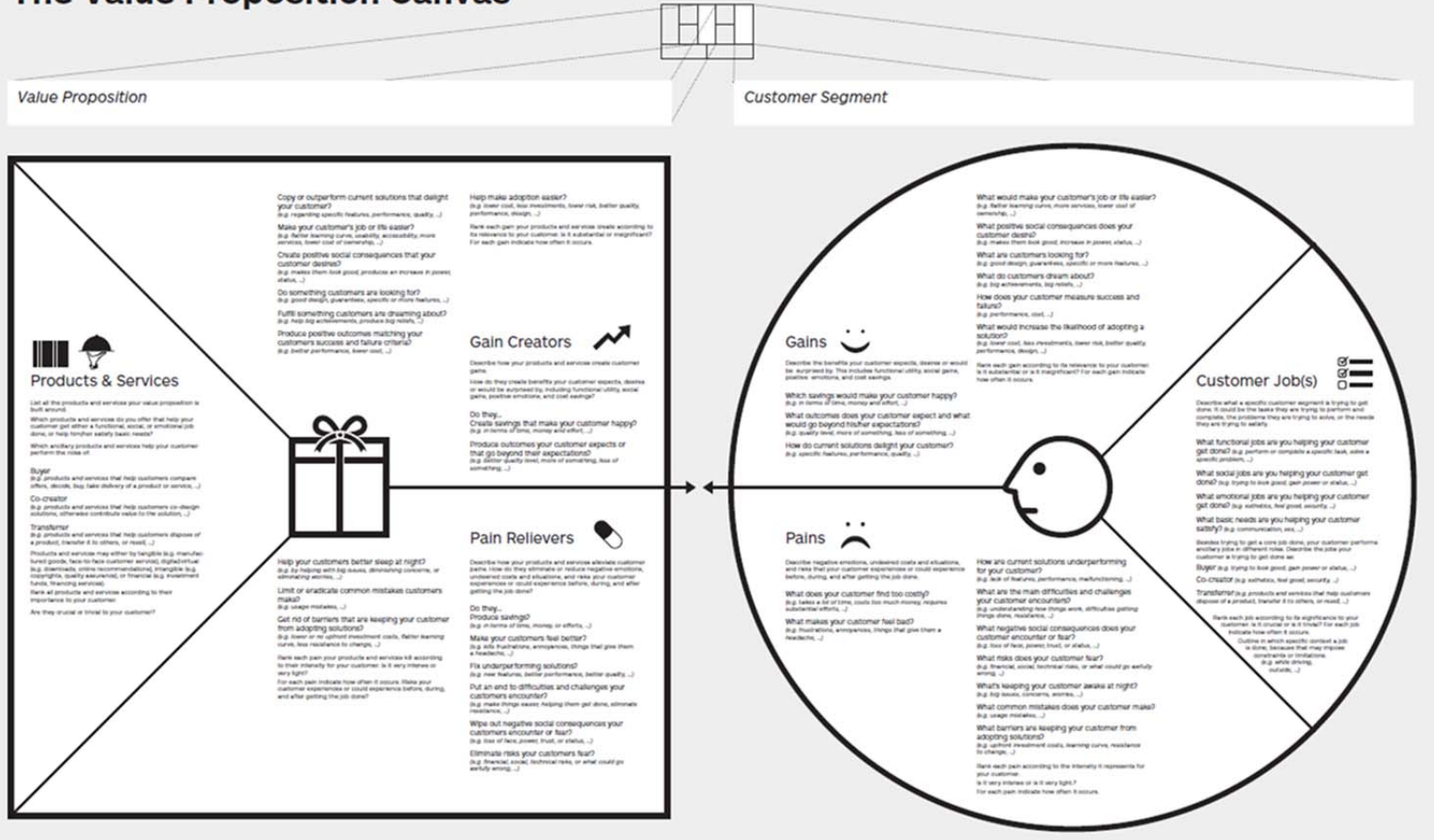
Figure 8. Value Proposition Canvas (Ostwerwalder et al., 2014)

Companies struggle at getting to the right problem.

In the author's experience, even experienced teams are often unsure what problem they were working on—even as they are typically clear about the unmet customer needs they seek to address and the solution. The practice of formulating the problem from the Point Of View of the user, or POV, promoted by IDEO's process (Bootcamp Bootleg[4]), is a powerful methodology that provides teams significant help in focusing on the right problem. The POV is a powerful reframing of the problem that is grounded in the needs and insights of users. A great POV provides a guide for the team and helps expose new opportunities by providing a fresh perspective on the concept and the problem. In addition, by its very nature, it helps ensure that the team remains emotionally connected to users' needs.

The POV has three elements: 1) the user, 2) the user's need, and 3) observation of the user in his or her environment and interpretation of the observations. IDEO teams often take weeks and sometimes even months to get the POV right. For example, a typical problem statement for a group working on developing nutritious food might be "A teenage girl needs more nutritious food because vitamins are vital to good health." The same problem formulated as a POV could be, "A teenage girl with a bleak outlook needs to feel socially accepted when eating healthy food because in her group a social risk is more dangerous than a health risk" (Bootcamp Bootleg, 2010, p. 21). The first formulation is a statement of fact, while the second POV formulation is an actionable description that drives empathy, provides direction for the effort to develop solutions and serves as a defining vision for the team.

Teams often ask if the POV should take into account multiple users and multiple needs. For example, in the previous example, additional stakeholders might include the parents of teenage girls and food suppliers. Each of these stakeholders may have different needs and insights. However, it is critical that the team focus on the single user who has the biggest or most urgent problem—in this case, the teenage girl. Had Sony focused on the early adopter— a male who needed to record a two-hour football game—in developing Betamax, the company may have avoided the mistake of sacrificing recording time to improve recording quality, and thus not have lost the battle to VHS.

Companies often confuse solution attributes with the solution.

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[4] http://dschool.stanford.edu/wp-content/uploads/2011/03/BootcampBootleg2010v2SLIM.pdf

It is difficult to separate out solution attributes without falling into the trap of talking about the value of different solutions. The use of a solution attributes map, illustrated in Figure 9, can keep teams from falling into this trap. In the example diagram, which offers a hypothetical map for a single-use coffee product, the four key solution attributes are coffee taste, ready to drink time, time to clean, and easy to use. The map illustrates how each competitor measures up on each attribute and assesses the relative importance of each attribute to the user. In the example, the attributes, competitor ratings, and relative importance ratings are all illustrative; in actual use, these factors would be derived from customer feedback.
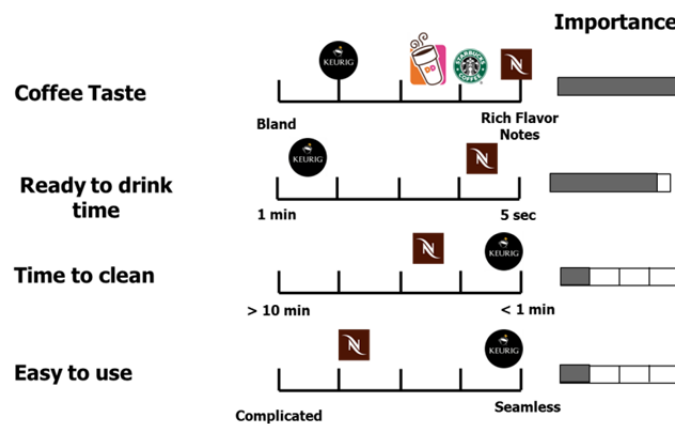

Figure 9. Solution Attributes Map

Teams focus on the wrong customers.

In almost all of the projects the author worked with, teams interviewed routine customers rather than lead users or early adopters. Routine customers typically want the same product or service they are currently using with higher performance or at a lower cost; they typically don't see the value of a transformational or disruptive innovation. Steelcase made this error in developing their Aero chair, which eventually turned out to be one of their most successful products. However, many of the company's mainstream customers disliked the new chair's design, commenting that it looked like a lawn chair skeleton that was yet to be finished. The chair found an audience among customers who had difficulty being comfortable in the existing chairs, some of whom had back problems—in other words, who are the users with the biggest problems unaddressed by current solutions.

Most teams envision the prototype as a fully featured solution.

In most cases, team members wanted to show potential customers a fully featured prototype, presumably to avoid embarrassing themselves or offending their users. As one team remarked, "How can we show this very rough prototype to an experienced surgeon? After all, we are a high-quality medical device company." Teams had difficulty understanding that the value of the prototype was to invite conversation and feedback. Proponents of design thinking advocate low-resolution prototypes made up of paper, pipe cleaners, cardboard, and even Lego bricks to rapidly depict the solution along a tangible dimension. As David Kelly, the founder of IDEO, has said, " if a picture is worth a thousand words, then a good prototype is worth a thousand pictures" (Fredman, 2002).

The objective of the prototype is to test particular solution attributes of the product being developed, _not_ to offer a realistic model of the final product in order to solicit feedback from the user.

Teams consistently make incorrect assumptions about channels, cost structure, and adoption rates.

Based on an in-depth retrospective study of three large enterprises developing business models outside their core, Bertels et al. (2015) identify three components of the new business model that are most susceptible to false assumptions: channels, cost structures, and product adoption rates. The enterprises had fewer false assumptions in other areas of the canvas, primarily because these changes are relatively easy to identify and firms can, with effort, resolve known uncertainties. For example, one of the new businesses studied involved a large change from the traditional market; the company spent six months conducting sophisticated ethnographic studies to determine the needs of the market. However, companies had engrained ways of thinking about cost structures, tended to expect similar adoption rates for new products, even breakthrough innovations, as they had seen with their sustaining products, and thought that the new products would fit within existing channels. Accordingly, they adopted into the new business models the same overhead structure associated with their sustaining businesses. They were well aware that they did not know their new markets, and so extensively studied those users. However, they assumed channel dynamics, cost structures, and adoption rates were well understood and so failed to give them sufficient attention.

The lean startup process should be managed by the same strategy exemplified in the emerging business opportunity (EBO) process established at IBM (Garvin and Levesque, 2005). Instead of having structured and preplanned meeting, such as occurs in Stage Gate, the EBO's hold review meetings at monthly intervals focused on lessons learned over the previous month. Perhaps the single valuable metric for lean startup approach is the how quickly the team can iterate based on a set of customer visits and MVP's to develop a new business model and new MVP to test.

CONCLUSION

Large enterprises usually have well-honed processes for developing sustaining projects but lack similar methods for transformational and disruptive innovations, which require an iterative "probe-and-learn" process. The lean startup process, which consists of developing the business model, identifying the customer, building a minimum viable prototype, and engaging in agile development cycles, offers a gold-standard methodology for innovations that require a learning strategy as they need to search for a business model while sustaining innovations execute on their current one. Human-centered design, which at its root focuses on solving problems by matching needs with what is technologically feasible, moves toward these goals through an iterative approach involving customer empathy and the use of simple prototypes; this iterative approach embodies many of the characteristics of the lean startup methodology. Just as the lean startup process focuses on the business model, the human-centered design approach begins with a focus on the problem, building its exploration around four key questions: What is the business problem? Who has the problem? What is the value to the user in solving the problem? What are the attributes of the solution?

The business model canvases used in the lean startup process accommodate these questions to varying degrees. The original, and very popular, Business Model Canvas (Osterwalder and Pigneur 2010) does not allow teams to separate out these areas, although the new Osterwalder and colleagues' (2014) Value Proposition Canvas does. The Lean Canvas (Maurya, 2012), which was developed specifically for startups, separates out the first two items, and the FEI Canvas, which was developed to support the FEI in large enterprises, offers separate spaces for all of them.

Large enterprises implementing a lean startup approach struggle in five areas: getting to the right problem, focusing on the right customers, separating solution attributes from the solution, envisioning the minimum viable prototype, and questioning assumptions around channels, cost structure, and adoption rates for the new innovation. The lean startup process has the potential, for becoming the gold standard project management process for transformational and disruptive innovations in much the same way that the Stage Gate process is the gold standard process for sustaining innovations.

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Table 1 – Attributes of Business Model Canvases

Attributes	Osterwalder and Pigneur's (2010) Business Model Canvas	Maurya's (2012) Lean Canvas	FEI Canvas
Major Focus	Sustaining projects	Startups	Transformational and disruptive innovation in large enterprises
Key Partners	1.Who are the key partners, suppliers? What key resources and activities are we acquiring from the partners?	Missing since the startup should first focus on customers rather than partners.	Partners are included as part of the redefined key processes box.
Key Activities	2. What are the key activities that our value proposition, distribution channels, customer relationships and revenue streams require?	Missing since the key activities can be determined once you know the solutions.	Key activities required to accomplish the business model are embedded in the other elements of the canvas.
Key Resources	3. What resources do our value proposition, distribution channels, customer relationships, and revenue streams require?	Replaced by Unfair Advantage box since many key resources—but not all—create competitive advantage.	1. Key resources needed to deliver the customer value proposition (CVP).
Value Proposition	4. What customer value do we deliver? What problems are we solving? What solutions are we offering? What customer needs are we satisfying?	1. Value Proposition. Restated in terms of a compelling message that states why you are different and worth paying attention to.	The value proposition is the CVP, which is captured in elements 1 through 8.
Customer Relationships	5. What type of relationships do our customer segments expect?	Captured in the customer segment box.	
Channels	6. Through which channels do our customer segments want to be reached?	2.Channels	2. Channels
Customer Segments	7. Who are we creating value for, and who are our most important customers?	3.Customer Segments	3. Formulated as Customer Circumstance.
Cost Structure	8. What are the most important costs inherent in our business model?	4.Cost Structure	4. Cost Structure
Revenue Streams	9. What are our customers willing to pay?	5.Revenue Streams	5. Revenue Streams and Adoption
Unique to both Maurya Lean Canvas and FEI Canvas			
Problem	What is the problem you are solving?	6. Problem. Separate box highlights fact that most startups fail because they fail to understand what problem they are solving	6. Problem, formulated as either a POV or "job to be done" statement.
Solution	What is the solution?	7. Solution. Broken out from the problem and value proposition boxes to help teams focus.	7. Solution.
Key Metrics	Defines the key metrics that the startup should be addressing.	8. Key Metrics. Encourages selection of three key metrics to foster focus.	Missing since this is not sufficiently important for enterprises.
Unfair Advantage	Competitive advantage or barriers to entry.	9. Unfair Advantage. Elements of advantage (or other firms' advantage) that can't be easily copied or bought.	8. Competition and Barriers.
Unique to FEI Canvas			
Key Processes	These are the key processes which a company uses to deliver its customer value proposition in a sustainable, repeatable, scalable and manageable way.		9. Key Processes. Processes that are unique to the corporation and needed to deliver the value proposition and enable competitive advantage.
Solution Attributes	What are the attributes which you need to deliver to the customer? Which problems are you solving with the attributes?		10. Customer Attributes. Separates solution attributes from the solution.
Payment Structure	What is the price and how does the customer pay for the solution?		11. Payment Structure.
Risks and Assumptions	What are the top three risks and assumptions?		12. Risks and Assumptions. All FEI projects have risks and assumptions that must be made explicit.

Note: Shaded areas indicate items included in each canvas. Unshaded areas depict elements that are not included in a given canvas.

Table 2 – Comparison of Human Centered Design Attributes with the different Business Model Canvas

Human-Centered Design Attributes	Osterwalder & Pigneur (2010) Business Model Canvas	Osterwalder et al. (2014) Value Proposition Canvas	Maurya (2012) Lean Canvas	FEI Canvas
What is the right problem?	Included in the Value Proposition part of the canvas	Customer Jobs, included as part of Customer Segments	Problem box	Problem box
Who has the problem (i.e., who is the customer)?	Captured in Customer Segments	Expanded definition of Customer Segments	Customer box	Customer Segments box
What is the value to the user to solve the problem (i.e., what are the solution attributes)?	Presumably included in the Value Proposition box, though it's not exactly clear what "value proposition" encompasses	Gain Creators and Pain Relievers	Presumably included in the Value Proposition box, though it's not specifically identified as such.	Solution Attributes box
The solution	Missing from the canvas	Highlighted as products and services	Solution box	Solution box

Note: Shaded areas indicate that the canvas has a separate box congruent with the human-centered design attribute.