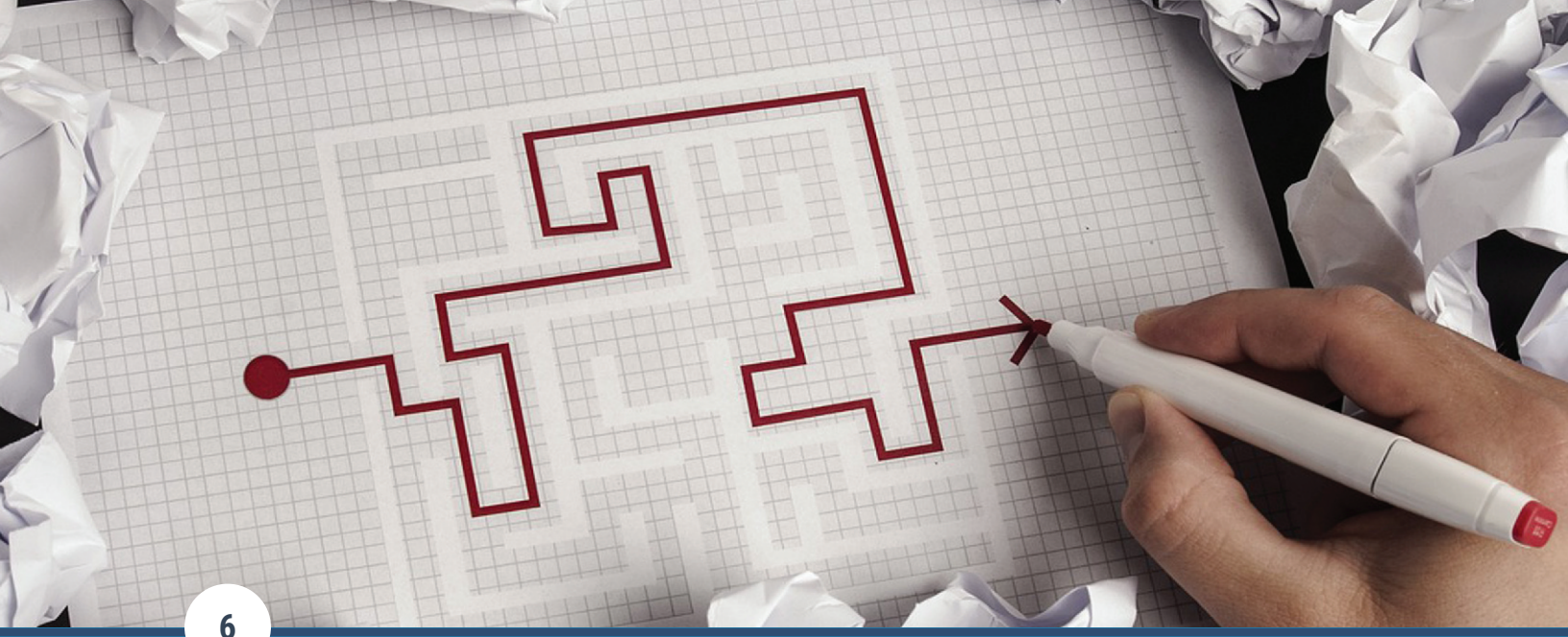

6

Problem Solving and Need Recognition Techniques

Figure 6.1 Sometimes, navigating from the recognition of an opportunity to overcoming problems in the development of that opportunity can feel like winding through a maze. (credit: modification of "human hand company paper solutions" by "Eluj"/Pixabay, CC0)

Chapter Outline

Introduction

Portions of the material in this section are based on original work by Geoffrey Graybeal and produced with support from the Rebus Community. The original is freely available under the terms of the CC BY 4.0 license at https://press.rebus.community/media-innovation-and-entrepreneurship/.

Marah Lidey and Naomi Hirabayashi met when they worked together at DoSomething.org, a youth-oriented global nonprofit organization. They considered each other aspirational peers—accessible friends they looked up to and leaned on. While working together, they got the idea to turn the support they gave each other into a product idea: an inspirational platform that would send users a motivational text message each day. In 2015, Hirabayashi and Lidey began to focus on turning their idea into a reality. They conducted a test with seventy individuals before publicly releasing Shine in beta in October 2015. They formally left DoSomething.Org in April 2016 and their startup venture, Shine, was born.

The problem Shine tackles is that "self-help is broken" and its value proposition addresses in part what is known as "the confidence gap," often cited as a barrier that holds women back when it comes to advancing in their careers, raising money, investing, and planning retirement. Shine has four pillars it is built to address: mental health, confidence, daily happiness, and productivity. As of 2018, the Shine community had two million

users from 189 countries. What began as a motivational text message service has since evolved to include an app and additional services such as Shine Talks and audio challenges.

Hirabayashi and Lidey recognized a need—or an *entrepreneurial opportunity*. You learned about identifying opportunities in the chapter on Identifying Entrepreneurial Opportunity. This chapter will explore what happens next—the problem solving and need recognition techniques that entrepreneurs employ to carry the idea forward, and to solve issues that arise as the enterprise advances. Problem solving is essential to the genesis of entrepreneurship. At the same time, problem-solving techniques can be used in management and in an individual's everyday personal life.

6.1 Problem Solving to Find Entrepreneurial Solutions

Learning Objectives

By the end of this section, you will be able to:

- Define problem solving in the context of entrepreneurship
- Describe and compare the adaptive model and the innovative model of problem solving
- Identify the skills entrepreneurs need for effective problem solving
- Identify types of problem solvers

As you've learned, entrepreneurs often visualize an opportunity gap, a gap between what exists and what could exist, as Hirabayashi and Lidey did with Shine. **Entrepreneurial problem solving** is the process of using innovation and creative solutions to close that gap by resolving societal, business, or technological problems. Sometimes, personal problems can lead to entrepreneurial opportunities if validated in the market. The entrepreneur visualizes the prospect of filling the gap with an innovative solution that might entail the revision of a product or the creation of an entirely new product. In any case, the entrepreneur approaches the problem-solving process in various ways. This chapter is more about problem solving as it pertains to the entrepreneur's thought process and approach rather than on problem solving in the sense of opportunity recognition and filling those gaps with new products.

For example, as we read in Identifying Entrepreneurial Opportunity, Sara Blakely (as shown in Figure 6.2) saw a need for body contouring and smoothing undergarments one day in the late 1990s when she was getting dressed for a party and couldn't find what she needed to give her a silhouette she'd be pleased with in a pair of slacks. She saw a problem: a market need. But her *problem-solving efforts* are what drove her to turn her solution (Spanx undergarments) into a viable product. Those efforts came from her self-admitted can-do attitude: "It's really important to be resourceful and scrappy—a glass half-full mindset."[1] Her efforts at creating a new undergarment met resistance with hosiery executives, most of whom were male and out of touch with their female consumers. The hosiery owner who decided to help Blakely initially passed on the idea until running it by his daughters and realizing she was on to something. That something became Spanx, and today, Blakely is a successful entrepreneur.[2]

1 Helen Lock. "'I Put My Butt on the Line': How Spanx Took Over the World." *The Guardian.* July 11, 2016. https://www.theguardian.com/small-business-network/2016/jul/11/put-butt-on-the-line-how-spanx-world

2 Gary Keller. "Business Success Series, Part 1: Sara Blakely-Spanx." *The One Thing.* n.d. https://www.the1thing.com/blog/the-one-thing/business-success-series-part-1-sara-blakely-spanx/

Figure 6.2 Sara Blakely (right) participates in a discussion at the 2018 Fast Company Innovation Festival. (credit: "Ed Bastian and Sara Blakely at the Fast Company Innovation Festival" by "Nan Palmero"/Flickr, CC BY 2.0)

Before getting into the heart of this chapter, we need to make a distinction: *Decision making is different from problem solving*. A decision is needed to continue or smooth a process affecting the operation of a firm. It can be intuitive or might require research and a long period of consideration. Problem solving, however, is more direct. It entails the solution of some problem where a gap exists between a current state and a desired state. Entrepreneurs are problem solvers who offer solutions using creativity or innovative ventures that exploit opportunities. This chapter focuses on different approaches to problem solving and need recognition that help potential entrepreneurs come up with ideas and refine those ideas.

Two Problem Solving Models: Adaptive and Innovative

There are two prominent established problem-solving models: *adaptive* and *innovative*. A renowned British psychologist, Michael Kirton, developed the Kirton Adaption-Innovation (KAI) Inventory to measure an individual's style of problem solving.[3] Problem-solving preferences are dependent on the personality characteristics of originality, conformity, and efficiency, according to Kirton. The KAI inventory identifies an individual's problem-solving approach by measuring agreement with statements that align with characteristics, such as the ability to produce many novel ideas, to follow rules and get along in groups, and to systematically orient daily behavior. The results categorize an individual as an innovator or an adaptor. Innovators are highly original, do not like to conform, and value efficiency less than adaptors.

The first and more conservative approach an entrepreneur may use to solve problems is the adaptive model. The **adaptive model** seeks solutions for problems in ways that are tested and known to be effective. An adaptive model accepts the problem definition and is concerned with resolving problems rather than finding them. This approach seeks greater efficiency while aiming at continuity and stability. The second and more creative approach is the **innovative model** of entrepreneurial problem solving, which uses techniques that are unknown to the market and that bring advantage to an organization. An innovative problem-solving style challenges the problem definition, discovers problems and avenues for their solutions, and questions existing

3 "Characteristics of Adaptors and Innovators." *Kirton KAI Inventory Tool*. n.d. http://pubs.acs.org/subscribe/archive/ci/31/i11/html/11hipple_box3.ci.html

assumptions—in a nutshell, it does things differently. It uses outside-the-box thinking and searches for novel solutions. Novelty is a shared trait of creative entrepreneurship, and it's why entrepreneurs gravitate toward this method of problem solving. According to Dr. Shaun M. Powell, a senior lecturer at the University of Wollongong, Australia: "Creative entrepreneurs are notable for a distinctive management style that is based on intuition, informality and rapid decision making, whereas the more conventional thinking styles are not in accord with the unique attributes of creative entrepreneurs."[4] This way of problem solving doesn't alter an existing product. It is the creation of something entirely new.

For example, healthcare facilities have long been known as a source of methicillin-resistant *Staphylococcus aureus* (MRSA), a deadly infection that can have long-term effects on patients. Vital Vio, led by Colleen Costello, has developed white light technology that effectively disinfects healthcare facilities by targeting a molecule specific to bacteria. The light, safe to humans, can burn constantly to kill regenerative bacteria. An adaptive problem-solving model would seek to minimize harm of MRSA within a hospital—to respond to it—whereas the Vital Vio is an entirely new technique that seeks to eliminate it. Adaptive solutions to MRSA include established processes and protocols for prevention, such as having doctors, nurses, and other healthcare providers clean their hands with soap and water, or an alcohol-based hand rub before and after patient care, testing patients to see if they have MRSA on their skin, cleaning hospital rooms and medical equipment, and washing and drying clothes and bed linens in the warmest recommended temperatures.[5]

LINK TO LEARNING

Visit *Inc. Magazine* for support and advice for up-and-coming startups (https://openstax.org/l/52AdviceStartup) to learn more. Examples of how "Dorm Room" entrepreneurs spot and pursue opportunities are shared along with tips and advice for making your startup a success.

Problem-Solving Skills

While identifying problems is a necessary part of the origin of the entrepreneurial process, managing problems is an entirely different aspect once a venture is off the ground and running. An entrepreneur does not have the luxury of avoiding problems and is often responsible for all problem solving in a startup or other form of business. There are certain skills that entrepreneurs possess that make them particularly good problem solvers. Let's examine each skill (shown in Figure 6.3) .

4 Shaun Powell. "The Management and Consumption of Organisational Creativity." *Journal of Consumer Marketing* 25, no. 3 (2008): 158–166.
5 N.C Healthcare-Associated Infections Prevention Program. *Healthcare-Associated Infections in North Carolina: 2014 Annual Report, Healthcare Consumer Version.* April 2015. https://epi.dph.ncdhhs.gov/cd/hai/figures/hai_apr2015_consumers_annual.pdf

Figure 6.3 These are a few of the skills that entrepreneurs possess that aid in solving problems. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Critical Thinking

Critical thinking is the complex analysis of a problem or issue with the goal of solving the problem or making a decision. The entrepreneur analyzes and peels away the layers of a problem to find the core of an issue facing a business. The entrepreneur focuses on the heart of the problem and responds reasonably and openly to suggestions for solving it. Critical thinking is not only important for developing entrepreneurial ideas: it is a sought-after asset in education and employment. Entrepreneur Rebecca Kantar dropped out of Harvard in 2015 to found the tech startup Imbellus, which aims to replace standardized college admissions tests like the SAT with interactive scenarios that test critical-thinking skills. Many standardized tests may include multiple choice questions asking for the answer to a straightforward knowledge question or math problem. Kantar seeks to create tests that are more concerned with the analytic ability and reasoning that goes into the process of solving the problem. Imbellus says it aims to test "how people think," not just what they know. The platform, which has not yet launched, will use simulations for its user assessments.[6]

6 Romesh Ratnesar. "What If Instead of Taking the SAT You Got to Play a Video Game?" *Bloomberg BusinessWeek.* March 19, 2019. https://www.bloomberg.com/news/features/2019-03-19/a-harvard-dropout-s-plan-to-fix-college-admissions-with-video-games

LINK TO LEARNING

Read more about problem solving and EnterpriseWorks/Vita's story (https://openstax.org/l/52ProbSolve) at *Harvard Business Review*.

Communication

Communication skills, the ability to communicate messages effectively to an intended recipient, are the skills entrepreneurs use to pool resources for the purposes of investigating solutions leading to innovative problem solving and competitive advantage. Good communication allows for the free association of ideas between entrepreneurs and businesses. It can illustrate a problem area or a shared vision, and seeks stakeholder buy-in from various constituencies. Networking and communication within an industry allow the entrepreneur to recognize the position of an enterprise in the market and work toward verbalizing solutions that move an organization beyond its current state. By "verbalizing," we mean communication from and with the company/entity. Internal communications include company emails, newsletters, presentations, and reports that can set strategic goals and objectives, and report on what has been accomplished and what goals and objectives remain, so that employees within an organization are knowledgeable and can work on solving problems that remain within the organization. External communications could include press releases, blogs and websites, social media, public speeches, and presentations that explain the company's solutions to problems. They could also be investor pitches complete with business plans and financial projections.

Ideation exercises, such as brainstorming sessions (discussed in Creativity, Innovation, and Invention, are good communication tools that entrepreneurs can use to generate solutions to problems. Another such tool is a **hackathon**—an event, usually hosted by a tech company or organization, which brings together programmers and workers with other degrees of specialization within the company, community, or organization to collaborate on a project over a short period of time. These can last from twenty-four hours to a few days over a weekend. A hackathon can be an internal company-wide initiative or an external event that brings community participants together. A business model canvas, which is covered in Business Model and Plan and other activities outlined in other chapters can be used internally or externally to identify problems and work toward creating a viable solution.

Networking is an important manifestation of useful communication. What better method is there of presenting one's concept, gaining funding and buy-in, and marketing for the startup than through building a network of individuals willing to support your venture? A network may consist of potential employees, customers, board members, outside advisors, investors, or champions (people who just love your product) with no direct vested interest. Social networks consist of weak ties and strong ties. Sociologist Mark Granovetter studied such networks back in the 1970s, and his findings still apply today, even if we include social media networks in the definition too. Weak ties facilitate flow of information and community organization, he said, whereas strong ties represent strong connections among close friends, family members, and supportive coworkers.[7] Strong ties require more work to maintain than weak ties (as illustrated by the strong lines and weak dotted lines in Figure 6.4) and in a business context, they don't lead to many new opportunities. Weak ties, in contrast, do open doors in that they act as bridges to other weak ties within functional areas or departments that you might not have had access to directly or through strong ties.[8]

7 Mark Granovetter. "The Strength of Weak Ties." *American Journal of Sociology* 5 (1973): 1360–1380.

Figure 6.4 Networking results in connecting individuals who otherwise might not have met and who may be able to help each other solve problems. (credit: "social media connections networking" by "GDJ"/Pixabay, CC0)

In fact, many young entrepreneurs, including tech entrepreneur Oliver Isaacs, realize college is a great place to begin building teams. Isaacs is the founder of viral opinion network Amirite.com, which is widely credited as the place where Internet memes started and online slang got a foothold.[9] Amirite.com consists of a large network of pages and partnerships on Facebook and Instagram that reach 15 million users each month. Isaacs recommends using your alumni network to build a team and customer base for your own venture because you never know if you're talking to a future employee or partner.

Sharing of ideas and resources is highly valued in the entrepreneurial process. Communication is a vital skill in problem solving because the ability to identify and articulate the problem (define the problem space) is necessary to adequately address a problem. A problem can be too vague or broad or narrow. Thus, communicating the problem is important, as is conveying the solution.

Decisiveness

Decisiveness is as it sounds: the ability to make a quick, effective decision, not letting too much time go by in the process. Entrepreneurs must be productive, even in the face of risk. They often rely on intuition as well as on hard facts in making a choice. They ask what problem needs to be solved, think about solutions, and then consider the means necessary to implement an idea. And the decisions must be informed with research.

For example, as explained in Adam Grant's book *The Originals*, the co-founders of Warby Parker, a venture-backed startup focused on the eyewear industry, started their company while they were graduate students. At

8 Jacob Morgan. "Why Every Employee Should Be Building Weak Ties at Work." *Forbes.* March 11, 2014. https://www.forbes.com/sites/jacobmorgan/2014/03/11/every-employee-weak-ties-work/#277851063168

9 John White. "Top UK Influencer Oliver Isaacs Reveals What It Takes to Go Viral." *Inc.* August 6, 2017. https://www.inc.com/john-white/top-uk-influencer-oliver-isaacs-reveals-what-it-ta.html

the time they knew little about the industry, but after conducting some detailed research, they learned that the industry was dominated by one major player—Luxottica. They used this information and other data to refine their strategy and business model (focusing mainly on value, quality, and convenience via an online channel). By the time they decided to launch the business, they had thought through the key details, and they attained rapid early success. Today Warby Parker has over 100 retail stores in the US, is profitable, and is valued at almost $2 billion.

Decisiveness is the catapult to progress. Amazon founder Jeff Bezos preaches the importance of decisiveness throughout his organization. Bezos believes that decisiveness can even lead to innovation. Bezos advocates for making decisions after obtaining 70 percent of the information you need to do so: "Being wrong may be less costly than you think, whereas being slow is going to be expensive for sure," Bezos wrote in a 2017 annual letter to stockholders.[10]

LINK TO LEARNING

Read this LinkedIn blog post on decisiveness (https://openstax.org/l/52decisiveness) to learn more.

Ability to Analyze Data

Data analysis is the process of analyzing data and modeling it into a structure that leads to innovative conclusions. Identifying Entrepreneurial Opportunity covered much of the sources of data that entrepreneurs might seek. But it is one thing to amass information and statistics. It is another to make sense of that data, to use it to fill a market need or forecast a trend to come. Successful founders know how to pose questions about and make meaning out of information. And if they can't do that themselves, they know how to bring in experts who can.

In addition to public sources of broad data, a business can collect data on customers when they interact with the company on social media or when they visit the company website, especially if they complete a credit card transaction. They can collect their own specific data on their own customers, including location, name, activity, and how they got to the website. Analyzing these data will give the entrepreneur a better idea about the interested audience's demographic.

In entrepreneurship, analyzing data can help with opportunity recognition, creation, and assessment by analyzing data in a variety of ways. Entrepreneurs can explore and leverage different data sources to identify and compare "attractive" opportunities, since such analyses can describe what has happened, why it happened, and how likely it is to happen again in the future. In business in general, analytics is used to help managers/entrepreneurs gain improved insight about their business operations/emerging ventures and make better, fact-based decisions.

Analytics can be descriptive, predictive, or prescriptive. Descriptive analytics involves understanding what has happened and what is happening; predictive analytics uses data from past performance to estimate future performance; and prescriptive analytics uses the results of descriptive and predictive analytics to make decisions. Data analysis can be applied to manage customer relations, inform financial and marketing activities, make pricing decisions, manage the supply chain, and plan for human resource needs, among other

10 Erik Larson. "How Jeff Bezos Uses Faster Better Decisions to Keep Amazon Innovating." *Forbes*. September 24, 2018. https://www.forbes.com/sites/eriklarson/2018/09/24/how-jeff-bezos-uses-faster-better-decisions-to-keep-amazon-innovating/#492c351b7a65

functions of a venture. In addition to statistical analysis, quantitative methods, and computer models to aid decision-making, companies are also increasingly using artificial intelligence algorithms to analyze data and make quick decisions.

Understanding of Business and Industry

Entrepreneurs need sound understanding of markets and industries. Often times, they are already working in a large organization when they see growth opportunities or inefficiencies in a market. The employee gains a deep understanding of the industry at hand. If the employee considers a possible solution for a problem, this solution might become the basis for a new business.

For example, consider a marketing agency that used traditional marketing for thirty years. This agency had an established clientele. An executive in the organization began studying social media analytics and social media. The executive approached the owner of the business to change processes and begin serving clients through social media, but the owner refused. Clients within the agency began to clamor for exposure on social media. The marketing executive investigated the possibility of building an agency in her locale servicing clients who wish to utilize social media. The marketing executive left the organization and started her own agency (providing, of course, that this is in compliance with any noncompete clauses in her contract). Her competitive advantage was familiarity with both traditional and social media venues. Later, the original agency started floundering because it did not offer social media advertising. Our intrepid executive purchased the agency to gain the clientele and serve those wishing to move away from traditional marketing.

A similar experience occurred for entrepreneur Katie Witkin. After working in traditional marketing roles, the University of Wisconsin-Madison graduate, pictured in Figure 6.5, left agency life behind four years out of college to cofound her own company, AGW Group. In 2009, Witkin had been interning at a music marketing agency that didn't have a social media department. She knew, both from her time at college and from observing industry trends, that social media was changing the way companies connected with customers. For her own venture, she expanded the focus to all supporting brands to manage all things digital. Today, the cultural and marketing communications agency has fifteen employees and big-name clients ranging from HBO to Red Bull.[11]

11 Stephanie Schomer. "How Getting Laid Off Empowered This Entrepreneur to Start Her Own Award-Winning Marketing Agency." *Entrepreneur.* January 15, 2019. https://www.entrepreneur.com/article/326212

Figure 6.5 Pictured is AGW Group cofounder Katie Witkin. (credit: photo provided by AGW Group)

Resourcefulness

Resourcefulness is the ability to discover clever solutions to obstacles. Sherrie Campbell, a psychologist, author, and frequent contributor to *Entrepreneur* magazine on business topics, put it this way:

> "There is not a more useful or important trait to possess than resourcefulness in the pursuit of success. Resourcefulness is a mindset, and is especially relevant when the goals you have set are difficult to achieve or you cannot envision a clear path to get to where you desire to go. With a resourcefulness mindset you are driven to find a way. An attitude of resourcefulness inspires out-of-the-box thinking, the generation of new ideas, and the ability to visualize all the possible ways to achieve what you desire. Resourcefulness turns you into a scrappy, inventive and enterprising entrepreneur. It places you a cut above the rest."[12]

Entrepreneurs start thinking about a business venture or startup by talking to people and procuring experts to help create, fund, and begin a business. Entrepreneurs are risk takers, passionate about new endeavors. If they don't have a college degree or a great deal of business experience, they understand there are many resources available to support them in the endeavor, such as the Service Corps of Retired Executives (SCORE) and the Small Business Administration (SBA). There are many sources available to fund the business with little or no debt and options, as you will see in the chapter on Entrepreneurial Finance and Accounting. The entrepreneur follows a vision and researches opportunities to move toward a dream.

For example, in the late 1990s, Bill McBean and his business partner Billy Sterett had an opportunity to buy an underperforming auto dealership that would make their company the dominant one in the market. Neither wanting to take cash from other ventures nor wanting to borrow more money and tie themselves to more debt, the entrepreneurs were resourceful by finding another path forward to obtaining the money necessary for the acquisition they both coveted. They changed banks and renegotiated their banking payback requirements, lowering their interest payments, reducing fees, and lowering their monthly payments, ultimately freeing up a significant amount of cash that allowed them to buy the new company.[13]

12 Sherrie Campbell. "6 Characteristics of Resourceful People That Bring Them Success." *Entrepreneur.* March 10, 2016. https://www.entrepreneur.com/article/272171

Types of Problem Solvers

Entrepreneurs have an insatiable appetite for problem solving. This drive motivates them to find a resolution when a gap in a product or service occurs. They recognize opportunities and take advantage of them. There are several types of entrepreneurial problem solvers, including self-regulators, theorists, and petitioners.

Self-Regulating Problem Solvers

Self-regulating problem solvers are autonomous and work on their own without external influence. They have the ability to see a problem, visualize a possible solution to the problem, and seek to devise a solution, as Figure 6.6 illustrates. The solution may be a risk, but a self-regulating problem solver will recognize, evaluate, and mitigate the risk. For example, an entrepreneur has programmed a computerized process for a client, but in testing it, finds the program continually falls into a loop, meaning it gets stuck in a cycle and doesn't progress. Rather than wait for the client to find the problem, the entrepreneur searches the code for the error causing the loop, immediately edits it, and delivers the corrected program to the customer. There is immediate analysis, immediate correction, and immediate implementation. The self-regulating problem solvers' biggest competitive advantage is the speed with which they recognize and provide solutions to problems.

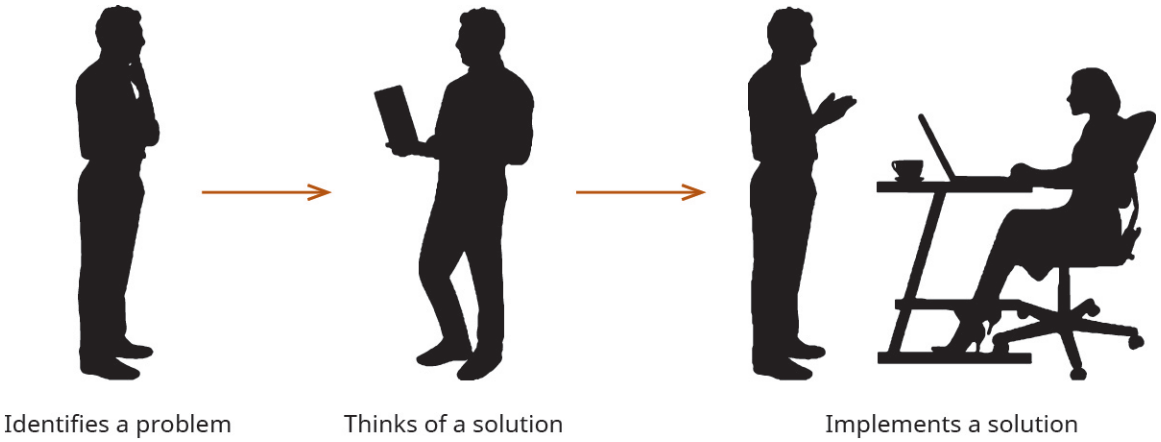

Figure 6.6 A self-regulating problem solver identifies a problem, thinks of solution, and then implements the solution. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Theorist Problem Solvers

Theorist problem solvers see a problem and begin to consider a path toward solving the problem using a theory. Theorist problem solvers are process oriented and systematic. While managers may start with a problem and focus on an outcome with little consideration of a means to an end, entrepreneurs may see a problem and begin to build a path with what is known, a theory, toward an outcome. That is, the entrepreneur proceeds through the steps to solve the problem and then builds on the successes, rejects the failures, and works toward the outcome by experimenting and building on known results. At this point, the problem solver may not know the outcome, but a solution will arise as experiments toward a solution occur. Figure 6.7 shows this process.

For example, if we consider Marie Curie as an entrepreneur, Curie worked toward the isolation of an element. As different approaches to isolating the element failed, Curie recorded the failures and attempted other possible solutions. Curie's failed theories eventually revealed the outcome for the isolation of radium. Like

13 "Resourcefulness Is More Important Than Resources." *The Ecommerce Mindset: How Successful Store Owners Think.* n.d. https://www.oberlo.com/ebooks/mindset/resourceful-entrepreneur

Curie, theorists use considered analysis, considered corrective action, and a considered implementation process. When time is of the essence, entrepreneurs should understand continual experimentation slows the problem-solving process.

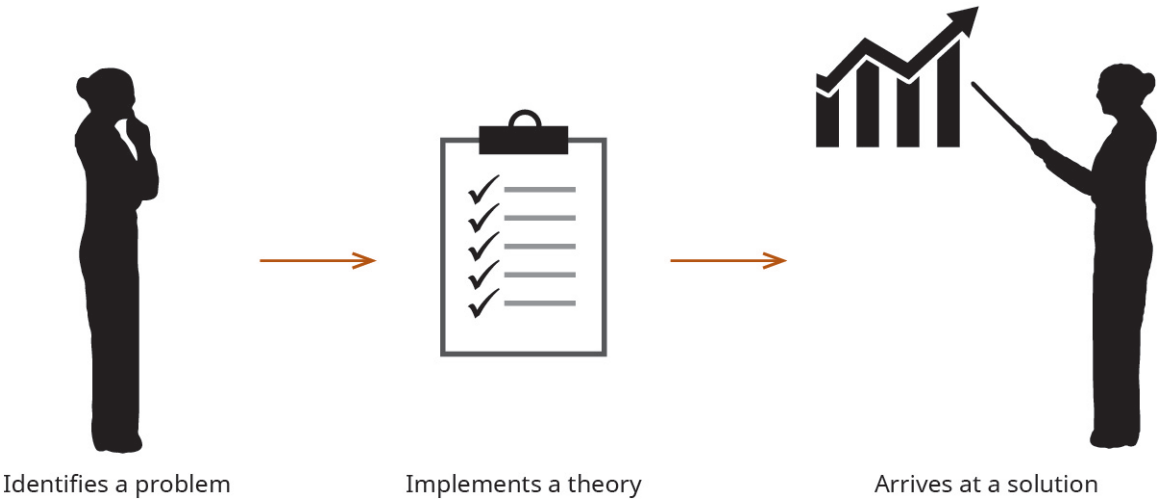

Figure 6.7 A theorist problem solver identifies a problem; implements a theory, sometimes repeatedly; and eventually arrives at a solution. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Petitioner Problem Solvers

Petitioner problem solvers (Figure 6.8) see a problem and ask others for solution ideas. This entrepreneur likes to consult a person who has "been there and done that." The petitioner might also prefer to solve the problem in a team environment. Petitioning the entrepreneurial team for input ensures that the entrepreneur is on a consensus-driven path. This type of problem solving takes the longest to complete because the entrepreneur must engage in a democratic process that allows all members on the team to have input. The process involves exploration of alternatives for the ultimate solution. In organizational decision-making, for example, comprehensiveness is a measure of the extent a firm attempts to be inclusive or exhaustive in its decision-making. Comprehensiveness can be gauged by the number of scheduled meetings, the process by which information is sought, the process by which input is obtained from external sources, the number of employees involved, the use of specialized consultants and the functional expertise of the people involved, the years of historical data review, and the assignment of primary responsibility, among other factors. Comprehensive decision-making would be an example of a petitioner problem-solving style, as it seeks input from a vast number of team members.

A *charette*—a meeting to resolve conflicts and identify solutions—is another example that employs a petitioner problem-solving approach. Often times, a developer of a new project might hold a community charette to aid in the design of a project, hoping to gain approval from elected officials. In the building example, this could consist of the developer and his team of architects, project designers, and people with expertise in the project working alongside community members, business executives, elected officials, or representatives like staff members or citizen-appointed boards like a planning board. Such an activity is representative of a petitioner problem-solving approach, as opposed to a developer representative designing the project with no input from anyone else.

Figure 6.8 A petitioner problem solver identifies a problem, discusses it with others, and arrives at solution agreeable to others. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

In summary, there is no right or wrong style of problem solving; each problem solver must rely on the instincts that best drive innovation. Further, they must remember that not all problem-solving methods work in every situation. They must be willing to adapt their own preference to the situation to maximize efficiency and ensure they find an effective solution. Attempting to force a problem-solving style may prevent an organization from finding the best solution. While general entrepreneurial problem-solving skills such as critical thinking, decisiveness, communication, and the ability to analyze data will likely be used on a regular basis in your life and entrepreneurial journey, other problem-solving skills and the approach you take will depend on the problem as it arises.

There are a number of resources online that can help analyze your problem-solving abilities. Mindtools.com is one such resource. These are useful to learn your general problem-solving tendencies before being called upon to apply them in a real-world setting. One of the problem-solving techniques available from mindtools.com offers that problems can be addressed from six different perspectives. Called CATWOE, the approach is an acronym for Customers, Actors (people within the organization), Transformative, Worldwide, Owner, and Environment (organizational).

LINK TO LEARNING

Learn more about the CATWOE technique (https://openstax.org/l/52CATWOE) for problem solving.

6.2 Creative Problem-Solving Process

Portions of the material in this section are based on original work by Geoffrey Graybeal and produced with support from the Rebus Community. The original is freely available under the terms of the CC BY 4.0 license at https://press.rebus.community/media-innovation-and-entrepreneurship/.

Learning Objectives

By the end of this section, you will be able to:

- Describe the five steps in the creative problem-solving process
- Identify and describe common creative problem-solving tools

Creativity can be an important trait of an entrepreneur, as the chapter on Creativity, Innovation, and Invention discussed. In that discussion, we learned about creativity's role in *innovation*. Here, we will look in more depth at creativity's role in *problem solving*. Let's first formally define **creativity** as the development of original ideas to solve an issue. The intent of being an entrepreneur is to break away from practical norms and use imagination to embrace quick and effective solutions to an existing problem, usually outside the corporate environment.

The Steps of the Creative Problem-Solving Process

Training oneself to think like an entrepreneur means learning the steps to evaluating a challenge: clarify, ideate, develop, implement, and evaluate (Figure 6.9).

Figure 6.9 The process of creativity is not random; it is a specific and logical process that includes evaluation. The entrepreneur repeats the creative process until reaching a successful solution. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Step 1: Clarify

To **clarify** is the critical step of recognizing the existence of a gap between the current state and a desired state. This can also be thought of as having **need awareness**, which occurs when the entrepreneur notes a gap between societal or customer needs and actual circumstances. Clarifying the problem by speaking with clients and developing a detailed description of the problem brings the specifics of a problem to light. Failure to identify the specifics of a problem leaves the entrepreneur with the impossible task of solving a ghost problem, a problem that is fully unknown or unseen. To establish and maintain credibility, an entrepreneur must clarify the problem by focusing on solving the problem itself, rather than solving a symptom of the problem.

For example, a farm could have polluted water, but it would not be enough to solve the problem only on that farm. Clarifying would involve identifying the source of the pollution to adequately tackle the problem. After gaining an understanding of a problem, the entrepreneur should begin to formulate plans for eliminating the gap. A fishbone diagram, as shown in Figure 6.10, is a tool that can be used to identify the causes of such a problem.

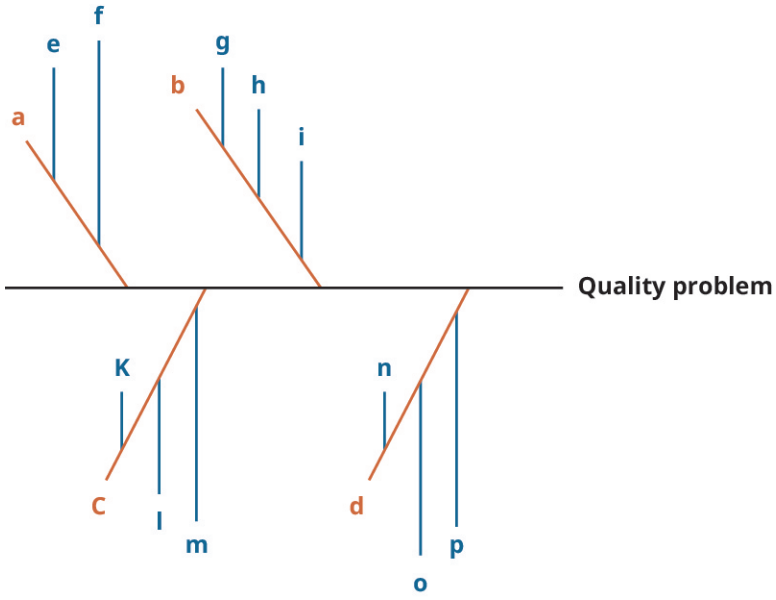

Figure 6.10 A quality problem has main causes—here designated as a, b, c, and d. Within these main causes, there are several causes that might need to be addressed to solve the quality problem. The goal of a fishbone diagram is to find the root causes of the quality problem. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

In the case of our water pollution example, a fishbone diagram exploring the issue might reveal the items shown in Figure 6.11.

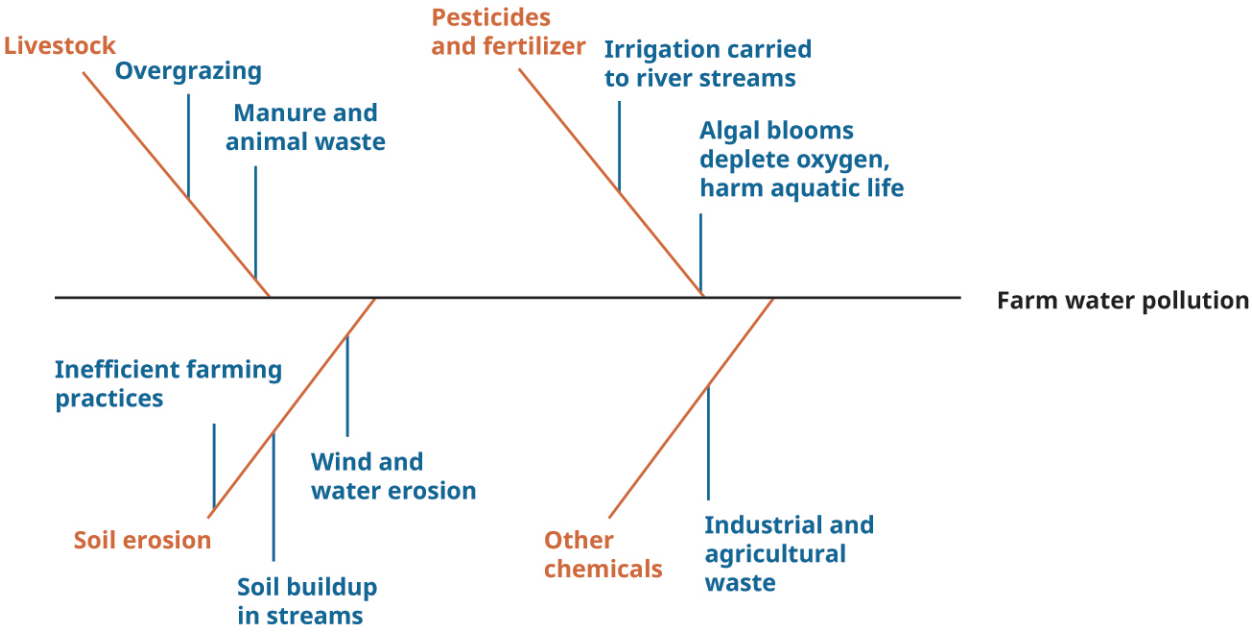

Figure 6.11 Farm water pollution could have four main causes, such as livestock, pesticide and fertilizer, soil erosion, and other chemicals. For each of those, there are other related causes. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

Step 2: Ideate

To **ideate** is the step of the creative problem-solving process that involves generating and detailing ideas by the entrepreneur. After collecting all information relevant to the problem, the entrepreneur lists as many causes of the problem as possible. This is the step in which the largest variety of ideas are put forth. Each idea must be evaluated for feasibility and cost as a solution to the problem. If a farm does not have clean water, for example, the entrepreneur must list causes of toxic water and eliminate as many of those causes as possible. The entrepreneur must then move forward investigating solutions to bring the water back to a safe state. If, say, nearby livestock are polluting the water, the livestock should be isolated from the water source.

Step 3: Develop

To **develop** is the step in which the entrepreneur takes the list of ideas generated and tests each solution for feasibility. The entrepreneur must consider the cost of each idea and the obstacles to implementation. In the preceding example, adding a chemical to the water may not be a feasible solution to the farmer. Not every farmer wants additional chloride or fluoride added to the water due to the effect on both humans and livestock. These tradeoffs should be addressed in the feasibility assessment. The farmer might prefer a filtration system, but the cost of that solution might not be practicable. The entrepreneur should identify and assess alternative solutions to find one that is most cost-effective and feasible to the customer.

Step 4: Implement

To **implement** is the step in which the solution to the problem is tested and evaluated. The entrepreneur walks through the planned implementation with the client and tests each part of the solution, if a service, or thoroughly tests a developed good. The entrepreneur implements the solution and goes through a structured system of follow-up to ensure the solution remains effective and viable. In the water example, the solution would be reducing runoff from toxic insecticides by adding prairie strips, buffers of grass, and vegetation along banks of streams.

Step 5: Evaluate

To **evaluate** is the step in which the final solution is assessed. This is a very important step that entrepreneurs often overlook. Any fallacy in the implementation of the product or service is reassessed, and new solutions are implemented. A continual testing process may be needed to find the final solution. The prairie strips, buffers of grass, and vegetation along banks of streams chosen in the farming water example should then be analyzed and tested to ensure the chosen solution changed the content of the water.

ARE YOU READY?

Implementing Creative Problem Solving

Removing waste is a problem, and it can also present an entrepreneurial opportunity. Try to examine ways in which waste products that you usually pay to have hauled away can now generate revenue. Whether it’s recycling aluminum cans or cardboard, or garbage that could be used to feed animals, your task is to come up with solutions to this entrepreneurial-oriented problem.

- Try following the first step of the creative problem-solving process and clearly identify the problem.
- Next, gather data and formulate the challenge.
- Then, explore ideas and come up with solutions.
- Develop a plan of action.
- Finally, note how you would evaluate the effectiveness of your solution.

Using Creativity to Solve Problems

Entrepreneurs are faced with solving many problems as they develop their ideas for filling gaps, whether those opportunities involve establishing a new company or starting a new enterprise within an existing company. Some of these problems include staffing, hiring and managing employees, handling legal compliance, funding, marketing, and paying taxes. Beyond the mundane activities listed, the entrepreneur, or the team that the entrepreneur puts in place, is indispensable in maintaining the ongoing creativity behind the product line or service offered. Innovation and creativity in the business are necessary to expand the product line or develop a groundbreaking service.

It is not necessary for the entrepreneur to feel isolated when it comes to finding creative solutions to a problem. There are societies, tools, and new methods available to spur the creativity of the entrepreneur that will further support the success and expansion of a new enterprise.[14] Learning and using entrepreneurial methods to solve problems alleviates the stress many startup owners feel. The entrepreneur's creativity will increase using collaborative methodologies. Some entrepreneurial collaborative methodologies include crowdsourcing, brainstorming, storyboarding, conducting quick online surveys to test ideas and concepts, and team creativity activities.

Crowdsourcing

Professor Daren Brabham at the University of Southern California has written books on crowdsourcing and touts its potential in for-profit and not-for-profit business sectors. He defines it simply as "an online, distributed problem-solving and production model."[15] **Crowdsourcing** involves teams of amateurs and nonexperts working together to form a solution to a problem.[16] The idea, as cbsnews.com's Jennifer Alsever has put it, is to "tap into the collective intelligence of the public at large to complete business-related tasks that a company would normally either perform itself or outsource to a third-party provider. Yet free labor is only a narrow part of crowdsourcing's appeal. More importantly, it enables managers to expand the size of their talent pool while also gaining deeper insight into what customers really want. The challenge is to take a cautionary approach to the 'wisdom of the crowd,' which can lead to a 'herd' mentality."[17]

14 "Creating a World of Opportunities." *The Collegiate Entrepreneurs' Organization*. n.d. https://www.c-e-o.org/

15 Daren C. Brabham. "Crowdsourcing as a Model for Problem Solving: An Introduction and Cases." *Convergence: The International Journal of Research into New Media Technologies* 14, no. 1 (2008): 75–90.

16 Michael Houlihan and Bonnie Harvey. "How Crowdsourcing Is Shaping the Future of Everything." *Entrepreneur*. January 13, 2018. https://www.entrepreneur.com/article/307438

17 Jennifer Alsever. "What Is Crowdsourcing?" *CBS News*. May 1, 2008. https://www.cbsnews.com/news/what-is-crowdsourcing

LINK TO LEARNING

Read this article that discusses what crowdsourcing is, how to use it, and its benefits (https://openstax.org/l/52CrowdSource) for more information.

This new business prototype, similar to outsourcing, features an enterprise posting a problem online and asking for volunteers to consider the problem and propose solutions. Volunteers earn a reward, such as prize money, promotional materials like a T-shirt, royalties on creative outlets like photos or designs, and in some cases, compensation for their labor. Before proposing the solution, volunteers learn that the solutions become the intellectual property of the startup posting the problem. The solution is then mass produced for profit by the startup that posted the problem.[18] The process evolves into the crowdsourcing process after the enterprise mass produces and profits from the labor of the volunteers and the team. Entrepreneurs should consider that untapped masses have solutions for many issues for which agendas do not yet exist. Crowdsourcing can exploit those agendas and add to the tools used to stimulate personal creativity. This type of innovation is planned and strategically implemented for profit.

For example, Bombardier held a crowdsourced innovation contest to solicit input on the future of train interiors, including seat design and coach class interior. A corporate jury judged the submissions, with the top ten receiving computers or cash prizes. Companies are often constrained, however, by internal rules limiting open source or external idea sourcing, as they could be accused of "stealing" an idea. While crowdsourcing outside of software can be problematic, some products such as MakerBot's 3D printers, 3DR's drones, and Jibo's Social Robot have used developer kits and "makers" to help build a community and stimulate innovation from the outside.

WORK IT OUT

A Crowdsourced Potato Chip

In an effort to increase sales among millennials, PepsiCo turned to crowdsourcing to get new flavor ideas for their Lay's potato chips (called Walker's in the UK). Their 2012 campaign, "Do Us a Flavor," was so successful that they received over 14 million submissions. The winner was Cheesy Garlic Bread, which increased their potato chip sales by 8 percent during the first three months after the launch.

- What are some other products that would work well for a crowdsourced campaign contest?
- What items wouldn't work well?

Amazon's Mechanical Turk is an online crowdsourcing platform that allows individuals to post tasks for workers to complete. In many instances, these tasks are compensated, but the payment can be less than one dollar per item completed. Mechanical Turk is one of the largest and most well-known crowdsourcing

18 Daren C. Brabham. "Crowdsourcing as a Model for Problem Solving: An Introduction and Cases." *Convergence: The International Journal of Research into New Media Technologies* 14, no. 1 (2008): 75–90.

platforms, but there are a number of other more niche ones as well that would apply to smaller markets. In the case of innovation contests and outsourced tasks from corporations, those tasks may be hosted internally by the corporation.

Brainstorming

Brainstorming is the generation of ideas in an environment free of judgment or dissension with the goal of creating solutions. See Creativity, Innovation, and Invention to refresh yourself on this technique. Brainstorming is meant to stimulate participants into thinking about problem solving in a new way. Using a multifunctional group, meaning participants come from different departments and with different skill sets, gives entrepreneurs and support teams a genuine chance to suggest and actualize ideas. The group works together to refine and prototype potential solutions to a problem.

LINK TO LEARNING

Brainstorming is a highly researched and often practiced technique for the development of innovative solutions. One of the more successful proponents of brainstorming is the United Nations Children's Fund (UNICEF). UNICEF faces unique problems of solving resource problems for mothers and children in underdeveloped nations. See how UNICEF practices brainstorming to solve problems (https://openstax.org/l/52UNICEFbrain) including child survival, gender inclusion, refugee crises, education, and others.

The setting for a brainstorming session should remain as informal and relaxed as possible. The group needs to avoid standard solutions. All ideas are welcome and listed and considered with no censorship and with no regard to administrative restrictions. All team members have an equal voice. The focus of brainstorming is on quantity of ideas rather than on the ideal solution provided in every suggestion. A classic entrepreneurial brainstorming activity, as popularized by business software developer Strategyzer, is known as the "silly cow" exercise. Teams come up with ideas for new business models pertaining to a cow, with the results often outrageous, ranging from sponsored cows to stroking cows for therapeutic release. Participants are asked to identify some aspect of a cow and develop three business models around that concept in a short time period, typically two minutes or fewer. The activity is designed to get creative juices flowing.

LINK TO LEARNING

Watch this video from ABC's Nightline that shows how IDEO designed a new shopping cart (https://openstax.org/l/52IDEOshopcart) for an example of a design process that involves brainstorming.

Storyboarding

Storyboarding is the process of presenting an idea in a step-by-step graphic format, as Figure 6.12 shows. This tool is useful when the entrepreneur is attempting to visualize a solution to a problem. The steps to the solution of a problem are sketched and hung in graphic format. Once the original graphic is placed, images of steps working toward a solution are added, subtracted, and rearranged on a continual basis, until the ultimate solution emerges in the ultimate graphic format. For many years, entrepreneurs have used this process to create a pre-visual for various media sequences.

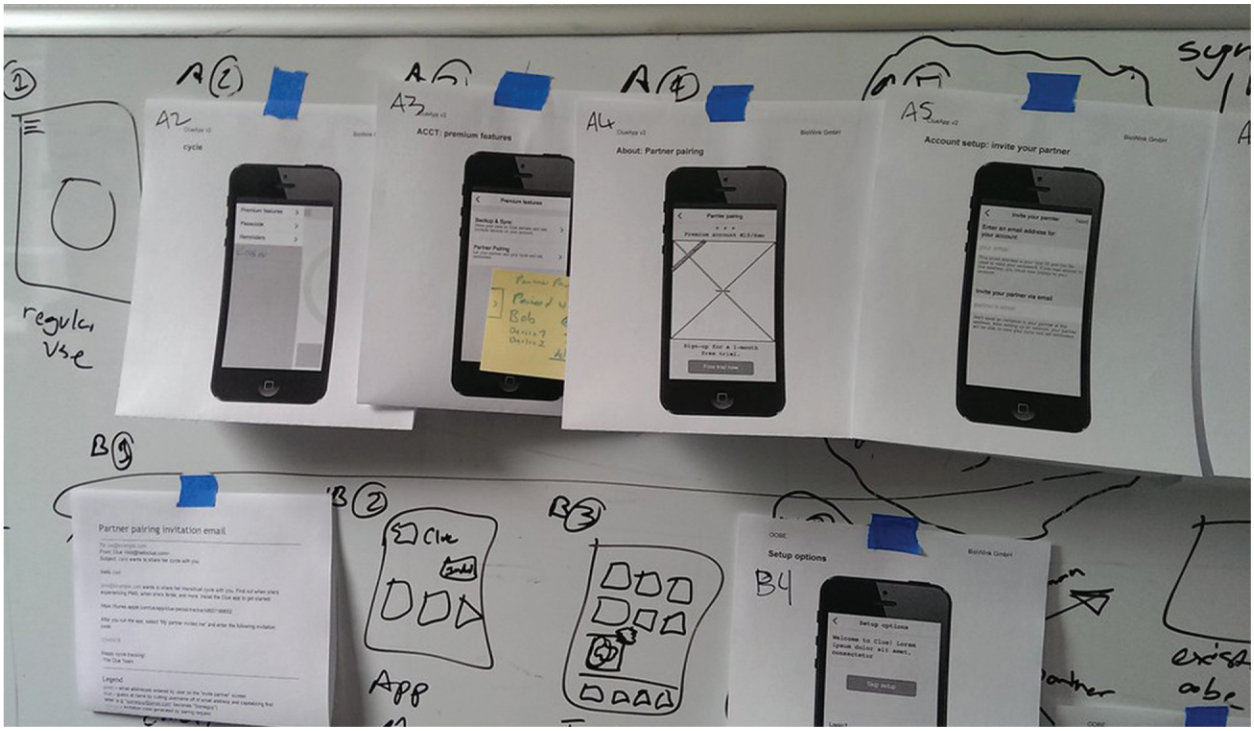

Figure 6.12 Storyboarding helps entrepreneurs and team members to visually represent steps in product creation and problem solving. (credit: "Clue storyboarding" by Adam Wiggins/Flickr, CC BY 2.0)

Team Creativity

Team creativity is the process whereby an entrepreneur works with a team to create an unexpected solution for an issue or challenge. Teams progress through the same creative problem-solving process described already: clarify, ideate, develop, implement, and evaluate. The main advantage of team creativity is the collaboration and support members receive from one another. Great teams trust in other team members, have diverse members with diverse points of view, are cohesive, and have chemistry.

Team members should work in a stress-free and relaxing environment. Reinforcement and expansion of ideas in the team environment motivates the team to continually expand horizons toward problem solution. A small idea in a team may spark the imagination of a team member to an original idea. Mark Zuckerberg, cofounder of Facebook, once said, "The most important thing for you as an entrepreneur trying to build something is, you need to build a really good team. And that's what I spend all my time on."[19]

19 "Three Tips for Entrepreneurs Creating the Perfect Team." *Virgin*. n.d. https://www.virgin.com/entrepreneur/three-tips-entrepreneurs-creating-perfect-team

ENTREPRENEUR IN ACTION

Taaluma Totes[20]

Young entrepreneurs Jack DuFour and Alley Heffern began to notice the beautiful fabrics that came from the different countries they visited. The entrepreneurs thought about what could be done with the fabrics to create employment opportunities both in the country from which the fabric originated and in their home base of Virginia. They decided to test producing totes from the fabrics they found and formed Taaluma Totes (Figure 6.13). DuFour and Heffern also wanted to promote the production of these fabrics and help underserved populations in countries where the fabric originated maintain a living or follow a dream.

Figure 6.13 This photograph was taken by a traveler, Kelsey Friedman, who studied abroad in Rwanda through Virginia Tech's International Business in Lugano: Combining Theory and Practice program. (credit: photo provided by Taaluma Totes)

The team continued to test the process and gathered original fabrics, which they sent to Virginia to create totes. They trained individuals with disabilities in Virginia to manufacture the totes, thus serving populations in the United States. The entrepreneurs then decided to take 20 percent of their profits and make microloans to farmers and small business owners in the countries where the fabric originated to create jobs there. Microloans are small loans, below $50,000, which certain lenders offer to enterprising startups. These startups, for various reasons (they are in poor nations, at poverty level), can't afford a traditional loan from a major bank. The lenders offer business support to the borrower, which in turn helps the borrower repay the microloan. The microloans from Taaluma are repaid when the borrower is able. Repayments are used to buy more fabric, completing Taaluma's desire to serve dual populations. If the process proved unsuccessful, the co-owners would revise the process to meet the plan's requirements.

DuFour and Heffern now have fabrics from dozens of countries from Thailand to Ecuador. The totes are specialized with features to meet individual needs. The product line is innovated regularly and Taaluma Totes serves a dual purpose of employing persons with disabilities in Virginia and creating employment for underserved populations in other countries.

20 "Backpacks That Carry a Country." *Taaluma Totes.* n.d. https://www.carryacountry.com/pages/about

6.3 Design Thinking

Learning Objectives

By the end of this section, you will be able to:

- Explain the design thinking process
- Discuss some design thinking tools

David Kelley, founder of Stanford University's Design School and cofounder of design company IDEO, is credited as the originator of design thinking, at least within business and entrepreneurial contexts. You were briefly introduced to design thinking in Creativity, Innovation, and Invention, but we will delve into it in more depth here. IDEO grew from a merger of the creator of Apple's first mouse and the first laptop computer designer, David Kelley Design and ID Two, respectively. Almost a decade after the 1982 Apple creations, the 1991-merged company primarily focused on the traditional design of products, ranging from toothbrushes to chairs. Yet another decade later, the company found itself designing consumer experiences more so than consumer products. Kelley began using the word "thinking" to describe the design process involved in creating customer experiences rather than creating physical products. The term *design thinking* was born.

The current IDEO CEO Tim Brown defines design thinking as "a human-centered and collaborative approach to problem-solving, using a designed mindset to solve complex problems."[21] **Design thinking** is a method to focus the design and development decisions of a product on the needs of the customer, typically involving an empathy-driven process to define complex problems and create solutions that address those problems.

A common core of design thinking is its application beyond the design studio, as the methods and tools have been articulated for use by those outside of the field, particularly business managers. Design practice is now being applied beyond product and graphic areas to the design of digital interactions, services, business strategy, and social policy.

LINK TO LEARNING

Watch this 2009 TEDGlobal talk where Tim Brown describes design thinking (https://openstax.org/l/52TEDTimBrown) from a historical perspective to modern times.

Design Thinking Process

Business schools have typically taught a rational, analytic approach to thinking. It focuses on well-defined goals and constraints, and thought precedes action in a sequential process of planning and analysis. The design thinking process approaches problem solving differently. Thinking and doing are often intertwined in an iterative exploration of the design "space," and the process uncovers goals and constraints, rather than

21 Mark Logan. "Design Thinking for Entrepreneurs." *Medium*. September 29, 2018. https://medium.com/idealect/design-thinking-for-entrepreneurs-392c8cbdcc24

identifying them up front.

One design thinking approach that is taught at places like Stanford's Design School and organizations like the LUMA Institute (a global company that teaches people how to be innovative) is **human-centered design (HCD)**. HCD, as the name suggests, focuses on people during design and development. This speaks to the Tim Brown definition of design thinking. Inspiration for ideas comes from exploration of actual people, their needs and problems.

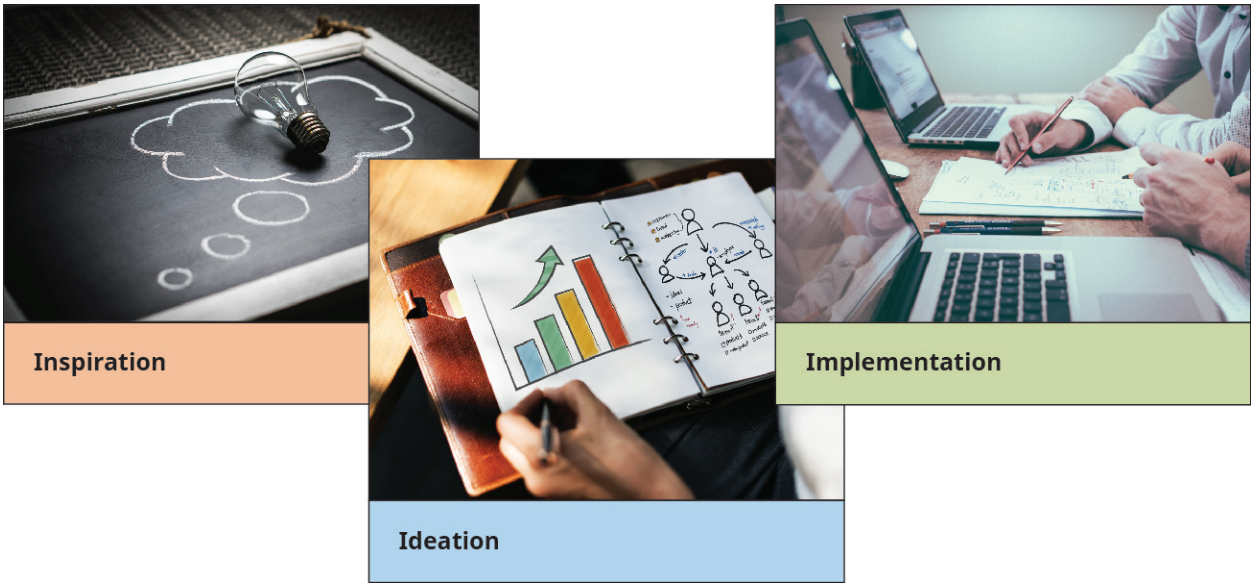

Figure 6.14 The design thinking process focuses on the spaces of inspiration, ideation, and implementation. (credit (left): modification of "thought idea innovation imagination" by "TeroVesalainen"/Pixabay, CC0; credit (center): modification of "document paper business chart" by "rawpixel"/Pixabay, CC0; credit (right): modification of "office business colleagues meeting" by "Free-Photos"/Pixabay, CC0)

Three spaces—inspiration, ideation, and implementation—compose the design thinking process (Figure 6.14). The process uses "spaces" and not "phases" because multiple spaces can happen simultaneously.

Nevertheless, inspiration usually occurs first. This entails identifying a problem or opportunity that motivates someone to search for solutions. Ideation is the process of generating ideas and solutions through various techniques such as brainstorming and sketching sessions. There are hundreds of ideation techniques available. A few examples of ideation exercises include Top Five, How Might We, Mash-up, and Co-Creation Session. In Top Five, everyone on the team writes down their top five ideas, shares them, and clusters similar ideas. In How Might We, the team looks at insight statements and reframes them as "How Might We" questions by adding that phrase at the beginning. The goal is to find opportunities for design that also allows for a variety of solutions. Mash-up involves combining existing brands or concepts to create something new. The team identifies those brands or concepts that represent a quality they desire in their solution, and they "mash up" those ideas to create a new idea. A co-creation session incorporates the desired market into the creation process by recruiting a group of people from the market to work on the design with the team. The goal is to capture the feedback the group provides by treating them as designers, not as interview subjects. Implemented solutions evolve from interactions with users and from the ongoing creation and refinement of possible solutions. Design thinking incorporates experience-based insights, judgments, and intuition from the end users' perspectives, while in a rational analytic approach, the solution process often becomes formalized into a set of rules.

Nesta is a UK-based innovation foundation that offers many design thinking tools and resources similar to IDEO. Named for the acronym NESTA, the National Endowment for Science, Technology and the Arts, the organization was established in 1998 with an endowment from the UK National Lottery and became an independent charity in 2012. Nesta's strategy focuses on health, government innovation, education, arts, and creative economy and innovation policy. Nesta offers a set of five criteria to ascertain that an occupation is creative:[22]

1. Novel process
2. Mechanization resistant
3. Nonrepetitive or nonuniform function
4. Makes a creative contribution to the value chain
5. Involves interpretation not merely a transformation in the service or artifact

As the name implies, design thinking originates from design. As design is one of the identified creative industries, there's a clear connection between creative industries and design thinking. In fact, Nesta offers inspiration and ideation exercises that are freely available for users wishing to implement design thinking practices.

Human-Centered Design Thinking Spaces

The Stanford Design School uses human-centered design thinking (HCD) as its design thinking approach. HCD emphasizes the following spaces of the design thinking process:

- Empathizing: As illustrated by the human-centered approach, it is important to have empathy for the problem you are attempting to solve. Empathy, as the chapter on Creativity, Innovation, and Invention defined, means observing and immersing yourself in the surrounding environment to engage with and understand people's experiences and motivations.
- Defining: This aspect involves describing the core problem(s) that you and your team have identified. Asking "how might we?" questions helps narrow the focus, as the ultimate aim here is to identify a problem statement that illustrates the problem you want to tackle. "Frame Your Design" is one such challenge in what IDEO calls its "toolkit" that works well here. Frame Your Design asks you to write down your problem and then refine it by following specific steps so that you end up with a design question that serves as a starting point but leaves room for creativity.[23]
- Ideating: This is where you begin to come up with ideas that address the problem "space" you have defined. There are hundreds of exercises aimed at the ideation process, ranging from brainstorming to "Five whys?" in the IDEO toolkit. The "Five whys" is a questioning method in which the researcher, in looking for information to solve a problem, asks a respondent a broad question, then asks "why" to get deeper into the respondent's thinking. IDEO puts it this way: "You'll use this method while you're conducting an interview and start with really broad questions like "Do you save much money?" or "How was your harvest this year?" Then, by asking why five times you'll get some essential answers to complicated problems. This can be a great method to use if you're trying to get at the human and emotional roots of a problem."[24]
- Prototyping: In this space, the entrepreneur creates and tests inexpensive, scaled-down versions of a

22 Christine Harris, Margaret Collins, and Dennis Cheek. *America's Creative Economy: A Study of Recent Conceptions, Definitions, and Approaches to Measurement across the USA*. National Creativity Network and Creative Alliance. August 2013. https://www.centerforcreativeeconomy.com/wp-content/uploads/2015/10/AmericasCreativeEconomyFULLReport.pdf

23 IDEO.org. *The Field Guide to Human Centered Design*. 2015. https://bestgraz.org/wp-content/uploads/2015/09/Field-Guide-to-Human-Centered-Design_IDEOorg.pdf

24 "The Five Whys." *Design Kit.* n.d. http://www.designkit.org/methods/66

product with features or benefits that serve as solutions for previously identified problems. This could be tested internally among employees, a process known as *dogfooding*, or externally with potential customers. This is an experimental phase.
- Testing: Designers apply rigorous tests of the complete product using the best solutions identified in the prototyping space.

WHAT CAN YOU DO?

Every Day a Little Closer

Some examples of everyday items that can be improved through design thinking are sinks on top of toilet cisterns that save water by refilling the cistern with the water you wash your hands with, video doorbells, and smart lightbulbs. Try to think of an improvement to one of your everyday items.

Design Thinking Tools

There are numerous design thinking tools aimed to aid or stimulate your design thinking activities. They stem from organizations dedicated to design thinking like IDEO and Google Ventures. While methodologies incorporate processes and techniques, tools are resources that enable such approaches. These may be activities, or templates that facilitate the approach.

- Innovation Flowchart: A sample innovation flowchart may map out the details of the process. The structured overview serves as an organizational tool in the development process.
- Question Ladder: A tool that helps you ask the "right" questions by refining your questions (Figure 6.15). Asking the "wrong" questions can yield meaningless or less-than-adequate results.

Simple ← QUESTION COMPLEXITY → Complex						
	IS	**DID**	**CAN**	**WILL**	**WOULD**	**MIGHT**
WHO	Who is	Who did	Who can	Who will	Who would	Who might
WHAT	What is	What did	What can	What will	What would	What might
WHERE	Where is	Where did	Where can	Where will	Where would	Where might
WHEN	When is	When did	When can	When will	When would	When might
HOW	How is	How did	How can	How will	How would	How might
WHY	Why is	Why did	Why can	Why will	Why would	Why might

Figure 6.15 A question ladder can help refine questions. (attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license)

- Design Thinking Tool Kit: There are various tool kits for select audiences. For example, the "design thinking for educators" toolkit has design thinking resources related to education. A typical tool kit includes a wide assortment of resources with methods and instructions to help you put design thinking

into action.

- IDEO Design Kit: IDEO offers an approximately 200-page free PDF, "The Field Guide to Human Centered Design," with activities on mindsets, ideation, inspiration, implementation and a few case studies: http://www.designkit.org/resources/1.
- Google Ventures Design Sprint: A five-day design-thinking exercise that helps resolve questions through design, prototyping, and testing: https://www.gv.com/sprint/.
- Design Thinking Mix Tapes: Stanford's Design School offers three "mixtapes" that serve as guides through a half day of design thinking work in the areas of understanding, experimentation, and ideation: https://dschool.stanford.edu/resources/chart-a-new-course-put-design-thinking-to-work.
- WE THINQ: Software designed to enable collaboration in innovation management: https://www.ideaconnection.com/software/we-thinq-258.html.

ENTREPRENEUR IN ACTION

BitGiving and Design Thinking

At age twenty-two, Ishita Anand created India's first live social crowdfunding platform that enabled artists, engineers, and creators to collaborate and raise funds for special causes by verifying causes and how the funds would be used, while charging a small percentage of the funds raised as a fee. Within five years of its inception, her social enterprise, called BitGiving, has led efforts to address problems through social change. The firm has contributed to various social campaigns related to children, women, education, health, and disaster among others. The firm partnered with charities and other organizations to raise funds for India's National Ice Hockey team to compete in Kuwait at the World Cup and for the victims of the 2015 Nepal earthquake through the crowdfunding platform and other social media platforms such as Twitter.[25]

As India's first social crowdfunding platform, BitGiving literally aimed to solve problems through social change. Describe some design thinking activities that would have been useful to Anand at BitGiving's inception.

As of September 2018, the company closed its website abruptly and reportedly shut down. While the exact reason for its failure is unknown, some reasons the venture could have failed were insufficient capital, regulation, management problems or strategic misalignment, or even poor timing. Failure is common in entrepreneurship, and conferences dedicated to failure are even conducted around the globe (FailCon is sort of the TED Talk of failure).

- How could the design thinking process have helped BitGiving from the outset?

6.4 Lean Processes

Portions of the material in this section are based on original work by Geoffrey Graybeal and produced with support from the Rebus Community. The original is freely available under the terms of the CC BY 4.0 license at https://press.rebus.community/media-innovation-and-entrepreneurship/.

25 "BitGiving." Crunchbase. n.d. https://www.crunchbase.com/organization/bitgiving#section-overview

Learning Objectives

By the end of this section, you will be able to:

- Discuss the lean process methodology
- Understand the phases of the lean problem-solving process.

You have learned about different problem-solving approaches that entrepreneurs take to lead their startups and work with others. Most of these approaches have had to do with the entrepreneur's cognitive or creative mindsets. Now we will learn about an approach that is more rooted in process, called *lean process*. Lean problem solving has been used as an entrepreneurial methodology in new and emerging ventures, and it's interesting that it comes from a large corporate, manufacturing background that focuses on efficiencies. The Six Sigma methodology, pioneered at Motorola in the 1970s and 1980s, and adopted by many companies, is a disciplined, data-driven approach that provides companies tools to improve the capability of their business processes. According to the American Society for Quality, "Six Sigma views all work as processes that can be defined, measured, analyzed, improved and controlled. A set of qualitative and quantitative tools is used to drive process improvement. This increase in performance and decrease in process variation helps lead to defect reduction and improvement in profits, employee morale, and quality of products or services."[26] GE copied it and created the "Process Excellence" programs that millions of managers and others have taken to get certified at various "belts." Although Six Sigma and Process Excellence do not fit strictly in terms of entrepreneurship, as they are used mainly by large, mature companies, many of the methods fit in the lean model.

Toyota pioneered the lean process in the 1980s. The term "lean manufacturing" is the most common, but it is much more than manufacturing. The **lean process** is a systematic method for the maximizing of continuous improvement and the minimization of surplus or unused material in the production of a process. The entrepreneur begins the startup with a sense the original product will be the product carrying the organization to success in the long term. In most cases, the good or service will require modification to maintain a process, technology, or up-to-date product offering. Lean problem solving means the entrepreneur's entire team scans both the company's internal and external environments for continuous improvement and methods for bringing additional revenue to the startup by cost improvement processes that promote sustainable value. The **external environment** encompasses customers, industry trends, and competition. The **internal environment** comprises the factors inside the enterprise, such as employees, and internal practices and processes. In lean manufacturing, for example, improving efficiencies in the internal environment should lead to advantages in the external environment (whether that be cost savings to customers, competitive advantage from more output/superior product, etc.).

For example, every mile saved per day per UPS truck driver results in approximately $50 million in savings per year, according to Juan Perez, the company's chief information and engineering officer. Using customer data and artificial intelligence, the company created a system dubbed ORION, which is an acronym for On-Road Integrated Optimization and Navigation.[27] To date, the system has resulted in $400 million in savings to UPS. By applying the lean process, everything that UPS saves on the input (by reducing mileage) leads to savings on the output, which leads faster deliveries, lower costs for consumers, and more profit for UPS.

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26 American Society for Quality. "What Is Six Sigma?" n.d. https://asq.org/quality-resources/six-sigma

27 Juan Perez. "UPS' Approach to Innovation and Technology." Presentation sponsored by J. Mack Robinson College of Business, Georgia State University, Atlanta, GA. March 28, 2019.

Lean Problem-Solving Process

The lean problem-solving process is a cycle of observation, assessment, and continual evaluation. As shown in Table 6.1, this cycle typically involves eight specific steps.

Steps in the Toyota Lean Problem-Solving Process

Step	Action
Step 1	Clarify the problem.
Step 2	Analyze the problem (genchi genbutsu is the Toyota practice of thoroughly understanding a condition by confirming information or data through personal observation at the source of the condition; the Japanese phrase essentially means "go and see").[28]
Step 3	Set targets.
Step 4	Identify root causes. Asking, "Why?" repeatedly can narrow down the factors to a root cause.
Step 5	Develop countermeasures by asking, "What is the specific change we want to make?" and involving others in the problem-solving process.
Step 6	Implement the countermeasures and see them through.
Step 7	Monitor results.
Step 8	Standardize processes that succeed. Lean problem solving is about learning more about the problem itself and its deep causes in context.

Table 6.1 The lean problem-solving, step-wise process allows the business to observe, assess, and continually evaluate.

ARE YOU READY?

Too Much Too Late?

Many entrepreneurs create a startup with an idea that they develop without any feedback from potential customers, relying on their own knowledge or assumptions about the market. Consider the story of Rapid SOS: https://hbr.org/2018/05/do-entrepreneurs-need-a-strategy. What would most likely happen when they decided to go forward with their product? Will it be a fit to the customer's needs or solve their problems? How is lean process different from this?

28 "Genchi Genbutsu." *Lean HE Glossary*. n.d. http://www.leanhe.org/lean-he/glossary#TOC-Genchi-Genbutsu

Lean Problem-Solving Phases

Observation is the phase in which the entrepreneur studies the challenge and notes all facets of the challenge requiring solution. In this phase, the entrepreneur asks questions and conducts research about the change needed for a successful product, outcome, or service. The entrepreneurs must determine why the change is needed. What is the purpose of the endeavor? Feedback is extremely important in this phase.

For example, a community asked a group of entrepreneurs to help address the youth obesity problem in a middle school. The entrepreneurs began to study the intake of food by the children and determined that both the content of the school lunch menu and the lifestyle of the majority of the children were affecting the obesity rate in the community. They then defined the purpose of the project as finding a low-cost, low-risk method of changing the lunch menu and agreed that the primary outcome would be a 30 percent reduction in the obesity rate of the children. The entrepreneurs began to assess the cost of changing the lunch menu and observing what else the kids ate. The entrepreneurs discovered that the lunch menu change required to reduce the obesity rate was beyond the financial capability of the school district. Research also showed that many of the children, products of single-parent homes, were eating high-calorie, high-fat, take-out foods for dinner. Further observation revealed that the children did not engage in physical activity after hours because the local surroundings were not safe. The community needed a process to transform the wellness of the children, and the entrepreneurs recommended using a lean process approach to help the children as quickly as possible.

After the observation of the problem comes **assessment**, the phase in which the entrepreneur experiments and analyzes the potential process and its capabilities. The entrepreneur leverages creative tools and resources to arrive at a solution and assesses each step of a possible solution. Each step must add value to the solution, or that step in the solution is unnecessary. In addition, the step must be capable of solving the issue and add flexibility to the solution. How is the process or product being improved? In this phase, a prototype of the product is developed and delivered. The entrepreneur must ask the customer if all needs and wants are satisfied with the prototype. If the prototype is being developed for mass production, surveying customers about potential sales is essential. In the school lunch example, the school system would have been the customer of the new food menu (prototype) in the assessment phase.

Evaluation is the phase in which behaviors are analyzed to assess success. The entrepreneur continually studies each phase of the solution to observe the effectiveness of outcomes desired by the client. The entrepreneur ensures that transformation is built into the habits of the school to obtain, maintain, and develop the desired outcomes.

In a real-world example of a company applying lean processes, the New Balance Company, which designs and manufactures both athletic and casual shoes, used a batching approach in the early 2000s that organized production by departments, so that all of the cutting took place in one department, all of the stitching took place in another, and so forth. While it seems that batching tasks would improve efficiency, at New Balance, it meant that production of one pair of shoes took nine days. Executives observed piles of inventory sitting between floors and departments, and noticed employees waiting while there were delays in the production line. They also noticed that the pay structure contributed to the piles of works in process because employees were paid by the piece, which encouraged them to produce as much as possible.

The company applied lean principles to rearrange the production floor by value streams, or the making of a product by sharing similar processing steps. On one side was “cut and stitch” products using US materials of leather and mesh, while another side used premade products from overseas for soles, inserts, and kits. This change cut the time to make a pair of shoes down to four hours, meaning that domestic plants could ship some orders in twenty-four hours, while competitors may need as much as 121 days to ship when they

outsourced manufacturing to Asia.

An often-used lean problem-solving tool is whiteboarding (Figure 6.16). **Whiteboarding** is a type of graphing that permits the entrepreneur to plot each step in a process to build comprehension and detailing of the process. The entrepreneur draws each step on the whiteboard using a linking-type diagram, and draws arrows to show how processes affect other processes. Seeing the flow of the process allows the entrepreneur to note where functions in the process are duplicated or inconsistent.

Figure 6.16 Whiteboarding is a technique that can help entrepreneurs visualize and analyze processes. (credit: "whiteboard man presentation write" by "StartupStockPhotos"/Pixabay, CC0)

For example, in a community garden, storing tools, such as hoes and hand trowels for weeding, in different sheds wastes time when preparing to begin the process of weeding. These tools should be stored collectively to eliminate multiple trips and wasted time. Seeing the process on a whiteboard or other medium brings awareness to how processes can be improved. After the process is changed, it is graphed again for further scrutiny.

ENTREPRENEUR IN ACTION

The Origin of Lean

Would it surprise you to know the origin of lean, in modern times, is considered to be Henry Ford's production line? Although we don't necessarily think of the creation of automobiles as an entrepreneurial venture in today's world, Henry Ford was truly an entrepreneur for his time when the manufacture of automobiles was just beginning. Not only did he recognize the opportunity inherent in the sale of automobiles, he recognized the need to create an efficient process for automobile production that could decrease costs and, consequently, the selling price of the vehicle. As the first entrepreneur to join the use of interchangeable parts with moving conveyance to develop fabrication processes, Ford was able to turn over inventory in a very short time; however, Ford's process could not deliver variety. In fact, Ford was quoted as saying of the Model T's color, "You can have any color as long as it's black."[29] It had the fastest drying time; hence, it was the only color he used for a number of years.

The Ford system was built around one static product. In the 1930s, when the market demanded product variety, the company was not set up to address this challenge. Kiichiro Toyoda (Figure 6.17), the second president of Toyota Motor Corporation, visited the Ford plant in Michigan to learn more about their application of the assembly line concept. After observing, he proposed a new production system that would strive to "right size" equipment to better match tasks and the volume of work, as well as introducing quality assurance steps in each sequence of the work process. Toyoda's approach shifted the focus from machinery to process, optimizing efficiency while maintaining quality.

Figure 6.17 Kiichiro Toyoda introduced new ways to improve processes. (credit: "Kiichiro Toyoda" by "Scanyaro"/Wikimedia Commons, Public Domain)

29 Diana T. Kurylko. "Model T Had Many Shades; Black Dried Fastest." *Automotive News*. June 16, 2003. http://www.autonews.com/article/20030616/SUB/306160713/model-t-had-many-shades%3B-black-dried-fastest

Key Terms

adaptive model method of entrepreneurial problem solving that seeks solutions in ways that are tested and known to be effective

assessment lean problem-solving process phase in which the entrepreneur experiments and analyzes the potential process and its capabilities

brainstorming generation of ideas in an environment free of judgment or dissension with the goal of creating solutions

clarify first step of the creative process, which involves recognizing the existence of a gap between the current state and a desired state

communication skills skills entrepreneurs use to pool resources for the purposes of investigating solutions leading to innovative problem solving and competitive advantage

creativity development of original ideas

critical thinking complex analysis of a problem or issue with the goal of solving the problem or making a decision

crowdsourcing teams of amateurs and non-experts working together to form a solution to a problem

data analysis process of analyzing data and modeling the data into a structure that leads to innovative conclusions

decisiveness ability to make a quick, effective decision, not letting too much time go by in the process

design thinking method to focus the design and development decisions of a product on the needs of the customer, typically involving an empathy-driven process to define complex problems and create solutions that address those problems

develop stage in which the entrepreneur takes the list of ideas generated and tests each solution for feasibility

entrepreneurial problem solving process of using innovation and creative solutions to close the opportunity gap by resolving complex societal, business, or technological problems

evaluate stage in which the final solution is assessed

evaluation lean problem-solving process phase in which behaviors are analyzed to assess success

external environment outside the enterprise and encompasses customers, industry trends, and competition

hackathon event, usually hosted by a tech company or organization, which brings together programmers and workers with other degrees of specialization within the company, community, or organization to collaborate on a project over a short period of time

human-centered design focuses on people during design and development

ideate stage of the creative problem-solving process leading to the detailing and formation of idea generation by the entrepreneur

implement means to enact the plan and test for success

innovative model method of entrepreneurial problem solving that uses techniques unknown to the market and that bring competitive advantage to an organization

internal environment comprises the factors inside the enterprise, such as employees, and internal practices and processes

lean process systematic process for the maximizing of continuous improvement and the minimization of surplus or unused material in the production of a process

need awareness occurs when the entrepreneur notes a gap between societal or customer needs and actual circumstances

observation lean problem-solving process phase in which the entrepreneur studies the challenge and notes all facets of the challenge requiring solution

petitioner problem solvers problem solvers who see a problem and ask others for solution ideas

resourcefulness ability to discover clever solutions to obstacles

self-regulating problem solvers problem solvers who are autonomous and work on their own, without external influence; they have the ability to see a problem, immediately visualize a possible solution to the problem, and seek to devise a solution

storyboarding process of presenting an idea in a step-by-step graphic format

team creativity process of a team creating an unexpected solution for an issue or challenge

theorist problem solvers problem solvers who see a problem and begin to consider a path toward solving the problem using a theory

whiteboarding type of graphing that permits the entrepreneur to plot each step in a process to build comprehension and detailing of the process

Summary

6.1 Problem Solving to Find Entrepreneurial Solutions

Problem solving involves more than making decisions. Problem solving is a necessary component of entrepreneurial genesis, used to manage your business and helpful in addressing everyday personal situations. Entrepreneurs must know their personal strengths and capitalize on applicable problem-solving methods to create innovative products. Moving a startup ahead of the competition requires the entrepreneur to use all problem-solving sources and skills in the entrepreneur's tool box. Problem-solving models can be adaptive or innovative, the latter being more common among entrepreneurs. Problem-solving skills include critical thinking, communication, decisiveness, resourcefulness, business and industry awareness, and an ability to analyze data. There are various types of problem solvers, including self-regulating, theorist, and petitioner problem solvers.

6.2 Creative Problem-Solving Process

The creative problem-solving process is a logical process. The steps to the creative problem-solving process are clarify, ideate, develop, implement, and evaluate. Each step is an aid to creating a solution. The steps are repeated cyclically until the entrepreneur develops an innovative solution. When entrepreneurs experience creativity block, tools to alleviate the block are available. These tools include crowdsourcing, brainstorming, and storyboarding. Each of these tools assist the entrepreneur in innovative thinking.

6.3 Design Thinking

Design thinking in business and entrepreneurship was made prevalent by David Kelley, founder of Stanford University's Design School and cofounder of design company IDEO. Design thinking, which espouses an HCD approach, can be applied beyond product and graphic design to include the design of social policy, business strategy, services, and digital interactions. The five stages as espoused in Stanford's design thinking model are empathizing, defining, ideating, prototyping, and testing. There are numerous design thinking tools that help develop and carry out these processes from various organizations and companies, ranging from IDEO to Google.

6.4 Lean Processes

Lean process is a systematic process for maximizing continuous improvement through minimizing surplus or unused material in the production of a current process. With origins in manufacturing, the lean process can be

applied to internal organizational processes as well as external product development. Lean process uses observation, assessment and evaluation, and whiteboarding techniques to solve problems.

Review Questions

1. What is the relationship between entrepreneurial thinking and problem solving?

2. What are the key aspects of the two types of problem-solving methods the entrepreneur uses to problem solve?

3. What are the key skills entrepreneurs need to arrive at innovative solutions?

4. What are the differences in the three major types of entrepreneurs?

5. List and describe the steps an entrepreneur uses in the specific and logical process of creativity?

6. What are the key aspects of the brainstorming process?

7. What is the main advantage of using teams to create a solution?

8. Discuss the advantages of storyboarding.

9. What are the differences between the design thinking process and the problem-solving process and why are they important?

10. What are the steps in human-centered design thinking? Briefly describe each.

11. What is human-centered design?

12. Observation is the phase in which entrepreneurs explore problems that requires solution. Which is not a step in this phase?

A. talk to clients and conduct research for potential solution
B. determine if change is needed
C. experiment and analyze potential solution
D. None of these options is correct.

13. What are some advantages of the lean process?

Discussion Questions

1. Which method do you think applies more to entrepreneurship, the innovative or adaptive problem-solving method? Do you see yourself as using one method more than the other in your entrepreneurial endeavors? If so, which one and why?

2. Do you think it is important for the entrepreneur to understand and develop all the problem-solving skills to manage a successful startup? Why or why not?

3. Which of the three types of entrepreneurs relies more on the innate skill of the entrepreneur?

4. How does the fishbone process aid entrepreneurs in finding the root cause to problems worth solving?

5. Discuss the different methodologies an entrepreneur might use when experiencing creativity block.

6. Discuss the crowdsourcing process, including how contributors to the solution are rewarded and how different platforms fit with different types of businesses.

7. Why is empathy needed in defining problems?

8. Why is it important to continuously ask for feedback and improve the current design?

9. What are some ways you can determine the true root cause of a problem and not just its symptoms?

10. What are the best ways to implement lean thinking in your company?

Case Questions

1. The team at AMD, the manufacturer of a chip processor, has a good grasp on how software giants build products around its processors. The teams at AMD design processors to feature attractive capabilities to the software giants by seeking input from researchers and designers on the AMD team who possess knowledge of current and upcoming trends. New processors will incorporate these trends in design. After identifying what type of problem-solving style this would be an example of, incorporate the key skills entrepreneurs must have according to the chapter and apply them in terms of the AMD team.

2. Tamika, a young entrepreneur, has been purpose-driven toward social change in her rural community. She has created solutions for pesticide runoff, erosion problems, and toxic well water. She has decided to focus more on energy conservation and local air quality. Her first client is interested in wind as a power source. Tamika is unfamiliar with wind power and needs to learn about innovative solutions for residential application. How might Tamika use creative problem solving methods to develop solutions for her client's request?

3. Based on input from his second-grade students, New York teacher Michael Schurr was able to redesign his classroom to better serve the students' needs. In the book *Design Thinking for Educators*, he redesigned the cubby space to make the room semi-private and lowered the boards so that students could see the content. He made all of these changes after asking the students for input. What are some ways you could improve your classroom if your instructor asked your opinion, using design thinking tools?

Suggested Resources

6.1 Problem Solving to Find Entrepreneurial Solutions

Tony Robbins' tips on decisiveness: https://www.tonyrobbins.com/stories/unleash-the-power/be-decisive/

6.2 Creative Problem-Solving Process

https://www.nngroup.com/articles/storyboards-visualize-ideas/

https://www.studiobinder.com/blog/downloads/storyboard-template/

https://www.mturk.com/

https://www.mindtools.com

6.3 Design Thinking

Google Ventures Design sprint: https://www.gv.com/sprint/

IDEO Design Kit: http://www.designkit.org

Stanford Design Thinking Mix Tapes: https://dschool.stanford.edu/resources/chart-a-new-course-put-design-thinking-to-work

Stanford Design Thinking Process Diagram: https://dschool.stanford.edu/executive-education/dbootcamp

6.4 Lean Processes

Lean Enterprise Institute: https://www.lean.org/WhatsLean/