INNOVATION

Innovation for Impact

by Curtis R. Carlson

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In 1998 I became the CEO of SRI International, the famous research center that received the first internet transmission, developed the first AI-based robot, launched the personal computing revolution, and created inventions such as the computer mouse, electronic banking, and robotic surgery. In 1998, though, SRI was on its last legs. At my first off-site meeting, a manager stood up and told me we were not going to grow because we couldn't. We were broke, our facilities urgently needed repair, and the land they sat on was being sold. Teams worked in silos, and most of the senior managers were pursuing their own agendas with little regard for what others were doing.

When I left in 2014, revenue had more than tripled, and world-changing ideas had generated tens of billions of dollars of new marketplace value. By revamping the way employees worked, using a systematic, efficient process for value creation, we reestablished SRI as one of the world's leading innovation enterprises. The success rate of our projects dramatically improved, and our people gained critical skills that would last a lifetime.

In this article I describe the process we used, which enabled us to produce technology such as HDTV and Siri (now on the iPhone). Our methodology is applicable for creating both disruptive and incremental innovations, and versions of it are used in major universities, national laboratories, and large global companies. It works for people in all positions and all professions because value creation is everyone's job.

Since leaving SRI, I have partnered with a former colleague there, Len Polizzotto, to further develop the methodology at Northeastern University and Worcester Polytechnic Institute. We call our approach Innovation for Impact, and in 2017 I coauthored a National Academy of Engineering report documenting aspects of the research behind it.

Creating Value Through Active Learning

What sets our approach apart from others is that we consider value creation to be an exercise in active learning. Coming up with a novel product or service is not simply a matter of waiting for inspiration to strike but a process of using proven practices from the education sciences to gain insights and improve fast.

Active learning depends on engagement. Students become master architects, for example, not just by reading textbooks, listening to lectures, or watching other architects but by constantly working on and revising actual projects. Through that activity, they synthesize

the theory they're taught, the techniques they see others using, and their own ability to manage the design process.

EDUCATOR SPOTLIGHT

5 Active Learning Principles That Saved SRI International

Exploring the education sciences roots of Curt Carlson's framework for value creation

People who try to learn purely through observation and theory miss a great deal and forget even more. That's particularly true for anyone seeking to create value in business. Innovation occurs in a complex, dynamic environment; those who succeed do so because they manage to find the right signals in a sea of noise. To create efficiently and effectively in that context, people must follow a structured process that includes five basic elements of active learning:

1. Iteration with real-time feedback.

In creative endeavors, repetition is central to learning. Serious piano students, for example, continually practice complex manual maneuvers and experiment with tempo and expression. Those activities are most effective when accompanied by real-time feedback from an expert who can reframe problems and provide potential solutions. Developing a new business idea is, of course, very different from learning to play the piano. The inputs are undefined and may come from a range of sources. So instead of a master-apprentice relationship, the process involves an innovator who keeps refining the idea and seeking feedback widely: from experts, peers, partners, competitors, and, most importantly, customers. Effective feedback initially focuses on arriving at one or two key insights into customer needs and possible solutions.

2. Concise mental models.

Psychologists assert that all of us construct "mental models"—frameworks carried in our minds to make sense of our experiences and inform our decisions. In active learning, we use these models to identify the beliefs, insights, and assumptions upon which we build hypotheses for what works. We can then test our hypotheses against collected evidence and, if warranted, revise them to develop improved models.

It's critical that the mental models that guide the initial inquiry respect the limitations of the people using them. Research shows that most of us retain only seven items, on average, in our short-term memory. What's more, we can think about only three or four items at once. If innovators use mental models that are too long or too complicated (as many are), they will not easily make sense of the evidence or rapidly learn their way to better hypotheses. But if mental models are concise, they can, over time, become intrinsic knowledge to be tapped almost automatically.

3. Multiple learning styles.

Active learning involves applying a variety of approaches to presenting and experimenting with ideas. Using images, simulations, and prototypes, for example, can bring ideas to life, highlight different aspects of a problem, and challenge people's thinking about possible solutions. Storytelling is effective because it can create the context for a mental model: Research shows that stories help people remember information and revise their beliefs, assumptions, and theories.

4. Teamwork.

Working in teams increases engagement, learning, and motivation. Research suggests that the optimal size for a business team is about five people. That number allows for a diversity of perspectives and skills, is small enough to prevent the group from subdividing, and reduces communication costs and the risks of miscommunication. Because value creation is a highly collaborative, interdisciplinary activity, no individual will have all the necessary knowledge, relevant mental models, or insights. This means that each person on the team must bring the distinct competencies and experiences required for his or her tasks. The goal is to assemble teams whose members have a shared vision but complementary skills and varied viewpoints.

5. Frequent comparison.

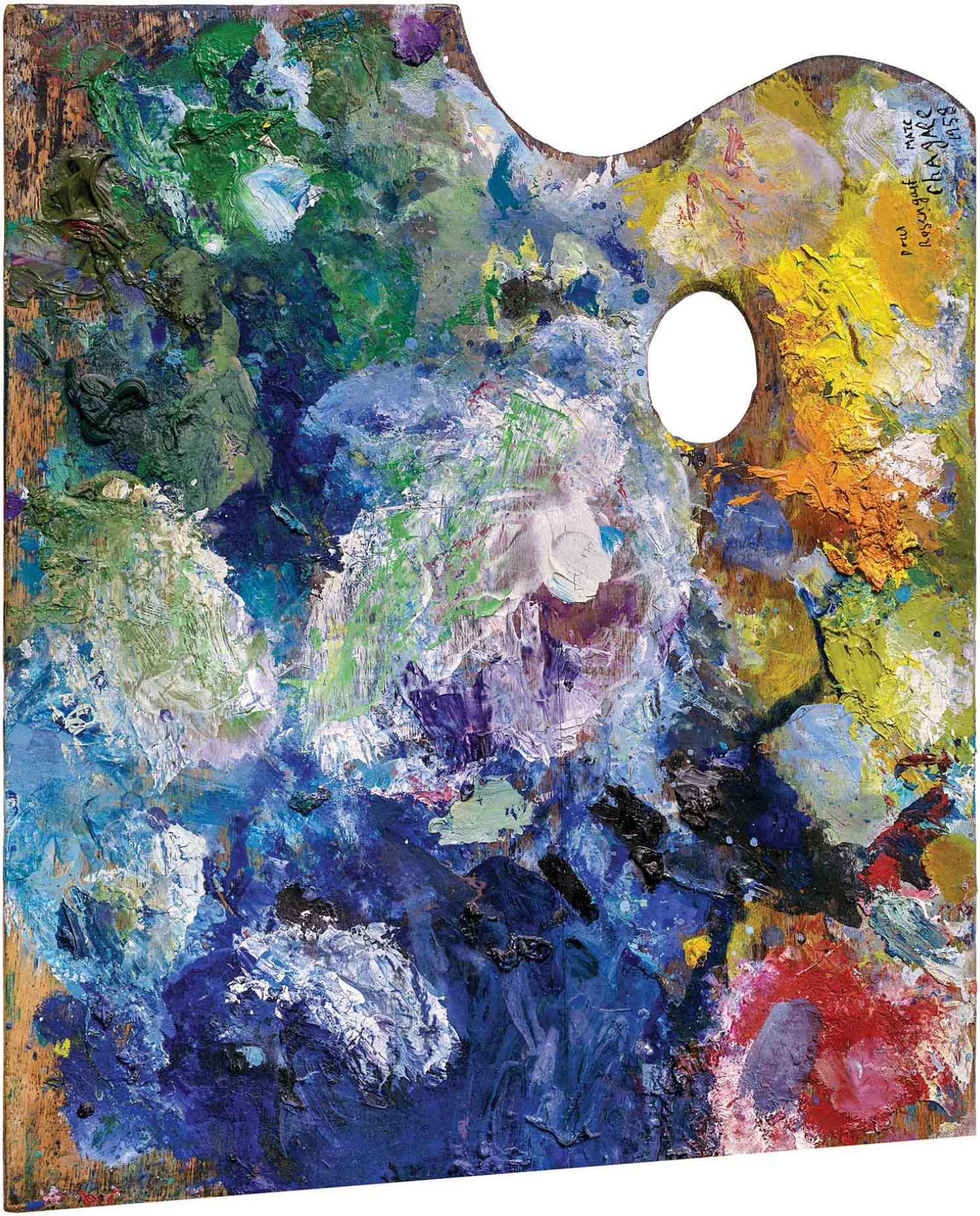
Comparison is how we learn our preferences and decide most things, whether we're buying a new car or choosing what to eat. And research shows that direct and rapid comparison of two similar objects greatly amplifies small differences. Suppose you need new eyeglasses. If you randomly try out different pairs, it may take a while to find one that helps you see better. So instead you get an exam in which you look into a machine that

displays lenses of different strengths. Your doctor rapidly switches the lens in front of each eye, asking, “Which is better, this or the previous one?” Having you quickly compare lenses with subtle distinctions enables the doctor to swiftly zero in on the right prescription.

The Framework: An NABC Value Proposition

Systematic success is achieved when all the building blocks of active learning are brought together in a complete value-creation system. Our approach focuses first on crafting a risk-mitigated value proposition for the offering you hope to bring to market. But how can you tell if you have a good proposition?

I once held a workshop for one of the world’s largest companies. The 30 participants were responsible for six initiatives, which they considered to be the firm’s most important ones. I started by asking them to write on sticky notes the company’s definitions for *innovation, customer value,* and *value proposition.* After they put all their notes up on a wall, what was obvious was the lack of shared definitions for the most basic concepts of value creation—a problem that was preventing everyone from being fully effective.



Palette of Marc Chagall | Photographs: ©Matthias Schaller/Courtesy Sonnabend Gallery, New York/VG Bildkunst 2020

I then gave the teams this instruction: “Write out your initiative’s value proposition on a flip chart. Tell us the customer needs, your approach for the offering, its benefits relative to its costs, and how it compares to the competition.” After half an hour, each team took two minutes to share its statement with the whole group. None was quantitative or convincing, and the teams went back to refine their presentations further. After several iterations, many of the teams found themselves questioning the merits of their initiatives. Some participants were visibly dismayed to realize that they’d been working on things that were interesting to them but of little importance to the company.

This is not unusual. My partners and I have held workshops with more than 500 teams from major companies, universities, national laboratories, and government agencies. None has had shared language for the core concepts of innovation, and none has initially been able to address what we regard as the basic components of a value proposition. After we give people a framework, they typically conclude that less than a fourth of their existing projects, if completed, would provide significant value for their enterprises.

Our framework is anchored in a fundamental, concise model of what a value proposition should be. We call it the NABC value proposition, and it’s described at length in my book with William Wilmot, *Innovation: The Five Disciplines for Creating What Customers Want.*

An NABC value proposition covers four topics:

- *Need:* The offering should fill a significant gap in the market.
- *Approach:* The offering should meet customers’ needs in a unique, compelling, and defensible way and present an attractive business model for investors.
- *Benefits relative to costs:* The offering should provide obviously superior value for customers.
- *Competition:* Customers should find the offering consistently more appealing than the alternatives.

The innovator's first task is to draft a value proposition that addresses all four elements. If one is missing, the proposition is incomplete and unlikely to support value creation. The elements are interdependent, which means that altering any one of them will affect some or all of the others. For example, if the customers' needs change, so will the benefits relative to costs, the competition, and likely the approach.

The conciseness of the NABC framework is part of its power. When people use it to evaluate a proposition, they need to think about only four elements. In contrast, overly complex frameworks violate core active-learning principles: The Heilmeier Catechism, for example, poses 11 questions, and the Business Model Canvas has nine sections, each with multiple questions.

At SRI we used the NABC model in defining the value proposition for Siri, which we originally conceived as a tool to help with travel arrangements. After it was spun out into a company that was acquired by Steve Jobs, Siri became a general-purpose assistant, but here's a short version of what we told potential investors early on:

- *Need:* Busy professionals need assistants available 24 hours a day to make travel plans and reservations. Hunt-and-peck internet browsing and keyword searches are difficult, time-consuming, and ineffective in gathering information and completing transactions. Each wrong click drops out 20% of offerings that might meet searchers' needs. Access to web services through mobile devices is a multibillion-dollar opportunity, growing at 35% a year, that is gated by the pain of the user experience.
- *Approach:* Siri responds to spoken English on smartphones, finding information and services and then performing tasks such as "Tell me the status of United flight 242." The business model is collecting reference fees from service providers. A full commercial offering will be built within 12 months. We have an outstanding team of top-notch researchers and a proven CEO.
- *Benefits/costs:* Siri is a fundamental breakthrough in the mobile-phone experience. Just ask, and Siri, your mobile assistant, will take care of it. Our app is free to users and enables them to find basic services rapidly. Service providers get additional customers for a referral fee of $3 to $30.

- *Competition:* Siri is the world's first computer personal assistant with a scalable business model. The app completes each search query twice as quickly as Google or Bing can. There are strong network effects, and our AI technology learns from users, which increases accuracy over time. Our intellectual property position is strong too; it includes 20 patents developed with $50 million of SRI R&D funding.

People are prone to making three major mistakes in formulating value propositions. First, most people fail to pay adequate attention to their customers' needs, which should be the foundation of the value proposition. Instead they fall in love with their idea, which means they focus almost exclusively on their approach. Over 95% of the innovation pitches I see are all about approach—a sign that the team has yet to figure out what really matters.

If teams avoid this trap and make an effort to look seriously at needs, they typically make a second mistake: over-relying on what customers say they're seeking, rather than identifying the real need. Consider the first iPhone. Apple's surveys at the time suggested that people wanted a better keyboard. What they actually wanted was more convenience and ease of use, and that is what the iPhone's revolutionary touchscreen delivered. Customers can ask only for what they know, and they rarely know what is possible.

The third major mistake is related to the other two: It involves spending too much money on an ill-defined approach. If the value proposition is not well-defined, building a minimally viable product wastes time and money. At the start, the smallest possible team should be assembled to address the major risks in the value proposition. Until those risks are mitigated, building the offering is almost always a costly error.

Value creation is a highly collaborative, interdisciplinary activity.

When an NABC proposition is successful, it is usually because the people formulating it reframe the problem and focus on one or two big ideas that offer potential solutions. Today we're all used to seeing upside-down ketchup bottles, but initially that design was startling. Bottles traditionally had narrow necks and stood upright to avoid messy leaks,

but you had to tip the bottle and pound the bottom to get ketchup out, and you often wound up with more on your plate than you wanted. The solution was obvious once inventor Paul Brown realized that the challenge was not to make a standard bottle that dispensed ketchup better but to make an upside-down bottle that didn't leak.

The People: Champions and Teams

Value creation begins when someone has an insight about how to solve an unmet need and is motivated to turn that insight into a product or service. I call these people *champions* because the term captures the spirit of what is required. Anyone at any level of the organization can act as a champion; no particular title or position is necessary. Champions are passionate about their initiatives and persevere. They self-select. You cannot direct people to be value creators; their drive comes from within.

At SRI my first question when someone came to see me with an idea was, "Will you be the champion?" If they were new, they might ask what that meant. I would explain: "Champions identify important opportunities, drive the value proposition's development, learn necessary value-creation skills, build the team, and exemplify positive human values. If you agree to this, let's get started." My fundamental rule remains the same: No champion, no project—no exceptions.

Once we have an idea and a champion, I ask that person to immediately write down the NABC value proposition and to quantify it instead of using vague terms like *bigger, better, faster,* or *cheaper.* If the champion is unsure about something, my advice is "Put down your best estimate." It will be wrong—that's always the case at the start—but this first step helps clarify the idea, the core challenges, and the skills to look for when you're building a team.

I then ask the champion to find an "iteration buddy" to drive progress and provide emotional support. My partner for developing HDTV was Glenn Reitmeier. We iterated our value proposition hundreds of times over several years before we identified the key insights that led to the solution.

As the value proposition develops, the champion will involve other colleagues, reaching out to people with the expertise to test the value proposition's assumptions and remove its significant risks. A team will often start with a person with business skills, another with technical expertise, and others who assist part-time with market analysis, technical issues, and operations. The first goal is to minimize risks, not create the product.

The Process: Value Creation Forums

Value creation forums are recurring meetings where three to six teams—each with up to five members—present value propositions for their initiatives and obtain input from the other participants. A typical forum will bring together 10 to 25 people, with outside experts and partners invited as needed to help participants identify and understand the market, the competition, and the range of potential solutions.

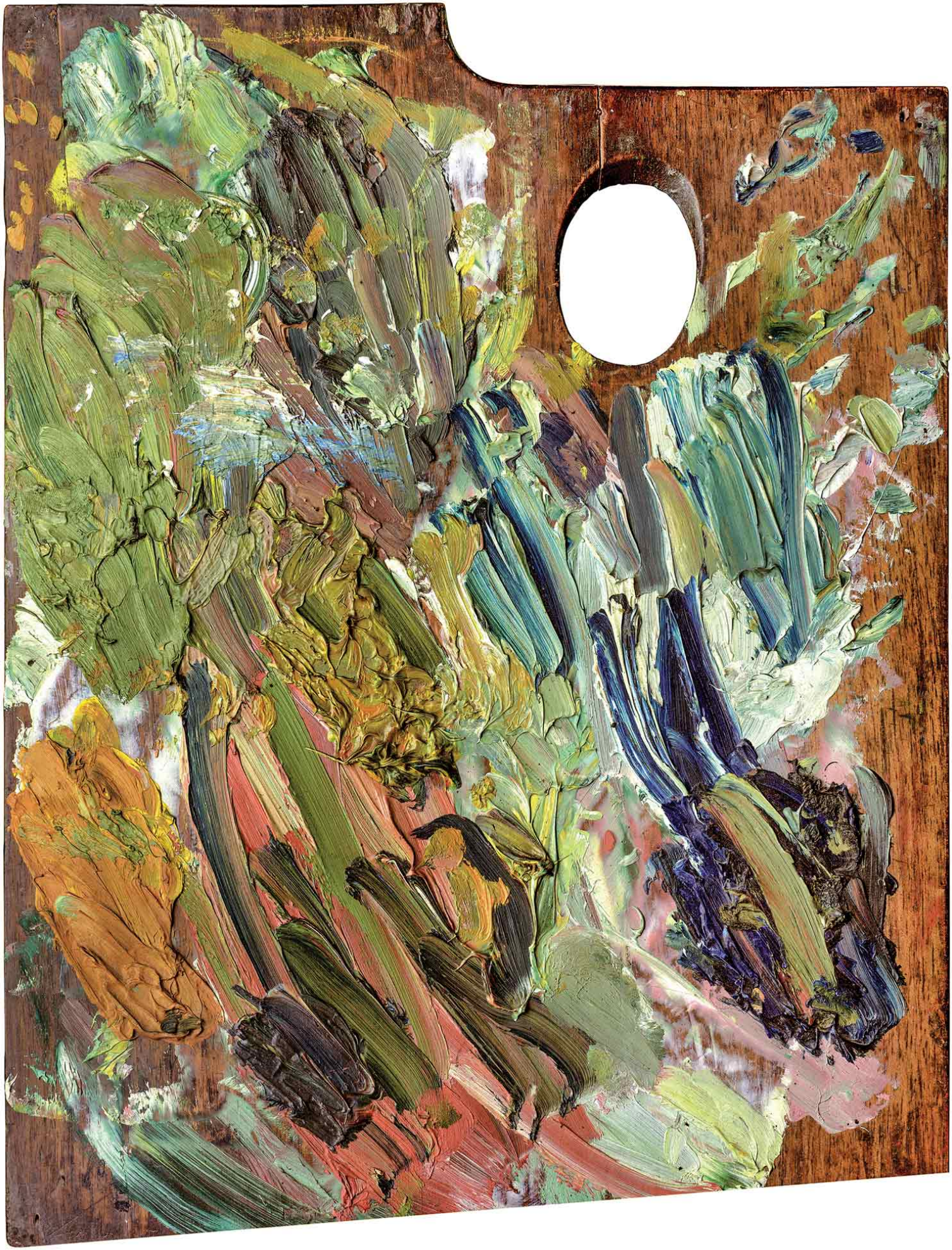
At SRI we held separate forums for different aspects of our enterprise—sustaining the core technical-services business, making strategic investments, and creating licenses and new ventures. In all cases we applied the same overall design: A facilitator organizes and moderates the forums, which take place in person or virtually over the web for one to three hours every two to six weeks, depending on the business objectives. Teams sign up to participate and start by attending a two-day workshop to learn the fundamentals of value creation, with the facilitator coaching them on roles and expectations.

Once per forum, someone from each team makes an NABC presentation, describing the team's value proposition in 10 minutes or less. Afterward, the facilitator randomly calls on individuals to answer these questions:

- What was convincing and should be saved?
- What might be improved, and how?
- If you were a potential customer, would you buy the offering? If not, what would make you change your mind?
- If you were an investor, would you invest? If not, what would change your mind?

The facilitator then asks all participants for any other observations. Finally, someone is asked to evaluate the quality of the feedback. While all this discussion takes place, the presenter stands and listens silently, as a teammate takes notes for review after the meeting. The reason is simple: Presenters may be tempted to defend their presentations rather than listen impartially to the comments, and the meeting may get bogged down in adversarial debate. Thinking about and responding to feedback is work for teams to do later.

The forum process makes comparative learning easy because, as already noted, the NABC model enables participants to compare the different value propositions across just four components. And teams benefit not only from the direct feedback they get but also from seeing what other teams do.



About the art: Matthias Schaller creates indirect portraits of famous painters by photographing the palettes they used. He has photographed more than 200 palettes from 86 artists, fascinated by what they reveal about each individual's creative process. The one above belonged to Vincent van Gogh. | Photographs: ©Matthias Schaller/Courtesy Sonnabend Gallery, New York/VG Bildkunst 2020

For example, imagine you work for a drone company that's seeking to develop new products. Your team's value proposition identifies a need for a novel drone for bird-watchers and says the overall consumer drone market generates several billion dollars in annual revenue. Other forum participants would probably comment on the lack of specificity about the need and the intended market segment. Although that feedback would be useful, you might remain unsure how to perform better at the next meeting.

But suppose another team says this when it presents: "There are 20 million active bird-watchers in America who spend almost $30 billion a year on equipment. Of that total, 1% are hardcore birders who buy the latest equipment and want to capture close-up images and videos of their experiences. The top 5% of spenders in that group of enthusiasts represent a potential market of $15 million a year for ultraquiet, camouflaged, bird-watching drones." That description of an unmet need, with its additional specificity about potential customers, makes the issues to be addressed more evident. It also sets the bar for other teams' presentations at the next forum.

This is comparative learning at work. When people repeat this process eight or more times in a two-day workshop and then participate in recurring value-creation forums, they see dramatic progress.

A good forum needs a good facilitator to manage the schedule and activities, help out when teams get stumped, and add new ideas and clarifications as appropriate. Facilitators are not there to give lectures; their job is to help the teams understand and apply the concepts, reframe issues, and get feedback from their teammates. At SRI we usually put senior staff or executives in that role, choosing people with proven track records at innovation and training them in our methodology.

Picking Winners

SRI projects went forward if they showed the potential to create significant value—typically a market valuation of $100 million or more for a new venture. That magnitude was necessary to attract top talent, gain the interest of knowledgeable investors, and provide a meaningful financial return. If SRI's criteria were not met, the project was either abandoned, redirected toward becoming a licensed technology, or rolled into another R&D initiative.

At any one time, our venture portfolio consisted of about a dozen projects at various stages of development, with several commercialized each year. We initially made incremental and modest investments, ranging from tens of thousands to hundreds of thousands of dollars, and focused on establishing the validity of the value proposition. Mid-level management funded the development work at first and then referred promising projects up the organization to gain more support. After an incubation period of up to five years, we would identify an experienced entrepreneur (usually from outside the firm) and assemble a world-class team to take the venture to market.

Innovation in the United States is highly inefficient. The per capita rate of job creation from new companies has declined for decades, and only 3% of patents are ever commercialized. Most university tech-transfer and start-up incubators lose money. Venture capitalists look at more than 100 deals to invest in one, and typically less than one in 10 delivers a significant return. Most venture capital firms in fact lose money; 5% earn 95% of the returns. All this despite the efforts of some 220 university entrepreneurial programs, 6,000 professors and instructors teaching entrepreneurship, 1,400 venture incubators, and billions of dollars a year in government investments.

We must do better. My experience with SRI and other organizations suggests that basing the value creation process on the principles of active learning and using the structured NABC methodology will deliver the improved innovative outcomes our economy needs and deserves.

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