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Whitepaper

Ideas-First or Needs-First: What Would Edison Say?

by Sarah Miller Caldicott

In just over 30 years, Thomas Edison pioneered six industries that today have a cumulative market value of more than $1 trillion. How did he do it? This article shows that Edison was ahead of his time, adopting a needs-first approach to innovation that is being hailed as the wave of the future today.

Contents

Introduction

America has reigned as the world's dominant innovation leader since drawing its first breaths as a nation in 1776. Pluck and "Yankee ingenuity" drove its growth during its first 100 years. But in America's second century, it was the genius of Thomas Alva Edison (1847–1931) and the efforts of his legions of employees that spurred the nation forward to global dominance as a leader in scientific and technological innovation.

Historical records indicate that the six industries pioneered by Edison generated a market value of $6.7 billion by 1910—or more than $100 billion in today's dollars.

With the creation of Edison's storied Menlo Park, New Jersey, laboratory in 1876, Edison not only invented what we know today as research and development, he also pioneered six industries in just over 30 years—all of which remain with us today. At Menlo Park and later in his West Orange, New Jersey, lab, Edison designed a systematic process for successfully moving concepts from an idea stage all the way through to commercialization.

Historical records indicate that the six industries pioneered by Edison generated a market value of $6.7 billion by 1910 (see Table 1)—or more than $100 billion in today's dollars. Furthermore, from the roots of those six industries grew much of the modern technology that shaped America in the 20th century. On a global level, the ripple effect of these six industries—alongside Edison's 1,093 U.S. patents and 1,293 international patents—accounts for more than $1 trillion in market value today.

Today, in an era when leaders in both developed and developing markets are grappling with how to pioneer new industries and drive value, Edison has a great deal to teach us. Edison's success provides numerous clues as to how to look at 21st-century markets, how to discover new market space, and how to slice through the complexity that often accompanies the development of new products and services. How was Edison able to consistently and so successfully carve out new market space in such a relatively short period of time? And how can we begin to leverage Edison's value creation insights today?

Table 1. The Six Industries Created by Edison

Inventions	Industry	Year
Edison electric pen and press	Document duplication	1873
Carbon button microphone (telephone transmitter)	Telecommunications	1876
First phonograph and record	Recorded sound	1877
Incandescent electric light and system of electrical power	Electrical power	1879
Motion picture camera and moving pictures	The movies	1893
Alkaline storage battery	Portable power	1905

I came to understand Edison's innovation competencies during three years of extensive research I conducted at Rutgers University, where I had access to hundreds of thousands of documents housed within the Thomas A. Edison Papers, an archive that chronicles Edison's life and accomplishments. The result was a first-ever analysis of the five innovation competencies that enabled Edison to innovate so successfully throughout his 62-year career. The five competencies of innovation are explained in depth in my book, Innovate Like Edison: The Five-Step System for Breakthrough Business Success, co-authored with Michael J. Gelb (Dutton Penguin, 2007).

This article addresses another important observation I made following my research. It explains how Edison successfully carved out new market space and drove efficient product development efforts by adopting a customer-needs-first approach to innovation rather than an ideas-first approach. I will explore the significance of this finding using two examples drawn from Edison's portfolio of successes: the development of the document duplication industry and the development of the lightbulb and the system of electrical power.

Throughout my analysis, I reference a modern needs-first approach to innovation that I've found to be closely aligned with Edison's own world-changing view on innovation. This approach, called Outcome-Driven Innovation (ODI), was developed by Strategyn, a US-based innovation consulting firm. It incorporates many of Edison's Five Competencies of Innovation and provides a modern language and process around Edison's approach to innovation. It is testimony to Edison's foresight and genius that his innovation practices offer fresh and profound insight for 21st-century executives.

Tough Lessons About Customer Needs and Utility

One of the most notable aspects of Edison's world-changing innovation process was his belief in linking basic research to applied science. Edison conducted his extensive basic research work (for example, studying the nature of vacuums, or identifying the rate at which the eye tracks moving images) shoulder to shoulder with his applied-science investigations, focusing on such practical questions as how to connect lightbulbs together. This meant that the insights that sprang from Edison's research laboratory could be efficiently corralled for use in commercial applications—but only if there was a perceived market or customer need.

One of the most notable aspects of Edison's world-changing innovation process was his belief in linking basic research to applied science.

Edison learned the hard way about the importance of understanding customer needs before launching an invention. His first tough lesson came with the commercial failure of his patented Electronic Vote Recorder in 1869. Deciding that he wanted to harness his extraordinary knack for creating devices that incorporated principles of mechanics and electrochemistry, Edison devised a machine that could quickly and accurately tally up the votes of legislators voting on a bill. By simply having the legislators punch in their name and whether they were voting yes or no, the votes in every legislative session could be accurately counted and ascribed to the appropriate legislator.

The problem? The legislators didn't care about voting accurately or quickly. Using terminology common to Strategyn's ODI methodology, it can be said that the device did not help legislators get the job of voting done any better. Although Edison's device worked perfectly well, it turned out that legislators liked taking their time when voting. They didn't care about speed. They wanted to lobby their cause, to talk about issues with constituents, and to negotiate votes—not only today's votes, but tomorrow's and next week's as well. The Electronic Vote Recorder didn't satisfy any of those needs.

Edison's Needs-First Mind-Set

> "Anything that won't sell, I don't want to invent. Its sale is proof of utility, and utility is success."
>
> —Thomas Edison

Edison learned a valuable lesson with this failure. He realized that his approach to innovation was somehow faulty. He began reshaping his efforts by redefining what success would need to look like for one of his inventions, and he decided that success was now going to be a function of utility; that is, a function of the ability to satisfy a customer need or a marketplace need. He said, "Anything that won't sell, I don't want to invent. Its sale is proof of utility, and utility is success."[1] This is the fundamental concept driving Strategyn's ODI process—a product or service must help a customer get a new job done or a job done better.

Edison realized it was fruitless to simply invent for invention's sake. Great as the temptation must have been to bring ideas together that he thought were clever, he realized that no one else might care about his ideas the way he did. After all, here he was, a genius, a man whose mind was like a fountain of robust ideas flowing all day, every day. He once said, "I would like to live about 300 years. I think I have enough ideas to last that long."[2] In an extraordinary shift, and spurred by the unexpected failure of the Electronic Vote Recorder, Edison moved from an ideas-first approach to innovation to a needs-first process. Importantly, this involved both a mind-set shift and a behavioral shift on Edison's part, both of which were a significant challenge for him.

Yet Edison made the change. He recognized that simply bringing hundreds of ideas to market would result in many failures. Being a man who was focused on efficiency and success, failure was an unattractive proposition. Edison realized that by understanding customer needs first, he could invent useful products more efficiently than he could otherwise. In the years that followed his setbacks from the Electronic Vote Recorder, Edison immersed himself in a needs-first approach to innovation, placing himself in the shoes of his targeted buyers. He literally went to their work or home locations and began analyzing the jobs they were trying to get done and how they struggled. No longer would he be risking creating technologies and inventions that customers were uninterested in: his new mind-set allowed him to focus on the inventions customers wanted most.

[1] Thomas Edison Papers
[2] *The Edison & Ford Quote Book,* Copyright 2004, Edison & Ford Winter Estates, page 28.

Inventing Document Duplication

Edison's first success using a needs-first approach came in 1873 with his invention of a process for document duplication—a breakthrough innovation we seldom associate with him today. Edison was keen to save money to design and build his own laboratory (the facility that became Menlo Park in 1876) and he began looking to marketplace trends to determine an initial direction for his work.

Objectivity remains very valuable to the modern executive, who must communicate needs to a variety of audiences, such as R&D, manufacturing, design, and purchasing.

With the end of the Civil War in 1865 came a dramatic upswing in the need for insurance. The U.S. government was rebuilding the South, and the demand for insurance policies covering homes, offices, shops, and new government facilities was driving significant growth in the insurance market. Edison noted these trends in the daily newspapers he read throughout the late 1860s.

Believing that insurance industry employers might have some extra money to spend, he went to visit various insurance agents in their local offices and gained permission to observe them and their clerks at work. In his observations, he noted that all the agents and clerks spent hours each day simply writing. And writing, and writing, and writing. When Edison examined the products of their labor, he discovered that each person was creating one master document and then making multiple copies of it by hand for the various parties involved in the transaction. Just making one extra copy of a multipage policy took hours. So Edison chose an attractive market in which to invent—helping insurance agents get a job done better. In the language of ODI, the insurance agents were the job executors, and the job they were trying to get done was preparing insurance contracts. Insurance agents were unsatisfied with several of the outcomes they used to measure success in accomplishing this job—notably, speed in generating copies of documents.

Edison Focused on Customer Needs

Edison believed he could create a solution for insurance agents that would allow them to spend less time writing and more time selling. Rather than beginning by asking, "What can I invent for this industry that would be useful?"—as he had done with the legislators—Edison did the equivalent of looking at outcomes that insurance agents were unsatisfied with. Cast in the language of ODI, insurance agents' desired outcomes might have looked something like this:

- Minimize the time it takes to copy identical clauses in an insurance policy.
- Minimize the likelihood that the terms of coverage vary from policy to policy.
- Increase the amount of time insurance agents spend with prospective customers.

These were among the main needs of the insurance agents. Armed with these insights into insurance agents' needs, Edison saved time; he was able to focus the innovation process on those needs rather than batting ideas around with little direction in what we would today call "the fuzzy front end" of innovation. In ODI language, he targeted the most underserved needs first, which made it possible for him to formulate an effective market growth strategy.

Edison Utilized Focused Idea Generation

After identifying the outcomes he determined were most important for utility, Edison began considering how to address them with his disciplined inventive approach. Here is a list of ideas that Edison might have come up with while considering how to tackle the outcomes required by insurance agents:

- A mechanism that can duplicate sentences multiple times.
- A mechanism that functions as a writing method identical to or nearly identical to the writing method insurance agents are using now.
- A liquid substance that can be used in conjunction with the writing mechanism that is similar or identical to the liquid substance insurance agents are using now.

Edison immersed himself in the context in which the job was being executed, looking at the writing instruments used at that time by the insurance agents: quill pens and inkwells. He examined the paper on which they wrote up the contracts, even noting the weight and porosity of the paper upon which the contracts were prepared. Edison took pride in remaining objective about the innovation process; his objective thinking became a hallmark of Edison's style. Objectivity remains very valuable to the modern executive, who must communicate needs to a variety of audiences, such as R&D, manufacturing, design, and purchasing. Although Edison brought passion to all his projects, he valued objectivity in every phase of his work. Focusing on needs-first rather than ideas-first enabled him to remain objective about the outcomes he sought at each step rather than getting caught up in the emotions surrounding ideas or potential solutions first.

By thinking objectively about outcomes, determining what technologies he had available to address them, and considering the users' work environment, Edison was able to extend his inventive thinking—just as ODI practitioners do today. Edison would combine and recombine his ideas, creatively refining them until he came up with a concept worth pursuing. In tackling the challenge faced by the insurance agents, his process might have looked like this:

- Consider an implement like a regular quill pen that interacts with the paper in a new way.
- Consider an electrified pen.
- Consider a small motor to power the electrified pen.

And the breakthrough concept emerged:

- Create a pen-and-power combination allowing the pen to make perfect perforations in the paper in one pass.
- Place liquid ink over the perforations created by the pen.
- Press the liquid ink through the perforations.
- Create a receiving surface for the ink flowing through the perforations.

Edison worked through a series of experiments in which he examined options for his pen-and-paper perforation idea. The electric pen made perfect perforations in the paper as the agent wrote in a smooth, natural way—not unlike how a tattoo stylus injects perforations in the skin while the tattoo artist works in smooth, easy strokes. Edison then devised a liquid substance—a particular kind of ink that would not pool or quickly coagulate—that was evenly spread by a roller across the paper surface bearing the insurance clauses. The roller pressed the ink down through the perforations onto a second sheet lying beneath the perforated master. In this way, the master sheet could be used like a stencil to create multiple identical copies.

Introduced in 1873, one Edison electric pen and press unit could generate as many as 5,000 copies of a single document (see photo, used with permission of the Thomas A. Edison Papers). The three foundational patents Edison received for his invention he later sold to Western Electric. The technology for the electric pen and press was soon superseded by another technology of his creation—the Edison mimeograph machine. Edison sold the patents for this invention to the A. B. Dick Company. Many readers may recognize the A. B. Dick brand name as a leader in document duplication today, and some may vividly recall the unique purple ink that created their grade school math and social studies worksheets using the mimeograph machine in the principal's office—a technology which, unbeknownst to many, sprang from the genius of Thomas Edison.

Edison's knowledge of the job to be done, the outcomes he was trying to achieve for utility, and the context of the user environment gave him the confidence he needed to pursue his ideas and apply the disciplined and systematic innovation skills that became his hallmark.

Let's turn now to consider a second innovation example that demonstrates Edison's mastery of the needs-first product development approach: the invention of the lightbulb and the creation of a system to distribute electrical power.

Eureka! The Lightbulb

Edison invented the incandescent electric light—more commonly known as the lightbulb—in 1879. For over 40 years, more than 20 scientists had tried to create light through incandescence, but they all failed. (Incandescence is a process whereby a heated substance emits light, but is not consumed.) In Edison's day, consumers burned whale oil and kerosene in their homes as a source of light. But these liquids often spilled, putting clothes, skin, and furniture at risk of burning. Sometimes they even exploded, killing or seriously injuring people.

A focus on safety-related outcomes led Edison to consider three critical improvements, which differentiated his ideas regarding the incandescent lamp from those of his predecessors.

Incandescence was deemed desirable because it had the potential to create a safer lighting source for homes, one that could be used alongside flammable materials such as fabric, thread, or paper without risk. Neither kerosene nor whale oil could be used in such situations. Here again, Edison was focused on an attractive market—people in homes and businesses who were trying to light rooms.

Edison Focused on Customer Needs

When he began his initial explorations of incandescence in 1878, Edison realized that an incandescent lighting source could potentially satisfy one very important and unmet customer need: preventing damage and injury when lighting homes and businesses. Here are a few of the more detailed outcomes Edison likely considered:

- Minimize the likelihood that a light source damages nearby materials (e.g., clothing, household furniture) when the source container is broken.
- Minimize the likelihood that people are harmed by a light source that malfunctions.
- Minimize the likelihood that the light source causes a fire.

A focus on these safety-related outcomes led Edison to consider three critical improvements, which differentiated his ideas regarding the incandescent lamp from those of his predecessors. First, he sequestered the incandescing materials in a vacuum rather than exposing them to the open air. His invention of the one-part-per-million vacuum early in his experimentation cycle was a key milestone, enabling other critical elements to unfold. The second improvement was to house the vacuum in a common material (glass) that could be readily handled without causing burns. Edison's early focus on customer needs led to experiments with hand-blown glass lamps, which were uniquely shaped to accommodate vacuum pump tubes. Edison's incandescent lamps looked from the very start much like the lightbulbs we recognize today.

The third improvement, which solved a majority of Edison's remaining challenges, was a spiral-shaped carbon-impregnated filament. This breakthrough resulted from an insight Edison had while visiting the laboratory of a colleague who was studying arc lighting—the prevailing lighting technology of that era. Edison's insight suggested that the radiating surface for an incandescent light would need to be small—like the spindly filament he created. Arc lights were like big Hollywood spotlights mounted on tall, thin poles and pointed toward the sky. (The light they emitted was too bright for the eye to bear.) These lights were powered by electrochemical batteries housed in devices that resembled large leather suitcases. If these suitcase-like devices leaked, which they frequently did, they could damage clothing, and they posed numerous health risks. However, the electrochemical batteries did succeed in driving a low-resistance current up the poles to the large radiating surface above. In contrast, Edison's carbon filament was just a few inches long and fit neatly inside the glass lamp. The filament was powered through small metal clips connected to copper wires. These wires in turn ran to an outside power source—a small motor.

Edison Addressed Consumption Chain Jobs

Edison's October 1879 invention was brilliant, but he realized that people would require a way to set these lights up in their homes, power them, turn them on and off, and maintain them. In the ODI paradigm, those activities are called consumption chain jobs. They are the jobs the customer must do in order to use the product or service being offered. When it's difficult for customers to do these consumption chain jobs, the primary invention will often fail.

To address this issue, Edison's trained teams visited people in their homes and watched how they used their current lighting products—kerosene, whale oil, and gas. The goal was to figure out what consumption chain jobs to consider and how to address them. This process enabled Edison to gain insight into all these critical jobs.

From there, Edison worked with numerous employee teams to develop products that would address the consumption chain jobs. Products like the electric circuit, the on-off wall switch, the fuse box, electric meters, and dynamos that could power the entire lighting system were all invented. Edison received over 40 patents for these inventions. Yes, Edison invented the lightbulb, but within three years he also invented the entire system of electrical power distribution, along with the world's first central power station. That's fast, even by modern standards.

Here again, Edison's needs-first approach enabled him to identify a large market and guided his research and development efforts. He was able to come up with a revolutionary lighting solution and address all the consumption chain jobs required to bring this solution to market. Because he kept his focus on exactly what customers needed, he could hone his product development timetable and production timetable very efficiently. Considering the complexity of the challenge he undertook—and the fact that the lights went on the very first time the power station switch was thrown—I think it's fair to admit that Edison succeeded brilliantly.

Today's fast-paced product development environment demands both speed and accuracy. It requires that companies get it right the first time. If your company wants to take a page out of Edison's innovation playbook, it should start by discarding ideas-first thinking and adopt an effective needs-first approach to innovation. This crucial lesson enabled Edison to pioneer the creation of six industries and lead the United States to a century of prosperity—a feat that has not been duplicated since.

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About the Author

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