Driving Honda: Inside the World's Most Innovative Car Company

Jeffrey Rothfeder
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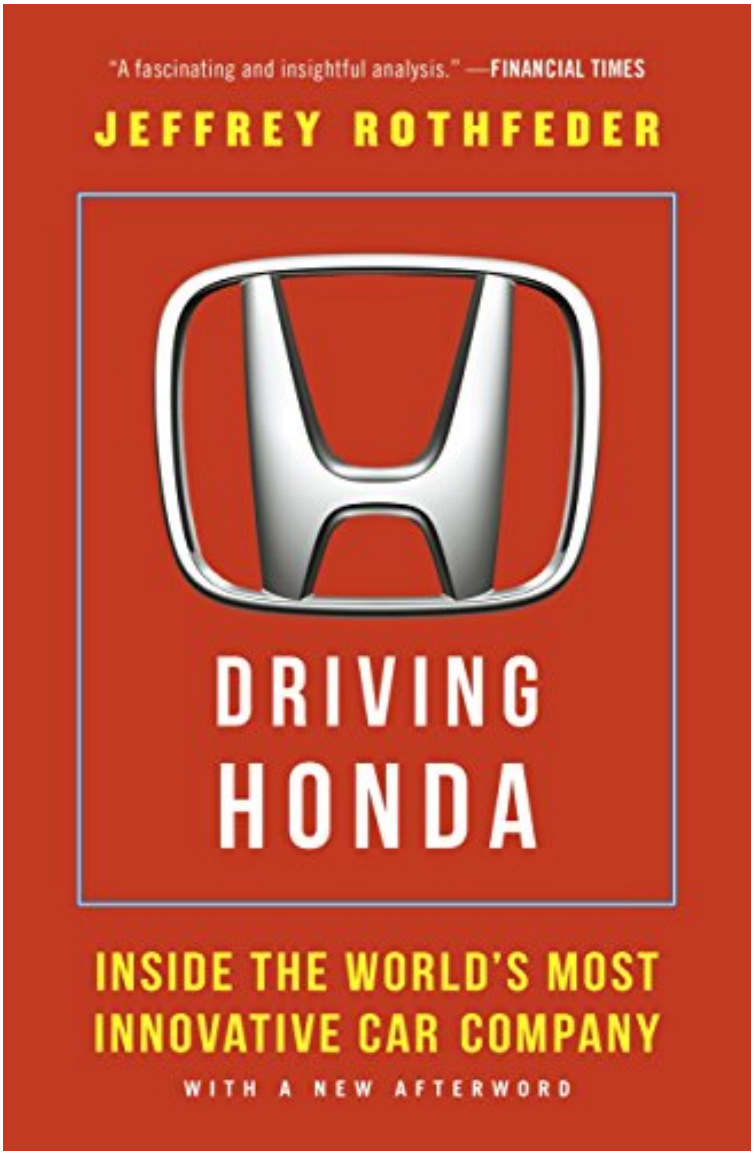

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Jeffrey Rothfeder : Driving Honda: Inside the World's Most Innovative Car Company before purchasing it in order to gage whether or not it would be worth my time, and all praised Driving Honda: Inside the World's Most Innovative Car Company:

1 of 1 people found the following review helpful. An insight into Honda cultureBy JordanI purchased my first Honda (Accord EX sedan 2.4l with 5spd manual transmission) in 2012 because it fit me like a finely-tailored suit. I have since gained an appreciation for many of Honda's historic vehicles, their engineering, and their magic-if you will. I honestly don't know how I found myself looking at books like this (an awesome feature), but I was hooked after reading the

free chapter. This book offers an in-depth look at the history, culture, business, and passion of Honda not only as an automaker, but also as a mobility company for the people. Even if you already have an appreciation and love for everything Honda, you'll come out of this book with a heightened passion for the company. Thank you, Jeffrey Rothfeder, for writing this pleasant read.2 of 2 people found the following review helpful. Another peek at an amazing company!By Shaughn KeeganI have been a fan of Honda for years. My family has owned several Honda products through the years from cars to lawn mowers to power generators. They are very reliable. To me Honda is THE company others should strive to be more like. This is a must read. It shows you what Honda is like as a business and how it operates. I enjoyed it and would recommend it for anyone interested in knowing more about this amazing company.4 of 4 people found the following review helpful. It is a real eye opener and explains a great deal about different approaches to doing business and why ...By jerry zimringA fascinating story about a man, his vision, and his pursuit. For a name we all know, I for one, knew nothing at all about the man, his core beliefs, and the trailblazing journey it put him on. It is a real eye opener and explains a great deal about different approaches to doing business and why we find ourselves on the ' slippery slope ' we do.Unfortunately American business has, for the most part, taken the short view. This tells the story of a different way.

Since its birth as a motorcycle company in 1949, Honda has steadily grown into one of the worldrsquo;s largest automakers and engine manufacturers, as well as one of the most beloved, most profitable, and most consistently innovative multinational corporations. What drives the company that keeps creating and improving award-winning and bestselling models like the Civic, Accord, Odyssey, CR-V, and Pilot?According to Jeffrey Rothfeder, what truly distinguishes Honda from its competitors, especially archrival Toyota, is a deep commitment to a set of unorthodox management tenets. The Honda Way, as insiders call it, is notable for decentralization over corporate control, simplicity over complexity, experimentation over Six Sigmandash;driven efficiency, and unyielding cynicism toward the status quo and whatever is assumed to be the truth. Those are just a few of the ideas that the companyrsquo;s colorful founder Soichiro Honda embedded in the DNA of his start-up sixty-five years ago.As the first journalist allowed behind Hondarsquo;s infamously private doors, Rothfeder interviewed dozens of executives, engineers, and frontline employees about Hondarsquo;s management practices and global strategy. He shows how the company developed and maintained its unmatched culture of innovation, resilience, and flexibilitymdash;and how it exported that culture to other countries that are strikingly different from Japan, establishing locally controlled operations in each region where it lays down roots.From the Trade Paperback edition.

ldquo;Rothfeder keeps the narrative lively and interesting, making it both an enjoyable and informative read. A well-written company profile that provides further insight into the history and management techniques behind Hondarsquo;s continued success.rdquo;mdash;Library Journalldquo;Great investors profit by running counter to the crowd, and in this respect Rothfederrsquo;s superb and readable book is the story of a great corporate contrarian. It explains how Hondarsquo;s idiosyncratic and often counterintuitive approaches to leadership, innovation, and growth have enabled it to prosper in a hypercompetitive industry dominated by giants.rdquo;mdash;John A. Casesa, senior managing director, Guggenheim Partnersldquo;Driving Honda is a fascinating look at one of the worldrsquo;s great iconoclastic corporations. Through extensive access to high-level Honda executives, Rothfeder dives deep into a corporate culture that sidesteps traditional hierarchy and remains devoted to individualism, accountability, and collaboration, proving that no organization is too large or established to stop thinking like a lean, flexible start-up.rdquo;mdash;Keith Ferrazzi, author of the #1 New York Times bestseller Whorsquo;s Got Your Back and Never Eat Aloneldquo;In this highly readable and entertaining book, Rothfeder details how Honda has successfully navigated globalization through a unique strategy. This strategy should be a model for other multinationals to follow.rdquo;mdash;Ray Kwong, senior advisor, USC US-China Institute, and Forbes contributorldquo;This highly readable book reveals the key to Honda's success: a culture of openness, innovation, and relentless commitment to quality. It's a must-read for anyone interested in the future of manufacturing in America."nbsp;mdash;Subir Chowdhury, Author ofnbsp;The Power of LEOnbsp;andnbsp;The Power of Six Sigmanbsp;ldquo;A fascinating and insightful analysis.rdquo;mdash;Financial Timesnbsp;nbsp;ldquo;A case study of the methods required to revive manufacturing industries.rdquo;mdash;Kirkus snbsp;nbsp;ldquo;Rothfederrsquo;s inside look at research and development and details about engines, motors, and assembly lines make this book an engineering or manufacturing fanaticrsquo;s dream, but readers from all industries will enjoy this entertaining and informative work.rdquo;mdash;Publishers Weeklynbsp;Starred ldquo;Superbhellip;A powerful corporate parable about how sticking to your guns can lead to real success.rdquo;mdash;Engineering and Technology Magazineldquo;Clear well-researched history makes for an entertaining lesson on how a relatively modest Japanese motorcycle company took on the giants of the US automotive industry in their own backyardmdash;and succeeded.rdquo;mdash;Professional Engineering MagazineAbout the AuthorJeffrey Rothfeder is a veteran award-winning journalist and former editor-in-chief at International Business Times. He has written numerous critically acclaimed books, including McIlhennyrsquo;s Gold, Every Drop for Sale, and Privacy for Sale. He was previously national news editor at

Bloomberg News, editor-in-chief at PC Magazine, executive editor at Time Inc., and an editor at Businessweek. He lives in Cortlandt Manor, New York.Excerpt. copy; Reprinted by permission. All rights reserved.1The Honda DifferenceSome of the people in attendance observed offhandedly that Soichiro Honda must have been spinning in his gravemdash;or at least letting loose with one of his well-crafted profane tirades.It was April 2000 when a ground breaking was held for a factory on a 1,300-acre site in Lincoln, an eastern Alabama town of fewer than 4,500 people at the time. A year earlier, Honda Motor Company had announced that it would construct its inaugural southern U.S. plant in this tiny hamlet. Because Honda had already made history in 1982 as the first Japanese carmaker in the United States by opening a manufacturing facility in Marysville, Ohio, the news that it was expanding into Alabama captured headlines around the world.And raised its share of questions. For one thing, what and where was Lincoln? Other automakers that had already set up shop in southern citiesmdash;among them Mercedes, Toyota, Nissan, and Hyundaimdash;chose large towns like Smyrna, Tennessee; and in Alabama, Huntsville, Montgomery, and Tuscaloosa. The companies wanted to be in cosmopolitan areas where the pool of potential workers who had experience with new manufacturing technologies and skill sets was sufficiently large. Moreover, they liked being able to offer visiting executives access to high-quality restaurants and hotels.Honda, on the other hand, picked Lincoln precisely because it offered what the company wanted most: anonymity and no big-city spotlights or distractions. Indeed, during the search process for a property in Alabama, Honda executives rejected Birmingham, the first option presented to them, saying it was too big and crowded and, well, messy. And they told the statersquo;s industrial development officials that they wanted a site at which they could work unobserved and inconspicuously.By those criteria, Lincoln was perfect. Before Honda arrived it was a sleepy flatland, left behind years earlier by farmers and defense factories, barely a pit stop on eastndash;west I-20 between Birmingham and Atlanta. Even now, with a world-class automobile factory in its midst, Lincoln is easy to pass by without noticing; it has a few fast-food places to get a bitemdash;Waffle House, Taco Bell, and Burger Kingmdash;and a couple of franchise motels, like Days Inn and Econo Lodge. But no signs trumpet the Honda factory on the highway or anywhere in town.Considering the depth of Hondarsquo;s reticencemdash;a single-minded self-preoccupation that manifests in the automakerrsquo;s almost religious regard for internal innovation and individualism and a concomitant ineptness about promoting its accomplishmentsmdash;the public ground breaking at Lincoln for Hondarsquo;s new 1.7-million-square-foot plant was bound to be perilous. At least the weather cooperated; temperatures reached near eighty that day and the sky was a milky blue. A crowd of a few hundred town residents and invited guests were on hand to watch.They heard short speeches welcoming Honda from Governor Don Siegelman, three-decade Lincoln mayor Carroll ldquo;Lewrdquo; Watson, and local congressman Bob Riley, as well as convocations given by the ministers of the arearsquo;s primary black and white churches and gospel songs sung by a choir that combined the best talent from the two. The speakers mainly touted the jobs, tax receipts, influx of supplier factories, and population growthmdash;all of it adding up to millions and ultimately billions of dollars in economic gains that would be drawn into the area by what would be built on this one unlikely spot of land. As Mayor Watson said later, with an impish grin and a syrupy drawl, ldquo;It was as if we won the lottery; in our wildest dreams, no one ever expected Lincoln to be in newspapers as far away as California or Tokyo.rdquo; (That was the same conversation in which he pointedly took pains to erase any misconceptions I had about the origin of his townrsquo;s name: virtually all southern cities named Lincoln, he said, are honoring Benjamin, the aide-de-camp to George Washington who accepted British general Charles Cornwallisrsquo;s surrender at Yorktown, and not Abraham.)Honda was represented by its leading global executive, CEO Hiroyuki Yoshino, and lesser officials from Honda of America and the Lincoln plant brain trust. Like every CEO in Hondarsquo;s history, Yoshino rose through the ranks of engineering and research and developmentmdash;an unspoken but unchallenged prerequisite for those following in the footsteps of Soichiro Honda, who was among Japanrsquo;s most creative engineers when he founded the company. Other automakers, like other outfits in any industry, tend to fill top jobs with MBAs whose expertise lies in marketing, sales, or finance.Having engineers in charge of the business fits Hondarsquo;s personality perfectlymdash;particularly, the companyrsquo;s bias toward an indispensable aspect of the engineerrsquo;s craft. Namely, the necessity to tear apart design, development, strategic, or manufacturing decisions by trying out alternate solutions arrived at with the same analytical probing and intellectual fervor that produced the original option. Criticizing and rejecting ideas and knowledge deemed to be truemdash;inverting conventional wisdommdash;is more valuable at Honda than repeated success using the same concepts. ldquo;No one will blame you for making a mistake if you tried something new; in fact you may be promoted for that,rdquo; said Chuck Ernst, who conceived and oversaw the building of the Honda factory in Lincoln, an unconventional facility that resembled and performed like no other auto plant in the world when it was constructed. Before that assignment, Ernst had never built a factory from scratch. ldquo;However, you could fall out of favor if yoursquo;re afraid to stray from what worked beforemdash;no matter how well it worked.rdquo;Or, as Satoshi Okubo, one of Yoshinorsquo;s predecessors in the CEOrsquo;s office, put it: ldquo;At Honda, itrsquo;s sink or swim. They donrsquo;t teach you step-by-step; they just throw you into the pool and let you figure it out on your own. If you donrsquo;t know how to swim at first, you need to be aggressive to survive. We are to try out whatever we think is necessary to take ourselves to the next level.rdquo;The tradition of engineers at the helm has also suffused Hondarsquo;s culture with the concept of sangen shugi, which some people translate as the three realities. In

Hondarsquo;s interpretation, sangen shugi means see it with your own eyes, go to the spot before making a decision. In other words, find out, say, what the customer wants or how a part should be designed so it can be assembled efficiently on the factory floor by asking the people who can show youmdash;not just tell youmdash;the answers face-to-face.Therersquo;s almost nothing about Hondarsquo;s unorthodox DNA that hasnrsquo;t been informed by the skepticism and curiositymdash;by the unpacking and then reassembling of knowledge and informationmdash;that characterizes the best of the engineering discipline. However, there is a downside to this: engineer CEOs are not, generally, inspiring or motivating public speakers. Thatrsquo;s where having a more traditional sales or marketing background, in which communication skills are necessarily honed to try to persuade people to buy your product, is a distinct advantage.And in this respect, in Lincoln, Honda CEO Yoshino did not deviate from the norm. Although gregarious and animated in small groups, at the ground breaking he appeared shy and halting; the speech itself was somewhat ham-fisted.Some in the crowd couldnrsquo;t hear him over the sound of the wind blowing across the open field in which they stood. But those who did pick up what he said heard a repeated theme: Honda has been successful because it is, above all, a company that focuses on doing one thing wellmdash;making engines that last a long time for cars, motorcycles, and so-called power products like lawn mowers, generators, snowblowers, and weed or garden trimmers. And Honda continually works to perfect this core skill to improve as a company. Yoshino pointed out that the Lincoln plant would be uncommon because Honda would build both cars and engines there; most other automakers donrsquo;t even manufacture many of their engines and virtually none of them interweaves engine development and manufacturing processes as closely as Honda does to ensure that automobile design decisions are explored holistically.And he added: ldquo;We earn more than ten million customers for these [engine] products every year. That makes us the largest engine maker in the world. The V6 engines we build here in Lincoln will give yet another meaning to the words lsquo;Powered by Honda.rsquo; In this way, a phrase so important to our past will have even more power in the future.rdquo;With that and a few more words, the breaking of the ground was about to begin. A Honda public relations person took to the microphone to tell the luminaries on the stage to step down and pick up a shovel.ldquo;Now, you may have noticed that everyone isnrsquo;t using a shovel,rdquo; he continued. ldquo;Well, Mr. Yoshino spoke earlier about the concept of lsquo;Powered by Honda.rsquo; The tiller that he and Mayor Watson are using to break ground is one of those lsquo;Powered by Hondarsquo; products. I want you to count down with me to the ground breaking. . . . Count down to this start-up of construction for Hondarsquo;s new facility in Alabama.ldquo;Five-four-three-two-one. Gentlemenmdash;start your engine . . . and shovels.rdquo;The shovels were not the problem. The tiller, however, was. It wouldnrsquo;t kick over. Yoshino first pulled the starter string smoothly and confidently, no response. Again, with a smile, dead. Then he yanked on it hardmdash;there was sweat appearing on his brow and upper lipmdash;just a cough from the machine. Now getting more nervous, Yoshino jerked on the rope with force, so hard that someone said it looked like he was going to strain a muscle. It didnrsquo;t help. People in the audience were growing more and more embarrassed for the CEO and by the obvious irony of a dead Honda engine dedicating the companyrsquo;s crown jewel greenfield factory; they wanted to look away or whispered to their neighbor about how they wished they were anyplace else but here.Then, something unexpected happened. Rather than give up or call for help from the Honda maintenance crew in the crowd, Yoshino tackled the balky tiller himself. More comfortable with technical complications than audiences anyway, he bent down and peered into the engine, casually playing with the spark plugs, the carburetor, the gas line. He flipped the choke. It took less than two minutes; then he stood up and pulled the cord. The engine came alive.brvbar;Those who believed that Soichiro Honda would have disapproved of what unfolded that spring afternoon on a nameless plot of land in the Deep South couldnrsquo;t have been more wrong. Quite to the contrary, Honda-san would have been proud for this reason: though unfortunate, the mishap with the tiller revealed yet again that Honda Motor, the company Soichiro founded some fifty years earlier, is an awkward outfit built on paradox and contradiction, full of enthusiasm and warts, yet wholly original, influential, creative, enterprising, resourceful, and successfulmdash;just as he was. More than anything, that public faux pas in central Alabama reflected how well his company echoes his uniqueness as an engineer and a businessman and how his unconventional management style and improvised, even intuitive, organizational genius has permanently infected the corporation that bears his name.Any number of Honda aphorisms would appropriately frame that Alabama misstep, sayings embedded deeply in the companyrsquo;s culture, but one maxim oft repeated by Soichiro Honda, who was fond of mistakes like these, fits best of all.ldquo;Success,rdquo; Honda said, ldquo;can be achieved only through repeated failure and introspection. In fact, success represents one percent of your work, which results only from the ninety-nine percent that is called failure.rdquo;To Soichiro, slip-ups were a sign of progress to come, a motivator to improve.Soichiro Hondarsquo;s business partner, Takeo Fujisawa, the management consulting genius whose personal style and temperament stood in sharp contrast to the founderrsquo;s but who nonetheless forged a common bond with Soichiro that united the pair for more than two decades, had a more nuanced way of looking at mistakes. To him, it was the fear of failure that drove people to achieve the most, rather than failure itself.Fujisawa was adept at shogi, a Japanese version of chess with at least one substantial variation: when you captured an opposing playerrsquo;s piece, it could be redeployed on your side. To Fujisawa that was an apt metaphor for business strategy. As he saw it, by outsmarting the competition, you not only vanquish a rival, you are enhanced by his losses. And the only way to avoid

being beaten yourself is by constantly being on alert and ready to respond to the errors in judgment and in practice that could give your competitors an opening.To make this point, Fujisawa quoted Kozo Masuda, a champion shogi player in the 1950s whom he idolized. Paraphrasing Masuda, Fujisawa would say, ldquo;Irsquo;m at my best in a match when Irsquo;m on the edge of victory or defeat. Irsquo;ve made many careless mistakes in my day and every one of them happened when I had some slack. . . . Itrsquo;s better for me to feel like my opponentrsquo;s closing in on me.rdquo;But beyond the positive effects of failure, Honda CEO Yoshinorsquo;s embarrassing moment and the way he recovered from it in Lincoln is still remembered todaymdash;still mentioned in the auto industry more than a decade latermdash;because it exemplifies in miniature the odd traits, the slightly askew culture, that have made Honda one of the most successful multinational companies in the world, profitable every year of its existence.As an auto company consultant who helped implement many of Toyota Motorrsquo;s operational strategies described it: ldquo;When I first heard about what happened in Lincolnmdash;everyone in the industry talked about itmdash;I laughed and said, lsquo;There goes that motorcycle company again trying to play in the big leagues of the auto industry.rsquo; And then a couple of days later I was driving to work and it hit me: Crap, Honda can make a mistake and rebound quickly, turn a negative into a positive; a few days after Lincoln and now everyone is asking, lsquo;Could my CEO get the engine going?rsquo; Probably notmdash;and he wouldnrsquo;t even try. Theyrsquo;re nimble and smart. To use a basketball term, they can go small or go big with equal skill.rdquo;That dexterity, he added, explains why Hondarsquo;s product development, production, and management methods have been quietly studied by most of the other auto companies as well as other industrial firms, seeking to emulate its personality and manufacturing prowess.What theyrsquo;ve found is that the Honda Way is unorthodox and in most cases the opposite of the approach chosen by large manufacturers, including all of Hondarsquo;s chief rivals in the auto industry, which generally are top-down, command-and-control businesses. You donrsquo;t have to scratch the surface too deeply to see that Honda, instead, is driven by a series of grassroots, Eastern-derived principles that emphasize:individual responsibility over corporate mandates;simplicity over complexity;decision making based on observed and verifiable facts, not theories or assumptions;minimalism over waste;a flat organization over an exploding flow chart;autonomous and ad hoc design, development, and manufacturing teams that are nonetheless continuously accountable to one another;perpetual change;unyielding cynicism about what is believed to be the truth;unambiguous goals for employees and suppliers, and the companyrsquo;s active participation in helping them reach those metrics; andfreely borrowing from the past as a bridge to what Honda calls innovative discontinuity in the present.By following these strategic tenets that are the backbone of Hondarsquo;s distinctive culture, many of them originally adopted or at least adapted by Soichiro Honda, the automaker has maintained the flexibility of a start-up even as it has grown to be the number-two Japanese car company producing some of the most celebrated and bestselling cars in the United States and across the globe. Richard Pascale, coauthor of the classic book The Art of Japanese Management, called Hondarsquo;s decidedly eccentric approach the ldquo;Honda Effect,rdquo;in which strategy is not a long-term concrete business plan but rather ldquo;the things necessary for the successful functioning of an organization as an adaptive mechanism.rdquo; While Honda understands the importance of structure and systems, it is equally drawn to a singular slate of business precepts that foster continuous reinvention of products, people, and processes. Honda, Pascale wrote, exists ldquo;in a sort of restless, uneasy state, which enables it to get a great deal out of its people and itself.rdquo;The companyrsquo;s achievements and proprietary strategies and tactics are not as well known as those of its chief competitor, Toyota, about which much has been written. But quietly Honda has amassed a record of accomplishments that often surpass Toyotarsquo;s. Honda has done this by drawing on fundamental business values that are virtually unchanged since the founding of the company, yet are far more inventive and suited to navigating the trials of the postglobalization environment than any other manufacturerrsquo;s.Among Hondarsquo;s striking achievements:Founded in 1949, Honda is the youngest and most versatile automotive manufacturer in the world. The company designed and built its first car in 1963, the S500 roadster, some sixty years after Henry Fordrsquo;s Model A debuted. Now, Honda employs 140,000 people globally to make a panoply of products: cars, trucks, vans, SUVs, motorcycles, lawn mowers, snowblowers, and other power equipment.By a large margin, Honda is the preeminent engine maker in the world with an output of more than 20 million internal combustion motors annually.Honda has never posted a loss in its history. Its automobile operating profit ratios of about 5 percent consistently top the industry.Hondarsquo;s stock price has nearly doubled since September 2008, when the global economy collapsed, and at the beginning of January 2014 stood at record territory of about 40. In that five-year period, Ford and GM (which had its postbankruptcy IPO in 2010) have been relatively flat. A dollar invested in Honda U.S. ADRs (American depositary receipts) when initially issued in 1987 would be worth $800 at the beginning of 2014; the same amount invested in Ford would have returned only about $100. Since Toyotarsquo;s U.S. ADR was issued in the 1990s, its shares are up 300 percent, while Hondarsquo;s are up nearly 600 percent. Moreover, Hondarsquo;s market capitalization of about $73 billion is well above Fordrsquo;s and GMrsquo;s.Honda automobiles rank high in sales in virtually every international market. In the United States, for example, the Accord, Civic, CR-V, and Odyssey are the number-one models (excluding fleet sales to rental companies, corporations, and government agencies) in the midsize, compact, compact SUV, and minivan sectors, respectively.Honda vehicles are the most durable and longest lasting of any automaker, with 75 percent of its

cars and trucks sold in the last twenty-five years still on the road, according to registration data from industry analysts Polk.Within ten years of Hondarsquo;s founding in a country whose economy was drained by war, political upheaval, and dozens of failures of major companies and banks, it had become the number-one motorcycle outfit in the world, besting more than two hundred competitors. Honda sells about 15 million motorcycles a year; the second-place company, Yamaha, produces only about 5 million motorcycles annually while Harley-Davidson struggles to reach 500,000.In 1974, about three years after entering the U.S. car market, Honda stunned the American auto industry by introducing a four-door Civic that met stringent Clean Air Act emissions standards, which called for a 90 percent decrease in carbon monoxide, hydrocarbon, and nitrogen oxide levels by 1975 compared with 1970 vehicles. This was the first car in the world to qualify under the new rules and it hit the streets just as the large U.S. automakers and Toyota were lobbying Washington to soften these requirements, claiming it was impossible to economically produce an engine that accomplished the actrsquo;s goals.After trumping its rivals by becoming the first Japanese company to manufacture cars in the United States in 1982, Honda again outpaced its domestic competitors by introducing a luxury brand, the Acura, in 1986. Toyotarsquo;s Lexus would not emerge for another three years. In addition, Honda built the first electric/gas hybrid, the Insight, in 1999, and the first fuel cellndash;powered vehicle, the FCX Clarity, in 2002. Indeed, Hondarsquo;s research and development arm, whose mission is broadly to study human mobility, has designed a robot, named ASIMO (Advanced Step in Innovative Mobility), that can climb stairs, run, and follow oral directions; a computerized leg harness that assists people who have difficulty walking by supporting their strides in response to information obtained from hip sensors; and a new lightweight private jet, made entirely of composite materials with unique design elements, including laminar flow body, an exaggerated, tapered nose, and engines mounted over the wing, that reduce drag substantially. As a percentage of revenue, Honda earmarks more money for RD than any other automaker.In terms of industrial performance, Honda surpasses the rest of the auto sector in almost every meaningful benchmark: factory utilization is routinely above 90 percent; production hours per car is in the teens; no automaker can make as many different vehicles on the same assembly line with virtually no turnaround time between models as Honda (this is known as Hondarsquo;s flexible manufacturing system); and compared with its rivals, Honda plants produce more cars per square foot and are typically the least expensive to build.When the Japanese automakersmdash;principally Toyota, Honda, Nissan, and Mazdamdash;began selling cars in volume in the United States in the 1970s, they brought with them an operating philosophy that American companies found to be odd and of questionable value: lean manufacturing. In the auto industry, mass production had worked well since the days of Henry Ford, producing iconic vehicles in large batches with unskilled workers manning discrete stations on the assembly line. There was plenty of wastemdash;too much inventory, supplies, workers, and spacemdash;but GM, Ford, and Chrysler were making big profits so there was no need to disrupt the system.And the Detroit 3rsquo;s dominancemdash;and confidence in their operating modelmdash;probably would have endured a while longer had events not conspired to make the timing of the arrival of the Japanese companies so fortuitous. The rise of OPEC and the subsequent oil embargos of 1973 and then 1979 sent gasoline prices soaring and engendered dread among Western drivers that the availability of oil could not be taken for granted anymore. Suddenly, the ideal car had a new set of criteria: instead of fancy, engorged designs, big chassis, and powerful engines, people sought high gas mileage and motors that ran efficiently and inexpensively for much longer than those of the typical American cars of that period did.The Japanese automakers delivered the desired gas mileage and sales ballooned, although initially drivers were skeptical about the quality of Japanese-built products. For much of the postndash;World War II era ldquo;Made in Japanrdquo; meant cheap knockoffs or plastic knickknacks. It didnrsquo;t take long, however, for people to realize that Toyota and Honda built very good cars; they were reliable, budget-conscious, and easy to repair, and spent much less time in mechanicsrsquo; bays than American automobiles. And as these cars caught onmdash;and seemingly impregnable American companies began to lose market share rapidlymdash;the lean manufacturing techniques that the Japanese used gained legitimacy. Perhaps, business theorists if not the U.S. auto companies posited, mass production had run its course.Toyota, the least shy among the Japanese automakers, took full advantage of the budding interest in Japanese manufacturing methods, opening its kimono to numerous Western academics and think tanksmdash;and subsequently enjoying the acclaim (and increased sales) from being the subject of a bestselling book that introduced the intimate details of lean manufacturing to the West, The Machine That Changed the World, by MIT professors James Womack, Daniel Jones, and Daniel Roos. The Toyota Production System, or TPS, and Toyota itself had become the new high bars for manufacturing in the post-Ford age. Indeed, by the late 1990s, even the Big 3 U.S. automakers had overcome their resistance to ldquo;leanrdquo; and actively, if unsuccessfully, tried to implement it in their factories.Stated simply, lean manufacturing is concerned with eliminating waste in production. It is an ongoing process that seeks factory floor ldquo;continuous improvement,rdquo; as the lean proponents call it, by reducing work flow; throughput time, or how long each specific manufacturing activity takes; the number of employees needed to do a job; the amount of supplies required; raw materials; parts and finished products on hand; and on and on as the production process narrows to its most stripped-down and efficient components.But as the authors of The Machine That Changed the World put it, the greatest distinction between lean manufacturing and mass production can be found in their objectives: ldquo;Mass producers set a limited goalmdash;lsquo;good enough,rsquo; which translates into an

acceptable number of defects, a maximum acceptable level of inventories, a narrow range of standardized products. . . . Lean producers, on the other hand, set their sights explicitly on perfection: continually declining costs, zero defects, zero inventories and endless product variety.rdquo;Presented that way, what company could afford not to adopt lean production? Indeed, hundreds of American manufacturers felt compelled to spend hundreds of millions of dollars to emulate Toyota since the MIT professors published their book and dozens of magazine articles piggybacked on the topic. Most of these companiesmdash;as many as 75 percent, lean consultants concedemdash;shelved the effort within a year or two.These failures are not an indictment of the goals or even the techniques that exemplify lean manufacturing, but rather they are evidence that lean, as a factory production concept, was misunderstood from the start. Because Toyota appeared to be radically different from every manufacturer that Westerners had known before, and outwardly at least one of Toyotarsquo;s most distinctive characteristics was its production system, lean manufacturing was confused with Toyotarsquo;s corporate culture. It was assumed to be the reason for Toyotarsquo;s success, the genetic code of the organization, rather than the tool Toyota used to be successful. To a great extent, even Toyota was fooled by this. Viewed through this blinkered lens, lean manufacturing became known as an operational strategy when in actuality it is a set of tactics.Which raises the question: what type of corporate DNAmdash;which set of operational attributesmdash;best suits a lean manufacturing company? For better and worse, Toyota offers some clues. At its best, Toyota is a disciplined company with a rigid command-and-control hierarchy that enabled it to maintain unwavering supervision over a global production system built on improvement and minimalism. Rules, systems, processes, and training modules were developed in Toyota City, the companyrsquo;s headquarters in Japan, and distributed throughout Toyotarsquo;s network by people taught at the home office. Thatrsquo;s not the only way or even the most desirable way to implement lean systems. But as Toyota has proven, if a company is sufficiently diligent about sustaining centralized control, it can effectively train and manage workers throughout the organization to rigorously apply lean methods to their day-to-day activities.However, recently at Toyota, we had the opportunity to observe how ineffective even the most intelligently orchestrated lean methods could be when a companyrsquo;s operational culture abandoned them. As Toyotarsquo;s growth exploded through the 1990s and into the 2000s, instead of an obsessive focus on preserving and enhancing lean techniques at all of the companyrsquo;s factories and on training the next generation of lean gurus who would teach others out in the field, managementrsquo;s attention had shifted to other priorities: for one, to overtake General Motors as the top-selling auto company in the world, and for another, to expand globally at an increasingly rapid pace. That meant producing more cars, new designs, and customized models than at any other time in the companyrsquo;s history.With its altered agenda, Toyota had become much more ordinary, closer to being just another automaker. Its production system was still lean, but its culture and strategic direction were tilted toward escalating sales growth, a hyperactive set of goals that were not aligned anymore with its manufacturing approach. On the factory floor, critical lean concepts, such as a strong emphasis on quality control throughout the assembly process, were still practiced, but Toyotarsquo;s management in Japan gave lean outcomes short shrift. And before long, this neglect from headquarters served to attenuate lean efforts at Toyota operations around the world.The disconnect within Toyota finally became public in 2009ndash;10 when Toyota recalled more than 15 million vehicles globally, the largest extended recall ever. Although these repairs covered everything from faulty spare tire carriers to oil hose leaks to fuel pump problems in all types of models, the most prominent malfunction involved unintended accelerationmdash;the car takes off, or feels like it is about to, even when braking.In early 2010, the National Highway Traffic Safety Administration (NHTSA) received dozens upon dozens of complaints about sudden acceleration in Toyota vehicles, and the automaker recalled well over 6 million cars in the United States alone and another 2 million in other countries. NHTSA ultimately linked five deaths to this issue, which the agency determined was the result of gas pedals that were stuck partially depressed or trapped under the floor mat. In addition, Toyota faces hundreds of wrongful death and personal injury lawsuits related to these flaws in its cars. In October 2013, Toyota lost a wrongful death civil case in Oklahoma and immediately settled for an undisclosed amount before the jury could award punitive damages. Now, Toyota is in negotiations to resolve the outstanding litigation, published reports say.Toyota management conceded that internal dysfunction led directly to these quality problems. ldquo;Toyota has, for the past few years, been expanding its business rapidly,rdquo; Akio Toyoda, the companyrsquo;s CEO, said. ldquo;Quite frankly, I fear the pace at which we have grown may have been too quick.rdquo; He added that the companyrsquo;s priorities ldquo;became confused, and we were not able to stop, think, and make improvements as much as we were able to before.rdquo;Toyodarsquo;s apology was no doubt sincere, but he wasnrsquo;t fully forthcoming about how pronounced and dangerous the misalignment between company managementrsquo;s goals and the lean concepts that essentially define Toyotarsquo;s operations had become. A group of Toyota workers in the United States told me that the real failure in the unintended acceleration episode was not that Toyota quality control workers did not know about it soon enough but rather that their attempts to notify higher-ups about the problem were thwarted. Indeed they had heard complaints from U.S. drivers in the months leading up to the recall, but no one would listen. In theory, this shouldnrsquo;t happen in a lean environment where workers are expected to go as far as stopping the assembly line when something is amiss and offer possible solutions to issues that threaten the quality of the product, to take control of their jobs and responsibility for the items that they build.

ldquo;When we mentioned that something was wrong with the gas pedalsmdash;and as people started complaining about themmdash;one supervisor told us, lsquo;Letrsquo;s just ride this out; Japan doesnrsquo;t want to hear this. Letrsquo;s not raise too much of a fuss right now,rsquo;rdquo; one of the workers said.The supervisorrsquo;s stance might not have been the result of a direct order from Toyota City; however, many Toyota employees in the United States got the message about managementrsquo;s preferences in a company memo that circulated a few years earlier. Under the heading ldquo;Wins for Toyota Safety Group,rdquo; Toyota executives boasted of $100 million in savings gained not by, for example, quality improvements, but by persuading U.S. regulators to agree to a more limited recall of Camry and Lexus models with defective floor mats than they had initially requested. The memo also includes millions of dollars in additional savings achieved through lobbying for delays to safety and other regulations.Those savings and more have been frittered away by Toyotarsquo;s foot-dragging on the balky gas pedal issue. Because Toyota failed to report internal knowledge about acceleration problems in its vehicles in a timely fashion, the automaker has paid upward of $70 million in fines to the U.S. government. And in March 2014, Toyota settled a Justice Department criminal investigation into its activities for $1.2 billion, the largest penalty of its kind ever imposed on an auto company.This incident highlights how seductive it is for a large company to mistakenly believe that lean production techniques could be a proxy for corporate culturemdash;that a successful lean strategy by default produces high levels of product quality and safety, customer service and organizational candor, and transparency. That temptation is what drove many Western multinationals to embrace lean in the past few decades, hoping that it would magically transform bloated and inefficient organizations into streamlined businesses that could deftly navigate rapid changes in global market conditions; however, they scuttled these efforts in disappointment after finding out that their organizational character was ill suited for the type of company they aspired to be. In Toyotarsquo;s case, that erroneous notion about lean methods was finally shattered when the automakerrsquo;s management ideology no longer viewed continuous improvement and quality control as priorities. As Toyotarsquo;s new, more aggressive strategic thrust took hold, the companyrsquo;s executives learned to their dismay that implementing lean tactics without a sympathetic organizational culture to nurture them was an exercise in futility.Although Honda never made the miscalculation that culture could be subordinate to the tools and techniques used by the organization, the company is nonetheless often misguidedly characterized as being similar to Toyota in its operating principles. In large part that is because like Toyota, Honda is fanatical about lean precepts such as reduction of waste, efficient and ergonomically sound factory floors, just-in-time parts logistics, and minimization of product defects. However, those facets of plant excellence are assumed by Honda to be the price to participate at the superior level the Japanese companies have chosen for making cars; they are the obvious prerequisites of being a first-class manufacturermdash;but they are not Hondarsquo;s identity.Indeed, Irsquo;ve spent nearly five years researching Honda and can count on five fingers the times that anyone who works for the company mentioned lean manufacturing. The opposite is true as well: Irsquo;ve never had a serious discussion with a Toyota insider that didnrsquo;t begin and end with hand-wringing over lean techniques.In its broadest expression, Honda and Toyota differ the most in the relationships between corporate headquarters and the companiesrsquo; many factories and offices around the world. When it is functioning smoothly, Toyota encourages global employees to think on their feet and recommend solutions to roadblocks, but inevitably ultimate power at Toyota resides in Japan. Local decisions must climb the chain of command and gain approval from the executive suite in Toyota City. By contrast, Honda is a decentralized organization that gets its strength from independent decision making at each of its facilities.Or as James Womack, one of the authors of The Machine That Changed the World, explains it: ldquo;I wouldnrsquo;t call Toyota a top down organization but rather itrsquo;s sort of bottom up, top down, bottom up, top down. They have rules that must be followed and upper management wants to be involved in critical changes. Honda is more relaxed about that; it comes closest to being a bottom up organization.rdquo;A tangible illustration of this distinction between the two companies comes from a former Toyota plant engineer who now works for Honda in Lincoln: ldquo;When I was at Toyota, I was asked to create a new assembly line at an existing factory. It was easy; my supervisors in Japan gave me the blueprint and said, lsquo;Herersquo;s how we do it, follow the plan.rsquo;ldquo;At Honda a few years later I had to oversee the setting up of the line at the Lincoln engine plant. The experience was so different. The only instruction I got was, lsquo;Go to the Anna engine plant in Ohio, study how they do it, talk to the workers and the managers about what they like and donrsquo;t like, what they would fix and what they would leave unchanged, and then make a better one in Lincoln.rsquo; I took this to mean, understand what theyrsquo;ve done, and then advance it.rdquo;While Toyota is permanently coupled with lean, Honda clearly sees itself in another lightmdash;as a big manufacturer embodying the spirit of an entrepreneurial small business exemplified by these traits: questioning common beliefs, innovation springing from risk taking and examining mistakes, open lines of communication, local control, and accumulated knowledge linking the global company like a bridge. Moreover, Honda views the factory as an elegant web of interchangeable tools and activities, rather than a series of discrete operations that can be leaned, streamlined, and automated to meet certain predetermined benchmarks that, in turn, squash the enthusiasm for creativity and contributing to improvements in the plant out of the local workers. Itrsquo;s worth noting in this regard that Hondarsquo;s factories are the least automated among carmakers, yet Honda enjoys the highest profit margins. These

characteristics and the way Honda employs them are striking because they have largely gone unexamined and yet provide a valuable cultural framework for multinationals struggling with the challenges of maintaining excellence, corporate values, localization, and continuous advances in design, development, engineering, and products throughout a far-flung network of factories and RD centers.Certainly Honda has had slip-ups. For example, the road into China, which Honda pioneered among Japanese companies, has been thorny (as it has been for most multinationals), although Honda appears to be on the verge of succeeding, and the devastating Japanese tsunami in 2011 caught the company unawares and vulnerable to the shortage of a single but critical part. But because of its uniquely downsized corporate culture, Honda has adroitly used those failures as vehicles for continuous improvement.The value of Hondarsquo;s unparalleled and extremely creative industrial model has taken on increased importance recently as the worldrsquo;s manufacturing landscape is becoming increasingly more chaotic. After a period of unprecedented manufacturing retrenchment in the West, when one factory after another was shuttered and tens of thousands of jobs were lost each month to new plants in low-cost nations like China, Thailand, Romania, and India, the concept behind this sweeping job migrationmdash;globalizationmdash;is losing its luster. Itrsquo;s not just wage inflation in these and other countries precipitating this change of heart. Instead, multinational manufacturersmdash;most of whom, including majors like General Electric, John Deere, and Xerox, are unprofitable in emerging economies, a fact that they prefer to not break out in their earnings reportsmdash;are learning that placing a factory in a distant country to serve other parts of the world creates a new set of problems they didnrsquo;t foresee.For example, by establishing factories thousands of miles away from research and development centers, which are generally considered skilled facilities that should be close to headquarters, manufacturers found that the quality of their products and factory productivity suffered, as did their ability to respond quickly to a sudden shift in customer preferences. Equally troubling, multinationals discovered that products made in an Asian country could be literally lost at sea for weeks during shipments to the West, leaving the company uncertain about when and in what shape the items would arrive. If the wrong goods were shipped, which happens all too frequently, the company could face millions of dollars in mislaid inventory.These issues and others, including the influence of state-owned companies and the strength of nationalism in many emerging nations, have put a quick end to globalization, at least as it has been defined up until now. Multinationals are hastily rethinking their factory footprints, turning away from low-cost nations to be closer to their customers and skilled workers in the West. Virtually every leading manufacturer has retrenched in this way, rejecting offshoring in favor of what is popularly known as reshoring.The CEO of Siemens USA, the electronics giant, describes it thus. ldquo;The labor componentsmdash;the need to choose where to set up manufacturing facilities based primarily on where the wages are cheapestmdash;is not the major driver anymore,rdquo; says Eric Spiegel. ldquo;Instead other factorsmdash;access to skilled labor, modern infrastructure, the ability to drive innovation with world-class RD, where the customers are, and capabilities like new manufacturing technologiesmdash;propel decisions about new factories.rdquo;But like globalization, this strategy, too, is full of potential obstacles. This new manufacturing era, which can be called localization, requires that companies set up full-scale operationsmdash;factories, engineering sites, research facilities, suppliers, and logistics channelsmdash;in key areas around the world to profitably and efficiently provide individualized products customized for each particular region. The centralized command-and-control structure that characterizes many multinationals is precisely the wrong culture for this type of global strategy, which essentially calls for separate businesses in each locale, connected to a larger corporation but relatively independent of it.Indeed, Honda is one of the few companies prepared for localization. For evidence, consider that over the past few years Honda has quietly remade itself from a Japanese multinational with smaller operations around the world into an automaker whose largest subsidiary is an autonomous U.S.-based producer of cars for the Americas, followed by similar operations in China, Japan, Thailand, Brazil, and numerous other places as well as separate businesses making motorcycles, power products, and new technologies like robots and alternative energy equipment. Hondarsquo;s ability to morph to a large degree seamlessly into a localized company of many different self-operating units around the globe is a testimony to the strength of its self-consciously decentralized structure and its embrace of local autonomy and independent workers. All of which springs directly from the entrepreneurial, do-it-yourself roots planted firmly by Soichiro Honda.Which is, after all, why the dead tiller engine in Lincoln, Alabama, and CEO Yoshinorsquo;s casual kick-start were so telling.2The Smell of Oilldquo;Therersquo;s something wrong with that manmdash;and his company, too.rdquo;At least three auto industry experts said they heard Eiji Toyoda, one of the founders of Toyota Motor, utter those words about Soichiro Honda. They all hastened to add that by the time Toyoda said this in their presence he was elderly and retired. His tone was playful, not bilious as it probably had been decades earlier when he had to dodge Hondarsquo;s unpredictability in a weary postwar Japan.For his part, Soichiro Honda surely relished the compliment. He was the least likely Japanese industrial giant of his generation. In a country where conventionalism, reticence, and humility are among the most admired traits, Honda rejected all three; he believed genius arose from idiosyncrasy.ldquo;Nonconformity is essential to an artist or an inventor,rdquo; he told his workers on more than one occasion.Indeed, Honda was in the thrall of the unconventional. Well before anyone thought of calling it a syndrome, he was infatuated with shiny new objectsmdash;more because they were different than new.Born in 1906 in a tiny hamlet outside of Hamamatsu, in Shizuoka Prefecture, about two hours south of Tokyo on the Pacific coast, Soichiro

Hondarsquo;s first real brush with mechanical novelty came in the 1910s when a Ford Model T drove down the dirt roads of his village. Hondarsquo;s father, Gihei, was a blacksmith who also fixed bicycles. Intrigued by his fatherrsquo;s dexterity and the tools he had to work with, Soichiro repaired bikes as well but didnrsquo;t find them particularly challenging. He was fascinated by the mechanics of mobility, but the way bicycles worked was too pedestrian.However, seeing the Model T was a revelation, especially in his sleepy community, where bicycles were just catching on. ldquo;I could not understand how it could move under its own power,rdquo; Honda was to say many years later. ldquo;And when it had driven past me, without even thinking why, I found myself chasing it down the road as far as I could run.ldquo;I was enchanted by the smell of that oil. I leaned over a spot of oil on the ground and put my nose right up to it, and rubbed my hands in the residue. From that moment on, I only had one fixed idea, and that was to invent machines and to get greasy with machine oil and lubricant.rdquo;For the days and weeks and months after that, Soichiro couldnrsquo;t take his mind off the magnificence of motor-driven engines. Whenever he could, he traveled with his grandfather to examine the inner workings of a nearby rice-polishing mill, which had one of the few mechanical engines in his remote area.ldquo;The sound of the machine was my first music,rdquo; Honda recalled. ldquo;From the veranda of our wooden house, I could see the blue smoke it emitted. Going to the mill became a habit. I loved the noise of the combustion motors, the smoke . . . and I stayed there for hours, watching the machine while my grandfather tried to talk me into going back.rdquo;And at fifteen, in 1922, the allure of motors had become too overwhelming to merely view from a distance. Soichiro dropped out of school and left home to seek a job working on internal combustion engines in Tokyo. He was hired as an apprentice at Art Shokai, an automobile and motorcycle repair shop.Art Shokairsquo;s owner was impressed by Hondarsquo;s innate technical expertise, but at that time well-traveled craftsmen still held sway over the tiny global auto industry; as the old-timers saw it then, it should take years of watching and training before an individual was given his own set of tools to work on a car. This expectation was obviously anathema to Soichirorsquo;s peripatetic personality. And itrsquo;s impossible to say what he would have done next if he had been forced to apprentice for a decade or so. But an unforeseen tragedy rendered this possibility moot.What became known as the Great Kanto earthquake struck the Japanese mainland in September 1923. The deadliest quake in the nationrsquo;s history, the episode lasted as long as ten minutes and leveled Tokyo as well as the port city of Yokohama. More than 140,000 people died. Among the more dramatic anecdotes still told to impress visitors with the strength of the quake, a ninety-three-ton, fourteen-foot statue of the Buddha was lifted up and moved two feet by the undulating movements of the earth.Art Shokai was spared by the event, but most of the shoprsquo;s surviving mechanics had to leave their jobs and return home to deal with their familiesrsquo; losses and rebuild their houses. Soichirorsquo;s town was too far away to be affected by the quake. So he filled in for the missing workers and became a full-fledged mechanic, repairing automobiles well before anyone his age was usually allowed to.Five years later, when he was twenty-one, Honda had mastered servicing cars so well that he moved back to Hamamatsu and opened a branch of Art Shokai in his hometown. It was a small business, a two-person shop that plodded along, making just enough money to keep the doors open. The shoprsquo;s fortunes changed, though, in the late 1920s when Honda produced his first automobile-related invention: a wheel with cast-iron spokes. Until then, wooden spokes were ubiquitous, but on the demanding unpaved or pockmarked roads that existed at the time, these wheels cracked with troubling regularity, routinely propelling cars into ditches or each other, and stranding motorists. Consequently, Hondarsquo;s new cast-iron supported wheel was a significant breakthrough, an idea he first thought of when still working on bicycles, which greatly improved automobile comfort and reduced accidents.Licensing money poured in from automakers around the world, and despite the global depression, Honda became a very rich man. Never one to be stingy with newfound wealth, he took up motorcycle racing on the back of his new Harley-Davidson; he spent a great deal of time carousing with geishas on motorboats he built himself; he had an auto accident or two, going overboard on rickety bridges above streamlets; he drank a lot. And he planned his next auto industry triumph. This time, piston rings.Still among the most elaborate parts of an engine, piston rings failed often in the early days of internal combustion motors. Their main task is to close the gap between the piston and the cylinder during the compression cycle, sealing gases and oil in the combustion chamber. Piston ring gap tolerances are minusculemdash;as little as a thousandth of an inchmdash;and must be machined perfectly or the engine could seize up.Soichiro Honda was convinced that he could make piston rings better than anyone else. He told one of his associates at the time: ldquo;I just need to look at something once to know how to build it.rdquo; He would come to regret saying that. From a man who decades hence would be called the Henry Ford of Japan, this statement displayed perhaps youthful but striking naiuml;veteacute; about the complexity of high-quality manufacturing.To back up his boast, in 1936 Honda founded the Art Piston Ring Research Institute. His designs were, not surprisingly, stellar and even inventive. But the pistons themselves were far less than satisfactory. He had overlooked quality control on the assembly line and in the raw materials he used; he had no benchmarks for ensuring that tolerances on the actual part met blueprint specifications and that each piston was a replica, relatively at least, of the one before it. Out of Hondarsquo;s first fifty piston rings, forty-seven were rejected by Toyota, Art Piston Ringrsquo;s most important account.He learned from failure, thoughmdash;a lesson that he embraced with enthusiasm and would frequently tell others to heed, so frequently that it became one of the bedrock principles of Honda Motor. Soichiro realized that he

didnrsquo;t know enough about metallurgy to be able to determine how specific metals would react in the manufacturing process, and thus, he didnrsquo;t have enough basic information to control the quality of his products. To fill this hole in his knowledge, at age thirty, he enrolled at the Hamamatsu School of Technology and took on a full schedule of courses involving steelmaking, machining techniques, stamping, tool-making dies, and manufacturing parts from designs. He went to classes diligently, but was expelled at the end of his second year for ignoring his exams. Nonetheless, Soichiro continued to go to school at Hamamatsu, sitting in on classes. He also visited dozens of factories to observe how they worked with metal.Finally, satisfied that he knew enough about piston rings to produce them in volume to any customer specifications, Honda quit school in 1939, three years after enrolling. He never received a diploma, which he described as ldquo;worth less than a movie ticket. With the ticket, you can at least enter the movie house and spend an enjoyable evening; but a diploma is by no means a sure ticket to life. I donrsquo;t give a damn for the diploma. What I want is the knowledge.rdquo;That he obtained. Enough so that before long he held twenty-eight patents related to piston rings and piston ring manufacturing. And with that expanding portfolio, Honda founded a new company, Tokai Seiki Heavy Industry, to make the part. In short order, Hondarsquo;s firm would employ two thousand people and become the sole supplier to Toyota and Nakajima Aircraft Company, two of Japanrsquo;s largest businesses.