NEW YORK TIMES BEST-SELLING AUTHOR

THE DIGITAL REVOLUTION

How Connected Digital Innovations Are Transforming Your Industry, Company, and Career

INDER SIDHU
with T.C. DOYLE

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The Digital Revolution

"By 2020, 75 percent of businesses will be fully digital, yet only a few have a real digital strategy. *The Digital Revolution* provides powerful insights and practical examples of how to develop a digital roadmap. Countries, cities, and companies must disrupt themselves or be disrupted in this new digital world."

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—Geoffrey Garrett, Dean, The Wharton School

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The Digital Revolution

How Connected Digital Innovations Are Transforming Your Industry, Company, and Career

Inder Sidhu
with T.C. Doyle

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To my wife, Deepna
You make everything possible.

and

To Sonia, Sabrina, and Neal
The digital revolutionaries.

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1

The Digital Revolution
Why You Should Care

The best ever.

Ask people to name the best of anything,—be it a sports hero, vacation destination, U.S. President, and so on—and they will no doubt volunteer an array of opinions. But if you were to ask car enthusiasts what is the most technologically advanced automobile on the road today—and quite possibly the best ever—they will most likely zero in on a single vehicle. The car?

The Tesla Model S.

If you live near a major metropolitan center, you've surely seen this car though you may not have heard it as it silently drove by. This is because the car is an all-electric vehicle built from the ground up not only to compete with the world's best carbon-fueled vehicles, but to beat them in every aspect of driving.

With a range of more than 250 miles, the car can travel three times the distance of other electric vehicles and rival some gas-powered vehicles in terms of driving range. And the Tesla can do so without producing any emissions.

As for performance, the Tesla Model S P85D, when used in "ludicrous mode," can accelerate from 0 to 60 mph in less than 3 seconds.[1] That's faster than a Ferrari F12 Berlinetta,[2] which is the fastest road car ever produced by the famed Italian sports car manufacturer.

When it comes to convenience, the Tesla is equally impressive. The entire vehicle, for example, can be controlled via a 17-inch touch-screen display that is handily mounted in the center console. Think of it as an over-sized iPad that can adjust everything from the temperature to the music to the stiffness of the suspension. When connected

to your calendar on your smart phone, the touchscreen will automatically display a driving map to your next appointment, complete with up-to-the-minute traffic conditions.

By almost any measure, the Model S, which was unveiled in 2012, has become the most successful alternatively powered car of the last 100 years. Since its debut, the company has sold more than 50,000 Model S cars. Though priced at nearly $100,000 each, consumers buy them as fast as Tesla can make them (there is currently a waiting list to get one), while journalists heap on the praise.

In 2013, *MotorTrend* named the Model S its "Car of the Year"—the first in the 64-year history of the award to not feature a traditional gasoline engine.[3] Not to be outdone, *Consumer Reports* said the Tesla Model S sedan was "the best performing car ever tested" in the history of the magazine.[4] It gave the car a score of 100 out of 100 in a road test, a score that had never been achieved by any car. And car reviewer Dan Neil of *The Wall Street Journal* said, "The Model S is a daring public experiment in automotive vision that has the impudence to make the finest, fastest luxury cars feel like Edwardian antiques."[5]

Unquestionably, the Model S is the best electric car on the planet. But to its owners and inventors, the Tesla Model S is remarkable not only because it is *electric*, but because it is *digital*.

While that may not sound like a big distinction, it's literally the difference between 20th-century ingenuity and 21st-century innovation.

Virtually everything in the car that can be measured has an active sensor on it that is connected to the car's digital network. You can tell your Tesla Model S to park itself neatly into your garage, so you don't have to wedge your body out when finished. And with its mobile app, you can remotely check the cabin temperature on a hot day and tell the vehicle to power up the AC, so it will be at a desired temperature when you get to the car.

The car has dozens of other cool features that leverage digital technology. But there's one feature that sets it apart from virtually any other vehicle on the road. Aside from a handful of parts that need routine replacement—think tires and wiper blades—the bulk of the vehicle's components and functions were designed to be upgraded, not by mechanics wielding wrenches, but by software engineers working in Tesla's Silicon Valley research and development labs.[6] Like an

iPhone, the Tesla S gets better every time the company releases a new software update over the Internet. They can make the car safer, more reliable, and even more pleasurable.

Take driving in San Francisco, which is something engineer and entrepreneur Robert Bigler, the inventor of the SmartMotor and Hoverboard, does quite frequently. Like a lot of successful people who work in Silicon Valley, Bigler was drawn to the Tesla Model S the moment that it was introduced. He bought one not long after it became available.

The more he drove the car, the more Bigler became a fan. But one thing bugged him about the vehicle, especially when he drove it around the streets of San Francisco, where street grades can exceed 30 percent.[7] When he drove his car over the famed hills of the city, he noticed it would roll back unnervingly when he stopped uphill at intersections for stop signs and street lights.

"It reminded me of driving an old manual transmission VW Beetle. Without a mechanical clutch, the Tesla wants to roll back on steep hills," Bigler says. Concerned about his safety, not to mention that of fellow Tesla drivers, he turned to Tesla for more information and discovered that other Tesla drivers had already alerted Tesla of the problem. A few days later, a message appeared on the touchscreen console when he started his car one morning. A fix, the message informed him, was automatically downloaded to Bigler's car (and every other Tesla) overnight while it charged in his garage.

Sure enough, when he next found himself stopped on an upward slope in San Francisco, the problem was gone. Tesla engineers had written some code that programmed the car to automatically engage the safety brake whenever it was stopped on a hill. When the vehicle begins to move forward now, the brake stays engaged for a few seconds until the motor can put sufficient torque on the wheels to give it the forward momentum it needs to prevent the vehicle from rolling backwards.

Much to the delight of Bigler and other Tesla drivers, the manufacturer has addressed other concerns and desires, too. He, for example, is excited that his vehicle's display can now show maps in the "track up" position. (As a pilot, he prefers his map to be shown in the direction that he is traveling.)

In addition to convenience, software upgrades have also improved safety. When one battery caught fire after being pierced by a piece of road debris, Tesla engineers made several changes. One reset the default height setting on the vehicle and raised it by a few inches with a simple software patch delivered wirelessly. No recall was required, and no fires have been reported since.

A recent software upgrade gave owners Blind Spot Warning and Automatic Emergency Braking. It also provided guidance for locating charging stations on road trips and improved the range monitoring while providing owners more options for safeguarding their cars, including speed restrictions when handing them over to parking valets.[8]

With its front-mounted camera, rear-mounted radar, and a phalanx of ultrasonic sensors, the car can start, stop, steer, drive, navigate, park, and avoid obstacles. With the AutoPilot software downloaded to the car recently, the Tesla can also operate like one of Google's much ballyhooed semi-autonomous driverless cars, leading Steven Colbert, host of *The Late Show*, to exclaim, "Tesla owners woke up to find that their cars could drive themselves." If and when the law allows for driverless cars, Tesla will be ready, much to the delight of its owners, who realize that the car they purchased is unlike any other.

"With my Tesla, I feel like I get a new car every time there's an upgrade. There are new features and new capabilities, and as a result the car just gets better and better," says Bigler.

A car that improves with age? That hasn't happened since *mechanical* cars were invented more than 100 years ago. But in the new world of *digital* transportation, this will become commonplace.

...

Look around you. If you haven't noticed, virtually everything is going digital. This includes *things* like cars, *industries* like transportation, and *careers* like driving. With each passing day, more of these are being connected to the Internet in ways we are only beginning to understand.

Unlike the first 14 billion things that were connected to the Internet, the remaining 99 percent of items on earth were never designed to be connected to the Internet. These atom-based things cannot be reduced to a "0" or a "1"—the DNA of all digital objects and

devices—so easily and thus require a steep effort to connect them securely and efficiently. But once they go *digital*, the benefits to mankind will be transformational.

Why? Because everything that gets connected to the Internet has the potential to produce data, which can yield revolutionary insights about the world around us. This includes the whereabouts of a bus you're waiting for, the temperature of a donor organ in transit, or the level of methane gas underground in a mine. When you consider the potential value of every sensor update, every electronic medical record, and every Twitter tweet, you begin to realize how transformative this information could be when leveraged intelligently. And this is only a sampling.

Once *everything* is connected to the Internet, we will have at our fingertips data on every activity, interaction, and condition known to man. Translating this data into information, of course, will require an immense effort. But thanks to infinitely scalable resources now available to everyone via the Internet and cloud, we now have the power required to collect, store, and process this information. With better analytical tools now being developed, we increasingly have the capability to translate this information into actionable knowledge and insights required for solving our problems and addressing our aspirations.

Again, take driving, which is being transformed by a multitude of technologies, including the ordinary mobile device in your backpack or purse. The smart device that you use for taking selfies, responding to emails, or sending texts is also helping you get home faster and helping municipal planners reduce traffic congestion and improve highway safety. How? By providing insights into our world.

Unbeknownst to you, the GPS device inside your smart phone sends a signal to every cell tower you pass as you move along your daily commute. This information is aggregated and anonymized by technology companies including Google to determine how congested local thoroughfares are at any one moment. After crunching the data, these third parties send this information back to consumers' smart devices and connected cars, revealing where traffic congestion is worst, the whereabouts of construction hazards, and even the exact locations of traffic accidents reported on social media. With this information,

which is often presented in the form of a color-coded map, consumers can reroute their courses, reducing fuel costs, emissions, and travel times. And city planners can ensure better traffic flow.

Although this might sound like a nice convenience to an individual commuter, it has the potential to be transformative to society as a whole. According to the 2012 Urban Mobility Report, the amount of fuel wasted in congested traffic each year would fill the New Orleans Superdome four times over. The cost of this fuel is estimated to be more than $120 billion annually, or more than $800 for every person who commutes daily in the U.S. For perspective, that total is more than the amount of revenue that United Airlines, Nike, McDonald's, and Starbucks generate in a year *combined*.

The implications of this example and other similar developments on transportation cannot be overestimated. The ridesharing company Uber, for example, is not only transforming the taxi industry, it is also influencing the automotive industry as a whole. In many cities, young men and women are not just asking themselves whether they want to drive or take Uber for a specific trip, they are wondering if they should take Uber for every trip. *Why own a car if a reliable service is cost-effective, ubiquitous, and safe?* many Millennials wonder.

For driving a transformation in their industries, these digital revolutionaries are being richly rewarded. For example, Tesla, as of this writing, has a market capitalization of approximately $32 billion, which is roughly half of what Ford and GM are each worth, despite the fact that Tesla commands less than 1 percent of the U.S. market. Similarly Uber, which is now valued at more than $50 billion, engages more than 1 million drivers worldwide and expects to double that figure to 2 million by the end of 2015.[9]

In this chapter, I've focused on automobiles, traffic, and getting around. But equally transformative changes are occurring in virtually every industry you can think of. In Part II, "Transforming Industries," I showcase several transformations underway in healthcare, education, retail, and government. In the examples, connected digital innovations are being leveraged to improve patient outcomes, increase access to learning, elevate shopping convenience, and support better living in smart cities.

The same is true when it comes to major business objectives. By connecting people, processes, and things, businesses are improving financial performance, enhancing customer experiences, and increasing employee engagement.

Add it all up, and you realize that we are in the early stages of a full-fledged digital revolution that will impact every industry, organization, business function, and career.

In terms of economic activity, the amount of commerce that will be generated from this digital revolution will be enormous. McKinsey's report on the Internet of Things estimates the potential economic impact between $4 trillion and $11 trillion a year by 2025.[10] Between 2013 and 2022, Cisco estimates that digital transformation will generate $19 trillion[11] in economic activity, nearly half of which will be from the replacement of activities or things that will simply fade away like the local travel agent, printed encyclopedia, and classified newspaper ad.

To put this into perspective, that's as much as the GDPs of Japan, Germany, UK, France, India, Brazil and South Korea combined—simply a staggering sum, in other words.

More than money, the digital revolution promises to have as big an impact on people's lives as their formal education, choice of careers, and physical activity. That's because digital technology will reshape virtually every facet of how we learn, work, and live.

While there are significant privacy, security, and regulatory issues to be sorted out, which I cover in detail in Part III, "Addressing Challenges," digital transformation may well turn out to be the single, biggest idea impacting humankind. The reason is simple: This digital revolution isn't just occurring in Silicon Valley or in long-overlooked nooks and crannies of our economy, such as the taxi and limousine industry. It's also happening in the industries and organizations that touch your life. This includes your bank, shopping mall, school, doctor's office, and more.

In the case of Tesla and Uber, the change is obvious. But in other instances, it is less apparent, at least for now. Take the work of GE, one of the oldest industrial companies on the *Fortune 500* list. Although the company has spent billions of dollars preparing to lead the digital revolution in the industrial economy, the company recognizes that few

outside the world of heavy industry understand how transformative digital innovation could be to heavy industry. To increase awareness, the company launched a series of ads in the fall of 2015 depicting a fictional college graduate named "Owen" who struggles to impress his family and friends with his cutting-edge work. When Owen excitedly tells one group of friends that he is going to work on software that will transform machines such as locomotives, one puzzled friend wonders aloud if Owen has taken a job to "work on a train."

While the self-deprecating GE ads are funny, the message behind them is serious: The digital revolution has the potential to transform all parts of our world, including the operations, functions, and processes we rarely consider.

Which brings me to you. No matter where you work, the revolution is surely happening inside *your* industry. For better or for worse, whether you like it or not, it will affect your organization, if it hasn't already. Now is the right moment to join the digital revolution and help transform your own company and your career. How you think about digital innovation, leverage it, and master it will determine how you survive and thrive.

While some will be tempted to ignore or even thwart the advance of digital innovation where they work, they do so at their own peril. Widespread innovation will make it next to impossible to slow the digital revolution. By 2020, 75 percent of businesses will become fully digital.[12] Will yours be one of them?

This book will put you in the driver's seat of the digital revolution so you can transform your industry, company, and career.

Hop on for the ride of your life.

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