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9B19M110

DIGITaL Transformation at Ge: WHAT WENT WRONG?[[1]](#endnote-1)

Genevieve Pelow and Professor Robert D. Austin wrote this case solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.

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On October 1, 2018, the General Electric (GE) board of directors installed H. Lawrence Culp as chief executive officer (CEO), replacing John Flannery, who had been in that position for only 14 months.[[2]](#endnote-2) Culp assumed command of a company in crisis. GE’s stock had declined to nearly US$10[[3]](#endnote-3) per share from more than $30 per share two years earlier, wiping out billions of dollars in shareholder value (see Exhibit 1). The quarterly dividend had been halved in November 2017—only its second reduction since the Great Depression[[4]](#endnote-4)—and, less than 30 days later, was on its way to another reduction, by 92 per cent to a mere one cent.[[5]](#endnote-5) Worries about the company’s costs structure and cash-generating ability had resulted in a credit downgrade[[6]](#endnote-6) (see Exhibit 2 for GE’s financial statements), despite Flannery having already trimmed the workforce by 30,000.[[7]](#endnote-7) The previous 10 months had seen a procession of high-profile departures, including the chief financial officer, who was the head of the largest business unit, and half of the board of directors (see Exhibit 3).[[8]](#endnote-8)

A few months earlier, in late July, reports had emerged that GE intended to sell GE Digital,[[9]](#endnote-9) its software and technology organization, which GE had built up from nothing since 2011. GE Digital *had* been described as *the* central component of a much-heralded transformation of the company’s business, architected by former CEO Jeffrey Immelt.[[10]](#endnote-10) In late February 2019, GE announced that it would streamline operations and focus on its core competencies—which no longer included GE Digital.[[11]](#endnote-11) GE would, ultimately, in 2019, spin off GE Digital as an independent company that would sell its services to other companies and be expected to survive on its own revenues (about $1.2 billion at that time), without further funds from GE.[[12]](#endnote-12)

Although the decision to spin off rather than sell GE Digital was interpreted as “a measured vote of confidence in the software business,”[[13]](#endnote-13) there could be little doubt that GE’s priorities had shifted. In a startling turnabout, Immelt’s digital transformation vision for the company had been set aside. A mere two years earlier, many had touted GE as an example of how established companies could pre-emptively transform their businesses digitally, without waiting to be forced by competition.[[14]](#endnote-14) By 2019, however, GE’s digitalization initiative looked more and more like a warning to others about the perils of being distracted by digital hype or attempting to change too fast.

A VERY BRIEF HISTORY OF GEneral Electric

Thomas Edison established the Edison General Electric Company in 1890. Two years later, it merged with a competitor, the Thomson-Houston Company, to form General Electric Company.[[15]](#endnote-15) From its beginning, GE prioritized research and development. Over the next 128 years, GE matured into one of the world’s largest conglomerates, and accumulated more than 150,000 patents for its many consumer and industrial products[[16]](#endnote-16) (e.g., the incandescent light bulb; the X-ray machine; the electric fan; the refrigerator; the jet engine; and the magnetic resonance imaging, or MRI, machine).[[17]](#endnote-17)

The company’s culture placed a high value on learning and professional development. In 1956, GE built an educational campus at Crotonville, New York, in an effort to become “the best-managed company” in the world.[[18]](#endnote-18) In 2017, GE spent more than $1 billion annually on employee training.[[19]](#endnote-19) And indeed, for much of its life, GE enjoyed a reputation as a “superbly managed company.”[[20]](#endnote-20)

But after 2000, the rapid advance of technology, free trade, and changes in customer behaviour, combined with changing global power dynamics and other macroeconomic influences such as fluctuating oil prices, put pressure on industrial companies to become more competitive and differentiate themselves.[[21]](#endnote-21) Globalization threatened to commoditize many GE product businesses.[[22]](#endnote-22) Annual revenues peaked in 2008 at more than $180 billion, but in 2017, after significant divestitures, GE revenues remained at more than $120 billion. In 2018, GE had an industrial base of more than $240 billion in service contracts, and market presence in 130 countries[[23]](#endnote-23) organized in eight major business units (see Exhibit 4).[[24]](#endnote-24)

The Jack Welch Era

Jack Welch served as GE’s CEO from 1981 to 2001. Under his leadership, the company’s revenues grew by more than 400 per cent, from $25 billion to $130 billion;[[25]](#endnote-25) he completed 600 acquisitions, including NBC Universal, and proposed a $45 billion acquisition of Honeywell International, which ultimately fell through.[[26]](#endnote-26) Welch required GE business units to be number one or number two in their respective industries.[[27]](#endnote-27) To help them achieve this goal, he drove streamlining to remove bureaucracy; launched progressive operational programs, such as Six Sigma;[[28]](#endnote-28) and emphasized running the company as if it were a smaller, more dynamic business.[[29]](#endnote-29) His management of the company was widely admired; in 1999, as the century and Welch’s tenure as CEO neared their ends, *Forbes* magazine proclaimed him the “Manager of the Century.”[[30]](#endnote-30)

Welch also had critics.[[31]](#endnote-31) Some blamed his employee ranking system, which required dismissing lower-ranking employees—referred to colloquially as “rank and yank”[[32]](#endnote-32)—for creating an overly competitive work environment that resulted in less collaboration.[[33]](#endnote-33) He was criticized, too, for his relentless “beat the quarter” approach to earnings management.[[34]](#endnote-34) Some have argued that the short-term orientation and complex systems for measuring and comparing internal business unit performance established during the Welch era contributed to the problems GE was suffering in 2019.[[35]](#endnote-35)

Immelt Takes the Reins

Jeffery Immelt, an 18-year GE veteran, followed Welch as CEO. Immelt had held leadership positions in GE’s Plastics, Appliances, and Healthcare businesses, and came to the top job highly regarded. He would serve as chairman and CEO from 2001 to 2017, leaving his own deep imprint on the company.[[36]](#endnote-36)

Immelt’s detailed knowledge of GE’s major businesses helped him execute five key strategies that defined his tenure as CEO. First, Immelt refocused the GE portfolio, divesting non-industrial and slow-growth businesses, and renewing a focus on high-tech and manufacturing-based products and services. Second, he made big investments in technology-driven innovation by increasing spending on research and development, and by concentrating on clean and energy-efficient products, the industrial Internet, and additive manufacturing. Third, he expanded the company’s presence globally, moving into developed and emerging markets, diversifying the revenues of what had been a primarily US-oriented company. Fourth, he modernized GE’s organizational structure, replacing it with a more agile and decentralized structure, in an effort to encourage entrepreneurial behaviour within the firm.[[37]](#endnote-37) Finally, Immelt aimed to shift GE’s strategy and competitive advantage away from making and selling increasingly commoditizing hardware toward new, higher-margin business models enabled by “smart, connected products.”[[38]](#endnote-38)

Immelt’s digital vision for the company attracted much interest. He accurately foresaw a world in which data would be more valuable than the industrial hardware that produced it, and companies that could deploy technology to monetize data would exert influence over firms with primarily industrial capabilities. Companies such as IBM, Microsoft, and SAP had already started to approach GE customers with offers to leverage data generated by GE systems to realize huge efficiencies.[[39]](#endnote-39) Immelt believed, though, that GE would be the best partner to help its customers make the existing systems more efficient, and that the company’s huge installed base of equipment would provide a big advantage in harvesting value from industrial data. To realize this outcome, Immelt envisioned transforming GE into something much more like a tech company than an industrial conglomerate—a “top ten software company.”[[40]](#endnote-40)

NEW DIGITAL BUSINESS MODELS

Industry pundits had coined the expression “Internet of Things” (IoT) to describe the idea of connecting a vast assortment of previously unconnected devices—including coffee makers, refrigerators, lighting systems, televisions, wearable devices (such as watches), and pretty much any product powered by electricity—to the Internet (and potentially, therefore, to manufacturers, other companies, and each other).[[41]](#endnote-41) Connecting such devices to the Internet enabled an entirely new business activity.

An Internet-connected device could report back to its manufacturer how well it was functioning (to trigger needed service or to suggest improvements for future products); how it was being used by customers (to help a firm make products more user-friendly); and even what customers were saying about it (to improve marketing or as a source for new product ideas).[[42]](#endnote-42) The functionality of a “smart product” could be updated across the Internet, adding functionality without anyone needing to physically access the device. Even more important, the data from connected devices could be used to identify customers’ behavioural patterns, and thus to suggest targeted advertising and cross-selling opportunities that the consumer might find useful, thereby yielding higher returns on advertising investments. Still more important, connected devices could become parts of ecosystems that provided new services to customers; for example, a smart refrigerator that realized the milk was getting low could automatically post a replenishment order to the shopping list on a consumer’s smart phone.

In 2018, many of the new service possibilities presented by the IoT also represented possible new business models. New services could be offered to consumers, leading to the facilitation of new consumer transactions; and data about device usage, location, and supply levels could be analyzed to create marketing possibilities. The result would be new sources of revenues and profits for companies.

The *Industrial* Internet of Things (IIoT) extended a similar idea to industrial devices, such as the turbines, locomotives, and jet engines that GE sold.[[43]](#endnote-43) Industrial devices contained embedded sensors that generated vast amounts of data about how they were functioning and being used. That data could be processed with advanced analytical techniques to help improve business performance.[[44]](#endnote-44)

For example, data from sensors on locomotives could be used to optimize braking, enabling train companies to realize huge reductions in fuel costs and emissions.[[45]](#endnote-45) Or, analytics could be used to successfully predict when an electric turbine was about to fail, enabling it to be proactively serviced, avoiding an unplanned outage.[[46]](#endnote-46) In 2018, the IIoT had potential applications across a range of industrial activities, including manufacturing, supply chain management, health care, and retail. This potential was relatively undeveloped, however, which left open the question of who would seize it and benefit most. Estimates suggested that the revenue opportunities were vast, $225 billion annually by 2020, or even $11.1 trillion by 2025.[[47]](#endnote-47)

As Immelt and his fellow GE strategists pondered these opportunities, they realized that a key to seizing them might be controlling the technological standards for information exchange in the IIoT ecosystem. Their thinking harkened back to some earlier technology examples, such as the ecosystem surrounding the IBM personal computer (PC) desktop. The IBM PC, released in the early 1980s, featured an operating system (OS) built by Microsoft, which, at the time, was a small, little-known company. Microsoft charged IBM a development fee, but allowed it to deploy the OS for free. Because deploying it was free, IBM had no cost incentive to limit its deployment. Crucially, though, Microsoft retained the sole legal rights to license the software for use by other companies. Because the operating system governed how software would interact with the IBM PC, it became an industry standard that Microsoft controlled. Third-party software developers who created software for the PC needed to use the standard owned by Microsoft, which made Microsoft the software gatekeeper for the PC ecosystem. As the ecosystem around IBM PCs (and PC clones) grew, Microsoft leveraged this control into dominance of the PC desktop through the Windows operating system. Ownership of the technology standard for data exchange gave Microsoft a key strategic position within the ecosystem. For years, Microsoft leveraged its position to relegate other competitors to secondary positions and to become one of the most important players in the computer industry.[[48]](#endnote-48)

Something similar could happen, Immelt knew, in the IIoT space. The source of competitive advantage for industrial companies was shifting from hardware manufacturing to software and sensors embedded in machines and analytics to optimize performance.[[49]](#endnote-49) As business school professor Karim R. Lakhani put it, “the data and analysis become worth more than the installed equipment itself.”[[50]](#endnote-50) Professors Michael Cusumano, Annabelle Gawer, and David Yoffie described the threat to GE in their book on platform strategy this way: “If a third-party software firm developed a winner-take-all platform that captured the analytics layer, GE could be forced to join the platform and cede a great deal of the value of its equipment, including its maintenance services, to the owner of the platform.”[[51]](#endnote-51) In other words, a tech company could achieve a dominant position in the IIoT ecosystem, similar to the position Microsoft held in the desktop PC ecosystem. Tech companies definitely saw the opportunity presented by the Industrial Internet and were manoeuvring to secure a first-mover advantage (see Exhibit 5 for an outline of key competitors in the Industrial Internet). Immelt believed GE could occupy the dominant position by leveraging its scale, industrial expertise, and customer relationships.[[52]](#endnote-52)

BUILDING AN INDUSTRIAL INTERNET PLATFORM

GE set out to create a platform called Predix that could go head to head with established digital platform players, such as Amazon, Google, IBM, Microsoft, and SAP. Applications of Predix would include preventative maintenance, process variance reduction, control system optimization, and manufacturing productivity in a variety of industries, including aviation, pharmaceuticals, power, mining, manufacturing, and oil and gas, to list but a few.[[53]](#endnote-53) GE would begin by rolling out the platform internally, which would allow the company to benefit quickly from internal network effects; and the large amount of data GE could collect from its own hardware would allow the company to rapidly improve its platform.[[54]](#endnote-54) As GE began to extend the platform externally, trying to convince customers and partners to use Predix data standards for coordinating their industrial activities, the company attempted to leverage a century’s worth of experience designing, manufacturing, and servicing hardware. GE argued, to anyone who would listen, that its superior industry experience made Predix a better choice than alternative offerings from technology companies.[[55]](#endnote-55)

“Predix’s goal,” suggested professors Cusumano, Gawer, and Yoffie, “was to become an operating system, designed to serve as an *innovation* platform for applications development, providing the services that permit programmers to quickly build apps for the industrial Internet.”[[56]](#endnote-56) To do this, they had to solve a “chicken-or-egg” problem: Predix was not the dominant platform until others—namely, vendors and customers—accepted it as a standard. But others were reluctant to invest heavily in Predix until they were confident it would emerge as the winning standard. GE attempted to gain a necessary critical mass of users by starting pilot projects with existing clients. But there were debates within GE about how Predix should be offered to clients.[[57]](#endnote-57)

Go-To-Market Options

GE had, in recent years, made the bulk of its sales from selling hardware (“selling boxes”) and from providing maintenance contracts (“contract service agreements,” or CSAs) on its installed hardware base. Digitalizing the company, according to Immelt’s vision, suggested new revenue options would arise from new services.[[58]](#endnote-58) But new digital offerings could be constructed in alternative ways, some more radical than others, compared with the company’s traditional business.

The least radical option would be to bundle new software and analytics services with hardware sales. GE would sell boxes and maintenance contracts, as it always had, but bundling extra digital services with GE products would differentiate this option from other manufacturers’ offerings, making GE products more valuable to customers, thereby providing a sales advantage and the ability to command higher prices—and generate higher profit margins. In effect, this option called for GE to stay ahead of its rivals by providing better integrated digital services, thereby resisting the pressures toward commoditization in selling hardware.

A second option called for selling Predix licences to clients, and creating specialized consulting services to help clients use Predix. In effect, Predix licensing and consulting would become a separate business line for GE. Predix services would be sold to GE hardware customers separately from hardware, as an add-on to help consumers optimize their use of GE hardware.

The third, and arguably most radical, option was to move increasingly in the direction of “outcomes-based” deals. This option would involve approaching existing customers with a value proposition very different from selling boxes. Sales consultants would work directly with client businesses, help them analyze how the unique features of their business could benefit from connecting to the Predix platform, and then structure contracts specific to that client company based on incremental revenue- and profit-sharing formulas.

Such a deal structure transferred the implementation risk to GE. The customer paid only if its business achieved measured improvements. But shifting the risk was part of the strategy: as a very large company, GE could bear risk more efficiently than most of its clients—and many of its competitors (which provided GE with a defensible advantage over its rivals). In exchange for carrying that risk, GE would recover bigger margins. However, making this vision a reality would require contracts that were based on a detailed understanding of clients’ businesses, and on reliable and agreed-on metrics for measuring savings[[59]](#endnote-59) so that customers would remain happy with the deal in the long term and GE would be adequately compensated for having absorbed the risk.

NEW CAPABILITIES REQUIRED

To compete with the likes of Amazon, Google, IBM, Microsoft, and SAP, GE would need to raise its game substantially in terms of its internal digital capabilities. The company already had information technology (IT) organizations, of course, but they were largely focused on the needs of specific business units. Immelt began working on this project in 2011, hiring a former Cisco executive, Bill Ruh, to develop GE’s Industrial Internet strategy.[[60]](#endnote-60) In 2015, GE Digital was formally established as a separate business unit; a press release described “a transformative move that brings together all of the digital capabilities from across the company into one organization.” Ruh was named chief digital officer and head of the new unit.[[61]](#endnote-61)

GE Digital would need to architect the Predix platform, create new software offerings, and develop new analytical capabilities that allowed for customization client by client.[[62]](#endnote-62) Ruh would need to build out a new organization for product management and platform support teams for ecosystem partners. The new business model and its associated services needed to be launched, marketed, and priced, requiring input from pricing, legal, marketing, sales, and customer support functions.[[63]](#endnote-63) From its beginning, GE Digital was based away from established GE organizations, in San Ramon, California, near Silicon Valley. Approximately 5,500 people were hired into the new unit between 2012 and 2016. Almost all of these new employees came from tech companies, not from within GE’s existing IT organizations.[[64]](#endnote-64)

Sales Force Capabilities

Over the years, GE’s technical sales force had been very good at selling “boxes” and maintenance contracts. To transition to the new digital GE, though, much more was needed. Outcomes-based contracts called on the technical sales force to dig into the details of how their clients’ businesses worked and analyze their businesses at a level of detail that would support the creation of revenue-sharing contracts unique to each business and its needs. For Ruh, “the value of the API [the application programming interface for connecting the client’s data flows into Predix] need[ed] to be based on the value of the outcomes it [could] achieve.”[[65]](#endnote-65) This focus on outcomes represented a major change in the way a typical sales engagement was designed. The new breed of GE salesperson would need to be part business consultant, part contract designer, part software customizer, and part ongoing relationship manager. In many situations, the individual they were selling to within the client organization would change since the grander scale of revenue-sharing contracts would require higher levels of approval within a client organization.[[66]](#endnote-66)

Relationships with Customers

Both convincing customers to treat the company’s Predix platform as a dominant standard and moving toward outcomes-based contracts would require a level of trust well beyond what GE had needed to sell hardware and maintenance contracts. For the new breed of GE salesperson to dig into a client’s business in sufficient detail to design outcomes-based contracts, clients would need to trust GE enough to allow this scrutiny. The client would need to open up its processes and accounts, which would run counter to many companies’ reflexive tendencies to keep their internal knowledge confidential. Client managers could perhaps be excused for suspecting that a vendor—even one as familiar and trusted as GE—might request access to internal information to fulfill some ulterior motives—for example, to gain an advantage in sales negotiations, or to achieve a dominant platform position that might eventually allow it to extract higher margins (as Microsoft had). To convince client leaders that it was in their own best interests to comply with what GE wanted to do would require further strengthening GE’s already strong customer relationships. Also, the level of technical sophistication of GE customers varied widely, across business lines and geography. Some customers might well be ready to talk with GE about Predix-based transformation; however, to others, any talk about data becoming more valuable than hardware and the notion of sharing incremental revenues and profits might be too much to process.

IMPLEMENTATION DIFFICULTIES

Immelt had thoroughly communicated his vision, and his successor, John Flannery, had pledged to see things through.[[67]](#endnote-67) However, implementation of GE’s digital transformation proved unexpectedly difficult, in a variety of ways.

The Predix Rollout

Disagreements flared as GE Digital sought to gain adoption of the Predix platform within GE. IT organizations within each business unit had commitments to the legacy infrastructure and a duty to support the existing businesses. Ruh explained: “Every one of our products had a different underpinning platform, architecture, technology and set of vendors.”[[68]](#endnote-68) Tensions rose when it became clear that Predix lacked certain features that managers had wanted—and that the legacy platforms *did* have. Because the San Ramon staff had been largely hired from outside GE, they lacked relationship capital within the broader organization, which made it more difficult to convince long-time GE employees of the value of the new platform. Different business units bought in, to varying degrees, with the greatest acceptance in units that relied less on the existing infrastructure.[[69]](#endnote-69) The uneven internal rollout translated into a similarly uneven external rollout.[[70]](#endnote-70)

Confidence in the new platform was undermined by a series of technical problems. Most of these problems related to unexpectedly complex legacy and integration issues, but some were caused by software glitches in the platform itself. The mid-course shift in strategy, from building data centres internally to using Amazon Web Services and Microsoft Azure services to host Predix, generated additional disruption.[[71]](#endnote-71) Accumulating difficulties warranted a “time out” in May and June of 2017, which put the rollout further behind schedule than it already was.[[72]](#endnote-72)

Salesforce Retraining

GE’s salesforce experienced challenges selling Predix. The salespeople needed to learn to adapt to a new engagement model. The new approach lengthened sales cycles and increased the need to educate customers in the new approach. It also increased the need for salespeople to understand their clients’ businesses in detail, including a customer’s industry, business model, and how the company made money.[[73]](#endnote-73)

This process implied significant retooling for the sales staff. GE’s salespeople knew how to sell tangible, physical hardware through a channel or directly to enterprise customers; however, they now needed to sell software, analytics services, and outcomes to senior business executives.[[74]](#endnote-74) In the new model, GE’s salespeople needed to look “at all the data we have, to help understand what kind of outcomes we could achieve by working with the business,”[[75]](#endnote-75) said Kate Johnson, GE’s chief commercial officer.

GE’s existing sales staff varied in their willingness and ability to move in this new direction. In outcomes-based selling, Johnson suggested, “The customer expects you to talk about outcomes and values—not the best widgets.”[[76]](#endnote-76) But explaining why GE widgets were the best was what GE’s salespeople had been doing for years.

Limited Customer Enthusiasm

GE’s vision also proved harder than expected to sell to customers. Many had trouble with understanding GE’s proposition and were held back by their own lack of organizational readiness:

GE had taken an informal poll of customers about their readiness and adoption of the Industrial Internet and learned that 63% of customers polled said their machines were connected to networks, but they were not yet using these data, 13% claimed they used data for competitive advantage, and 63% were not performing any condition-based maintenance.[[77]](#endnote-77)

Many GE customers had not made the mental leap to appreciating the possibilities of an Industrial Internet, lacked the required infrastructure to support GE’s new methodologies, and did not collect the data that was driving the new approach. Beth Comstock, GE’s chief marketing officer, explained: “We’re trying to sell them something they don’t know they need.”[[78]](#endnote-78) Educating clients was needed to help them see the opportunities. Even when GE’s education efforts worked and customers woke up to the new possibilities, they immediately realized that it would require them, as Ruh put it, “to rethink what they’re doing entirely,”[[79]](#endnote-79)—a daunting prospect that many could not quickly wrap their heads around.

CONTRIBUTING DIFFICULTIES

Not all of GE’s difficulties in 2019 were attributable to the digitalization efforts. Other factors presented additional challenges at about the same time.

Accounting Problems

Due to GE’s long-standing emphasis on metrics to evaluate performance, the company’s internal accounting used a complicated design and, over time, had accumulated additional complexity. The complexity seemed to reach a critical point toward the end of Immelt’s tenure as CEO, during a series of analyst surprises and volatile stock price movements. The US Securities and Exchange Commission (SEC) began investigating GE’s accounting practices in 2017, after GE reported a $6.2 billion after-tax charge and suddenly had to reserve $15 billion to cover a previously undisclosed, decade-old liability in the insurance component of GE Capital.[[80]](#endnote-80) The SEC expanded its investigations in 2018.[[81]](#endnote-81)

Doubts were raised about the transparency of the company’s financial disclosures. Material difficulties, some suggested, were buried in the complexities of the company’s “black box” and in multi-business unit accounting,[[82]](#endnote-82) and quarterly earnings were being smoothed through “window-dressing.”[[83]](#endnote-83) The doubts were exacerbated by Immelt’s unwavering optimism regarding the company’s position and future, which turned out to be far from reality.[[84]](#endnote-84) Some former executives and investors charged that, despite Immelt’s publicized attempts to remove bureaucracy from the organization, his sanguinity spawned a culture in which people believed that he did not want to hear discouraging reports.[[85]](#endnote-85)

GE’s Power Business (and Other Acquisition Difficulties)

GE’s power business—its largest, accounting for more than 23 per cent of revenues in 2018—experienced a 22 per cent revenue decrease from 2017 to 2018.[[86]](#endnote-86) GE purchased Alstom’s power and grid assets in late 2015, for $10.6 billion.[[87]](#endnote-87) The U.S. Department of Justice (DOJ) pressured GE to divest the part of Alstom that serviced turbines made by its competitors,[[88]](#endnote-88) and GE also agreed to divest Alstom’s program to build a state-of-the-art gas turbine, after being pressured by the European Union.[[89]](#endnote-89) These concessions weakened the acquisition’s justification, causing GE insiders to rally against it. But Immelt wanted it, and GE’s largest-ever acquisition closed.[[90]](#endnote-90) The timing was bad, however; it was “a massive investment in natural gas power plants just as the market for them was contracting.”[[91]](#endnote-91)

Alstom was not GE’s only poorly timed acquisition. From 2010 to 2014, the company bought nine firms in the oil and gas business, only to see oil prices collapse. The company also lost money on acquisitions in the home mortgage industry (see the next section) and in the homeland security business.[[92]](#endnote-92)

In addition, the GE Power business lagged its competitors in recognizing the market signals, which led to overcapacity and significant unsold inventory; cash tied up in working capital forced discounts and decreased sales profits.[[93]](#endnote-93) GE had poorly forecasted the impacts of developments in the renewable energy market, such as intensified competition that lowered prices in the wind turbine market and a global shift toward solar power.[[94]](#endnote-94) Operational mishaps, faulty pricing strategies, and unexpected warranty costs added to the malaise.[[95]](#endnote-95)

A Legacy of Problems at GE Capital

Although GE had sold off the majority of its assets in GE Capital in 2015 (more than $350 billion),[[96]](#endnote-96) difficulties in GE Capital, especially during the 2008 financial crisis, contributed to GE’s downward spiral.

Prior to the financial crisis, GE Capital had operated as a “shadow bank”—a business that facilitated the creation of credit in the financial markets but was not subject to the same strict rules and regulations of a bank.[[97]](#endnote-97) This framework allowed it to take actions—and risks—that banks could not, by providing cheap capital to GE’s own businesses and customers.[[98]](#endnote-98) For a time, this arrangement was very lucrative for GE; at its peak, during the Welch years, GE Capital accounted for more than 60 per cent of GE profits.[[99]](#endnote-99)

But this lucrative situation all backfired when the financial crisis hit, and credit market liquidity evaporated. GE was unable to finance its customers or its own operations, and the Federal Reserve had to provide the company with an emergency bailout of $139 billion in government-guaranteed debt.[[100]](#endnote-100) When the crisis abated, GE Capital was designated as a systemically important financial institution, and was required to adhere to strict regulations—an arrangement that was not nearly as lucrative for GE.[[101]](#endnote-101)

Also haunting GE were issues related to a subprime mortgage origination company, WMC Mortgage (WMC), which GE Capital acquired in 2004. In 2015, the DOJ began investigating how WMC sold loans in 2006 and 2007.[[102]](#endnote-102) The DOJ found that that WMC had misrepresented the quality of residential mortgage-backed securities and that “failure to disclose material deficiencies in those loans contributed to the financial crisis.”[[103]](#endnote-103) Settling these allegations cost GE a $1.5 billion fine, and WMC filed for bankruptcy.[[104]](#endnote-104)

LOOKING FORWARD

As recently as three years earlier, GE had seemed to be on the fast track to becoming an Industrial Internet leader. However, after $4 billion in investments in GE Digital, that vision had narrowed. Layoffs had come to San Ramon,[[105]](#endnote-105) and Bill Ruh had announced his departure.[[106]](#endnote-106) Many people asked: What went wrong?

The possibilities were numerous. Perhaps the vision was flawed. Or perhaps the vision was fine, but GE’s implementation was faulty. Or perhaps GE was just unlucky, in that a perfect storm of adverse developments arrived at exactly the wrong time. Or perhaps GE gave up too soon; maybe such major change takes far longer than it expected, and if it had persisted, the company would have eventually prevailed. It was even possible that the company would eventually, in the fullness of time, succeed with some version of its original digital vision, once it got clear of the current difficulties; it did, after all, retain ownership of GE Digital.

The debate raged, but one thing was not in doubt: the once-proud GE, in 2019, was scrambling to recover some semblance of its former greatness. Only time would tell how the story would end.

EXHIBIT 1: General electric’s stock prices, December 2016 to october 2018 (IN US$)

Source: Created by case authors based on data from Yahoo! Finance, “General Electric Company (GE),” accessed August 9, 2019, https://finance.yahoo.com/quote/GE/history?period1=1480564800&period2=1538362800&interval=1d&filter=history&frequency=1d.

**EXHIBIT 2: General Electric FINANCIAL STATEMENTS, 2016–2018 (in US$ Million)**

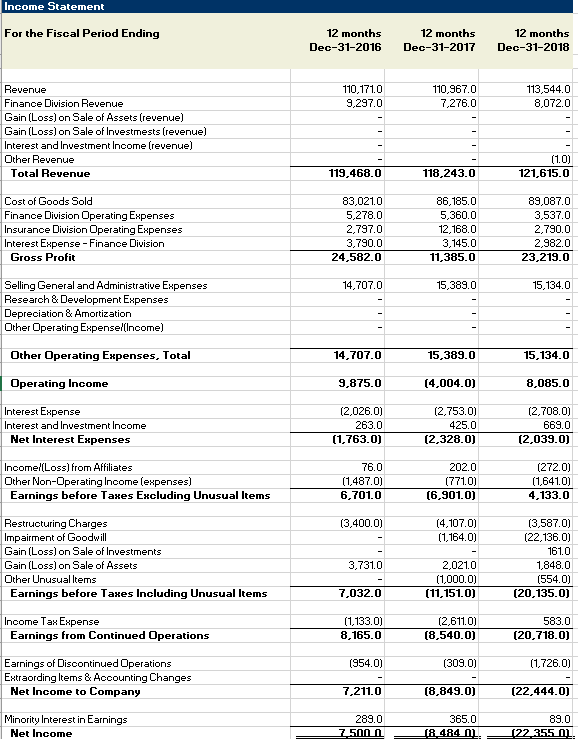
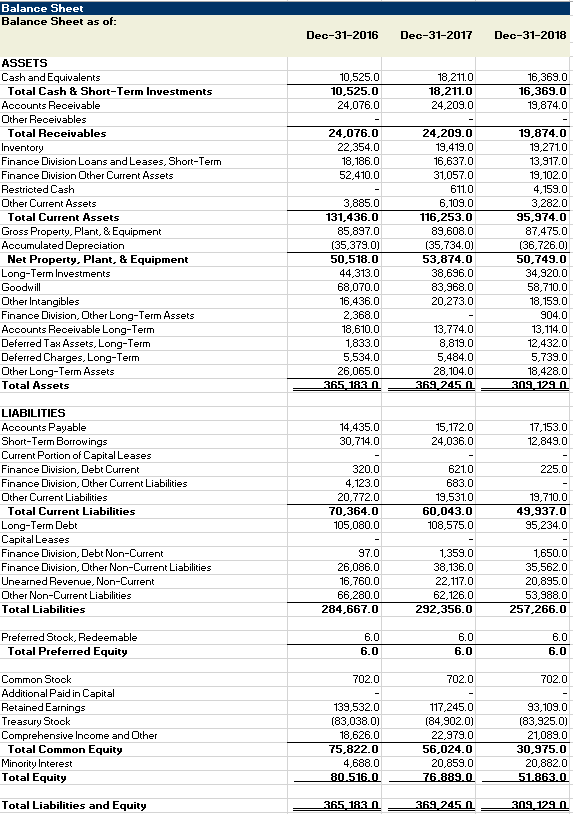


Exhibit 2 (continued)



Source: General Electric, “Financial Statements, 2016–2018,” Capital IQ, accessed August 9, 2019.

Vice Chairs Beth Comstock and John Rice retire

GE Power CEO Steve Bolze announces retirement after 24-year tenure at GE,

*June 14, 2017*

CFO Jeffrey S. Bornstein ends 28-year tenure at GE,

*December 31, 2017*

GE Digital CEO

Bill Ruh announces end of 5-year tenure at GE,

*December 13, 2018*

CEO Jeffrey Immelt ends 16-year tenure at GE and is replaced by John Flannery,

*October 2, 2017*

GE Digital CCO

Kate Johnson ends 4-year tenure at GE,

*September 8, 2017*

GE reduces board size from 18 to 12 directors, including 3 new directors

*February 26, 2018*

Vice Chairs Beth Comstock and John Rice retire

GE Power CEO Steve Bolze announces retirement after 24-year tenure at GE,

*June 14, 2017*

John Flannery ends 14-month tenure and is replaced by Lawrence Culp as CEO

*October 1, 2018*

CFO Jeffrey S. Bornstein ends 28-year tenure at GE,

*December 31, 2017*

GE Digital CEO

Bill Ruh announces end of 5-year tenure at GE,

*December 13, 2018*

CEO Jeffrey Immelt ends 16-year tenure at GE and is replaced by John Flannery,

*October 2, 2017*

GE Digital CCO

Kate Johnson ends 4-year tenure at GE,

*September 8, 2017*

GE reduces board size from 18 to 12 directors, including 3 new directors

*February 26, 2018*

EXHIBIT 3: General Electric’s MANAGEMENT DEPARTURES

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| GE Power CEO  Steve Bolze  Retires after 24-year tenure at GE, June 14, 2017 | GE CEO  Jeffrey Immelt  Retires after 16-year tenure at GE (replaced by John Flannery), October 2, 2017 | GE Digital CCO  Kate Johnson  Ends four-year tenure at GE, September 8, 2017 | Vice-Chairs  Beth Comstock and  John Rice  Retire | GE CFO  Jeffrey S. Bornstein  Retires after 28-year tenure at GE, December 31, 2017 | GE reduces board size from 18 to 12, adds three new directors (nine board departures), February 26, 2018 | GE CEO  John Flannery  Retires after 14-month tenure as CEO (replaced by Lawrence Culp), October 1, 2018 | GE Digital CEO  Bill Ruh  Announces end of five-year tenure at GE, December 13, 2018 |

Note: GE = General Electric; CEO = chief executive officer; CCO = chief commercial officer; CFO = chief financial officer

Source: Compiled by case authors based on Alywn Scott, “GE Merges Power Units as Executive Who Lost Out on GE CEO Job Retires,” Reuters, June 14, 2017, accessed March 14, 2019, www.reuters.com/article/us-ge-power/ge-merges-power-units-as-executive-who-lost-out-on-ge-ceo-job-retires-idUSKBN19524Z?utm\_source=34553&utm\_ medium=partner4; “John Flannery Succeeds Jeff Immelt as Chairman of GE; Lorenzo Simonelli Named Chairman of Baker Hughes GE,” General Electric, press release, October 2, 2017, accessed April 25, 2019, www.genewsroom.com/press-releases/john-flannery-succeeds-jeff-immelt-chairman-ge-lorenzo-simonelli-named-chairman; “Kate Johnson, GE Digital Chief Commercial Officer, to Join Microsoft as President, CVP of Microsoft US,” Official Microsoft Blog, July 17, 2017, accessed April 24, 2019, https://blogs.microsoft.com/blog/2017/07/17/kate-johnson-ge-digital-chief-commercial-officer-join-microsoft-president-cvp-microsoft-us/; “GE Names Jamie Miller as CFO; Jeff Bornstein to Leave the Company,” General Electric, press release, October 6, 2017, accessed March 14, 2019, www.genewsroom.com/press-releases/ge-names-jamie-miller-cfo-jeff-bornstein-leave-company-284049; “GE Announces 2018 Board of Directors Slate; Includes Three New Directors,” General Electric, press release, February 26, 2018, accessed April 25, 2019, www.genewsroom.com/press-releases/ge-announces-2018-board-directors-slate-includes-three-new-directors-284255; “H. Lawrence Culp, Jr. Named Chairman and CEO of GE,” General Electric, press release, October 1, 2018, accessed April 25, 2019, www.genewsroom.com/press-releases/h-lawrence-culp-jr-named-chairman-and-ceo-ge-284509; “GE Advances Digital Leadership with Launch of $1.2 Billion Industrial IoT Software Company,” General Electric, press release, December 13, 2018, accessed April 18, 2019, www.genewsroom.com/press-releases/ge-advances-digital-leadership-launch-12-billion-industrial-iot-software-company.

EXHIBIT 4: GENERAL ELECTRIC’S BUSINESS UNITS IN 2019

GE Power created energy technologies under the following operating units: Gas Power Systems, Steam Power Systems, Power Services, Grid Solutions, Power Conversion, Automation & Controls, and GE Hitachi Nuclear.

GE Aviation provided and serviced aircraft engines under the following operating units: Commercial, Military, and Business and General Aviation.

GE Lighting provided industrial, commercial, and consumer lighting solutions.

GE Renewable Energy provided equipment for the production of energy from renewable sources under the following operating units: Wind, Hydro, Hybrid, and Grid.

GE Oil & Gas was a full-stream provider of integrated oilfield products, services, and digital solutions.

GE Healthcare provided a portfolio of products, solution and services used in the diagnosis, treatment, and monitoring of patients under the following operating units: Healthcare Systems and Life Sciences. Healthcare Systems comprised Imaging, Ultrasound, Life Care Solutions, and Enterprise Software & Solutions business units.

GE Transportation provided equipment to the rail, mining, marine, stationary power, and drilling industries.

GE Capital was GE’s financial services, which focused on financing customers in GE’s industrial businesses, primarily in aviation and energy finance.

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EXHIBIT 5: General electric’s COMPETITORS IN THE INDUSTRIAL INTERNET

**IBM**

IBM, a global technology company with 381,100 employees, offered consulting and information technology (IT) implementation services, cloud, digital, and cognitive offerings, and enterprise systems and software. In 2013, IBM’s supercomputer, *Watson*, launched its first commercial application in health care to provide a range of enterprise artificial intelligence services, applications, and solutions.

**Philips**

Philips, a Dutch multinational health care and lighting electronics company with 77,400 employees, operated in the diagnostic & treatment, connected care & health informatics, personal health, and other businesses. Philips operated its HealthSuite Digital Platform in its “other” business unit and offered Internet of Things (IoT) solutions for industrial, commercial, and consumer applications through its lighting business. Philips partnered with Cisco in 2015 to sell Internet-connected lights to the global office market.

**Toshiba**

Toshiba, a Japanese multinational company with 141,256 employees, operated in the power systems and industrial systems industries. Toshiba launched SPINEX, an IoT architecture, in November 2016, and aimed to expand its IoT-related sales to ¥200 billion (US$2 billion) by 2020, doubling its 2016 sales.

**Google**

Google, an American multinational technology company with 98,771 employees, produced and supported products and platforms, including Android, Chrome, Gmail, Google Maps, Google Play, Search, and YouTube. Google launched its *Things* platform of IoT products and services in May 2018.

**Microsoft**

Microsoft, a global technology company with 131,000 employees, developed and supported software, services, devices, and solutions for individual and enterprise customers. Microsoft Azure was a set of cloud products and services that, among other functions, provided the infrastructure for customers to develop IoT capabilities. Microsoft Azure’s IoT capabilities were launched in April 2018. At the same time, Microsoft announced it would spend $5 billion to further develop its IoT capabilities over the next four years.

**Cisco**

Cisco, an American multinational technology company with 74,200 employees, designed and sold a broad range of Internet-enabling technologies and operated in the infrastructure platforms, applications, security, and other products businesses. Cisco produced switches, a networking hardware used in the IoT, and IoT and analytics software offerings.

EXHIBIT 5 (continued)

**Honeywell**

Honeywell, a diversified technology and manufacturing company with 114,000 employees, operated in the aerospace, building technologies, performance materials and technologies, and safety and productivity solutions businesses. IIoT by Honeywell, a cloud-enabled software service, was launched in October 2016.

**Amazon**

Amazon, an American multinational technology company with 647,500 employees, operated an ecommerce marketplace and provided services to developers and enterprises through its Amazon Web Services (AWS) segment. Amazon had both consumer and industrial applications in the Industrial Internet of Things (IIoT). AWS launched its managed IoT cloud platform in October 2015.

**Siemens**

Siemens, a German conglomerate with 379,000 employees, competed with GE in its power, oil and gas, transportation, medical products, and renewable power businesses. Siemens entered the IIoT market with a launch, in March 2016, of MindSphere 3.0, a cloud-based, open IoT operating system connecting products, plants, systems, and machines. Siemens acquired Mendix, a low-code application development platform in August 2018.

Note: Each company’s number of employees is stated as listed in each company’s 2018 annual report.

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ENDNOTES

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