

Going Digital: General Electric and its Digital Transformation

General Electric: Preparing for a Digital Storm

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GE is the only company to be listed in the Dow Jones Industrial Index today that was included in the original index in 1896.”

In the same way that Millennials seem to adopt the latest digital technology with ease, our economy's younger companies also display a natural aptitude for the new economy. However, while the stories of the digital natives are instructive, what about more established corporates with longer histories? How can a company that is over a century old transform itself to thrive in a digital economy?

For GE, responding to change is part of its modus operandi. This is a company that has famously made change a core capability and a constant in its history. For over 120 years, GE has ploughed forward under a banner of “Building, powering, moving and curing the world. Not just imagining. Doing¹.” This constant focus on innovation and transformation has made the company the only one to still

remain in the Dow Jones Industrial Index since the original index was established in 1896².

The Need for Transformation

Over the last century, GE made the bulk of its revenues by selling industrial equipment and maintenance services to its customers. However, in recent years, it faced increased competition from companies that were not just in the business of selling equipment. These new competitors used information generated by large machines or equipment to provide services that improved productivity and reduced downtime.

GE realized that this trend had the potential to reduce it to just a commodity equipment provider. CEO Jeff Immelt underlined the importance of this shift, and the need to make drastic changes in GE's business model, when he said in 2013: “We know that there will be partnerships between the industrial world and the internet world. And we cannot afford to concede how the data gathered in our industry is used by other companies. We have to be part of that conversation”³.

GE started taking steps to transform itself from an organization predominantly involved in selling hardware or industrial equipment to one selling data-based services. It started building software around its products, enabling its consumers to create new revenue streams and become more efficient. In doing so, it also wanted to secure the value being created by its equipment. As Bill Ruh, Vice President and Head of GE's software and analytics business, said: “We want to deliver software services across all our products at the Silicon Valley speed. We are not going to sell software. If you look at Google, they have software but they sell advertising, Amazon too sells retail. What we are going to do is sell services wrapped around our machines that make them more efficient”⁴.

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We want to deliver software services across all our products at the Silicon Valley speed.”

–GE Vice President

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Betting Big on Software and Analytics to Drive the Next Wave of Growth

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I took over an industrial company, now it will be known as an analytics company.

—Jeff Immelt, CEO, GE

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GE is betting big on software and analytics to bring about its transformation, with Jeff Immelt stating: “I took over an industrial company, now it will be known as an analytics company”⁵. GE’s focus on data analytics was clear back in 2012 when it set aside up to \$1.5 billion for small take-overs to boost its presence in analytics. By 2013, the company was able to introduce a wide range of big data products. These include predictive software products, a Hadoop-based big data software for ingesting and managing industrial data, and a relationship with Amazon Web Services to share industrial data in public cloud⁶.

GE’s transformation was based on a combination of tactics: developing data-driven solutions and opening up its big data platform to external applications.

Providing Clients with Data-driven Solutions to Improve Machine Efficiency

GE is attaching sensors to its machines that enable it to capture performance data. This data is then analyzed to provide real-time information to improve machine efficiency, prevent downtime and enable effective scheduling of predictive maintenance (see Figure 1). By attaching sensors to its machines, GE currently monitors and analyzes 50 million data elements from 10 million sensors on \$1 trillion of managed assets daily. The overall goal is to move customers toward zero unplanned downtime⁷ and GE has christened this convergence of industrial machines, data and internet connectivity the ‘Industrial Internet’.

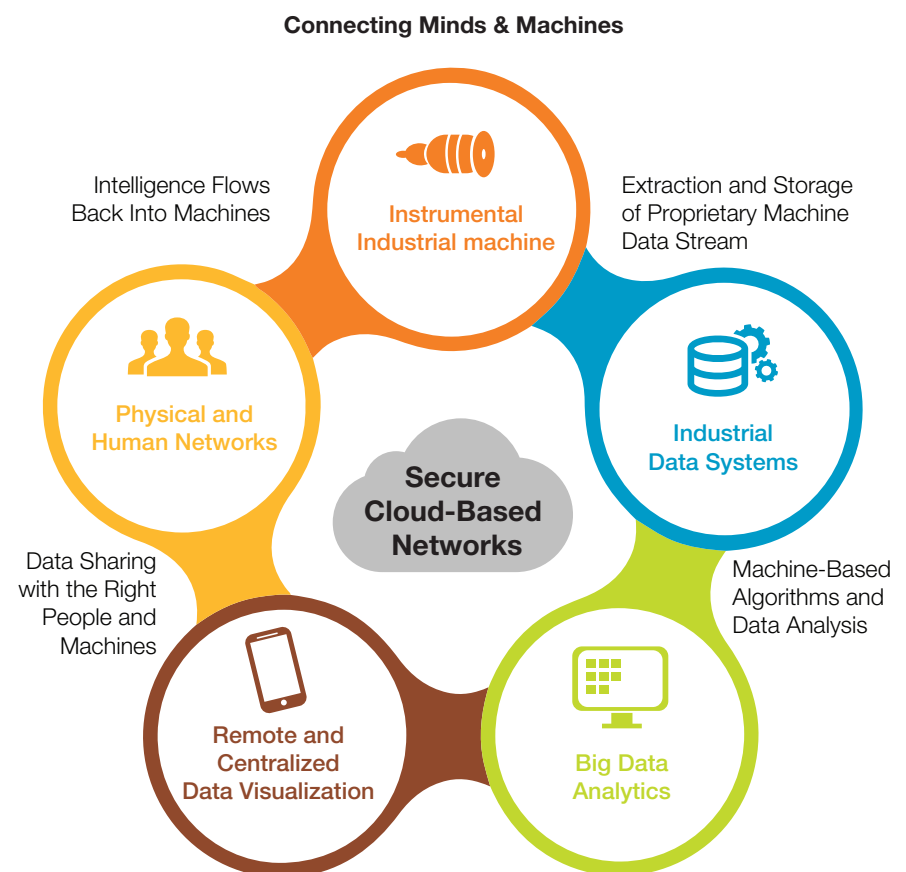
Since 2011, when GE resolved to expand its business into the software and analytics domain, it has developed and introduced nearly 40 software products under its “Predictivity” brand.⁸ These solutions have been seeing strong traction across industries. For instance, one of these products, PowerUp, is being used by E.ON to improve its operational efficiency. In one year, over 1,400 turbines have been contracted under the PowerUp services. Using the product on a trial run, E.ON experienced an overall increase of 4% in power output on 60% of its turbines⁹. If rolled out across E.ON’s entire turbine range, it is the equivalent to adding 19 new wind turbines. Revenues from ‘Predictivity’ solutions were expected to touch \$1.1 billion during 2014 and are estimated to bring in \$5 billion by 2017¹⁰.

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Figure 1: Connecting the components of the Industrial Internet



Source: Innovation World 2013 Keynote, Bill Ruh, GE Software—The Emerging Industrial Internet

Throwing Open the Big Data Platform to enable Cross-Industry Application

A sign of GE's rapid digital progress can be seen in how it has transitioned its internal big data platform as an external service. Before late 2014, GE had used its Big Data platform Predix to build its proprietary Predictivity solutions. The platform was built in order to bring all of GE's industrial machines onto one cloud-connected system. The goal was to drive a 1% increase in performance per industry. For instance, just in aviation, a 1% increase in performance can mean savings of around \$15 billion in jet fuel and other costs in a few years¹¹(see Figure 2).

However, in October 2014, GE announced it was opening the Predix platform to other companies that would like to create their own customized industry apps. With this move, GE intends to make Predix the default platform for industrial Big Data. As Dave Barlett, Chief Technology Officer for GE Aviation, says: "We want Predix to become the Android or iOS of the machine world. We want it to become the language of the Industrial Internet ." Throwing open Predix also helps GE in monetizing its big data platform directly and provides an opportunity to expand in geographies and industries where it had little presence. In December 2014, GE licensed its Predix software platform to the Japanese telecom giant SoftBank Telecom, allowing it to build apps for shipping, manufacturing and other industries. This deal is expected to earn potential revenues of \$200 million across major industries in Japan over the next 5 years¹³.

Figure 2: Savings as a Result of 1% Improvement in Efficiency

Driving customer outcomes		
	Power of 1%	Annual impact
Airlines	1% fuel	\$2-3B
Utility	1% fuel	\$4-5B
Oil & Gas	1% uptime	\$5-7B
Healthcare	1% productivity	\$4-5B
Transportation	1% mile velocity	\$5-7B

Source: Company presentation

Apart from opening up its big data platform to others, GE is also partnering with Intel and Cisco to develop the next generation of Predix-ready devices. This would allow operators to integrate Predix into existing infrastructure, increasing its uptake amongst companies with existing industrial assets.

Using Smart Tools to Encourage Collaboration Among Employees

GE is fostering a digital culture across the organization by adapting new devices and services. GE was among the early adopters of devices such as the Apple iPhone and iPad. In order to maximize its mobile capabilities, GE set up the GE Mobile Center of Excellence, an internal group that develops tools to make mobile devices more useful for its many business units¹⁴. Similarly, GE also partnered with Box, an enterprise content sharing

and collaboration company, to help its employees and partners take advantage of the cloud to share content across devices and platforms¹⁵.

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We want Predix to become the Android or iOS of the machine world. We want it to become the language of the Industrial Internet.

Dave Barlett, CTO, GE Aviation

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Making Digital a Key Part of the Organizational DNA

GE's digital transformation is not the result of being in the right place at the right time. Instead, it is the result of a structured approach that involved a strong top-down digital vision, capability development, achieving all-round buy-in and a constant focus on innovation (see Figure 3).

Drive the Digital Agenda from the Top

Outlining a compelling leadership vision for the organization

Highly visible digital leadership has been a constant in GE's transformation since 2011, when CEO Jeff Immelt outlined his determination that GE would counter any commoditization threat by capitalizing on innovations in software and analytics. His stated aim was "to create a global network of connected machines from which GE can offer outcomes-based solutions that drive significant operational improvement for customers"¹⁶.

Building the right team to achieve the vision

GE has long been recognized as a breeding ground of outstanding business leaders. However, the nature and potential of the talent required for its software and services offerings were different. GE made a number of new hires at senior levels to drive the transformation. It hired William (Bill) Ruh as the Vice President of its Global Software Center and made him responsible for developing the software to power the Industrial Internet. Prior to joining GE, Bill Ruh was responsible for developing advanced services and solutions at Cisco and had more than 25 years of industry experience in enterprise application integration and object oriented technology.

GE also hired Kate Johnson as Chief Commercial Officer for sales and marketing, with the aim of building new software and solution sales capabilities. She had previously held senior roles at

Oracle Corporation. In May 2015, GE named her CEO of the Industrial Internet Software Group¹⁷. Another key hire was Harel Kodesh who joined GE as CTO of GE Software. Harel was CEO and founder of Nurego, an analytics company, and prior to that a senior executive at EMC and Amdocs¹⁸.

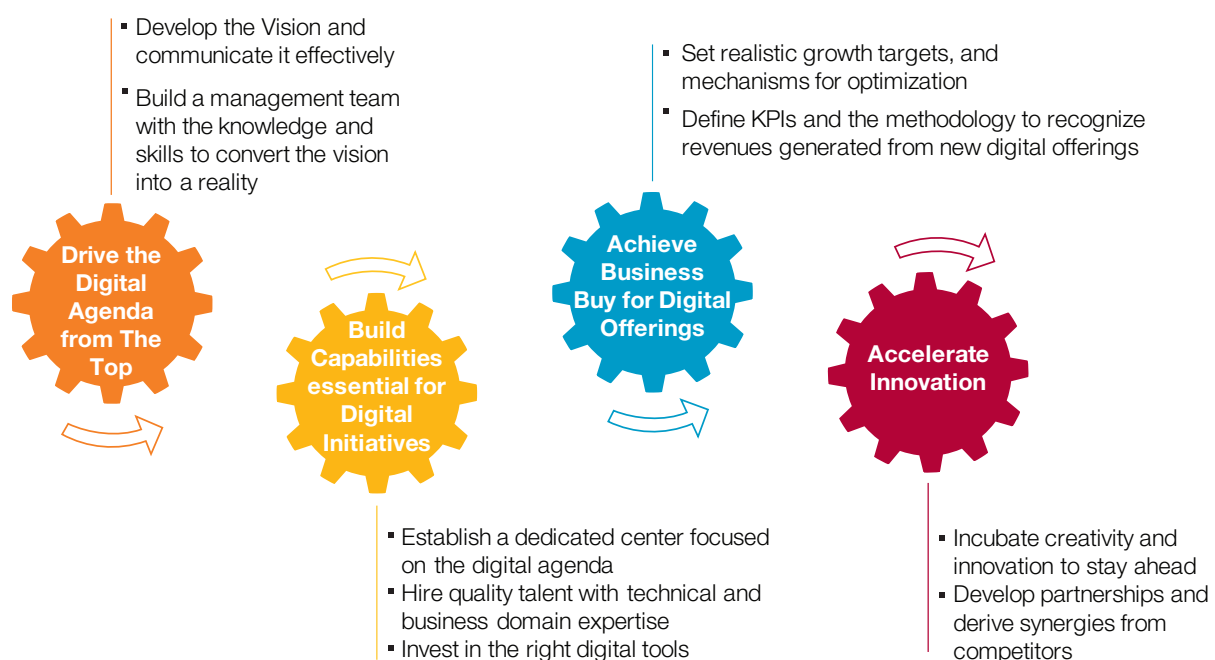
The importance of bringing in leaders from outside was outlined by Jeff Immelt when he said: "We never made real progress here until we brought people in from outside GE"¹⁹.

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- Jeff Immelt, CEO, GE

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Figure 3: GE's Journey towards Digital



Building Capabilities to Support Organization-Wide Digital Initiatives

Setting up a Center of Excellence (CoE) for digital initiatives

GE set up a Global Software Center based out of San Ramon, California. Unlike traditional GE business units, the CoE was not set up as a business unit with its own P&L but was funded centrally through a corpus amount of \$1 billion²⁰. The center, led by Bill Ruh, is dedicated to developing predictive services based on data collected from GE's industrial machines, which is essential for powering GE's Industrial Internet offering. GE also set up a User Experience CoE tasked with improving the quality of GE's digital experiences and defining the human interface to the Industrial Internet. The CoE's team work across all businesses to introduce user-experience methods and improve the design of software applications²¹.

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Instead of a features list with pricing and discount caps, we're shaping deals from the ground up that are based on the value derived by the customer.

- Kate Johnson,
Chief Commercial Officer, GE

Developing functional capabilities to sell solutions along with products

One key challenge in transitioning a traditional, hardware-focused company to selling software solutions is to change the mindset of its sales force. At GE, the sales force had to abandon its traditional product-selling mindset and embrace a solution-based sales approach. As Jeff

Injecting the spirit of a startup into a century-old giant

Since 2011, GE has been working with Eric Reis, a tech entrepreneur and author of 'The Lean Startup'. This collaboration has developed a program called FastWorks - designed to help GE foster innovation and accelerate product development. The program combines a set of tools and behaviors designed to deliver better outcomes for customers faster. The method focuses on building imperfect early versions, releasing them to customers, getting feedback, and then "pivoting" or adapting the products when necessary.

By August 2014, GE had already trained 40,000 employees under the FastWorks initiative, one of the largest in the company's history²⁴. The program has the backing of GE's top management, including Jeff Immelt and Chief Marketing Officer Beth Comstock. It is expected to bring the agility and innovative spirit of a startup into this much larger corporate giant.

An early result from the FastWorks initiative was an oil well flow meter technology, GE Safire™, aimed at managing oil and gas reservoirs efficiently. The FastWorks program helped GE to move from a problem statement to a prototype within a year and the solution is now being commercialized with Chevron²⁵. FastWorks' principles were also seen in action with the five-year, \$500 million project by GE engineers to upgrade its H-class turbine. The FastWorks approach was applied to the project, which started with a proof-of-concept exercise costing \$25 million, and it is now expected to be completed for half the cost²⁶.

Immelt says, "The transition we have to make with our customers is going from agreements that are break/fix to agreements that guarantee outcomes".

As part of the process to develop its go-to-market and commercialization strategies, GE hired Kate Johnson as Chief Commercial Officer. Her aim was to create and expand GE's outcome-based sales capabilities. She also led a new Commercial CoE that had been set up to focus on increasing service revenue and margin growth²².

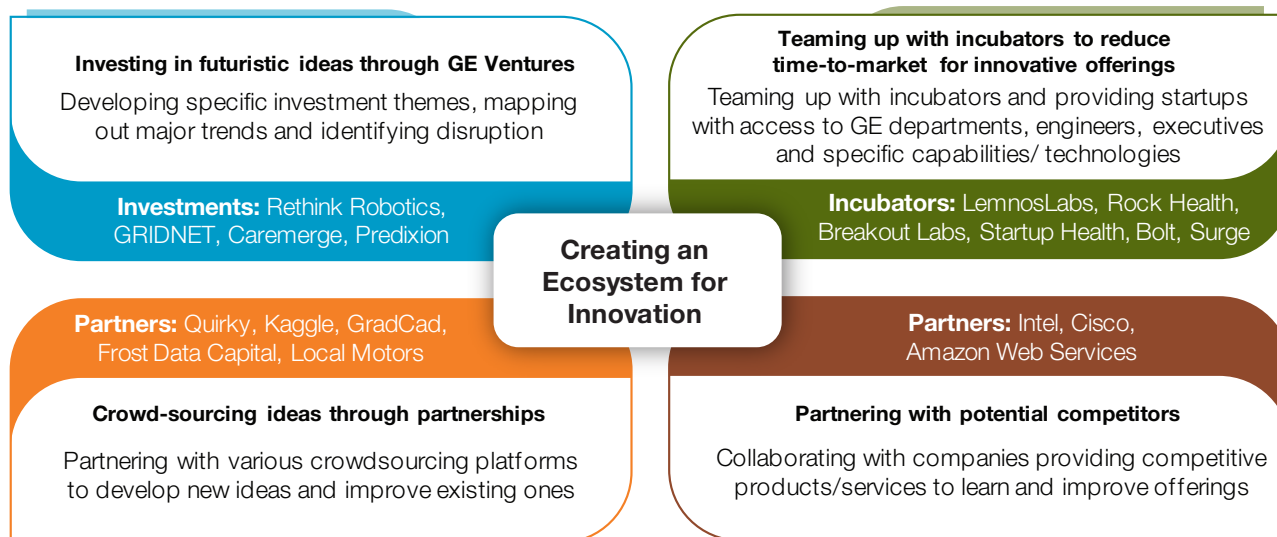
GE's sales team now includes solution architects, who combine industrial knowledge with advanced analytics to develop models for setting and achieving business outcomes. Sales professionals now needed to do a whole range of calculations and modeling before they even approached a potential customer. This completely changed the way GE's offerings are priced to their customers.

As Kate Johnson says: "Instead of a features list with pricing and discount caps, we're shaping deals from the ground up that are based on the value derived by the customer. It's a completely different set of economics that is very disruptive in the industry"²³. Moving to such a model was not easy though. GE had to convince its salesforce of the need to move from a transactional sales model to a consultative selling model that has a different incentive philosophy.

Achieve Business Buy-In for Digital Offerings

Transforming GE's business inevitably led to some friction between the deep-rooted industrial mindset of keeping things within a defined step-by-step process and the startup ethic of fail-fast and learn. To overcome this resistance, the Global Software Center team

Figure 4: Creating an Ecosystem to Foster Innovation



Source: Capgemini Consulting Analysis

engaged with business units that were eager to participate in the initiative during its inception. The rapid transformations achieved by these pioneering business units, and the revenue returns they delivered from Industrial Internet offerings, made it difficult for other units to remain agnostic.

As Bill Ruh explains: “I said, ‘We’re going to do this; who wants to be first in line?’ A number wanted to, so we developed them at a very fast pace and got them successful quickly. The performance gains and revenue enhancements were visible to other executives, who then asked their own businesses, ‘How can we do this?’” The peer pressure and the visible benefits led to a domino effect across business units, resulting in others to start experimenting with software services²⁷.

Creating an Ecosystem to Speed-Up Innovation

Transformation is an ongoing journey and organizations need to constantly innovate to stay ahead. GE has created

an entire ecosystem that enables it to gather innovative ideas and speed up the process of taking new products to market (see Figure 4).

Investing in tomorrow's ideas through GE Ventures

In January 2013, GE started its corporate venture capital entity, ‘GE Ventures’. It was born out of a restructuring of its health, energy, software and manufacturing venture investment groups. The venture has an annual fund commitment of \$150 million²⁸. It invests in a variety of areas such as software, analytics, healthcare, energy, advanced manufacturing, among others. One notable exit is Veracyte, a molecular diagnostic company. The company IPO’d in 2013 and has in recent months announced a research collaboration with GE’s healthcare team²⁹.

As of January 2015, GE Ventures had 61 startups in its portfolio covering software, energy, healthcare and advanced manufacturing³⁰. The venture arm has specialized teams focused on in-depth research and analysis - the teams identify unmet needs, isolate opportunities and

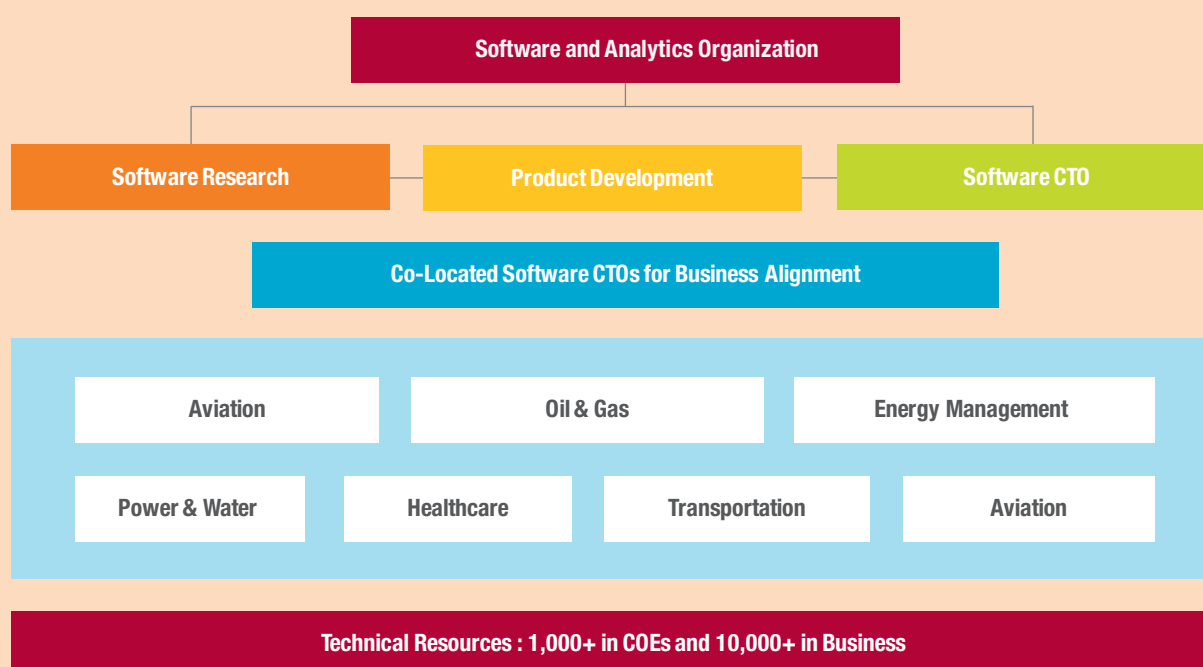
look for companies that fulfill the need gap. As Noah Lewis, Managing Partner for GE Ventures, explains: “We spend a lot of time developing specific investment themes, starting 10 years out in the marketplace. We map out the major trends and directions as well as profit pools, and identify disruption”³¹.

“GE Venture has specialized teams focused on in-depth research and analysis - the teams identify unmet needs, isolate opportunities and look for companies that fulfill the need gap.”

Governing the Transformation

To avoid fragmentation of approach and investment, GE's software and analytics commercialization team was designated a common capability that would support the rest of the organization.

Within the software group, there are distinct roles for heads of software research, product development and software CTO. These executives work with dedicated co-located software CTOs to encourage business alignment. This team is then supported by over 1,000 technical resources in dedicated CoEs and around 10,000 people in all businesses. These technical resources include computational and analytical scientists, platform developers and software engineers.



Nurturing startups to reduce time-to-market for products and solutions

GE Ventures has also teamed up with various startup incubation labs such as Lemnos Labs, Rock Health, Breakout Labs, Startup Health, Bolt and Surge. These collaborative partnerships enable the incubation labs to provide startups with access to GE technologies and information resources. Simultaneously, it allows GE to gain experience in engaging with startup communities. Executives from GE Ventures also act as a guide for startups, facilitating interaction with GE departments, engineers or executives

who may become pilot customers, advisers or business partners for their ideas³².

GE has also partnered with Frost Data Capital, an incubator for Big Data startups, and launched an Industrial Internet incubator called Frost I3, which aims to launch 30 startups³³.

Crowdsourcing ideas through partnerships

GE has also partnered with various crowdsourcing platforms to gain access to new and innovative product

ideas. It has partnered with Quirky, a crowdsourced invention platform, to develop its Wink range of connected products. GE also gave Quirky and its inventor community access to thousands of its patents. The aim is to work with this agile startup to develop new and innovative products and to do so at speed.³⁴ The partnership has yielded products such as a smart window and door sensor, Tripper; an outlet for monitoring and managing power usage, Outlink;³⁵ and Aros, a smart air conditioner³⁶. Other GE partnerships include Kaggle – an online community of data scientists – which

it is using for obtaining algorithms to optimize airline paths and reduce air delays³⁷; and Local Motors, an open source hardware innovator for designing, testing, and producing large appliances³⁸.

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The apparent rapid transformation of peer business units and the revenue benefits that they derived out of Industrial Internet offerings made it difficult for other units to remain ignorant.
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Collaborating with potential competitors to learn and improve

GE is collaborating with potential competitors, such as Intel, Cisco, Amazon Web Services and Microsoft, which provide similar technology solutions. The company is deploying the majority of its new apps from the cloud. The idea is to introduce a data analytics platform that can manage large-scale industrial machines in the cloud. GE is also part of an open membership group, the Industrial Internet Consortium (IIC). The consortium focuses on sharing best practices and reference architectures. It also influences the global standards development process for Internet and industrial systems³⁹.

Corporate Revolutionary

GE is not an organization that believes in sitting still. Since its inception, it has reinvented itself at critical junctures. This certainly holds true in the digital age as well. GE has made a bold play to lead the ‘Industrial Internet’ and has shown an impressive appetite for radically changing its normal ways of working and its culture to achieve results. While many digital natives, from FaceBook to Uber, continue to take much of the limelight, this 120-year-old giant of the corporate world shows that digital agility is not just confined to the new Millennial corporates.

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Authors

Jerome Buvat

Head of Digital Transformation
Research Institute
jerome.buvat@capgemini.com

Subrahmanyam KVJ

Manager, Digital Transformation
Research Institute
subrahmanyam.KVJ@capgemini.com

Digital Transformation Research Institute

dtri.in@capgemini.com

Digital
Transformation
Research Institute

Ashish Bisht

Senior Consultant, Digital Transformation
Research Institute
ashish.bisht@capgemini.com

For more information contact

Jerome Buvat

jerome.buvat@capgemini.com

Didier Bonnet

didier.bonnet@capgemini.com



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