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The Retraining Paradox

The Retraining Paradox
The New York Times Magazine
By: Ruth Graham
2/23/2017

When Nathan Key graduated from Plymouth State University in New Hampshire a decade ago with a bachelor's degree in communications, he found himself with about \$10,000 in debt and few clear career options. He first found work as a door-to-door salesman ("a pyramid scheme," he recalls) and then in telemarketing. Finally he landed a job as an infrastructure specialist for Datamatic, a Texas-based water-meter-technology company. He was traveling across the country installing meters, making a decent salary. But he lost his job after the company restructured in 2012, he said, and soon he found that his skills weren't easily transferable to a new field; Datamatic's technology was proprietary, and his expertise in the company's installation program wasn't appealing to employers outside that particular industry. He tried going into business with a friend, but the relationship soured. By then he had a baby and a fiancée, and he felt stuck.

Now 32, Key is a few months away from finishing a six-month certificate program in advanced composites manufacturing at Great Bay Community College in Rochester, N.H. The program operates out of a satellite campus that opened in 2013, with aid from a Labor Department grant meant to help community colleges reach "trade displaced" workers who need help training for new careers. The unemployment rate in southern New Hampshire is low, less than 3 percent. At one state job fair last summer, just 350 people showed up for 1,200 available jobs. In Strafford County, where Rochester is located, the largest employers include the University of New Hampshire and Liberty Mutual, but also manufacturers like Turbocam and Contitech. Key's classmates include veterans, recent high-school graduates and older workers whose careers had reached dead ends. All of them are looking for hope and a decent paycheck by acquiring a new set of skills. "Within six months, I'm going to go from regular guy to working in the aerospace community," says Tommy Florentino, a disabled veteran with a background in construction and automotive manufacturing. He has friends who went to Boston College or Suffolk University, "and they're waiters and waitresses."

The college's 27,000-square-foot Advanced Technology and Academic Center is at the edge of a nondescript shopping center. The complex also houses a Dollar Tree, a J.C. Penney and a Kmart, where a banner out front reads, "Now hiring." Cashiers there earn close to minimum wage. But Kecy expects to earn at least \$16 an hour when he graduates and to move up quickly from there. Composites is a broad field in manufacturing, with applications including automotive parts, sporting goods and prosthetics, as well as in the locally prominent aerospace industry. The state's department of economic development bills its seacoast region as "the emerging composites region," and it points to Great Bay's program as a reason for more aerospace and defense businesses in particular to relocate there. "I've got some options, which is something I've never really experienced before," Kecy says.

There's a strange disconnect between two of the big narratives about the American blue-collar work force right now. In one story, there is a population of unemployed and underemployed working-class adults for whom well-paying work seems increasingly out of reach; their jobs have gone overseas or become automated, and they find themselves working retail, or not working at all. But an apparently conflicting story comes from American employers, which have been insisting for years that they have a hard time finding workers to fill many skilled blue-collar jobs. A 2015 report from the Manufacturing Institute, for example, found that seven in 10 manufacturing executives said they faced shortages of workers with adequate tech skills. A high proportion of existing skilled workers is also nearing retirement, which means a bigger gap is looming soon. By 2025, the report warned, two million jobs will be going unfilled. (Health care, also a big focus of retraining programs, is another rapidly expanding field.)

The tantalizing promise of government-funded job training is that it can bridge the gap between those narratives in a way that benefits individual workers, employers and the country as a whole. Hard-working Americans get good jobs, employers get skilled labor and the economy benefits from their mutual good fortune. The image of that virtuous cycle has made the promotion of training programs appealing for politicians on the left and the right. Hillary Clinton proposed retraining former coal-industry workers in new careers as part of a \$30 billion package meant "to ensure that coal miners and their families get the benefits they've earned and respect they deserve." Even as Republicans have voted to cut funding for training in recent years, they have paid it lip service as a way to put Americans back to work.

It's perhaps not surprising, though, that so much of the working class gravitated in the last election to Donald Trump, whose rhetoric about displaced workers was very different: blunt (if unrealistic) promises to stop old careers from disappearing, to "bring back our jobs." In its zeal for retraining, the federal government's approach to the problem has become increasingly byzantine, a dizzying constellation of programs to help struggling workers prepare for new careers. Some of them are intended for employees laid off en masse when their jobs went overseas, and others are for those who are simply unemployed and underqualified for well-paying work. In the 2009 fiscal year, the Government Accountability Office counted 47 different federal training-related programs administered by nine agencies, numbers Republicans have since used to argue that many of the programs were redundant. In his 2012 State of the Union address, even President Obama criticized the "maze of confusing training programs" unemployed workers had to navigate to get help. The Workforce Innovation and Opportunity Act, signed into law in 2014 with bipartisan support, was designed in part to streamline the government's approach.

Critics also say that job training is costly and too often ineffective. Take the primary federal effort specifically aimed at workers affected by global trade, the Labor Department's Trade Adjustment Assistance program. Through T.A.A., qualified workers can receive free retraining, typically through a community-college program like Great Bay's. The program is generous, spending more than \$11,500 on each person who participated in retraining in the 2015 fiscal year. But it serves relatively few people, and recent analysis has shown iffy results: A 2012 evaluation prepared for the Labor Department found that while 85 percent of those who went through T.A.A.-funded training eventually received a certificate or degree, only 37 percent of them were working in that field four years later. (The program was later amended to include more individualized support.)

All too often, skeptics say, publicly funded training programs are a sop to well-connected companies who want taxpayers to foot the bill to train their workers. Critics also point at research suggesting that on-the-job training by employers themselves has been declining in recent years. But it simply doesn't make economic sense for most employers to do all of their own training anymore. In part, this is because of technology: Jobs in advanced manufacturing and health care require intense technological instruction, usually accompanied by classroom time. At the same time, standardization means employers often poach skilled workers from one another, which discourages them from investing a lot of time and money in training their own workers. "It's unrealistic today to think of traditional, very idiosyncratic manufacturing jobs where you're going to walk in, get a job, get trained in a bunch of very specific skills, and they'll hold onto you for decades," says Lawrence Katz, an economist at Harvard

University. "That's just not the trajectory of employment anymore."

After completing the certificate program in April, Kecy will have specializations in "nondestructive testing" and "bonding and finishing," skills that set him up for specific positions that local employers have been struggling to fill. The simplest description of composites manufacturing is that it is the process of putting two materials together; adobe, for example, is a composite of straw and mud. "Advanced" composites manufacturing typically involves adding high-tech resin to woven fibers. The strong, lightweight finished products are replacing metal in many manufacturing areas, including aerospace. Great Bay students further specialize in areas like quality inspection or resin-transfer molding; the goal is that when they graduate, they are ready for high-end entry-level jobs. Advanced manufacturing in general is a strong industry in New England; a recent analysis by Deloitte and the New England Council found that in 2012, 59 percent of the region's 641,000 manufacturing jobs were "advanced."

With his certificate, Kecy is confident that he will find a job locally, and he's probably right. Great Bay's composites program was developed in a close relationship with Safran Aerospace Composites and Albany Engineered Composites, two companies that opened a shared plant in Rochester in 2014. Safran helped develop the program's curriculum and stays in touch about which specializations the company will be needing in the coming months. It guarantees interviews to all graduates of the program and has hired about 30 of the more than 170 participants so far. Over all, more than half the program's graduates have been hired by five large local manufacturers, according to its director, Debra Mattson.

That level of coordination with local industry, ideally touching on everything from curriculum to recruitment, is now seen by policy experts as a crucial dividing line between programs that work and those that don't. The federal government now emphasizes this kind of "demand driven" training in part to ensure that workers aren't being retrained with new skills as obsolete as their old ones. "A good sign is if the program was co-developed with the firm," says Mark Muro, a senior fellow at the Brookings Institution's Metropolitan Policy Program. "One of the fundamental problems is training divorced from labor-market dynamics — people being trained without the presence of jobs they could actually arrive in." (The Nordic countries, which spend more on job training in general, have a strong record in developing training with input from both industry and labor.) The evidence in the United States for demand-driven training is promising so far. A 2010 study of three such programs found that enrollees were earning almost 30 percent more than a control group two years after they began the program and were significantly more likely to be employed.

The Great Bay program has relationships with Safran, A.E.C. and other area employers, including BAE Systems, Turbocam International and the gun manufacturer Sig Sauer, which recently landed a \$580 million contract with the Army. The program is short by design, and new cohorts start three times a year to ensure a steady stream of graduates for local employers. "Industry is dying for bodies, just dying for skilled workers," says Will Arvelo, Great Bay's president. "They can't wait two years."

On a snowy afternoon a few weeks ago, Kecy and his classmates in his Fundamentals of Composites Manufacturing class were at work in the "clean room." The setting looked more like a science lab than a factory. A large cooler stacked with vacuum-sealed bags of thick fabric pieces stood in the corner, and work tables held clusters of metal tubes. The class instructor, Peter Dow, watched as two teams of students worked on a project they had been planning for several weeks: constructing a three-inch carbon-fiber tube with a finished exterior. Later they would have a chance to tweak their plans and try it all over again, a lesson in the manufacturing principle of "continuous improvement."

For all the ways in which technology has changed the manufacturing industry, one of the most striking to an outsider is the appearance of the work space itself. The students in the clean room wore white coats and safety glasses as they used hair dryers and refrigerant spray to fiddle with the sticky material. Outside their small work area, the facility's spotless manufacturing lab offered the capacity to build a product from start to finish: a huge, three-dimensional loom for weaving carbon fiber, a five-axis machining center, an automatic autoclave. Practically every piece of equipment seemed to feature a keyboard or touch screen.

But manufacturing's new high-tech, high-skill profile is also what makes it daunting for many older workers looking for new careers. The dilemma illustrates some of the broader challenges of retraining later in life. Kerri Uyeno, a 43-year-old single mother of three who graduated in the Great Bay program's first cohort in 2014, began working at Safran as a bonding operator three weeks after earning her certificate. It was such a happy ending that she featured prominently in early publicity materials for the program. But she had conflicts with her supervisors and lasted just over a year in the job before quitting. She didn't work again for six months; her house went into foreclosure. An administrator at Great Bay tried to persuade her to come back and work toward her associate degree, but the prospect was exhausting. "It was so hard to get through that six months to my certificate," she said,

"I just didn't have it in me to get more schooling." Today she is an office manager at a flooring showroom nearby. She still exudes pride when she talks about earning her certificate, but she also calls the experience "one of the biggest heartbreaks I've ever gone through."

At 49, Dean Kandilakis is one of the oldest students in the program's current cohort. He has a master's degree in international relations, but he spent most of his career doing administrative work. "There's a really large learning curve for someone who's just re-entering from a different field," he said during a break from class. "It's been a very stressful time for me, because it's an adjustment in my identity as a human being." But he says it's worth it to feel as if he's finally becoming a specialist in something.

It can take enormous intellectual and emotional efforts to pursue retraining, especially for people who have been rattled by sudden job loss or depressed by declining career prospects. For all his grandiosity, Donald Trump's approach to working-class voters was characterized by relentless pessimism: dark visions of "poverty and heartache," warnings about Mexicans "taking our manufacturing jobs." Nostalgia, with its disdain for the present and mistrust of the future, is actually quite a gloomy sentiment. Job training, by contrast, makes the smaller-but-sunnier assurance that starting over is possible with help and time. It takes optimism on the part of both policy makers and workers. Back in the lab, Kandilakis's team had been having some difficulty with their tube; the material was too warm, and it was thickening too quickly as they molded it. "We're having some problems today," he said, but he didn't sound concerned. "Thankfully we'll have another run."

Hiring for the Factory Floor – Are Hard Skills or Soft Skills More Important?

Hiring for the Factory Floor – Are Hard Skills or Soft Skills More Important?

IndustryWeek

By: Larry Fast

2/21/2017

We've received a couple of questions regarding metrics in other areas of a manufacturing business (purchasing, for example), which I'll be happy to address. However, since we've just finished a five-part series on factory metrics, I'm going to first catch up on a few questions that have come in on other topics.

Question: When you hired for the factory floor, what was more important to you in the candidate – the hard skills (e.g., CNC machining experience) or softer skills like problem-solving or being a team player. And why?

Answer: As is often the case, it depends. First let's deal with the hard skills. Any time a company has the opportunity to avoid a lot of training expense and learning-curve time, it's a major plus. Of course we have to pay more up front with the starting wage, but the value to the company Day One is much higher than training our own or sending them to school to be tutored for months or years in the case of journeyman jobs like electricians, plumbers, electronic techs, etc. A technical person should be involved in interviews for these types of jobs to validate the candidate's knowledge and ask detailed questions while HR checks to validate the credentials listed on the applications (certificate/diploma of accomplishment from technical schools). HR also makes certain the applicant passes drug testing, background check, etc.

Once the technical skills have been validated, then the evaluation of the talent moves to the soft skills side. I always asked about personal experiences as well as work examples. For instance, my experience is that people who have grown up participating in team sports are typically more compatible to working in teams than those who haven't. They understand there is no "I" in team. They tend to be more helpful. They tend to have more initiative for what it takes to win. They also know how to use a coach to get better. It isn't always the case, but it's a good conversation to have to learn a lot about the person.

For example, are they interested in improving their skills and behaviors to help the business prosper? We're looking for hints here: Will this person fit into the culture that we have or that we're trying to create? What kind of culture has this person worked with in other companies? Ask for an example of what his opinion is on that culture. All these factors are relevant when you're bringing experienced people in from other companies. If they're the best there is in their craft but would prefer to just do their job and be left alone, it isn't likely they'll engage in team improvement activities and become a contributing part of the new culture. It's simply not worth taking on the resistance/non-

engagement that you'll have to deal with until your patience runs out and you're right back where you started—looking for a CNC operator.

Because skills in these technical areas (the same applies for salaried engineering and lean/Six Sigma jobs) are often in short supply, or you're in a similar situation to that just described, you are probably better off hiring a smart, trainable person who thinks and behaves the right way. We can always train-in the technical skills if the person is capable of learning and performing. We can also help with the soft skills where there are gaps. For example, a relatively new engineer may be great at the nuts and bolts of her work as an IE/ME/EE, etc., but not yet have mastered how to lead the use of fishbone diagramming or lead a kaizen event. She may also need greenbelt or blackbelt skills in order to lead lean/Six Sigma projects or group dynamics, or whatever to be more effective and to "walk the talk" of the culture the company has or seeks. Their soft skills can also be improved using the two tools noted below.

As for the soft skills of applicants, there is certain testing that your HR department can provide to give you insight about personal traits that are complementary to your culture or traits that put up a red flag. Employee surveys also are helpful to developing your own database of what behaviors work best in your business. That way you can look for evidence of those qualities in new applicants. In addition to home-grown databases there are wonderful, time-tested tools available.

Two of my favorites over the years are the Myers-Briggs www.myersbriggs.org and FIRO-B www.psychometrics.com/assessments/firo-b/. These tools are also quite effective for helping legacy employees improve skills that make them better workers and team players. Both tools historically have been used primarily for salaried employees, but they will work equally well with hourly workers.

Final thoughts:

1. Follow up how well the new person is being accepted in their group and contributing to good performance. If there is an issue after the person has been brought on board, deal with it. Nip it in the bud. If it persists, don't waste time in hand wringing. Get them out. On the other hand, for those who are adapting well, making positive contributions and working well with their teammates, be proactive and timely in recognizing and communicating how much you appreciate the early work, and let them know their supervisor and HR folks are always available to assist the transition from new employee to a long-service employee.
2. Don't forget to trust your gut. If the answers to your questions seem shallow; or if you sense an underlying attitude of superiority or of entitlement; or the personality just isn't a fit for the people in similar jobs being applied for, move on to the next candidate. We can make a bad hire in an hour and spend a year pushing a rope before we have to terminate the bad hire and start over. Make sure your HR counterpart and you are in complete alignment on this.
3. Don't settle under the pressures of the business. If the candidate isn't right as a regular employee, try to fill the immediate need on a contract basis until you find the right match of technical and soft skills. Recently retired folks are often a good temporary solution.
4. Plan beyond the end of your nose. I sat down in the plant manager's chair in the fall of 1980 and immediately had to put together the budget for the new year. During the course of that preparation, my maintenance manager stopped by, stuck his head in my office and said, "By the way, I've got a pipefitter retiring in April so I'm putting that in the budget for the four-month overlap of expenses." There had been no planning and the slotting of when apprentices should be started to make a seamless transition for any of the trade positions. That was the beginning of succession planning in maintenance because of the special, often scarce skills they possess. We also embarked on developing a relationship with the local technical school where we could forecast our needs and "place our orders." Every company should have such a relationship.

"Don't water your weeds." – Harvey MacKay

"A certificate does not make you certified. Attitude, performance, commitment to self and team—these and a certificate make you certified." – Author Unknown

"We don't just pay a person for their skills. We also pay for their attitudes and their behaviors." – Larry E. Fast

U.S. Needs to Prepare Manufacturing Workers of Tomorrow

U.S. Needs to Prepare Manufacturing Workers of Tomorrow

Houston Chronicle

By: Chris Tomlinson

2/18/2017

The best way to boost the number of manufacturing jobs in the U.S. is to create new, high-paying jobs, not to bring back jobs from poor countries.

That may sound like a subtle difference from what President Donald Trump promised on the campaign trail, but it is a distinction that makes a big difference. The United States shouldn't want low-paying, low-skilled jobs using 20th-century technology. To boost the economy, we need the latest technology operated by the most highly skilled workers.

"Manufacturing today is very different from manufacturing that existed 10, 20 or 30 years ago. It is technology-driven, it is efficient, it is very focused on a different type of production," said Jay Timmons, president of the National Association of Manufacturers, which represents 14,000 companies.

The only reason many companies found it economical to move manufacturing overseas was that the jobs didn't require a lot of education. Almost anyone can do basic assembly work, which is repetitive and boring. Bringing that work home makes no sense if lower-cost labor in another country is willing to do it for us.

The real challenge comes when a company wants to invest in a new plant using new technology that requires more highly skilled workers. Timmons said U.S. taxes and regulations discourage American companies from investing here.

"In my mind, it's not about moving jobs from one country to another," Timmons said in an interview. "Our goal is for investments in the jobs of the future to be made here."

The new administration and Congress are ready to do their part by overhauling the tax code and regulations, he added. But the United States also needs to invest in better roads, bridges, ports and other infrastructure.

Preparing students

What's missing from the policy debate, though, is talk of investing more in education. And that's a problem, since American workers aren't prepared for the jobs currently available, let alone the jobs of the future.

"We've literally got hundreds of thousands of jobs right now in manufacturing in the United States that remain unfilled because we don't have folks with the right skill set or the right technology background," Timmons said.

Manufacturers would like to see more investment in education, but they aren't waiting for lawmakers to wake up to the problem. They are explaining to high schools, community colleges and universities what kind of workers they need, Timmons said.

"Yes, the government has a role in providing training dollars, block grants and those types of things, but ultimately, manufacturers have a role themselves to make sure we are building the programs locally to address the need," he added.

The National Association of Manufacturers will launch their State of Manufacturing Tour on Wednesday at a \$70 million Emerson plant in Round Rock. The plant develops automation processes for oil and gas companies. The tour will then go to Austin to visit the General Motors IT Innovation Center and the Helm Boots factory.

Hopefully, lawmakers across the country will pay attention to what American manufacturers say they need, rather than simply responding to voter anger.

What businesses need

For example, many American plants purchase parts and inputs from overseas factories, and a border tax adjustment could make those parts more expensive. As Texas lawmakers consider cutting billions from education, they should recognize that employers need students with more education, not less.

How the Republicans in control of Washington and Austin translate political slogans into policies that actually achieve the intended consequences will not be easy. But they should start by listening to what businesses say they need, not what may sound good in a fundraising letter.

Why It's Not Too Late to Build Your Own Industrial Internet Platform

Why It's Not Too Late to Build Your Own Industrial Internet Platform

IndustryWeek

By: Michael Brady, Ned Calder, & Joe Sinfield

2/8/2017

Over the past three years, the emergence of the Industrial Internet of Things (IIoT) has led to an outpouring of technological cooperation, as more than 350 firms have joined various consortia to hammer out standards around open digital platforms. Yet this leaves industrial companies in an uncertain competitive position in terms of creating and capturing value for themselves. With the industrial internet accounting for nearly \$800 billion in commerce last year and growing to a multi-trillion dollar opportunity over the next decade, companies don't just need to cooperate: they need to focus on forging a digital platform strategy that generates growth.

Indeed, while these digital networks are meant to be "open," there is also great advantage in being the provider of the platform. The Industrial Internet Consortium, for instance, counts Bosch, GE, Intel, IBM, SAP, and Schneider Electric among founding members working to assure that different equipment can share data for energy, health care, manufacturing, transportation, and smart cities applications. While the rise of Industrial Internet platforms does not mean every company must build one, every company must have a strategy for how to remain relevant to their customers.

For a prime example of a company doing both, we need to look no further than General Electric, whose turbines generate 300 data points per second (see image). If GE increases fuel efficiency 1% in its jet engines by analyzing data from embedded sensors, airline industry profits could increase by \$3 billion.

At the same time it is providing those kinds of benefits for those who plug into its Predix operating system, GE's digital industrial business generated about \$7 billion in revenue last year and is on track to reach \$15 billion by 2020. That is good for GE, but the question for other firms is clear: is there still an opportunity to build your own digital platform, even on a smaller scale, or is the best strategy to simply plug your equipment in and cooperate?

What is your digital platform strategy?

The challenge for companies that want to capture new value is that industrial applications often exist in a 'systems of systems.' That is, there are many systems and subsystems from different manufacturers that need to work together. This requires coordination. 'Platforms' are a type of solution that enables different systems and stakeholders to coordinate all the various inputs and outputs—and to provide developers the ability to build vertical software applications that are used by end users.

As the central clearinghouse, the company that owns and manages the platform is well positioned to capture a significant portion of the value. Dozens of companies have launched IoT platforms targeting industrial applications, with analysts expecting this new capability to add \$14.2 trillion to cumulative global GDP by 2030. According to Forrester Research, 60% of decision-makers at global enterprises are using or planning to use IoT-enabled applications over the next two years." Gartner has suggested that two thirds of industrial enterprises will be doing so with an IIoT Platform by 2020.

We suggest that there are two types of Industrial Internet systems: broad platforms like GE's and niche platforms

that serve specific industries or applications. To determine where you are best able to play, it helps to begin with a common understanding: First, building an IIoT platform is not cheap. It requires a significant and sustained investment to build infrastructure to develop capabilities required to sustain the platform, and to fund customer acquisition activities. Second, building an IIoT platform is very different from making, say, a jet engine. Industrials considering playing in these new areas will need new strategies, business models, and organizational structures to succeed. IIoT platforms have the potential to widen a company's competitive landscape while also provide a source of future growth.

To achieve the optimal IIoT platform strategy we believe it is fruitful to study the recent history of platforms, which yield these five lessons:

Lesson #1: Outside hires and agile development cycles are required to deliver constant iteration.

Most industrial businesses have long development cycles that require focused development activities with incremental changes spanning years and sometimes decades. Like most digital opportunities, IIoT platforms entail dramatically shorter, faster development cycles. Whether you're considering a broad or a niche platform, many industrial companies will need to fundamentally revisit their internal development process and talent base.

Here we can learn from the cloud computing space, where competitors seek differentiation by constantly adding new features. Recently, Google Cloud has added artificial intelligence and data analysis. The IBM Cloud has focused on tailoring vertical solutions for different markets. Amazon Web Services added 1,000 distinct features in 2016. In all these cases, agile development is core to those cultures.

Constant iteration is necessary for several reasons including staying competitive, increasing revenue from existing customers, and creating features targeted at niches. For example, AWS targeted government customers by adding Criminal Justice Information Services compliance and by launching a "GovCloud" with security for government use.

Most industrials presently lack the ability to ship hundreds of features per year, so this means a new agile software capability must be built. Agile development is an iterative approach to building software that accelerates the delivery of finished projects. Many industrial companies, including John Deere, have moved their existing software groups to an agile workflow and seen delivery timelines drop by 92%. In addition to agile many industrial companies are pursuing what is known as bimodal IT. According to Gartner, bimodal refers to the practice of managing two separate IT work styles. One group is focused on predictable, well understood legacy products. While a second group explores new problems in a fast-moving, assumption driven manner.

Strategic acquisitions are one way to rapidly build an agile software capability. Bosch used a technology acquisition to form its Intelligent Solutions Group which has since developed an IIoT platform.

But for most industrials, achieving agile development or bimodal IT to build a viable IIoT platform requires consistent hiring of outside talent. GE CEO Jeffrey Immelt has said that GE never made progress in digital "until we brought people in from outside." Despite employing over 10,000 software developers, GE still chose to initially staff its software center of excellence with 98% outside hires. To attract talent, GE has located offices near software hubs, which included moving its headquarters from Connecticut to Boston. In doing so, GE also changed compensation packages and launched advertising campaigns focused on the potential impact GE's work can have.

Lesson #2: Leveraging B2B relationships are essential for incumbents to gain a fast foothold.

When discussing market entry strategies, many players focus on technology development strategies and ignore the human side of IoT. Incumbents with customer relationships have multiple advantages that new entrants will lack in this regard. First, existing relationships provide a source of first mover advantage and serve as potential platform validators. GE has relied on existing customers to serve as validation stories for its Predix platform. Second, customer trust built over time will help incumbents address customer's top concerns around security and compliance.

The same lesson is reinforced in the cloud computing environment. More than a decade into the cloud revolution, many large enterprises are still in the early stages of adopting a cloud computing platform. But the transition is quickening; a 2015 study found that 77% of companies primarily used traditional on premise data centers for at least one workload, but that by 2018 the percentage will drop to 43%. The shift is being driven by cost savings, decreased time to market, and the quality of cloud systems. This lag has provides incumbents that can leverage a sense of trust to address concerns around security and compliance with an opportunity to catch up to early entrants.

That's because a minimum viable platform needs a significant customer base to be financially sustainable. For example, Johnson Controls shuttered its Panoptix platform after failing to attract enough interest to justify development costs. Thus, IIoT platform operators should focus on attracting customers, knowing that the lifetime value will be high. Google recently used incentives to help provide capacity to host the Spotify music service and even Apple's own iCloud platform. Customer acquisition in the early stages of the industry lifecycle is crucial for the platform to gain critical mass in the long term.

Lesson #3: Niche platforms can differentiate by focusing on critical customer-job-circumstance combinations

Even if your organization can't sustain the investment and operational speed that is required to grow a broad-based IIoT platform, smaller companies can win by focusing on narrower customer jobs, or problems that crop up in specific circumstances. This requires a more targeted feature set, which are not sufficiently addressed by the broad IIoT platforms.

A good way to start is with a simple mapping of jobs, or needs, addressable by IIoT versus the circumstances that specific customers may encounter. This map can allow you to understand where general platforms compete and highlight opportunities where your unique capabilities and knowledge can provide an advantage.

SKF Group, the Sweden-based leader in the ball bearing systems industry, has developed IIoT solutions designed to increase the performance of its products. SKF Insight provides real time updates to customers alerting them to when conditions such as temperature or lubrication levels may cause a system to fail. SKF Insight is able to provide this service by collecting data generated by tiny sensors embedded in bearings that are powered by kinetic energy generated by the motion of the bearings. Preventing bearing failures is an important job many SKF customers have. Replacing the main bearing on a wind turbine is so costly that doing so can undermine the business case for building the turbine.

Companies have also found success partnering with established IIoT platforms. Pitney Bowes, a leader in the mailing equipment industry, has been forced by a long-term decline in mail volume to transform itself. To fortify its legacy mailing equipment business the company has partnered with GE's IIoT platform, Predix, to develop a suite of software tools for its equipment. These tools are available to customers as a paid subscription. Seeking new growth, the company has leveraged its experience in the mailing industry to simplify the international shipping process for retailers. Pitney Bowes has pursued a conservative IIoT strategy for its legacy business while pursuing new growth opportunities enabled by digital.

In creating nice platforms and partnering, SKF and Pitney have both been successful decreasing downtime—a priority job for many industrial customers.

Lesson #4: Platform operators should build core features and when possible allow partners to provide supporting features.

Regardless of the scope of an industrial IIoT platform, industrial companies should look to partners to provide basic IIoT platform functionality. For example, Apple famously built Apple Maps because of the increasing importance of mapping to mobile platforms. Mapping was becoming a differentiating feature that Apple risked losing control of unless an internal capability was developed. Yet Apple still partners with third parties to provide weather and stock data for their mobile platform. Weather and stock data are basic features that customers expect but not features upon which they base their purchasing decisions.

Another example can again be seen in the cloud computing industry where basic computing and storage has become a basic feature expected by customers. Prices for these features have fallen over time, partly driven by Moore's law and partly by the willingness of competitors to sell basic computing at prices that allow little margin.

This trend suggests to industrial IIoT platform managers that these features may be best provided through a partner. Digital leaders have already recognized this insight and begun partnering with Microsoft's Azure, AWS, and others to host their IIoT platforms on established cloud computing platforms. Similarly, General Electric recently paired with Microsoft to host Predix on Microsoft's Azure platform. This partnership allows GE to focus resources on building core IIoT features rather than dedicating resources to supporting features.

Lesson #5: Not every company is positioned to build an IIoT platform but every company must develop a strategy to remain relevant.

Few companies are positioned to become broad IIoT platform operators, like GE, IBM or Google. Even smaller, more niche solutions like SKF Insight are not an option for every company.

However, companies that do not pursue IIoT platform strategies must still find ways to remain relevant to customers and to protect against disruption caused by digital.

For instance, Yard Club is a startup seeking to de-link the value construction equipment creates from actually ownership of that equipment. The company allows equipment owners to rent their machines to operators during periods of downtime. Yard Club thus has the potential to significantly reduce the demand for new equipment by increasing the utilization of existing equipment. Rather than ignore this potentially disruptive business model, Caterpillar has invested in the company and has instructed its dealer network to list their rental inventories on the platform. This enables it to add the benefits enabled by another IIoT platform while remaining relevant to its customers.

Second to Caterpillar, in construction equipment sales, Komatsu faces a similar threat. Rather than wait to be disrupted, Komatsu has pursued efforts to create disruptive concepts internally. Komatsu's Smart Construction unit provides a service that semi-autonomously excavates sites. The service combines drones, remote operators, and Komatsu equipment to accomplish a job that previously required ownership of expensive equipment and significant labor. Selling excavation as a service is a significant departure from selling equipment and could eventually reduce Komatsu's traditional equipment sales.

Moving forward with your digital strategy

Leaders must identify where their company is positioned in the industry ecosystem to determine the optimal strategic action. Incumbents do not have to be the first mover but waiting too long will make it difficult for a platform to reach viability. This is seen in the cloud space the top five or six platforms, from Google, IBM, Amazon, and Microsoft together control about 60% of a giant market.

A successful IIoT platform will begin by targeting existing customers with differentiated features created through constant iteration funded with sustained investments. Not every company should build a general-purpose IIoT platform; opportunities exist for niche platforms as well as in adjacent areas. To determine an optimal IIoT platform strategy, leaders should assess their existing data portfolio as well as the priority jobs of their target customers. But it's now becoming vital to settle on your strategy soon, as the cloud platform business shows just how momentum can entrench the strongest digital marketplaces.

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