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The Boeing Debacle: Seven Lessons Every CEO Must Learn

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images.eforbes.com/stevedenning/files/2013/01/Boeing-787.jpg)Brake problems. A fuel leak. A cracked windshield. One electrical fire. Then another. An emergency landing in Japan. A safety investigation imposed by the FAA. Then two premier customers—Japan's two main airlines, ANA and JAL, ground their fleet of Boeing [BA] 787s. Then the FAA grounds all 787s used by the only American carrier. Now other regulators around the world follow suit, grounding all 50 of the 787s delivered so far. The regulatory grounding of an entire fleet is unusual—the first since 1979—and relates to a key to the plane's claimed energy-efficiency: the novel use of lithium ion batteries, which have shown a propensity to overheat and lead to fires—fires that generate oxygen and hence are difficult to put out.

And keep in mind: Boeing's 787 project is already billions of dollars over budget. The delivery schedule has been pushed back at least seven times. The first planes were delivered over three years late. In fact, out of a total of 848 planes sold, only 6 percent have been delivered.

Yet grave as these issues seem, they are merely symptoms of a deeper disease that has been gnawing at the US economy for decades: flawed offshoring decisions by the C-suite. Offshoring is not some menial matter to be left to accountants in the backroom or high-priced consultants armed with

spreadsheets, promising quick profits. It raises mission-critical issues potentially affecting the survival of entire firms, whole industries and ultimately the economy.

Not just Boeing: an economy-wide problem

Thus Boeing is hardly alone in making flawed offshoring decisions. Boeing is just the latest and most spectacular example of an economy-wide problem.

"Many companies that offshored manufacturing didn't really do the math," Harry Moser, an MIT-trained engineer and founder of the Reshoring Initiative (http://www.reshorenow.org) told me. As many as 60 percent of the decisions were based on miscalculations.

As noted by Gary Pisano and Willy Shih in their classic article, "Restoring American Competitiveness (http://hbr.org/hbr-main/resources/pdfs/comm/fmglobal/restoring-american-competitiveness.pdf)" (Harvard Business Review, July-August 2009), offshoring has been devastating whole US industries, stunting innovation, and crippling capacity to compete long-term.

Pisano and Shih write: "The decline of manufacturing in a region sets off a chain reaction. Once manufacturing is outsourced, process-engineering expertise can't be maintained, since it depends on daily interactions with manufacturing. Without process-engineering capabilities, companies find it increasingly difficult to conduct advanced research on next-generation process technologies. Without the ability to develop such new processes, they find they can no longer develop new products. In the long term, then, an economy that lacks an infrastructure for advanced process engineering and manufacturing will lose its ability to innovate."

Pisano and Shih have a frighteningly long list of industries that are "already lost" to the USA, including: compact fluorescent lighting; LCDs for monitors, TVs and handheld devices like mobile phones; electrophoretic displays; lithium ion, lithium polymer and NiMH batteries; advanced rechargeable batteries for hybrid vehicles; crystalline and polycrystalline silicon solar cells, inverters and power semiconductors for solar panels; desktop, notebook and netbook PCs; low-end servers; hard-disk drives; consumer networking gear such as routers, access points, and home set-top boxes; advanced composite used in sporting goods and other consumer gear; advanced ceramics and integrated circuit packaging.

The list of industries "at risk" is even longer and more worrisome.

Now unless Boeing can quickly fix the technical issues afflicting the 787, its entire airline business will also be "at risk". Manufacturing airplanes could even become an addition to the list of industries "already lost."

These issues are a wakeup call not just to Boeing but to every CEO whose firm or whose suppliers have been or will be involved in offshoring. Every CEO must learn seven lessons.

1. Use the right metrics to evaluate offshoring

In analyzing offshoring, firms must get beyond rudimentary cost calculations focused on short-term profit,, such as the cost of labor or the ex-factory cost and incorporate the total cost and risk of extended international supply chains. This is easily done with the help of the Reshoring Initiative, whose website includes an analytical tool enabling companies to calculate the full risks and costs of offshoring. It's called the Total Cost of Ownership Estimator (http://www.reshorenow.org/TCO_Estimator.cfm)[TM]. And the price is right. It doesn't require hiring high-priced consultants: it's free.

The Estimator poses a series of questions. What's the price of the part from each of the destinations? How far is it away? How often are you going to travel to see the supplier? How much intellectual property risk is there? How long do you think you are going to make it? It uses the answers to calculate twenty-five different costs. When they are added up, that's the Total Cost of Ownership.

Most companies have tended to make their sourcing decisions based on the wage rate or the ex-works price or the landed cost, and leave out another twenty cost categories. The Estimator makes it easy for the company to calculate the other twenty costs.

"Often what firms find," says Moser, "is that whereas the offshoring price is perhaps 30 percent less than the US price, all these other costs add up to more than 30 percent. If they are willing to recognize all of them, then they can see that it may be profitable to bring the work back."

"For instance," says Moser, "I took the last 27 cases where users compared China to the US. On average, the US price was 69 percent higher than the production price in China. It turned out that the US total cost of ownership was 4 percent lower. So it made a huge difference to make that calculation. That's an indication that a substantial portion of the work that has been offshored would come back if people would use the right metrics."

2. Review whether earlier outsourcing decisions made sense

Let's back up a bit and note that Boeing's problems have been visible for some time. In August 2011, my article (http://www.forbes.com/sites/stevedenning/2011/08/30/amazonkindle-part-5-is-outsourcing-a-national-security-issue/)drew attention to the perilous offshoring course on which Boeing was embarked.

In December 2012, fellow Forbes contributor Jonathan Salem Baskin wrote (http://www.forbes.com/sites/jonathansalembaskin/2013/01/10/boeing-has-an-airplane-problem-not-a-pr-problem/): "The company was convinced by one or more management consulting firms to outsource design and production of the 787's components. While this idea might make sense for sourcing coffeemakers, it was a nonsense approach to assembling perhaps the most complicated and potentially dangerous machines shy of nuclear reactors. I'm sure blather from Harvard Business Review supported the idea that distances between factories in Seattle (http://www.forbes.com/places/wa/seattle/) and Outer Mongolia were no farther than a VOIP chat, but the reality was a mess. Parts didn't fit together with others. Some suppliers subcontracted work to *their* suppliers and then shrugged at problems with assembly. When one part wasn't available, the next one that depended on it couldn't be attached and the global supply chain all but seized up. Boeing had to spend $1 billion in 2009 to buy one of the worst offenders and bring the work back in-house."

"The grounding — an unusual action for a new plane — focuses on one of the more risky design choices made by Boeing, namely to make extensive use of lithium ion batteries aboard its airplanes for the first time," write Christopher Drew, Jad Mouawad and Matthew Wald in the New York Times (http://www.nytimes.com/2013/01/17/business/faa-orders-grounding-of-us-operated-boeing-787s.html?pagewanted=all): "The 787's problems could jeopardize one of its major features, its ability to fly long distances at a cheaper cost... The maker of the 787's batteries, Japan's GS Yuasa, has declined to comment on the problems so far. "

What was Boeing thinking when they opted to embrace such extensive offshoring? Moser believes the error lay in using the wrong measure of the impact of offshoring on earnings. "Many companies that offshored manufacturing didn't really do the math," Harry Moser, an MIT-trained engineer and founder of the Reshoring Initiative told me. "A study the consulting company, Archstone, showed that **60 percent** of offshoring decisions used only rudimentary cost calculations, maybe just price or labor costs rather than something holistic like total cost. Most of the true risks and cost of offshoring were hidden."

For many companies, it's time to redo the math, and then verify whether they still have the expertise to bring manufacturing back.

3. Don't outsource mission-critical components

"Boeing has acknowledged, says Moser, "that its biggest problem was in outsourcing not only manufacturing but also a lot of the engineering. There were multiple tiers of outsourced companies who were supposed to be making their designs consistent so that the parts fit together. And they didn't fit together. If Boeing had taken full responsibility for the engineering and then had jobbed the parts out and gotten them made to print, their problems would

have been a lot less severe. It seems like they had this brilliant idea of outsourcing a lot of engineering with the manufacturing. There's almost nothing as complicated as a Dreamliner.

"For example, an iPhone isn't nearly as complicated. The downside risk isn't as great. Apple has succeeded with outsourcing almost everything to Foxconn, mainly because they first completely manufacture the new product in the US. They make sure it's right, while Foxconn is working in parallel with them, developing their tooling and whatever. So Apple has a finished product and they say to Foxconn: make it just like this! What Apple has done has worked amazingly well, because they have the capability to do the perfect prototype here, before it gets offshored to Foxconn. Most companies don't have that.

"Thus Boeing didn't have a finished product. So there were all kinds of risks of things not coming together. The tendency is too often for companies to try to do the engineering over here and the manufacturing over there. Eventually the innovation declines and the risk increases, as outlined by Pisano and Shih."

4. Bring some manufacturing back

Moser estimates that when the total costs are included, around **25 percent** of manufacturing that is currently outsourced could be profitably brought home, if the manufacturing expertise still exists. Looking ahead, changes in relative economics are likely to increase that percentage.

It is important to take into account rapid changes in relative costs. Oil prices are three times what they were in 2000. Natural gas in the US is a quarter of what it is in Asia. Chinese wages are five times what they were in 2000 and are expected to keep rising rapidly. And in any event labor is a steadily decreasing percentage of the cost of manufacturing.

Reshoring is already happening to a limited extent. Apple [AAPL] announced recently that it will resume manufacturing of one of the existing Mac lines in the US next year. GE [GE] is spending some $800 million to re-establish manufacturing in its giant facility—until recently, almost defunct—at Appliance Park, in Louisville, Kentucky. Whirlpool [WHR] is bringing mixer-making back from China to Ohio. Otis is bringing elevator production back from Mexico to South Carolina. And Wham-O Toys is bringing Frisbee-molding back from China to California. Based on the reshoring articles in the ReshoreNow Library (http://www.reshorenow.org/resources/library.cfm), Moser calculates that at least 50,000 manufacturing jobs have recently been reshored in the last three years.

Where companies see that it could be profitable to bring manufacturing back, they will need to ensure that they either have or can rebuild the necessary expertise—sometimes a daunting challenge.

5. Adequately assess the risk factors of offshoring

In Boeing's case, as Jonathan Salem Baskin notes: "It didn't help that the outsourcing plan included skipping the detailed blueprints the company would have normally prepared, and allowing vendors to come up with their own. Delivered components arrived with instructions and notes written in Chinese, Italian, and other languages. Oh, and they decided to build the airplane out of plastic along with other novel materials and technologies, so it would have been a big experiment even if Boeing approached manufacturing like it always had."

Clearly firms have underestimated the risk of having extended international supply chains. I asked Moser whether Total Cost of Ownership Estimator can help firms get a better handle on that risk.

"The TCO Estimator assigns no factor values apart from freight," says Moser. "The user assigns all the factors. The user answers questions about the delivery time, and the price. That enables the Estimator's algorithm to assess the inventory and the inventory carrying costs. There's a section on opportunity cost. If the firm will lose orders because it can't deliver, then put a value on that. There are sections on natural disaster risk and political risk. "

If Boeing had been using this earlier what would be the implications? If they underestimated the delay risk or the technical risk as low, the Estimator would have reflected the underestimation of the risk.

"The Estimator would have encouraged them to try to estimate each of the risks," says Moser. "When you have twenty-five of them, you only have to put in 1 percent in each to balance the savings you might get from going offshore.

"If you are buying pencils, not much intellectual property risk; if you can't get it from this source, you can get it from somewhere else. The margins aren't big, so you don't lose so much. You don't have much image to lose. But when you are making airplanes, there's a lot of risk. Instead of having one size fit all, the Estimator lets you adapt for each product, each market, and make a more holistic and informed decision.

"The Reshoring Initiative site also offers resources. Library contains articles about transportation industry and equipment, and firms can understand where production was reshored and why. They might conclude: 'Looks like a lot of companies are having problems with these things. Maybe we should increase our risk levels?'

"The Initiative also has information on what other users have found on the distribution of average costs. If they look at that, they might realize that some costs and risks have been underestimated. So the Estimator can help them make better decisions."

6. Adequately value the role of innovation

Much of the offshoring that has taken place has assumed that the outsourced items are "little do-hickeys" with low value and so didn't really matter much in the overall scheme of things. The little do-hickeys are worth pennies or less and have next-to-no margin. While those "little do-hickeys" might seem cheap in themselves, the lessons to be learned in improving their manufacture in the end can turn out to be highly valuable. (In cost accounting and economics, which usually don't explicitly value knowledge, this loss is invisible and so doesn't get taken into account.)

Firms often haven't thought through how often they are going to redesign this product. "If it's a bracket and you're not going to redesign it for 30 years, it doesn't matter very much," says Moser. These days however there are very few components that are good for another thirty years. "If it is something that you are updating every six months or every year, then that becomes a lot more important. It's the difference between a commodity and something that's design-driven. The result of answering those questions is an 'innovation cost of being at a distance.' The Reshoring Initiative has resources so that firms can develop the understanding to make better decisions."

The opportunity cost of lost innovation can be significant. Thus when GE decided to bring manufacturing of its innovative GeoSpring water heater back from the "cheap" Chinese factory to the "expensive" Kentucky factory, the cost of production went down. "The material cost went down. The labor required to make it went down. The quality went up. Even the energy efficiency went up. GE wasn't just able to hold the retail sticker to the 'China price.' It beat that price by nearly 20 percent. The China-made GeoSpring retailed for $1,599. The Louisville-made GeoSpring retails for $1,299.

GE's water heater as originally designed for manufacture in China had a tangle of copper tubing that was difficult to weld together. In the past, GE had been shipping the design to China and telling them to "make it". Confronted with making the water heater themselves, they discovered that "in terms of manufacturability, it was terrible." So GE's designers got together with the welders and redesigned the heater so that it was easier and cheaper to make. They eliminated the tangle of tubing that couldn't be easily welded. By having those workers right at the table with the designers, the work hours necessary to assemble the water heater went from 10 hours in China to two hours in Louisville.

"For years," Charles Fishman writes in a great article in The Atlantic (http://www.theatlantic.com/magazine/archive/2012/12/the-insourcing-boom/309166/), "too many American companies have treated the actual manufacturing of their products as incidental—a generic, interchangeable, relatively low-value part of their business. If you spec'd the item closely enough—if you created a good design, and your drawings had precision; if you hired a cheap factory and inspected for quality—who cared what language the

factory workers spoke? ... It was like writing a cookbook without ever cooking.... there is an inherent understanding that moves out when you move the manufacturing out. And you never get it back."

What is only now dawning on the smart American companies, Lou Lenzi, head of design for GE appliances says, is that when you outsource the making of the products, "your whole business goes with the outsourcing."

7. Get to the root of the problem: maximizing shareholder value

While several decades of outsourcing were under way, why didn't these smart managers think about the importance of innovating and protecting intellectual property? Why didn't these well-educated managers realize that it was important to have designers, engineers, and assembly-line workers talk to each other? Why didn't these MBA graduates realize that outsourcing might be mortgaging the future of their firms?

"There was a herd mentality to the offshoring," John Shook, the CEO of the Lean Enterprise Institute, in Cambridge, Massachusetts. "And there was some bullshit. But it was also the inability to see the total costs—the engineers in the U.S. and factory managers in China who can't talk to each other; the management hours and money flying to Asia to find out why the quality they wanted wasn't being delivered. The cost of all that is huge."

When managers manage with a spreadsheet rather than real-world knowledge about what is actually going on in the factory and what were its possibilities, they overlook hidden costs of the erosion of skills, the loss of quality and constraints on innovation. They also missed the potential added value to customers that could be generated by designing and manufacturing things differently. They also missed the costs and risks of an international supply chain, which is increasingly out of step with the shorter, faster product cycles.

Why did all these smart, highly educated people make all these mistakes? The root cause of these errors is a focus on the dumbest idea in the world: maximizing shareholder value. Focusing on short-term shareholder value ended up destroying vast quantities of long-term shareholder value.

A focus on maximizing shareholder value leads the firm to do things that detract from maximizing long-term shareholder value, such as offshoring, favoring cost-cutting over innovation, and pursuit of "corner cutting" and "bad profits" that destroy brand equity. The net result can be seen in the disastrously declining ROA and ROIC over the last four decades in large US firms as documented by Deloitte's Shift Index.

The errors of offshoring are thus not isolated events. They are the result of the underlying philosophy of shareholder value, rather than the true purpose of every firm: create value for customers. The resurrection of American manufacturing will require more than simply bringing back production to America. Global manufacturing is at the cusp of a massive transformation as

the new economics of energy and labor plays out and a set of new technologies —robotics, artificial intelligence, 3D printing, and nanotechnology—are advancing rapidly. Together these developments will spark a radical transformation of manufacturing around the world over the next decade. The winners in the rapidly changing world of manufacturing will be those firms that have mastered the agility needed to generate rapid and continuous customer-based innovation.

Success in this new world of manufacturing will require a radically different kind of management from the hierarchical bureaucracy focused on shareholder value that is now prevalent. It will require a different goal (adding value for customers), a different role for managers (enabling self-organizing teams), a different way of coordinating work (dynamic linking), different values (continuous improvement and radical transparency) and different communications (horizontal conversations). Merely shifting the locus of production is not enough. Companies need systemic change—a new management paradigm.

Pursuit of maximizing shareholder value at Boeing led to offshoring that has caused massive damage to shareholder value. The eventual scale of the damage can only be guessed at today. The remedy lies not in pointing fingers at Boeing's management, but rather in treating the economy-wide disease that caused the problem.

Read Part 2: What went wrong at Boeing (http://www.forbes.com/sites/stevedenning/2013/01/21/what-went-wrong-at-boeing/)

And read also:

- Why Amazon Can't Make A Kindle In The USA (http://www.forbes.com/sites/stevedenning/2011/08/17/why-amazon-cant-make-a-kindle-in-the-usa/)
- Dont's Diss The Paradigm Shift In Management (http://www.forbes.com/sites/stevedenning/2012/10/31/dont-diss-the-paradigm-shift-in-management/)
- How Manufacturing Can Learn from Software To Become Agile (http://www.forbes.com/sites/stevedenning/2012/09/24/how-manufacturing-can-learn-from-software-to-become-agile/)
- The dumbest idea in the world: maximizing shareholder value (http://www.forbes.com/sites/stevedenning/2011/11/28/maximizing-shareholder-value-the-dumbest-idea-in-the-world/)
- The five big surprises of radical management (http://blogs.forbes.com/stevedenning/2011/07/08/the-five-big-surprises-of-radical-management/)

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Steve Denning (http://blogs.forbes.com/stevedenning/)'s most recent book is: The Leader's Guide to Radical Management (http://www.amazon.com/gp/product/0470548681/ref=as_li_ss_tl?ie=UTF8&tag=stevdenndotco-20&linkCode=as2&camp=1789&creative=390957&creativeASIN=0470548681) (Jossey-Bass, 2010).

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