



## The R&D elite of the market: The CNBC RQ 50

CNBC.com staff | @CNBC Wednesday, 6 Aug 2014

The CNBC RQ 50 is a new ranking of the most innovative companies in the market. From old-guard sectors, including industrials, oil and gas and defence to toy makers and some of Silicon Valley's elite, the R&D cultures within the RQ 50 companies prove that **innovation isn't just about spending big**, it's about a relentless long-term focus on R&D that optimizes return on innovation to shareholders. [Read more about the RQ 50 methodology](#), created by Anne Marie Knott, professor of strategy at Washington University in St. Louis.

Rank	Name	2013 R&D Expense (\$M)	% of Rev. spent on R&D	Projected Rev. Increase (\$M)*
1	<b>McKesson</b>	456.0	0.33%	3,801.4
2	<b>Medicines</b>	146.9	21.36%	18.2
3	<b>USEC</b>	186.1	14.23%	33.6
4	<b>Amazon.com</b>	6,565.0	8.82%	1,718.0
5	<b>Silicon Laboratories</b>	157.8	27.20%	11.7
6	<b>Salix Pharmaceuticals</b>	150.0	16.06%	18.7
7	<b>Advanced Micro Devices</b>	1,201.0	22.66%	104.9
8	<b>SanDisk</b>	742.3	12.03%	121.1
9	<b>Informatica</b>	165.9	17.49%	17.6
10	<b>Arris Group</b>	425.8	11.72%	66.8
11	<b>PMC-Sierra</b>	211.0	41.54%	9.2
12	<b>Cubist Pharmaceuticals</b>	513.0	48.66%	19.2
13	<b>Synaptics</b>	144.7	21.81%	12.0



Rank	Name	2013 R&D Expense (\$M)	% of Rev. spent on R&D	Projected Rev. Increase (\$M)*
14	<b>NewMarket</b>	136.6	5.99%	40.1
15	<b>Merck &amp; Co</b>	7,503.0	17.04%	762.1
16	<b>Lam Research</b>	683.7	19.00%	59.4
17	<b>Activision Blizzard</b>	584.0	12.74%	75.3
18	<b>First Solar</b>	134.3	4.06%	54.3
19	<b>Rovi</b>	112.8	20.96%	8.7
20	<b>TiVo</b>	106.9	26.32%	6.4
21	<b>Harmonic</b>	99.9	21.63%	7.3
22	<b>OshKosh</b>	112.9	1.47%	119.6
23	<b>Xerox</b>	479.0	2.23%	329.8
24	<b>Northrop Grumman</b>	507.0	2.06%	378.7
25	<b>Riverbed Technology</b>	189.7	18.22%	15.8
26	<b>Aruba Networks</b>	139.7	23.29%	8.9
27	<b>Intuitive Surgical</b>	167.7	7.40%	33.7
28	<b>F5 Networks</b>	209.6	14.15%	22
29	<b>Dolby Laboratories</b>	168.7	18.55%	13.5
30	<b>Hasbro</b>	207.6	5.09%	58.4
31	<b>Spansion</b>	126.8	13.05%	13.8
32	<b>ConocoPhillips</b>	258.0	0.47%	771.6
33	<b>Forest Laboratories**</b>	788.3	21.61%	51.7
34	<b>Ciena</b>	383.4	18.41%	29.1
35	<b>Xilinx</b>	492.4	20.67%	33.2
36	<b>Exxon Mobil</b>	1,044.0	0.27%	5,395.8
37	<b>Hewlett-Packard</b>	3,135.0	2.79%	1,542.9
38	<b>B/E Aerospace</b>	220.9	6.34%	47.4
39	<b>VeriFone Systems</b>	173.3	10.15%	23.2
40	<b>ResMed</b>	120.1	7.93%	20.5
41	<b>Google</b>	7,952.0	13.29%	800.3
42	<b>Salesforce.com</b>	623.8	15.32%	54.2
43	<b>Exelixis</b>	178.8	570.44%	0.4



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Rank	Name	2013 R&D Expense (\$M)	% of Rev. spent on R&D	Projected Rev. Increase (\$M)*
44	<b>Altera</b>	385.2	22.23%	22.7
45	<b>Netflix</b>	378.8	8.66%	57.1
46	<b>Microsemi</b>	170.6	17.48%	12.7
47	<b>Bristol-Myers Squibb</b>	3,731.0	22.77%	212.6
48	<b>QLogic</b>	147.0	31.90%	6.0
49	<b>Dow Chemical</b>	1,747.0	3.06%	740.1
50	<b>Polaris Industries</b>	139.2	3.69%	48.7

\* from a 10% Increase in R&D Spending

\*\*Forest Labs acquired by Actavis July 1, 2014

The CNBC RQ 50 is a unique list of publicly traded companies that derive the greatest shareholder value from their research and development spending (at a minimum of \$100M annually), created in partnership with Washington University in St. Louis professor Anne Marie Knott, inventor of the Research Quotient (RQ). The RQ is calculated based on Professor Knott's proprietary formula and is designed to help investors know what a company can expect to gain in revenue from an increase in R&D investment.

## The R&D Hall of Fame: Which companies got elected?

When it comes to corporations that excel in research and development productivity, a consistent philosophy is a big part of the formula for success. The **just-unveiled 2014 CNBC RQ 50** is a new annual list that identifies the market's smartest R&D spenders—those companies that don't just spend big on research and development but spend in a way that maximizes the potential return on innovation to shareholders.

The data for the RQ 50 actually goes back 25 years, and this history has allowed CNBC to supplement the 2014 RQ 50 with a deep dive into recent R&D history, using the RQ 50 data to elect an R&D Hall of Fame. It's not an easy list to make: Only 10 of this year's 50 made the Hall of Fame. Changes in senior leadership of companies and booms and busts in business cycles can cause a firm to lose its R&D focus. There are also few **firms that have enough scale to constantly stay ahead of the curve** in R&D productivity.



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Of the 280 unique companies in the RQ 50 over the past 25 years, there are 106 that appear in five years or more; 150 are on the list for three years or less. There are only 28 companies that appear in the RQ 50 for 10 or more years—the R&D Hall of Fame. Here they are:

### The Research Quotient All-Stars

Here are the 28 companies with high RQ scores for at least 10 of the last 25 years. Click on a company to see how well its R&D spending has paid off. Hover over a company for more details. (SOURCE: amkAnalytics)



<http://www.tableausoftware.com/public/>



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# R&D all-stars every value investor needs to know about

Lori Ioannou | @Loriloannou1

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For value investors, finding a predictive tool that can help locate stocks that offer long-term opportunity based on their proprietary growth strategy is sacrosanct. That's because few exist.

Recognizing the problem, CNBC partnered with Washington University in St. Louis business school professor Anne Marie Knott, who specializes in innovation, to develop a list of publicly-held U.S. companies investing \$100 million or more in R&D. We then ranked their research quotient (RQ): the measure of R&D productivity that links R&D spending to corporate revenue growth and market value. Companies are ranked based on ability to increase revenue from R&D, not the absolute dollar value of projected revenue increase.

**The R&D All-Stars: CNBC RQ 50** is the first of its kind. It calculates the percentage increase in revenues associated with a 1 percent increase in R&D.



YanLev | iStock / 360 | Getty Images

**What the list reveals is that spending more on R&D does not necessarily generate higher returns. This allows investors to identify firms that fall below other innovation measures' radar. This is why an RQ portfolio consistently outperforms the market. In addition, RQ allows investors to anticipate the impact of increased R&D on future stock price.**



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To develop the **2014 R&D All-Stars: CNBC RQ 50**, we combined the 2013 fiscal year financial data—including revenues, property, plant and equipment, advertising budgets and R&D investments—for all 5,998 public U.S. companies for the last eight years (2006 through 2013). To find R&D leaders, we winnowed our universe to companies that were not acquired or divested, and those that did not outsource this function during this period. Then we ranked the remaining firms in descending order of RQ to come up with the top 50.

The **companies on the list represent a wide swath of the U.S. economy. The industry sector with the highest RQ is electronics (20 percent); followed by computer software/services and pharmaceuticals (both 14 percent); computer storage (10 percent); medical instruments and communication equipment (both 6 percent); petroleum and industrial chemicals (both 4 percent); and others (22 percent).**

There are key differences to RQ over other measures of innovation.

- First, it's transparent—you can estimate it yourself if you have the full set of firms' financial data.
- Second, it's universal, and you can construct it for any firm doing R&D (whereas you can't count patents for the 50 percent of firms who don't patent their R&D).
- Third, it's uniform—since it's unitless (essentially a ratio of revenues/R&D), you can compare firms regardless of the type of R&D they do (many of the RQ 50 firms are overlooked by other innovation rankings because they do process R&D—which isn't as visible as product R&D).

According to Knott, who has been tracking RQ using data going back 40 years, there are a few common traits among companies with high RQ share.

"Most are strategic and put innovation front and center in their organizations," said Knott, who is a professor of strategy at the Olin Business School at Washington University. "These firms tend to have centralized R&D, and they fund it consistently," she noted.



Just as important, they are ahead of technology trends and are able to anticipate market shifts to exploit niche opportunities. Since they tend to have large market shares, they have pricing power in the market, so they can often diffuse innovations at a lower cost than rivals, Knott said.

The findings lend additional evidence that **R&D's role as an engine of growth is as important as ever. And it creates great value for shareholders that few can ignore.**

—By Lori Ioannou, senior editor, CNBC.com

## Boring stocks that generate R&D heat—and profits

[David Spiegel](#) | [@dwspiegel](#)

Wednesday, 6 Aug 2014

"Innovate or die" may be a Silicon Valley mantra, but it's one that many companies in more traditional industries have embraced. In fact, if you're going to risk your investing money making bets on the value of innovation, you might do well by looking away from Silicon Valley.

Last year computing and software companies together accounted for one-third of all R&D spending, according to The Global Innovation 1000 Study from Booz & Co. However, simply adding up the R&D dollars and ranking companies based on who spent the most won't identify nearly all the companies adding steadily to shareholder wealth through innovation.

That's the message in the first-ever [CNBC RQ 50 ranking](#), a list of the market's smartest—not biggest—R&D spenders. Looking past Silicon Valley buzz can help investors locate the "boring edge" of innovation, where shareholder wealth is being created by companies such as Oshkosh, Dow Chemical and Xerox.



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Jason Cohn | Reuters

Oshkosh Corporation chief engineer for Unmanned Systems, demonstrates a remote steering device for the TerraMax autonomous vehicle on a test course outside of Pittsburgh, Pennsylvania.

**"RQ is NOT about spending. It's about productivity of that spending,"** said Anne Marie Knott, professor of strategy at Washington University in St. Louis and creator of the Research Quotient (RQ) model for measuring optimal R&D.

This year [Oshkosh](#) had a higher RQ ([a measure of R&D productivity that links R&D spending to corporate revenue growth and market value](#)) than Silicon Valley darlings like [Google](#) and [Netflix](#).

How did Oshkosh do it? A good place to begin answering this question is with a fire hydrant.

"A hose that fits a hydrant in Phoenix will not fit a hydrant in New York City," said Gary Schmiedel, executive vice president of technology at Oshkosh, the market leader in fire truck manufacturing. "It's not exactly high tech, but from a practical standpoint, you have to deal with all those things."

The average buyer of a fire truck has about 20,000 options to consider, according to Oshkosh. There are decisions to be made about suspension, ladder height, color and water pumping.



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Product challenges with many variables require innovation, but the products don't need to be sexy to require advanced R&D thinking. At [Dow Chemical](#), a product as ordinary as exterior house paint is a global innovation challenge. When designing a new paint, Dow needs to take into account the materials that are most commonly used for home exteriors across the regions of the U.S., and the fact that in Saudi Arabia the sand will erode paint, and that in India it pours for months every year.

"How can one project attack all of those problems?" said A.N. Sreeram, vice president of research and development at Dow.

Not just dealing with but also constantly improving and rethinking all of the variables has made Oshkosh a hotbed for innovation. One of the company's most popular fire truck innovations is Side-Roll Protection: a system of electronic sensors, automatic-tighten seatbelts and side-curtain air bags developed, in part, as a response to a troubling number of firefighter deaths en route to the scene of a fire (since 2004, 62 firefighters have been killed while driving or operating their vehicles, according to the U.S. Fire Administration).

You may not expect to hear it from Oshkosh, but Schmiedel said, "If we don't innovate, we die."

## The customer comes before Wall Street

Companies like Oshkosh, Dow and Xerox don't like to use the term R&D spending.

"The value investors and day traders see R&D as an expense, so we target the long-term growth investors and tell the growth story," Sreeram said.

At Xerox, now 75 years old and the epitome of old tech, R&D is an investment. That distinction has allowed Xerox to transform itself into a provider of business services as the need for its eponymous machines faded and the world becomes ever-more paperless.





Source: Xerox  
Xerox's Impika Inkjet Innovation Centre in Aubagne, France

**"As a company we have successfully surfed the wave of transition in our market and not been swept away from it by trying just to keep selling ink and toner."** - Sophie Vandebroek, Xerox chief technology officer

**Xerox** puts about 15 percent of its R&D investment toward unknown outcomes, with the understanding that a failed effort will pay off in other ways.

The approach is a reflection of the fact that when it comes to R&D, the customer—not Wall Street and investors—comes first, but in the end, earnings will grow as a result of the efforts. Sreeram said, "We don't go to Wall Street taking the approach, 'Here is what R&D is doing for you.'

**On average, our customers realize the value of R&D faster than someone on Wall Street."**

Most Xerox R&D investment decisions begin by asking customers what they want or what they dream up. "If you just give them what they want," Vanderbroek said, paraphrasing a quote often attributed to Henry Ford, "all they'd ask for is a faster horse."



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One path to innovation started nearly three decades ago, when Xerox began looking at how to help its customers process the information on the documents they were printing and copying. The company invested in automated natural language processing, developing software that could understand unstructured information in official documents. The resulting technology is now at the core of high-margin services for Xerox, including everything from health-care claims processing to license plate identification in highway HOV lanes.

Every new Dow product is tracked for five years to see how its EBITDA compares with older product lines, and company-wide new products resulting from R&D have a 1,000-basis-point edge over older Dow lines.

"If I invest a chunk of [R&D] dollars in a given technology approach, I want to have three, four or five different market opportunities," Schmiedel said. For example, Oshkosh first introduced independent suspension technology in a very small segment of its fire-rescue business, but soon defense and municipal customers expressed a need for the same technology, and the product was expanded.

## **Faster, better R&D**

Since joining Dow in 2006 from [DuPont](#) Electronic Technologies—the first senior R&D leader brought in from the outside by the 117-year-old company—Sreeram has brought in roughly 100 new scientists annually and introduced new technology that lowers the cost of individual R&D experiments. Dow had a large R&D staff in many businesses and departments, with 100 PhDs—90 to 95 of them organic chemists, Sreeram said. Nine out of 10 efforts failed. "We wanted to improve the probability of success," he said.

Dow kept the 100 scientists but diversified the mix to include more chemical engineers, material scientists and statisticians, in addition to having robots carry out experiments, to improve success rates and speed up the pace of discovery. Since the transformation of Dow's R&D philosophy, Sreeram said Dow is succeeding with 3 out of 4 rather than 1 out of 10 R&D efforts, and more rapidly.

At Oshkosh, the discovery process is surprisingly fast. New technologies tend to spend just one to two years in development at Oshkosh, and the promise of guaranteed demand can make that even shorter. For example, a mine-resistant ambush-protected vehicle commissioned by the U.S. Defense Department went from



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concept to delivery in 11 months. Oshkosh's Side-Roll Protection system was taken from initial concept to marketability in less than two years. The key, Schmiedel said, was a "very clear definition of what success looks like."

**Even for companies on the boring edge of innovation, there's nothing wrong with having a couple of moonshots in the pipeline.** Oshkosh has been developing autonomous vehicles, responding to the Defense Department's expressed desire to put fewer soldiers in harm's way, by using supply convoys that drive themselves.

—By CNBC's David Spiegel

## End this corporate tax giveaway: R&D incentives

Anne Marie Knott, professor of strategy, Washington University Olin School of Business  
Friday, 8 Aug 2014 | 8:00 AM ETCNBC.com

One of the bills before Congress this year makes R&D tax credits permanent at an estimated cost of \$156 billion over the next decade. R&D tax credits were originally implemented as part of the Economic Recovery Tax Act (ERTA) of 1981 to reverse the dramatic decline in R&D that began in 1964. The twin goals were reviving economic growth and bolstering U.S. competitiveness against the rising threat from Japanese manufacturing.

They haven't delivered on their goal, and in an era of hotly debated corporate tax reform, this cut is easy to make: It's time to end R&D tax credits.

Proponents, such as [TechNet](#)—an organization of technology CEOs founded in 1997 by tech luminaries John Doerr (Kleiner Perkins), John Chambers ([Cisco Systems](#)) and Jim Barksdale (Netscape)—have been successful in sustaining the credits by focusing attention on the wrong question: Do the credits increase R&D?

The answer to that question is a resounding yes: Within four years of implementation, R&D was restored to within 10 percent of its 1964 peak (2.9 percent of sales). This ability of tax credits to increase R&D holds whether we look within the U.S. or across the globe—on average, a dollar of tax credits increases R&D by a dollar.

But we've been focused on the wrong question. When we consider whether the tax credits achieve their primary goal of stimulating economic growth, there are no studies quantifying the "social returns" to tax credits. We can attempt to answer that



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question by looking at nominal GDP growth. It has declined since the ERTA was implemented. So the answer would be an equally resounding no.

So why does TechNet continue to advocate for tax credits? Skeptics would argue these firms want the government to pick up the tab for R&D they would have done anyway. Indeed, according to the 2009 Government Accountability Office study, "The Research Tax Credit's Design and Administration Can Be Improved," these "windfalls" comprise 50 percent of tax credits.

## R&D fact-check

So why aren't the tax credits delivering on their true goal? That's the critical question, and I argue it's because the economic logic of tax credits relies on two faulty assumptions:

**Assumption # 1:** Firms are investing optimally in R&D, so the only way to increase spending is to provide a tax incentive.

**The truth:** 56 percent of public firms are underinvesting in R&D relative to the amounts that would maximize their profits.

**Assumption # 2:** Increasing R&D in and of itself will increase growth.

**The truth:** GDP growth is driven by firms' R&D productivity rather than R&D spending. Mean RQ (the increase in revenue from a 10 percent increase in R&D) has dropped 67 percent since 1979.

Because tax credits rely on faulty assumptions, I believe we can eliminate tax credits and achieve even higher R&D merely by educating firms on how to identify their optimal R&D investment.

Let's use McKesson—[No. 1 in the 2014 CNBC RQ 50 ranking](#)—as an example of an under-investing firm.

[McKesson](#) reported \$456 million R&D investment in 2012, but they should be spending a lot more (assuming everything else about their markets and operations stays the same). The company's RQ score of 130.6 reflects what I call an "elasticity" of 0.276. It sounds complicated, but [it's easier than you think to understand RQ.](#)



## Doing the math on McKesson

If McKesson increased R&D by 10 percent (\$45.6 million), the company should see a revenue increase of 2.76 percent (remember the elasticity score of 0.276). That 2.76 percent increase is equal to \$3.8 billion. Even with relatively slim operating margins (6.4 percent), that's still \$198 million in incremental profits for McKesson. The company shouldn't need tax credits to increase its R&D. At its current P/E ratio of 35.4, shareholders would increase their wealth \$7 billion if McKesson increased its R&D 10 percent.

Assuming a 10 percent increase in R&D across all 697 companies that I have identified as underinvestors, the net increase in R&D is \$18.6 billion.

That's three times GAO estimate for the size of the R&D tax subsidy in 2009, which was \$5.6 billion. How do we get three times the benefit of the tax credit without a government dime?

## Doing the math on the R&D underinvestors

The conventional thinking is that each dollar of subsidy translates to a dollar of additional R&D (see the 2011 Ernst & Young report, "The R&D Credit: An Effective Policy for Promoting Research Spending"), which means near-\$6 billion in R&D, and much less than the \$18.6 billion net increase using the RQ methodology.

Even better, the corresponding shareholder wealth creation is \$825 billion, meaning even the government potentially makes out on the change in R&D philosophy, to the tune of \$124 billion in capital gains.

Can education make more progress than tax incentives on the real goal of economic growth? I think it can. First, by removing the tax credit we remove firms' incentives to invest in R&D that only has "social returns." This inherently increases the productivity of the remaining R&D, since the combined effects of social and private returns are 80 percent higher than social returns alone (see Griliches & Lichtenberg's 1984 paper, "Interindustry Technology Flows and Productivity Growth: A Reexamination").



Let's use Intel as an example of companies who over-invest in R&D. Intel reported \$10.1 billion in R&D investment in 2012. That's 2.7 times what the company should be investing (\$4 billion) if it were hewing to optimal R&D. Intel's RQ score of 94.8 reflects an elasticity of 0.078, meaning a 10 percent increase in R&D should increase revenue 0.78 percent. This sounds good, but the problem given Intel's financials is that the additional R&D (\$1 billion) exceeds the expected additional revenue (\$411 million). So the last thing Intel shareholders need is the company basing its R&D budget on tax credits. At the current P/E of 15 (2014 consensus earnings estimate), shareholders would increase their wealth \$90 billion if Intel cut its R&D by roughly \$6 billion.

### **Doing the math on Intel's lost-income opportunity**

Intel is overspending by \$6 billion, so if they cut that spending, it goes straight to net income. Multiplying the additional net income of \$6 billion with the P/E ratio of 15 results in \$90 billion. [How I calculate the optimal R&D spend](#) is more complicated, but it's one of the most valuable things you can do with RQ.

Intel is a single example, but even firms that are productive from an R&D standpoint can be in the R&D over-investment boat—36.4 percent, according to my RQ database. While getting these firms—497 in all—to spend optimally actually reduces R&D, multiplying the amount these firms overspend on R&D with their P/E ratio would generate \$86 billion in higher profits that could be redeployed more effectively—remember, merely increasing R&D doesn't have an effect on GDP growth.

### **An end to the R&D tax-credit era**

If the R&D emphasis were shifted from spending more to spending more effectively, firms would be able to improve their R&D productivity—ideally to the level enjoyed in 1970—by learning how productive they are, benchmarking against other firms, and then emulating the R&D best practices of higher RQ firms.

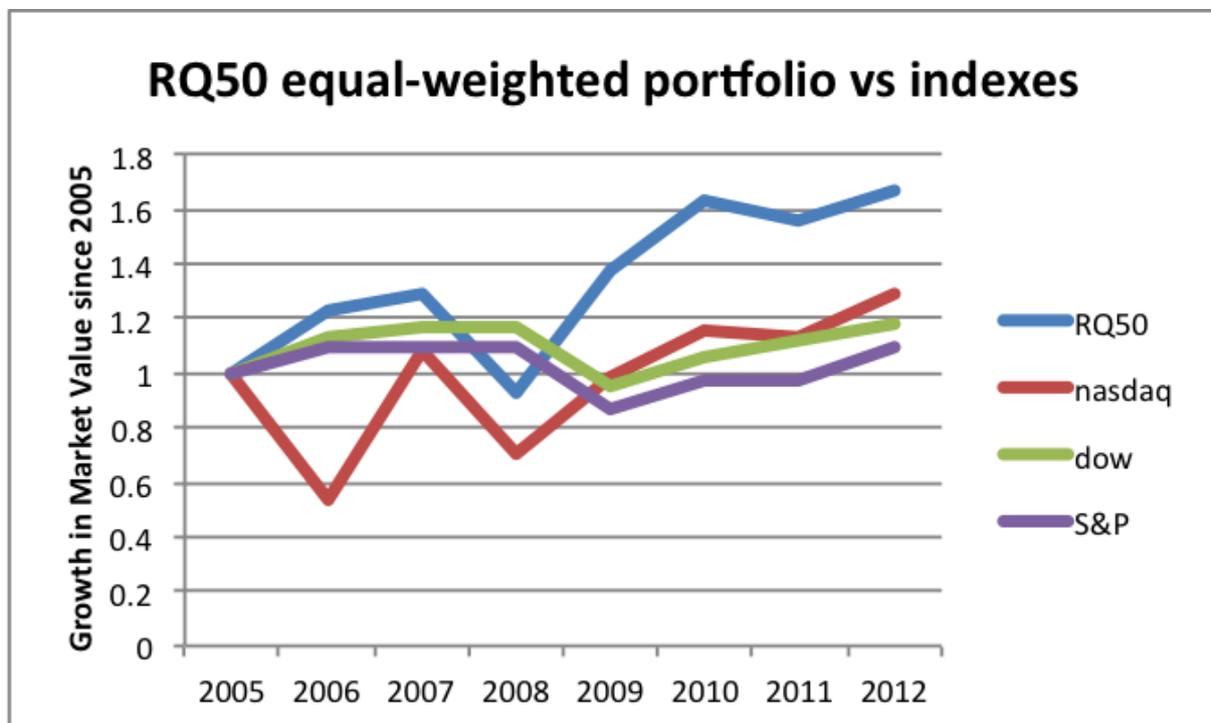
What are these best practices? While we're only beginning to learn what sets high RQ firms apart, we can generally say—based on dozens of interviews with high and low RQ companies and case studies from public documents—that R&D is more integral to their top-level strategy. High RQ firms tend to have more centralized R&D, as well as more consistent R&D spending. Firms with centralized R&D have a forty



percent higher RQ score than those with decentralized R&D. R&D spending inconsistency also lowers RQ—a 10 percent increase in spending inconsistency decreases RQ by 8 percent. Identifying and quantifying the value of a broader set of R&D best practices is [the goal of current research](#) funded by the National Science Foundation.

These steps of benchmarking and best practice adoption should seem familiar. They are precisely how TQM restored manufacturing productivity and how hospital report cards improved morbidity. Improving R&D productivity requires a similar rethinking, but first, an end to the era of R&D tax incentives that haven't delivered.

—By Anne Marie Knott, professor of strategy, Washington University Olin School of Business



NB: The chart should be shown rel. to the equal weighted S&P (RSP) and FTSE RAFI US 1000 (PRF)

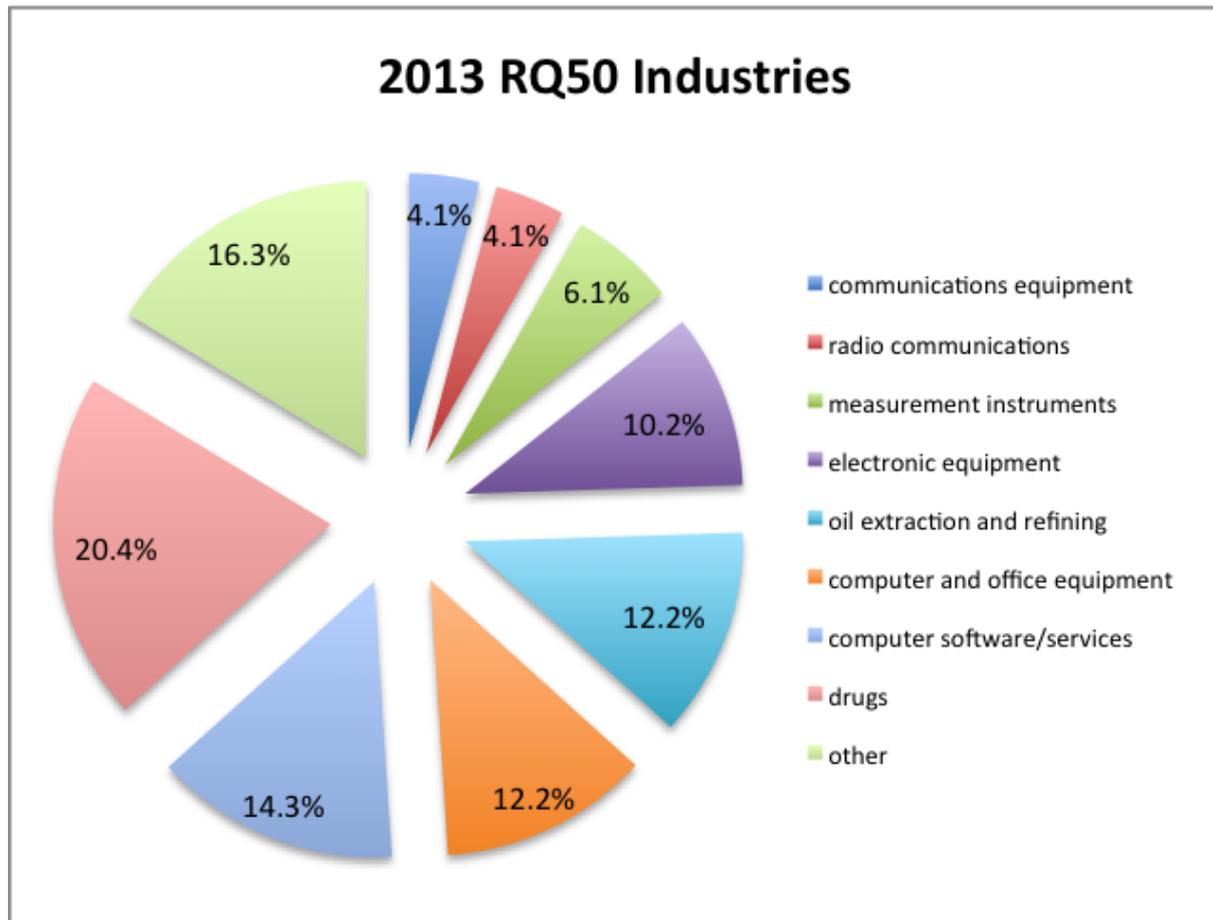
The RQ50 are the publicly traded companies whose R&D investment creates the greatest value for their shareholders. This ranking is not a beauty contest based on surveyed opinion. Rather it utilizes the RQ measure featured in the May 2012 Harvard Business Review article, [“The Trillion Dollar R&D Fix”](#)—the measure of R&D productivity in theoretical models linking R&D investment to revenue growth and market value. These are precisely the results executives and investors care about! ...and the RQ50 firms produce outstanding results!



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Portfolios of the RQ50 from 2005 to 2011 each substantially outperformed the NASDAQ, Dow and S&P500 indexes (as shown below). The annual market value growth for these firms averaged 7.6%, versus 3.6%(NASDAQ), 2.4%(Dow) and 1.3%(S&P).



So what do companies in 2013 RQ50 look like? First, they represent a broad swath of the economy. The biggest representation (20%) comes from drugs, followed by computer software/services (14%) and oil (12%), but fully 16% of the RQ50 are the only firms in their industry to make cut. So it's not the case these firms are all riding the same wave of opportunity. Second, the RQ50 is fairly stable: 60% of firms from the 2011 ranking and 40% of the firms in the 2010 ranking appear again in 2012.

#### What does it take to make the RQ50—to reliably produce results from R&D?

Case studies of a random sample of the RQ50 reveal a number of interesting patterns.

First, R&D strategy in these firms is **tightly interconnected** with their corporate and competitive strategies. Dolby is able to charge a price premium because it innovates ahead of would-be competitors. Amazon defines what new markets to enter (e.g., cloud computing) in-part based on capabilities that emerge from innovations intended to solve its internal operational problems.



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Second, these firms have **enhanced detection capability**--both to sense new market trends as well as new technologies that could exploit these trends or create new ones. These come either from technology push (diverse research sites and expertise) or market pull (diverse markets).

Third, these firms tend to have **flexible technology sourcing** strategies. In most cases, they develop technologies internally, but they are also willing to acquire and integrate firms that are further along the learning curve on a needed technology.

Finally, these firms have **substantial capacity for exploiting innovations**. They tend to have large market shares, giving them pricing power in the market. Note the large shares may have originally come from an initial innovation, but the firms have managed to reinforce that power through subsequent innovations. In addition the firms have developed complementary assets for diffusing the innovations at lower cost than rivals.

The characteristics revealed across these case studies resemble those obtained from a preliminary [National Science Foundation](#) (NSF) study of Belgian firms conducted by Bruno Cassiman, Carl Vieregger, Annelies Wastyn and myself. But stay tuned! We hope to understand more from a [newer NSF study](#) linking firm RQs to the NSF database of firms' R&D practices.

## The sexy R&D behind boring chip companies

[Ari Levy](#) | [@levynews](#)

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When lists are generated of the [hottest companies](#) and trends in technology, the dominant words have become predictable: mobile, viral, cloud, big data and wearable. These are the niches that will define the future. Noticeably absent: silicon, semiconductor and microprocessor—or, in other words, the foundation for the revolution in modern computing.

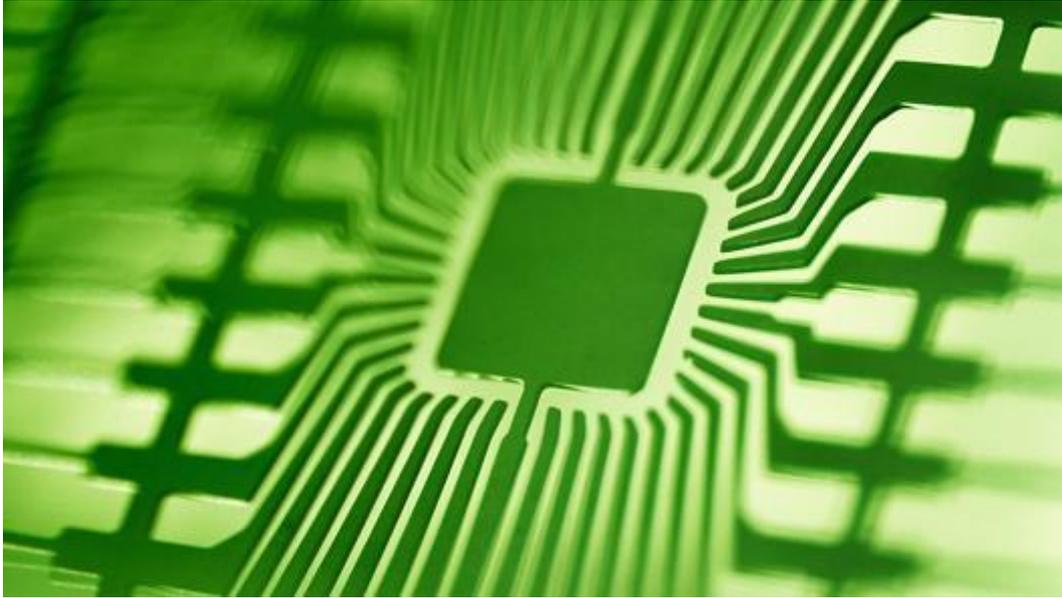
These are, after all, the companies that continue to bend the laws of physics to cram more and more intelligence into ever smaller chips that enable the world's devices. Innovation remains a major part of the story—and long-term survival strategy—for semiconductor-related companies.

"There's still some cool and interesting stuff going on at places people aren't paying attention to," said Anne Marie Knott, professor of strategy at Washington University's Olin School of Business in St. Louis.



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**The Research Quotient (RQ), a measure of R&D resourcefulness** created by Knott, shows that innovation doesn't always equate to buzz: Companies from old-guard industries and from the technology sector's old guard, specifically, show that being boring is still in when it comes to ranking the market's R&D elite. Knott teamed with CNBC this year to create **the first-ever CNBC RQ 50 list**, and it contains nine companies in and around the semiconductor market, including three of the CNBC RQ 50 top 10 companies.

These unheralded companies are also behind the buzzy companies that do get all the attention. At **Silicon Laboratories** in Austin, Texas, for example, engineers are designing chips for Google's **Nest** Web-connected thermostat, bringing together programmable software and speedy Wi-Fi connectivity without requiring a ton of power.

With a stock market value of \$1.8 billion and a history that dates back to the 1990s, Silicon Labs is ranked fifth—just behind **Amazon.com**—on the CNBC RQ 50, which includes publicly held U.S. companies investing \$100 million or more in R&D. **The list measures R&D productivity by forecasting the percentage increase in revenue that would be associated with a 1 percent increase in R&D.**

Other chip-market players to make the CNBC RQ 50 are **Advanced Micro Devices**, **SanDisk**, **PMC-Sierra**, **Lam Research**, **Spansion**, **Xilinx**, **Altera** and **Microsemi**. More broadly within



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tech, [Google](#) finished in the 41st position, just ahead of [Salesforce.com](#) and four spots above [Netflix](#).

## Creating a competitive moat with R&D

For Silicon Labs, an almost 20-year history has given the company plenty of time to figure out how to perform R&D to maximize every dollar spent. Going up against heavyweights like [Texas Instruments](#), it has no choice.

As a fabless semiconductor maker, Silicon Labs designs chips internally but has them built elsewhere, by manufacturers including [Taiwan Semiconductor Manufacturing](#). Alessandro Piovaccari, vice president of engineering at Silicon Labs, said R&D is improving at the same rate as its products, because the company doesn't distinguish between the two.

"Our R&D and product development are the same thing," Piovaccari said. "It's necessary if you're doing cutting-edge products."

One major benefit that any established semiconductor maker or chip-equipment manufacturer has is the extremely high cost of doing business, particularly in the early days, compared with software and Internet businesses that are getting cheaper and easier to get off the ground. Venture capitalists invested \$311.8 million in semiconductor companies in the first half of 2014, compared with \$10 billion in software start-ups and \$5 billion in Internet companies, according to the [National Venture Capital Association](#).

## What smart investors understand

Unlike photo-sharing app makers and Web-based business software developers, who constantly have to put resources into tracking and beating back the new competition, **companies in the chip market can focus their investments on products and listen to the demands of their customers.**

**"Over the long term, that's what creates competitive moats,"** said John Pitzer, an equity analyst covering semiconductor companies for Credit Suisse in New York. **"In all of tech, they tend to have the highest barriers to entry."**



Silicon Laboratories hasn't seen a direct correlation in its recent stock performance—it's up only 8 percent in the past year—but smart investors are finding plenty of opportunity in these chip companies. **The Philadelphia Semiconductor Index (SOX), consisting of 30 chip-related stocks, has jumped 27 percent in the past year, through Aug. 6, topping the 12.5 percent gain in the Standard & Poor's 500 and 23 percent Nasdaq 100 return. This year, the semi index is up 12.5 percent versus an S&P 500 return of 3 percent and Nasdaq 100 gain of 7 percent. The SOX members are benefiting from a spate of acquisitions in the market, which is leaving fewer players to compete for the pool of available dollars.** The most recent was [Applied Materials](#)' agreement last year to buy [Tokyo Electron](#) for more than \$9 billion, a deal that's yet to close.

**Lam, a major equipment supplier to chipmakers and No. 16 on the CNBC RQ 50 list, has been a recent winner, with its stock up 40 percent in the past 12 months, through Aug. 6.** The Fremont, California-based company sells to the likes of [Samsung](#) and TSMC and is profiting from surging demand for chips in all sorts of mobile devices. In June industry group [Semi](#) forecast that semiconductor fab-equipment spending would jump 24 percent this year, to \$35.7 billion, and another 11 percent in 2015 to near-record levels.

Ruben Roy, a semiconductor analyst at Piper Jaffray in New York, calls Lam his favorite stock in the semiconductor equipment market.

**"They're a share taker," said Roy, who has an \$80 price target on the stock, approximately 15 percent above its current share price. "From a pure R&D perspective, they've probably done the best job over the past five years."**

Lam CFO Doug Bettinger said the company's R&D expertise comes from close interactions with its customers and research institutions, which are critical to meet the engineering challenges of building more sophisticated features onto smaller chips. Lam signed an agreement in June with [Imec](#), a nanoelectronics research center in Belgium, expanding an R&D partnership that includes sharing of tools and resources for the development of integrated circuit technology.

**"We spend a lot of time talking with our counterparts at a customer level, trying to understand what they're going to need in three years and how can we work together with them to anticipate what's going to be needed,"** Bettinger said.



"There are only so many dollars you can spend to do all the development you need to do and still meet the financial model for your investors," he said.

—By CNBC's Ari Levy. Follow him on Twitter: [@levynews](https://twitter.com/levynews)



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