Rethinking innovation in industrial manufacturing

Are you up for the challenge?

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Foreword

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In our work with industrial manufacturing clients, we see the critical impact of innovation up close every day. It's one sector where innovation has a dramatic impact on not just the bottom line of individual companies, but also on the productivity of entire sectors like mining, construction or agriculture. And it has a dramatic impact on company competitiveness. The most innovative manufacturing companies managed a 38% increase in revenues over the past three years. That's nearly four times the rate of growth of the least innovative companies in the sector.

Most of our industrial manufacturing clients already recognise the importance of innovation. But they're not always getting the benefits they could be from their investments. That's where this paper comes in.

It's not easy to build a strong innovative culture, but the payoffs are high for those companies that succeed. Perhaps some of the biggest challenges for industrial manufacturing companies lie in finding the right talent, pursuing the right partners and getting the right metrics in place to measure innovation progress.

In this report we look at these challenges and urge you to start asking yourself some key questions to sharpen the innovation focus at your company.

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About this report

Rethinking innovation in industrial manufacturing: are you up to the challenge?, is a companion paper to PwC's thorough survey report on innovation, *Breakthrough innovation and growth*. It explores the impact that innovation has on growth and examines how leading companies are making innovation work for their organisations. *Breakthrough innovation and growth* explores three key questions:

1. How are companies using innovation to drive growth and what is the return on this investment?
2. How are approaches to innovation changing, particularly in light of a trend towards more disciplined innovation?
3. What are the leading practices and critical success factors that deliver tangible business results?

To find the answers we drew on insights from interviews with 1,757 C-suite and executive-level respondents across more than 25 countries and 30 industries who are responsible for overseeing innovation within their company. Our sample included 249 executives from the industrial manufacturing industry from 20 countries. Their responses form the basis for this companion paper.

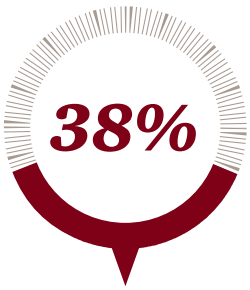
Rethinking innovation in industrial manufacturing shows why industrial manufacturing executives should take a fresh look at their innovation strategy. To lead on innovation, manufacturers need to broaden their innovation efforts beyond products, focus on a strong culture to attract and motivate talent, enhance collaboration and look for meaningful ways to measure innovation success.

249
Executives from the industrial manufacturing industry respondents

20 From 20 countries

Industrial manufacturing needs innovation to spur growth

The most innovative companies overall are growing significantly faster than the least innovative



20% most innovative companies
(11.3% year-on-year)

20% least innovative companies
(3.2% year-on-year)

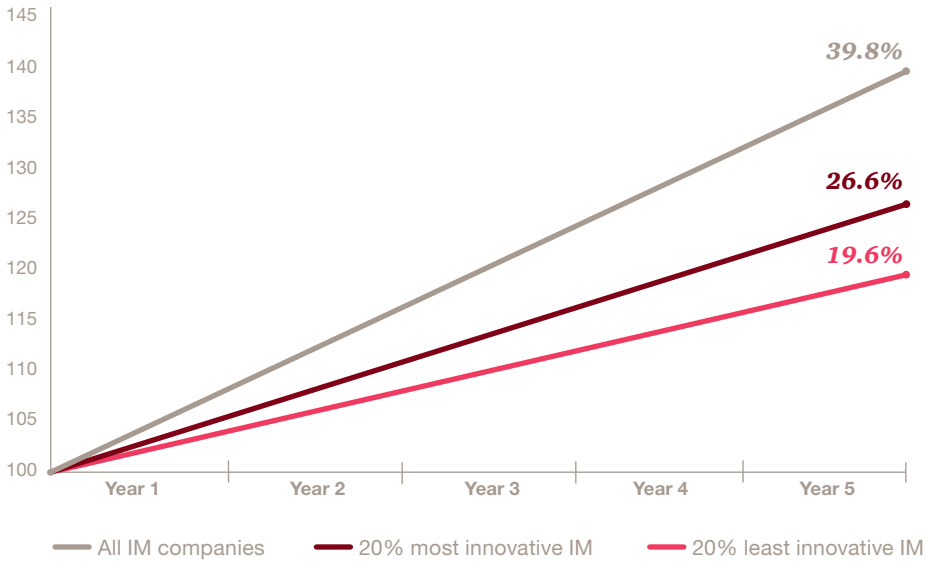
In past years, the general public hasn't often seen machinery and equipment makers as leading innovators. And yet, over the years, innovation in industrial manufacturing has had an enormous impact on society. Agricultural equipment has made farming vastly more efficient. Automation has transformed factory floors and made it cheaper and faster to produce everything from cars to TV's. And now new technologies for wind turbines and electrical grids are forming the foundation for a shift to cleaner sources of energy.

In our research across industries, we've found a clear correlation between innovation and success in growing revenues. In Breakthrough innovation and growth, we report that the most innovative companies overall are growing significantly faster than the least innovative. The difference for industrial manufacturing companies is dramatic. The sector's most innovative companies grew 38% over the last three years—nearly 12% per year—while the least innovative managed just 10% growth over the same period.

Looking forward, the sector's top innovators have somewhat more modest expectations, but they're still targeting annual growth of 6.9%, while the least innovative companies expect to manage just 3.6%. Over the course of five years, that will create a major gap (see Figure 1).

Figure 1: IM's top innovators expect to significantly outperform the rest over the next five years

What is your company's annual revenue? What do you forecast your annual revenue will be in five years' time?



Source: PwC, *Breakthrough Innovation and Growth*
Base: Industrial manufacturing, 249; most innovative 20% of industrial manufacturing respondents, 46; least innovative 20% of industrial manufacturing respondents, 57

Why does making innovation a priority have such a major impact?

The answer is simple: top innovators are getting three times as many revenues from new products or services. The least innovative group of industrial manufacturing companies only generated 7.1% of their revenues from new products and services launched in the last year, while the top innovators managed a revenue boost of 22.8%.

Most industrial manufacturing executives expect that they'll need to generate the majority of their growth organically going forward. While global expansion was the biggest driver of growth for many over the past decades, our research shows that the tide is turning and innovation now tops the list. Are manufacturers up to the task?

To meet their growth targets and start to catch up with the top innovators, we believe industrial manufacturing executives will need to define or refine a solid innovation strategy, balance their innovation portfolio, make sure they can attract and keep top talent, enhance collaboration (including public/private sector initiatives) and accurately measure what they're getting from their innovation investment.

Starting with a solid strategy

92%

Ninety-two percent of industrial manufacturing executives say innovation is important to future revenue growth.

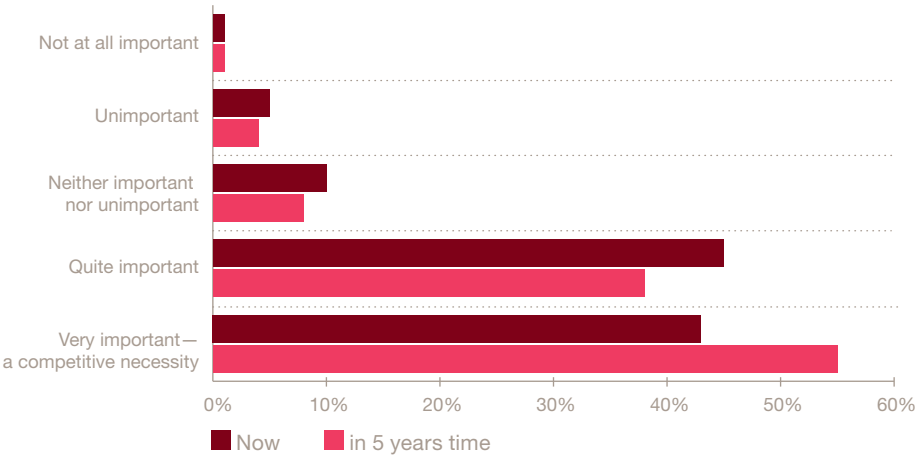
Most of our industrial manufacturing respondents say innovation is important to their business (see Figure 2). And more than half believe it's a competitive necessity for future success. That's higher than the average across industries.

But while 92% of industrial manufacturing executives say innovation is important to future revenue growth, only two-thirds of executives across the sector believe their companies already have a well-defined innovation strategy. Here, too, the difference between top innovators and laggards is dramatic (see Figure 3). That's a serious gap with major implications for execution. Without a clear vision, innovation efforts aren't likely to take off.

And your innovation roadmap should take into account some of the major trends that are re-shaping the marketplace. New technologies like additive manufacturing and the emergence of the 'industrial internet' (or 'Internet 4.0') may have a significant impact on the direction of innovation efforts. And the changing business environment is important. Companies that ignore these factors are likely to find their revenues shrinking while more innovative competitors take a larger slice of the pie.

Figure 2: Industrial manufacturing executives view innovation as vital to future success

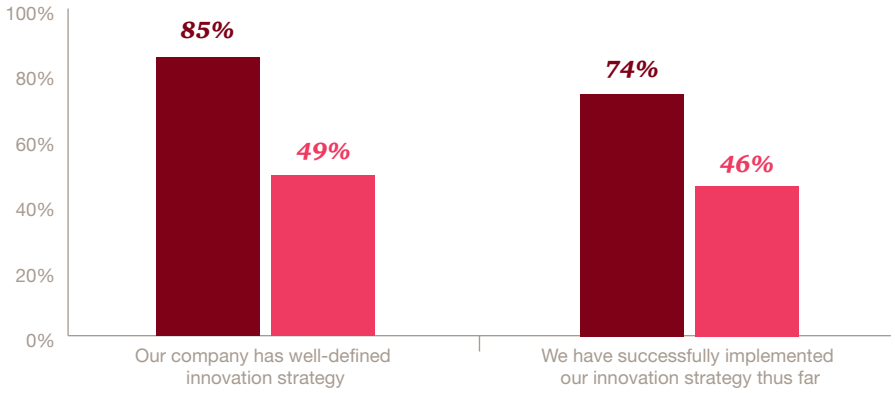
How important is innovation to the success of your company now?



Source: PwC, *Breakthrough Innovation and Growth*
Base: Industrial Manufacturing, 249

Figure 3: Innovation leaders' edge in strategy translates into better execution too

How important is innovation to the success of your company now?



If your company doesn't yet have a focused, robust innovation strategy, it's time to define one. And even if you're confident in your vision, it's important to keep evaluating what's working and what's not. Sticking with the status quo is a sure way to fall behind the competition.

We've identified some fundamental questions industrial manufacturing executives need to ask themselves when taking a closer look at their company's innovation vision:

1 ***Where are we now, and where do we want to go?*** Is our current market position good enough in the short term—and in the long term? Is our innovation strategy linked to future business opportunities? Are we taking into account the possible impact of major trends like the rise of the industrial internet and the emergence of additive manufacturing?

2 ***What balance of innovation do we need?*** Are we focusing solely on product innovation? What can we do to make sure we're innovating enough in other areas like business model, services, supply chain and technology? Do we have the right mix of incremental vs. radical and breakthrough innovation?

3 ***Can we attract, keep and motivate key innovation talent?*** Are we actively working to foster a strong innovation culture and position our company as a supportive environment for top talent? Are we able to recruit and integrate skilled staff from new and emerging markets?

4 ***Are we collaborating enough outside of the organisation?*** How strong are our strategic partnerships? Are we making good enough use of open innovation or other strategies like corporate venturing to identify and develop new relationships and ideas?

5 ***How will we know success when we see it?*** What measurement systems for innovation are in place? How well are they working? Do they support innovation efforts or stifle them?

New technologies like additive manufacturing and the emergence of the 'industrial internet' (or 'Internet 4.0') may have a significant impact on the direction of innovation efforts.

Balancing the innovation portfolio

We've found that one of the keys to driving growth while still maintaining the health of established products and services is to focus on a balanced innovation portfolio. That means finding the right mix of investments in incremental, breakthrough and radical innovation across the whole range of innovation areas. While that includes products, technology and processes, business models, services, the customer experience and the supply chain are critical too.

The top industrial manufacturing innovators already understand this. They're targeting significantly more breakthrough and radical innovation—30-40% breakthrough innovation in every area. And they're looking more at technology and business model innovation. The laggards are focused on products and incremental improvements. They expect just 15-20% of their innovations to be real breakthroughs.

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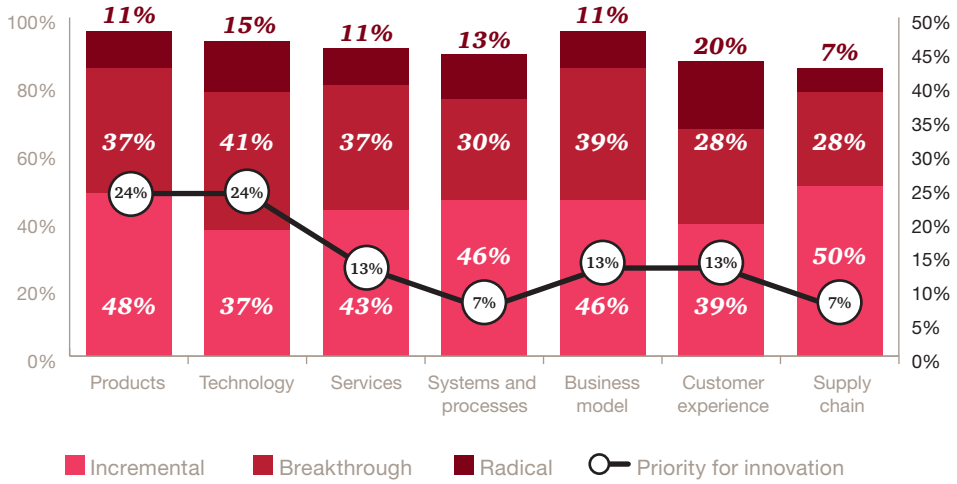
Figure 4a: Top industrial manufacturing innovators are expecting more breakthrough and radical innovations. They're also paying special attention to technology and business model innovation

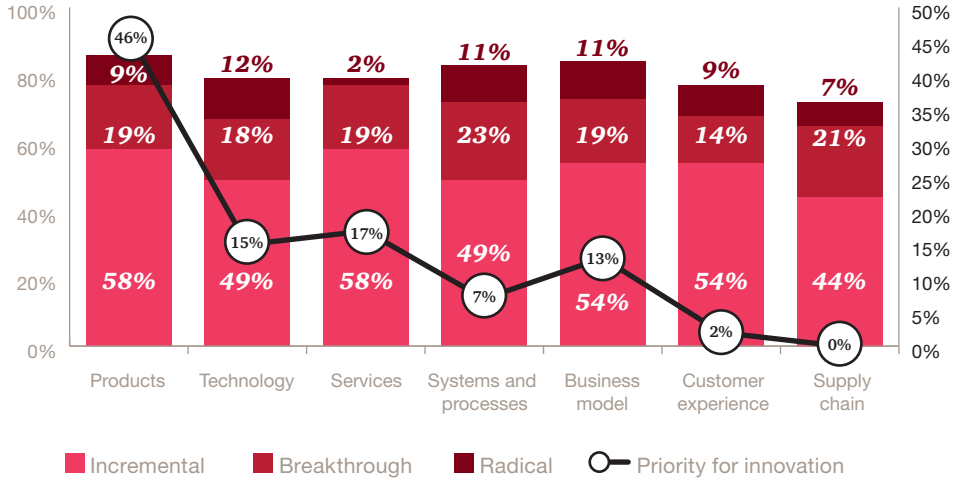
How significant will your innovations in the following areas be over the next three years? Of these areas, which is your priority for innovation the next 12 months?



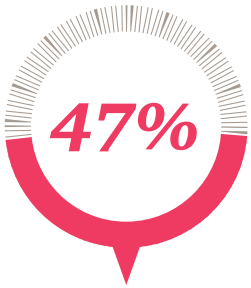
Base: Most innovative 20% of industrial manufacturing respondents, 46

Figure 4b: Industrial manufacturing innovation laggards are expecting fewer breakthrough and radical innovations and are overwhelmingly focused on products

How significant will your innovations in the following areas be over the next three years? Of these areas, which is your priority for innovation the next 12 months?



Base: Least innovative 20% of industrial manufacturing respondents, 57



Forty-seven percent of industrial manufacturing respondents say their companies have separate innovation facilities in important markets

Getting ready for the industrial internet

Why are top industrial manufacturing innovators paying so much attention to technology? One reason is the emergence of the 'industrial internet', also known as the 'internet of things'. Major improvements in sensor technology and radio frequency identification (RFID) tags are making it possible for machines and equipment to send detailed information about how they're being used and to talk to each other. That creates a huge amount of data, which new tools are making it possible to analyse in real-time. General Electric (GE) has estimated that the efficiencies from fully implementing these types of technologies could increase global GDP $10 to $15 trillion—that's not a typo—by 2030.[1]

Germany's Siemens is also committed to what it and the German government calls Industrie 4.0—the 4th industrial revolution based on the use of cyber-physical systems.[2] The goal is to develop together with manufacturers 'digital enterprises' that can adapt to market conditions and use resources efficiently. That means using technology to integrate product and production lifecycle processes. Siemens envisions a future where "engineers who plan a new product, such as a new switchgear, will use special software to simultaneously design its manufacturing process, including all associated mechanical, electronic, and automation systems."[3]

Often technology investments have a two-fold benefit. They can help improve company operations, while at the same time opening up new markets. For example, data analysis tools can help companies track parts and other resources in real time, which can help efficiency. But they also have the potential to deliver valuable insights on how customers are using equipment and the impact of different conditions. Ultimately that could help pave the way for new service offerings too.

Megatrends have mega implications for products

Products are still the primary focus for many industrial manufacturing companies. Here, too, the most innovative companies are also significantly more ambitious when it comes to targeting breakthrough and radical innovation, while less innovative companies concentrate more on incremental improvements. Some companies are explicitly linking their product development strategies to global mega-trends like urbanisation and geographic shifts in economic power. And many companies are already making it a priority to adapt products regionally—nearly half of industrial manufacturing respondents (47%) say their companies have separate innovation facilities in important markets.

Looking beyond product innovation

Relatively few executives say business models, services, processes and systems, customer experience or supply chain are #1 on their list of innovation priorities. But many companies are nonetheless starting to take a closer look at some of these areas. Nearly all of the top innovators expect to revisit their business models, and around half anticipate breakthrough or radical changes.

Just what are they doing? Top innovators in particular are looking for new value offerings like expanding services; the least innovative companies are more inclined to focus on lower-cost models.

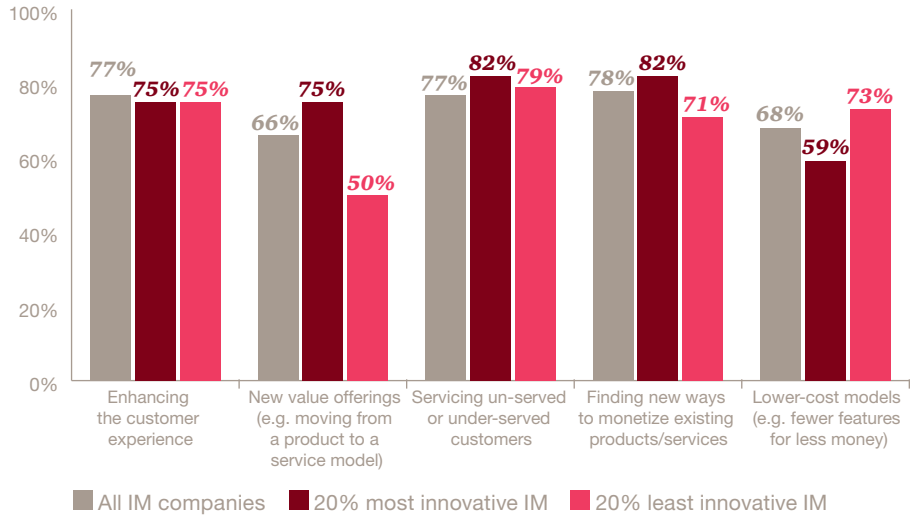
1 GE, "New 'Industrial Internet' Report From GE Finds That Combination of Networks and Machines Could Add $10 to $15 Trillion to Global GDP", November 26, 2012. http://www.gereports.com/meeting-of-minds-and-machines/

2 Siemens, "Self-organizing factories", http://www.siemens.com/innovation/apps/pof_microsite/_pof-spring-2013/_html_en/industry-40.html

3 Ibid.

Figure 5: Industrial manufacturing innovation leaders are more focused on new value offerings and lower-costs models

How significant will your innovations in the following areas be over the next three years? Of these areas, which is your priority for innovation the next 12 months?



Base: Most innovative 20% of industrial manufacturing respondents, 46; Least innovative 20% of industrial manufacturing respondents, 57

Service innovation to drive growth

What about service innovation? Around a third of industrial manufacturing CEOs expect radical or breakthrough innovations in services. That's significantly less than the 47% of top innovators targeting major steps forward in service areas.

In other research we found that manufacturers with a more mature approach to service innovation—the 'service leaders' who are able to offer new and expanded services as a real value add—performed better financially, with more stable results.[4] 'Service followers' who see services as merely an extension of their product portfolio lag behind in financial performance.

Industrial services already generate more than 100bn Euros per year, and revenues are increasing steadily. Studies of industrial equipment manufacturers show that the operating margins (EBIT) for services such as maintenance, modernisation and financing of new equipment are nearly four times as high as those for the sale of new products.[5]

Services can help generate revenues and margins during downturns, so it helps balance risk in cyclical product businesses. Strong service offerings also help improve product sales, with customers increasingly saying they are a must-have. In our research on service innovation, we found that many companies aren't yet integrated in product and service development. By taking a combined approach, they can significantly enhance performance.

Tyco International (Tyco) is one company that's taking a comprehensive approach to accelerating services growth. Their service offerings include preventive maintenance and repair and monitoring of their equipment, but they're also innovating to produce significantly more value through remote diagnostics, cloud-based services, integration, command & control systems, and even mission critical control rooms.[6] Services now make up the biggest share of the company's overall revenues, more than products or installation—and more than half of service revenue is recurring.

Process innovations can lead to breakthroughs in products and supply chains too

Often innovation in one area can cross over into others. Additive manufacturing, or 3-d printing, has attracted a lot of attention lately. It's a new way of manufacturing parts by printing them three-dimensionally using fine powder or liquids. Companies and governments alike have been showing interest. Essentially additive manufacturing techniques are a process innovation, but they're having a major impact on product innovation processes, by bringing down the costs of prototyping. And they open up new design possibilities, as the process can create complex geometric shapes that weren't possible using traditional techniques.

The implications for supply chains could be even more profound. Companies may be able to print out spare parts on demand, in remote locations, for expensive equipment. That has massive implications for how equipment and machinery makers will serve customers.

4 PwC, *Service innovation: Growth engine and profit machine.* 2013.

5 Ibid.

6 Tyco Investor Day Presentation, New York, NY, September 18, 2012. http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MTUzNTk1fENoaWxkSUQ9LTF8VHlwZT0z&t=1

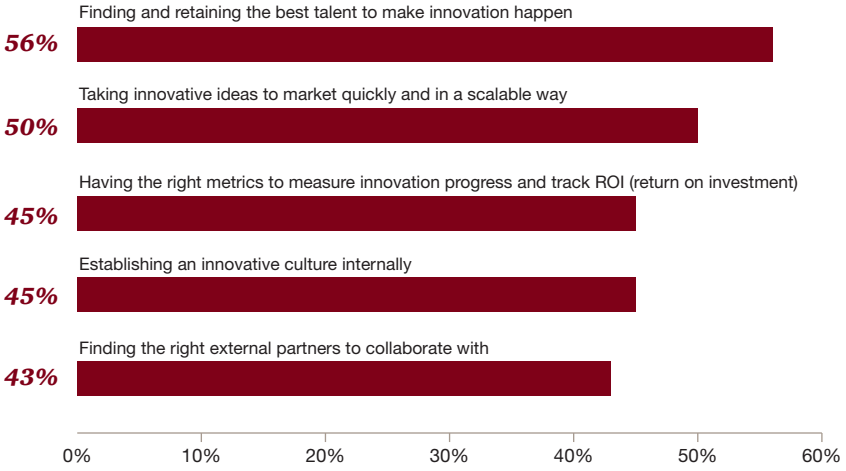
Focusing on culture and talent

Once you've charted your strategy and mapped out a good balance for innovation, you need to make sure you have the people on board who can make it happen. Finding the right talent can be a big challenge for industrial manufacturing companies; more than half of executives see it as a hurdle (see Figure 6). That reflects a very real talent gap.

Manufacturing companies will need to make sure they're well-positioned to compete when it comes to attracting and retaining workers with the right skills. But what do innovative people want out of their employer? In our experience, the leading breakthrough innovators want to be recognised as somebody who makes a difference—to their profession, to the company, and sometimes to the world. So companies with a strong innovative culture have an advantage when it comes to attracting, keeping and motivating key talent.

Figure 6: Talent leads the list of innovation challenges for industrial manufacturing executives

How challenging do you find the following aspects of making innovation happen within your company? Respondents who said 'very' or 'somewhat' challenging



Source: PwC, *Breakthrough Innovation and Growth*
Base: Industrial manufacturing, 249

In our experience, the best breakthrough innovators want to be recognised as somebody who makes a difference—to their profession, to the company, and sometimes to the world.

Developing a strong innovation culture

But even when the need is clear, creating an environment that supports innovation isn't easy. In fact 45% of industrial manufacturing respondents say that establishing an innovative culture internally is a challenge for their organisation. For many, one critical prerequisite is to set the tone from the top. Three-quarters of industrial manufacturing respondents say it's important to get senior executives involved in innovation projects. Some companies have even given innovation its own spot in the C-suite.

It's not just top executives who need to be committed. Innovation needs to become part of your corporate DNA. Again, industrial manufacturing executives are already convinced. More than 70% of them say that giving employees the chance to lead or participate in high-profile innovation initiatives is important to developing a strong innovation culture, and nearly as many are convinced of the need to recognise and reward innovation initiatives.

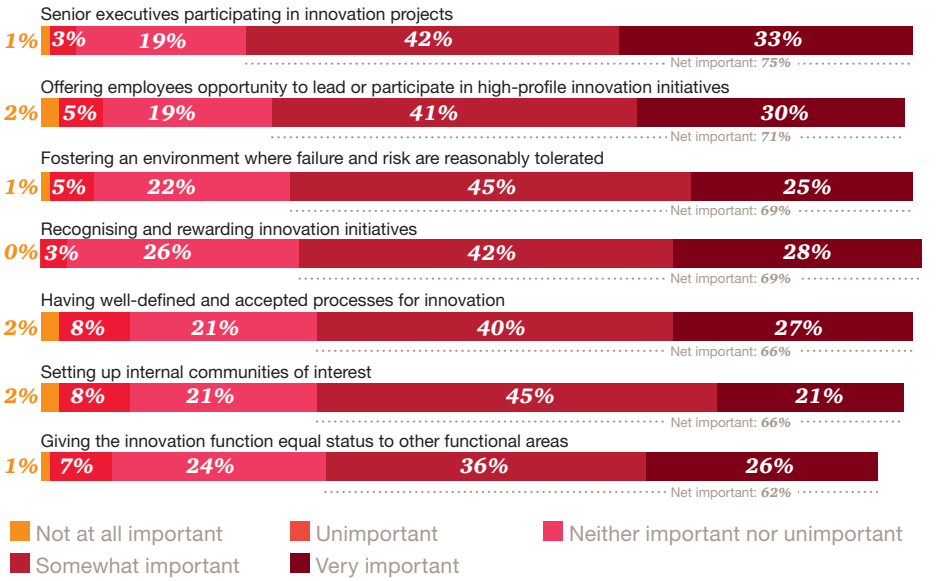
When it comes to getting the right culture established, lots of other factors are important too. More than two-thirds of industrial manufacturing respondents believe it's necessary to tolerate some missteps. Companies that are able to tolerate failure and risk can develop what's sometimes called an 'intrapeneurial' spirit—entrepreneurial zeal and speed coupled with the ability to leverage the assets of the large company. Many innovators need creative freedom, something that can be difficult to find in a large organisation.

It's also vital to innovate across the entire business, not just in the headquarters country. Industrial manufacturing has become global, with most major players looking around the world—and increasingly to emerging markets—for revenues. And they're using talent from around the world too. For example, when Tyco identified a customer need for automatic fire detection and suppression on unmanned oil platforms in the North Sea, it looked to R&D centers in both England and the Czech Republic for enabling technologies, which a team in India than used to develop the company's innovative new solution for high performance large area fire protection.[7]

It's also important to make sure your most talented people are available for the projects that will bring the most value to your organisation—another reason why defining your innovation strategy is so critical. We've been seeing companies revisiting their resource allocation to free up capacity and ensure the best talent is focused on the highest priorities, rather than day-to-day activities.

Three-quarters of industrial manufacturing respondents say it's important to get senior executives involved in innovation projects. Some companies have even given innovation its own spot in the C-suite.

Figure 7: Leadership is key to innovation culture for manufacturing execs but it's not just about setting tone from the top—opportunities for employees to set the agenda rank high too



7 Tyco Investor Day Presentation, New York, NY, September 18, 2012. http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MTUzNTk1fENoaWxkSUQ9LTF8VHlwZT0z&t=1

Expanding collaboration

Even if your company has a strong innovative culture and is attracting top talent, you'll still need to make sure that your smart people are collaborating with the billion IQ points outside of your organisation.

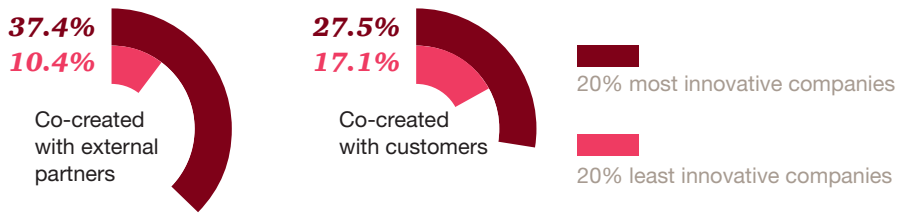
A full 95% of industrial manufacturing executives say their companies have plans to collaborate with strategic partners over the next three years. That's not all. They're planning to work together with their customers, suppliers, academics, even with the competition—to spur innovation.

These collaborations are bringing results —especially for the 20% of companies who are innovating most successfully. More than a quarter (28%) of executives from the leading industrial manufacturing innovators say they're already co-creating innovative products and services with customers. That compares to 17% for the least innovative group. In our 'Manufacturing excellence' series report Customer collaboration designs excellence, we explored some of the ways that sector companies are working together with customers. These can actually go well beyond co-developing products. For example, some manufacturers are working with customers to help reduce their energy usage and carbon footprint.

The difference between the leading innovators and the laggards is even more dramatic when it comes to co-creating products and services with other external partners. While 37% of the top innovators do so, just 10% of the laggards are successfully collaborating with external parties. That's a clear indication that innovation leaders are partnering far more than the laggards. The most successful eventually become the 'Partner of Choice' in their innovation ecosystem. That helps them attract the best ideas from strategic partners and suppliers alike, giving them access to faster, better, and cheaper innovations—a major competitive advantage.

Figure 8: Industrial manufacturing's most innovative companies are co-creating far more of their products and services

What percentage of your innovative products and services are co-created with customers? With external partners?



Base: 20% most innovative IM respondents, 46; 20% least innovative IM manufacturing, 57

The top IM innovators are collaborating far more than their less innovative counterparts.

We're also seeing a trend towards more collaboration across industry sectors. For example, General Motors (GM) and ABB Ltd. (ABB) recently completed a two year joint research project looking at the potential of using battery packs from plug-in hybrid Chevy Volts to power the grid.[8]

Using open innovation to spur growth

One way to collaborate with external partners is through open innovation. Across industries, open innovation stood out as the innovation process that executives felt was most likely to drive growth. It tops the list for industrial manufacturers too, and there are already some high-profile examples. GE has used open innovation extensively over the past several years. When it ran a challenge around smart grids as part of its ecoMagination programme users submitted nearly 4,000 ideas.[9] GE gave cash awards to five young companies and formed strategic partnerships with 12 others.[10] GE has also localized the programme, with challenges to create natural gas energy solutions in China and to reduce the carbon footprint in Australia and New Zealand. The company's latest challenges tackle additive manufacturing.

ABB is taking a somewhat different approach, but it's also looking across the globe for partners. In addition to 70 university collaborations the company recently launched the ABB Research Grant Program which is intended to support promising graduate students and senior researchers working on projects with industrial applications in the power and automation area.[11] ABB hopes to partner with researchers from their Corporate Research Centers with the best graduate students and professors from around the world to support a truly collaborative innovation ecosystem.

8 ABB corporate website, http://www.abb.com/cawp/abbzh258/3a177ddbaf92e6c2c12573150032b278.aspx

9 GE corporate website, http://visualization.geblogs.com/visualization/ecomagination_challenge/

10 GE corporate website, http://challenge.ecomagination.com/ct/e.bix?c=ideas

11 ABB corporate website, http://www.abb.com/cawp/abbzh258/3a177ddbaf92e6c2c12573150032b278.aspx

7.53% vs. 8.57%

On average the industrial manufacturing companies we interviewed actually spend a smaller percentage of their revenues on innovation than do companies across the sample as a whole.

Measuring success

As innovation portfolios diversify, metrics for breakthrough and truly radical innovations need to change to reflect the new processes and types of value

On average the industrial manufacturing companies we interviewed actually spend a smaller percentage of their revenues on innovation than do companies across the sample as a whole (7.53% vs. 8.57%). And in other recent research, five of the top 20 R&D spenders in 2012 were automotive OEMs and seven were healthcare (primarily pharmaceuticals) companies.[12] Not one was an industrial manufacturing company. That's not necessarily bad news, because spending more doesn't always mean innovating better. The trick is to make sure you are getting the most out of your innovation investment.

In our view, that means making sure to establish clear metrics. But what aspects of innovation need to be measured? What are reasonable targets? These are two questions that continue to perplex executives—nearly half of industrial manufacturing respondents (45%) say that having the right metrics is a challenge for their companies.

One powerful metric is tracking the percentage of revenue coming from new products and services. Our research looked at the previous 12 months; some companies measure a three-year period. Either way, focusing on what's often known as the 'vitality index' can help focus efforts. But it's important to measure the impact of other types of innovation too. For example, by using a metric that quantifies savings on capital costs (capex) achieved by applying innovative technology instead of the best alternative technology available on the shelf, companies can track the impact of technology and process innovation.

In our view, the true measure of innovation success cannot only be seen through a financial lens. Leading companies define measurements that go well beyond the traditional ROI. Some companies are tracking patents, publications, and transfer of know-how to other business units.

12 Booz & Co., "The Global Innovation 1000: Top 20 R&D Spenders 2005-2013" http://www.booz.com/global/home/what-we-think/global-innovation-1000/top-20-rd-spenders-2013

Where next for your business?

Product and process innovation have been transforming manufacturing for decades. The future will hold many more advances, as research around nanotechnology, analytics and additive manufacturing starts to influence applications.

Companies with an innovation edge will have a strong competitive advantage. What can you do to make sure your company is a leader and not a laggard?

- ***Know where you want to go and how you'll get there.*** Innovation requires careful planning and a clearly defined strategy. According to our survey, industrial manufacturing companies lag behind the top innovators when it comes to having a defined strategy.
- ***Look beyond R&D.*** Investing in research and development is an important part of innovation, but it's far from the whole story. Industrial manufacturing companies need to make sure that they're paying attention to fostering innovation in areas like business models, services, customer experience and the supply chain too.
- ***Focus on people.*** The executives we surveyed say it can be hard to get and keep the right people on board to make innovation happen. Developing and maintaining a strong innovation culture that supports top talent is critical. And so is looking to new markets.
- ***Work together with the right partners.*** Finding the right external partners is a challenge for many of the executives we surveyed. But it's vital. In countries around the world, new research institutions are emerging to help bridge the gap between academic research and practical application. Industrial manufacturers need to make sure they're reaping the benefits.
- ***Carefully measure success.*** That means developing the right KPI's for different types of innovation and business units. And while looking at innovation through a financial lens is important, so are other perspectives.

Want to find out more?

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We look forward to speaking to you.