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Issue 6

Innovation and the path to success

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These are challenging times for the aerospace and defense (A&D) industry. Despite a tepid economic recovery, commercial aviation demand has been resilient. Original equipment manufacturer (OEM) production is setting records, and there is a steady stream of new product introductions. The combination of strong demand and technological advancements in aircraft is powering the strongest and longest growth cycle in aviation history, causing an interesting challenge: finding the resources, both human and economic, to support innovation and product development. As one company executive described it, "We have more opportunities with good business cases than we can afford." The challenge, therefore, is to gain greater productivity from research and development activities, as well as to prioritize investments.

The challenge for the defense industry is quite different. Western governments are reducing spending for defense and space, which has been the primary source of funding and a tremendous source of innovation for the global economy. Many of the world's largest commercial markets have their origins in defense and space spending; computers, computer networking, and telecommunications, for example, owe much of their heritage to defense and space innovations. The challenge for the defense and space industry is to become more commercial in its approach to innovation. Some successful examples of the commercial approach include military unmanned aerial vehicles, derivative aircraft, and commercial spacecraft.

Although the defense and commercial sectors are working their way through different challenges, both are under pressure to improve the productivity of innovation so that it enhances their business performance. Defense companies need innovative ideas to help them exploit adjacent markets and improve the affordability of their products, while commercial companies need innovative ideas to help them outpace their competitors and reduce investment risk. But

"Necessity is the mother of invention."—An ancient proverb

This axiom is as true today as it was thousands of years ago. In commercial aviation we see the need for affordable travel and environmental sustainability driving innovative solutions. The next generation of narrow-body aircraft will deliver 15%–20% improvement in efficiency, increasing the pace of such improvement more than ten-fold.

In defense, we have seen innovations in the past decade, which were not even imagined previously, to adapt to the changing threats, particularly in intelligence, surveillance and reconnaissance systems.

In a recent PwC research paper, *A&D Insights: Programs Under Pressure*, PwC interviewed more than 20 executives from leading A&D companies. The business priority that these executives collectively ranked highest was innovation. The A&D industry has a proud history of innovation, but it is now facing some unprecedented challenges.

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successful innovation can be elusive, and it may not be enough to be first to market or to have a distinctive product. Success in today's economy requires developing a culture of innovation that is balanced with rigorous financial discipline, including return on investment analysis.

How is innovation success achieved?

For many companies, innovation is the single most important success factor, as confirmed by PwC's recent survey of industry executives. Failure to innovate may pose the greatest risk to an enterprise, yet many companies do not include innovation among their top enterprise risks . They are often focused on financial and compliance risks when, in fact, a failure to innovate may pose the greatest risk to an enterprise. Perhaps the reason that innovation is omitted is because it is challenging to evaluate. We are more adept at measuring financial and compliance risks, including operational risks that have financial consequences. But in looking at innovation risk, we need to evaluate opportunity risk — and that is much more difficult.

While it may be challenging to evaluate innovation opportunity risk and R&D return on investment, it is somewhat surprising that many companies lack this discipline, as difficult and imperfect as it may be. Certainly, all companies have annual R&D investment budgets and evaluate the best use of those budgets. But budgeting is a short-term analysis, and innovation, by its nature, requires a long-term outlook. So innovation must be more closely linked with a company's long-term strategy than with its annual budget process. It is also critical that the finance function is a partner in developing the financial analysis of innovation. The CEO of a respected aerospace supplier once said, "We spend hundreds of millions of dollars on R&D each year. It's not acceptable to not know the value we get from it. We have to figure out how to measure it so we can manage it." And the CEO of a leading pharmaceutical company recently said, "We've been spending over 10 percent of revenue on R&D for years, and we have too little to show for it. If we're not going to get much, I might as well spend less." Taken together, these two statements frame the R&D investment challenge: figure out how to evaluate innovation and manage R&D in order to create competitive advantage and optimize investments. This issue is especially pressing in today's A&D sector, where shareholders and government regulators are paying increasingly close attention to the return on investments in R&D and innovation strategies.

It is generally true that industry-leading companies are able to manage their investments in R&D to produce significant returns. They consistently achieve higher enterprise values per R&D dollar invested than their peers by choosing good investments and then managing them successfully. However, even highly successful companies may not be disciplined enough to optimize innovation success.

Innovation must be more closely linked with a company's long-term strategy than with its annual budget process

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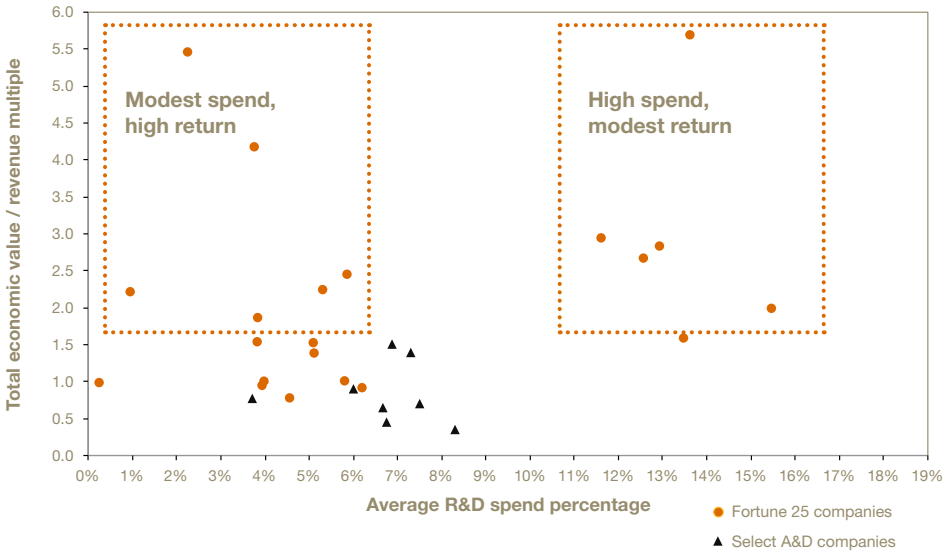
A&D companies do not stack up well against other industries: they have been "challenged" in their ability to manage increasingly scarce development dollars. With the notable exception of two suppliers, A&D companies have value-to-revenue ratios that are less than 1.0, the bright line between value creation and value destruction. This measure of innovation value includes both internally funded R&D and customer funded R&D; eight of the world's top eleven A&D firms report both sets of figures. Over sustained periods of time, low value-to-revenue ratios negatively impact growth, profit margins, and enterprise viability.

As the graphic below shows, when R&D is managed well, it can boost enterprise value tremendously. The key challenge for A&D executives is how to accomplish this success.

Enterprise value of R&D spend (2011)



Sources: PwC Analysis, Company Annual Reports 2011, CapIQ
Total Enterprise Value = Market Cap - Cash & Short Term Investments + Total Debt + Pref. Equity + Total Minority Interest

What are the components of innovation excellence?

There are four dimensions to innovation excellence: market understanding, technology management, product line planning, and product and process development. Industry leaders, as measured by enterprise value versus R&D investment, consistently excel at one or more of these dimensions. Sometimes it is possible to succeed with a "killer app," the perfect product for a particular niche, but that success tends to be short-lived. Also short-lived is driving uninspired ideas through a really good execution engine, since this, too, does little to produce sustainable growth and value. The obvious conclusion is that companies need to create really good ideas through unparalleled customer understanding and then drive them through a well-tuned planning, development, and innovation delivery system. This takes more than just metrics and tools; it takes a strategy and culture that are focused on innovation and managing related risks.

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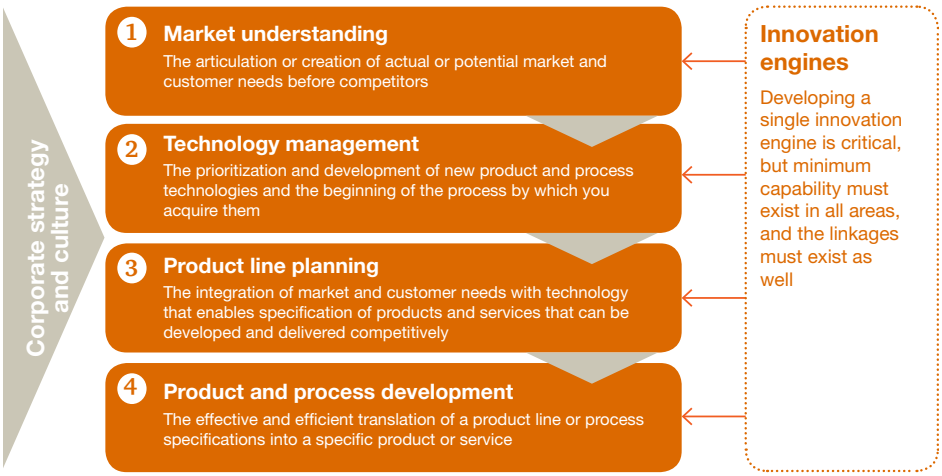
Four dimensions of innovation excellence



How can A&D companies achieve innovation excellence?

1 *Market understanding*

A theme that emerged from PwC's interviews of industry executives concerned "customer intimacy." For commercial aviation, that means close contact with the direct customer. Today, OEMs need intimacy with airline operators, and suppliers need intimacy with the OEMs and others in the supply chain. But the aviation supply chain is evolving. Since the OEMs are asking suppliers to provide more system solutions, the suppliers have to assume greater responsibility for innovation. To do so, the suppliers need more direct access up the supply chain, even to airline operators, in order to be able to create better solutions.

For defense companies, the decrease in government spending means it is no longer viable to focus only on the requirements of military buyers. Defense companies must look to the needs of other constituents that have a stake in A&D products and programs. To define these needs, companies have to first invest in fact-finding and then integrate what they have learned into their market and product strategies.

To gain an understanding of the market, companies need to gather both quantitative and qualitative information. A quantitative look at the market involves an extensive analysis of target markets, including size, growth, profitability, competitive intensity, demand trajectory, and so on. This is not a one-time exercise but an ongoing investment of time and resources that leads to an understanding of a target market over time. The qualitative element involves speaking directly to people in each target market to learn about their needs and values and how a new product or program stacks up against their requirements. In cases where there are multiple targets, it's important to get input from all stakeholders. A defense program, for example, might have eight or more distinctly different, but equally important, stakeholder groups: the government acquisition office, the program management office, US defense leadership, elected officials, foreign military organizations, the operator or pilot, the ancillary war fighting units, the government depot, the maintenance staff, and the office of the secretary of defense. The input from all these groups needs to be collected, analyzed, and synthesized, and, considered with the quantitative findings, will provide a firm foundation from which to launch new products and innovations.

2 *Technology management*

Following scope creep, the single most commonly cited reason for program overruns is unforeseen technology insertion (TI) problems. Despite a robust body of industry knowledge in this area, A&D companies still struggle with how to effectively execute TI programs.

In PwC's Global Product Innovation Benchmark Study, we found that the biggest problem A&D companies have with TI is the critical path scheduling of new technology developments. An effective method of dealing with this problem is to break down new technologies into clearly definable sub-systems, and then develop alternative technology solutions within the boundaries of those sub-systems. Self-contained sub-systems designed with standard interfaces enable program teams to insert new technologies with a much higher probability of success, and, should a problem occur, the pre-existing technology solution is available as backup. Automotive OEMs use this strategy to introduce a steady stream of new, technologically advantageous products in industry-leading development cycle times of 24 to 36 months. This strategy, combined with a well-conceived product platform strategy, is an excellent way to bring new technologies onto pre-existing vehicle platforms.

3 *Product line planning*

Compared with their peers in other industries, A&D companies have been slow to incorporate leading practices into product platform management. In many cases, a program is its own platform, with unique hardware, software, and vehicle architectures, and it leverages little, if any, design content from previous programs or products.

Based on PwC's Global Product Innovation Benchmark Study, we estimate that defense programs generally leverage less than 10 percent of design content from previous programs or products. By comparison, some enlightened companies in other industry sectors achieve up to 70 percent leverage of design content. The unique nature of defense procurement may keep A&D companies from achieving 70 percent platform leverage, but there is little doubt that much more can be done to raise the current level. The key to platform leverage is architecture design: consolidated sets of customer requirements, standard architecture partitions, architecture rules, and standard interfaces. These four design elements enable companies to develop product platforms capable of supporting multiple products and hosting multiple generations of technology innovations. While it is already common in the automotive and electronics industries, some savvy A&D companies are now starting to embrace the power of product platform strategies; in fact, one aircraft engine manufacturer used product platforms to become a leader in its segment.

4 *Product and process development*

There remains much room for improvement in new development delivery in the A&D sector: fewer programs are meeting their targets, and Nunn-McCurdy breaches are common. Certainly in the government sector, with its focus on controlling costs in this budget-conscious time, cost overruns are more likely to elicit greater scrutiny. A successful new development delivery approach requires at least two elements: 1) a robust cross-functional development process, and 2) an integrated governance system that aligns executives, managers, project teams, and engineers. According to PwC's Global Product Innovation Benchmark Study, a robust new product development process combined with an integrated, effective governance system can result in 30 percent faster cycle times and 50 percent better financial returns.

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> *"[Innovation] improves the competitiveness of a customer or a consumer. …If you measure it any other way, you get innovation for innovation's sake."* [1]
>
> *—James McNereny, CEO The Boeing Company*

Putting it all together

Technology must be commercially successful in order to be truly qualified as an "innovation." In an interview with *Aviation Week & Space Technology*, James McNerney, CEO of The Boeing Company, put it this way: "[Innovation] improves the competitiveness of a customer or a consumer. …If you measure it any other way, you get innovation for innovation's sake."[1] In other words, research and development investments need to be evaluated for return, like any other investment. This evaluation will serve to improve the effectiveness of innovation as well as the culture, strategy, and processes surrounding research and development. However, it is also a major challenge. R&D investments have a long development cycle and often cross more than one generation of management, particularly in aerospace and defense. Therefore, a company has to ensure it has built a culture that supports R&D efforts through management changes. It is also unquestionably difficult to estimate the value of future returns. This work requires marketplace understanding, including competitive efforts, and a realistic assessment of a nascent product's timeline and costs, which can in turn serve as the foundation for creating future return scenarios.

Although both of these challenges are real, there are strategies, processes, and new analytics available to help executives do a better job of extracting higher returns from investments in R&D.

PwC advises A&D companies to take the following steps to help boost returns from their investments in R&D:

- Know the market. Invest in the market and customer research in order to understand market and customer needs and how they might evolve over time.
- Focus on platforms. Take the time to define product platform strategies capable of hosting new technologies and spanning multiple applications.
- Differentiate on technology. Isolate and modularize technologies that deliver the greatest customer value and focus development efforts on those technologies.
- Streamline development. Organize product development as an end-to-end business process and manage it for value, delivery, and quality.
- Embrace new business models. Look at novel ways to move beyond traditional product or service business models.

1 *Aviation Week & Space Technology*, October 26, 2009. Vol. 171, Issue 16, p. 66

How PwC can help

For additional information on how we can help you enhance your innovation strategies and execution, please contact a member of our A&D leadership team in your region:

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PwC's Advisory practice is a recognized leader in innovation and product development management consulting services. We have a comprehensive body of knowledge related to innovation, technology, platforming and product strategies, and management best practices. We periodically benchmark innovation and development performance and correlate it to management practices to determine which really do create value. Our professionals have completed over 1,400 innovation and development excellence-related engagements with a wide variety of technology, manufacturing, and aerospace and defense leaders.

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