Building a reliable innovation engine

Volatile, competitive markets make it hard to be both fast and innovative. Changes to the design and governance of the R&D organization can help.

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McKinsey&Company
Operations Extranet

March 2017

Bringing innovative products to market faster than competitors is difficult. Doing it again and again, year after year, is very challenging indeed. And many organizations struggle—especially when combining ideas into a steady stream of profitable innovations that generate real customer value.

Lack of effort is hardly the problem. Organizations devote serious resources to internal R&D departments, collaborative efforts with suppliers, external funding opportunities for universities, and open-market acquisitions of intellectual property. The real gap is usually deeper: the processes, management approach, and culture required to deliver innovative products to market next year are very different from those required to investigate and develop breakthrough technologies for release in five or even ten years.

But only a few companies fully grasp that difference. Instead, too often they run short- and long-term development activities in the same way, or even as part of the same projects. Or they make the opposite mistake, running separate upstream (research) and downstream (development) activities without the appropriate organization, planning, or governance to keep the different efforts aligned.

Companies can overcome many of these difficulties by changing the way they design and run and their R&D organizations. A successful "innovation engine" comprises three important elements:

- A stable, long-term direction and **detailed roadmap**, to keep the entire organization aligned.
- **Management and leadership approaches** that are tailored to the fundamentally different challenges in upstream and downstream R&D activities.
- An **upstream R&D culture** that recognizes the **value of failure,** with both the ability to learn from mistakes and the agility to switch direction quickly to avoid dead ends and wasted effort.

Set long-term direction with an innovation road map

The huge costs, long lead times, and high failure rates associated with, say, pharmaceutical R&D activities leave little room for error in prioritizing R&D resources. Consequently, the best pharmaceutical companies develop a clear, overarching vision and strategy—typically centering on particular diagnostic categories. Their long-term road maps focus scientific discovery on these therapeutic areas, so that the product organization can plan launches years in advance.

Few organizations in other sectors can claim long-term visions of such clarity. Still fewer have created a road map to guide them to their desired destination. They need one. The organization's long-term strategy should identify the customers and markets it aims to reach, and the needs it wants to address—laying out a few strategic R&D efforts for the company as a whole. The road map should then identify the technologies that are likely to meet those customer requirements, as well as the suppliers and other stakeholders best placed to provide support.

Rebalance toward the longer term

In most organizations, the road map splits naturally into three time horizons. The first horizon consists of the products people are working on today. Most companies already have a detailed understanding of this horizon, so the focus needs to be on the two horizons that remain.

Second horizon: Identified technologies. The second horizon includes the more challenging steps needed to translate emerging, but identified technologies into a form suitable for future generations of products. In many companies, this second horizon takes up the majority of the "research" part of R&D. Its objective is the delivery of a construction kit of new technologies or solutions that can be adopted off-the-shelf in future product generations. It also encompasses cross-product activities, such as part-count reduction plans or the development of new platforms or modular-system architectures.

Third horizon: Future contingencies. The third horizon includes broader themes, concepts, or areas of technology that may or may not prove successful. Only by investigating such areas, however, can the organization make the breakthrough innovations that will allow it fulfill the ambitions of its long-term strategic plans.

Today, many companies' road maps of the second horizon are only patchy at best, with R&D resources tilted heavily toward the "development" side. Interest in the third horizon is often limited to just a few researchers in isolated parts of the business. Both limitations are hugely risky: The success of second- and third-horizon research efforts may determine the organization's long-term future.

Filling the white spots in the second-and third-horizon road maps is therefore essential. For the second horizon, where technologies are already known, each specific product line's road map should span the next three to five product development cycles. For the third horizon, the map should identify likely inflection points—such as the introduction of new technologies—and attempt to quantify the probable impact of those of those changes.

A continuously evolving vision

Naturally, the long-term vision should be subject to regular review as well. Customer and company priorities may change. Unexpected new technologies may emerge. Promising areas of research may fail. All of these sorts of surprises mean that the original vision needs updating, with the road map evolving as a result. That way, the organization can continually check to ensure its R&D investments and priorities are still taking it in right direction.

Adopting a differentiated management approach

In our experience, most companies devote large majority—often around 80 percent—of the R&D budget to specific downstream products. That leaves the remaining 20 percent to cover all of the upstream development portions of the road map: the second horizon, which involves building the production-ready ready technologies that will be included in future product generations, and the third horizon, which fulfills the organization's strategic need for basic research and development. But even though upstream research may be represent only a small minority of the R&D budget, it must be funded and managed completely differently from the downstream.

Ring-fencing research funding

That's more difficult in organizations where R&D does not fully control its own funding, as is too frequently the case. In some companies, the head of R&D may have no more budgetary authority than a product manager—and both may be part of a same executive committee responsible for allocating resources among product-development products.

In this sort of structure, a lack of clear allocation rules can put upstream funding under threat. Product managers may be tempted to raid the upstream budget in order to fund downstream projects that are running short. That might help to balance the books in the short term, but at the expense of the long-term health of the innovation engine.

The solution is a clear differentiation of funding, in line with the needs identified in the development road map. Upstream funding decisions are best made at a higher level than the product manager, with real insulation from the demands of first-horizon product development. That way the leadership can make informed decisions about whether resources are better spent on a product about to be released that may be over budget or on longer-term investments that may be important to future product lines.

Redefining management rigor

Many companies have worked hard on making their downstream processes rigorous: the familiar quality gates and review mechanisms, with well-defined change- and risk-management processes and detailed performance indicators. But this entire structure is designed to leave little room for high risk innovation, which is at the core of upstream product development. Upstream needs rigor as well, but in a different way.

That calls for a fundamentally different management approach. When the gap between research and development projects is blurred, ideas make the leap into new product designs before they are mature or fully tested. That causes additional costs and delays as problems are fixed or tests repeated.

In energy storage, for example, new chemistries and battery cell geometries have been introduced into products after limited, small-scale testing. The result has been problems in parts production that lead to extensive additional testing and safeguarding. Similarly, in the rail sector, new vehicle architectures are often finalized in pilot projects with customers. The designs that work well for one customer don't always

fulfil the requirements of others, however, so future projects require significant, and costly, adaptation and rework.

To avoid these issues, companies need separate KPIs and progress gates for second- and third-horizon research projects. Given that early-stage innovation variables are often hard (or impossible) to measure, though, the KPIs cannot replicate the mathematical precision demanded for horizon-1 projects' net-present-value calculations. Instead, the indicators must reflect qualitative judgments, such as how closely a project aligns with the company's innovation road map.

Many successful companies use a venture-capital-inspired approach: projects are regularly assessed, with funding for the next phase of development released only if the project passes all the relevant criteria. The cancellation rate is high; only a small fraction of the ideas an organization begins to explore will make it through all of the evaluation gates. But this gantlet means that the most promising projects receive most of the funding.

Upstream-specific KPIs also ensure that the final deliverable of the development process is a well-filled shelf of innovative concepts and prototypes that have already passed the most critical testing and validation steps. That greatly reduces the risks for downstream product teams as they build these innovations into future products.

Connecting "R" to "D," too

"Managed differently" shouldn't mean "isolated," however. Walling off research into a separate unit from product development increases the risk of misalignment, with research seen as an ivory tower. Companies must address this risk systematically. In addition to instituting an effective road map and strong review processes, they should encourage informal interaction between researchers and development teams—such as by co-locating activities, and ensuring the regular exchange of staff between upstream and downstream projects.

Embracing a failure-tolerant culture

All innovation carries with it the risk of failure, and the more innovative the concept, the higher the risk. As companies explore new ideas, reversals and dead ends become the norm rather than the exception.

Accordingly, in upstream innovation, the final essential ingredient for an innovation-friendly environment is a change in attitude toward failure. In downstream, horizon-1 innovation, seeking to prevent failure makes sense, given the resources that have already been committed to an advanced product design and the reputational and financial risks of a product's failure to meet requirements. But following that same logic for horizons 2 and 3 would defeat their purpose—which is to take risk.

A more balanced view of risk in upstream shifts the focus from prevention to early identification. The organizational mind-set instead encourages people to bring issues and potential failures to the surface quickly, and identify promising alternative plans. If no viable solution can be found, the project should be stopped, without blaming the people involved. Indeed, such failures are valuable, even worth celebrating: the organization can learn from each one.

The real challenge in a failure-tolerant management is speed. Once a problem has been identified, but not resolved, every hour of continued

work on the project is money wasted. Spread over hundreds of teams, delays of only a week can cost organizations millions. The solution is the adoption of agile development principles, with frequent, timely testing and failure mode assessment, and a quick response by project managers.

That evaluation process also needs to consider projects in the context of the organization's evolving innovation road map. A technology may be technically feasible, but if it provides a solution that company doesn't need, the funding would be better spent elsewhere.

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A robust innovation engine can't be built overnight. Long-established structures, processes, and habits will need to change. Mistakes will be made along the way. But by building the right organization today, companies can transform their ability to generate innovative, successful, and profitable products in the years and decades to come■

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