R&D Retains Strong Focus on Return

Most companies focus on long-term knowledge building and productivity of teams

THINKING GREEN: Arkema's liquid thermoplastic acrylic enables recyling of wind turbine blades.

Gregory DL Morris

Chemical makers are generally satisfied with the financial return of R&D investment, according to a *Chemical Week* survey on R&D and innovation, supported by Argo Consulting (Chicago). Frustrations were noted on time it takes to get innovation to market.

The survey of 53 executives found that 60% of R&D of innovation leaders surveyed were satisfied or very satisfied with the return of product Innovation and R&D Investments (chart). About 8% of respondents said they were very dissatisfied and 2% were dissatisfied.

Other key findings showed that 50% were satisfied or very satisfied with the number of projects delivered by the innovation or R&D teams to drive revenue growth, while only 23% were satisfied or very satisfied with time to market for new projects. About 59% were satisfied or very satisfied that product innovation and R&D organization are aligned with the needs of the market.

Two surprises stood out in the survey results, said Dantar Oosterwal, senior vice president and partner at Argo Consulting. "The first was the number of people who said they were satisfied with their return on R&D. That was 60%, which is extremely high. I was shocked. Usually we see about 70% to 80% dissatisfied." One possible reason, Oosterwal suggested, is that "CEOs tend to be more satisfied with their return on R&D, while R&D people themselves tend to be dissatisfied."

In contrast, the response that only 23% were satisfied with time to market was in line with expectations. "Timing to market [neither before markets are receptive to innovation, nor too late with an offering] is important," said Oosterwal. "The focus is on the amount of R&D to get throughput and maximum output."

The other surprise was that 22% of respondents had no formal methodology for their R&D process. "By the time you are a successful company, you should have a formal process," said Oosterwal. "That should be fundamental. The fact that nearly a quarter of companies do not represents a huge opportunity."

Innovation playbook

Companies say it is vital to align R&D investment with market and customer needs.

"R&D is a privilege, not a right," said A. N. Sreeram, chief technology officer and senior vice president for research and development at Dow. "Growth happens because you take care of your base business. You are not going to get market share just because you have market share." Dow starts tracking new product offerings at $10,000 in commercial sales and continues through the first five years, careful to discern if that is truly new revenue rather than just replacing revenue from existing sales.

"We have an innovation playbook in which we track all projects, about 700 of them," Sreeram said. Metrics include sales productivity and margin improvement. "We know not all projects will make it, so we track the 'say/do' ratio for how closely the teams do what they say. One of our board members suggested it should be the 'do/say' ratio to encourage people to do more than they say."

R&D investment has to be balanced not just for effectiveness within the company but across the supply chain, Sreeram noted. "Value-chain management is very important," he said. "We are alert to investing too soon, too many dollars ahead of where we or customers may be ready." That is especially true, he added, when the company is not a direct supplier to the end-use market. Innovation can have great potential for the producer and even direct customers, but may require changes elsewhere in the value chain that must be taken into account.

At the opposite end of the scale, internal innovation can improve processes and performance without any outside implications. "Block testing in paints goes back 100 years," Sreeram said. "You paint two blocks and stick them together to test for tack. Today we have robots using tribology, but it is still a block test. We get better and more accurate measurements. It used to take two or three years to develop a new paint, now it is every year, and we are moving to every season. We are able to accelerate to meet the accelerating need for do-it-yourself markets during [the COVID-19 pandemic]. Ten years ago, paint formulators would not have wanted innovation that fast. Now it is a competitive advantage."

Sreeram considers institutional knowledge another competitive advantage. "We have every research report since 1934 digitized in our internal database," he said. "Our people can look at the raw data. Those are golden nuggets, the family jewels."

Tracking returns

The question of whether a strict financial return is a barrier or spur to innovation remains open. "It is a good discipline to look at profit and loss for research and development," said David Bem, chief technology officer and vice president of science and

technology for PPG (Pittsburgh). "That P&L review has to be done with the understanding that there is a value in knowledge. You could have three projects that generate no sales, but the learning informs the fourth project that creates significant value."

Like most, PPG tracks its spending on innovation in several ways. "We look at what percentage of sales come from developments in their first four years," said Bem. "We also look at margin lift and business level. We have a centralized project classification system. When a project is started, it is coded into the enterprise resource planning system. That is typical of most companies. We have dashboards and scoreboards at various levels of the organization."

SREERAM: Growth happens when you meet market needs.

There are also incentives. "We recognize the contributions of both individuals and teams," said Bem. "In the short term, the first six months of sales for a new development will be reflected in performance ratings and variable bonuses. Real recognition is important. There is a dual career ladder, salary and title, and also internal titles such as corporate fellows. Those are not uncommon around the industry to recognize people who are well respected and trusted advisors within the company."

COLLETTE: Addressing known needs and expanding markets.

Environmental stewardship drives a lot of opportunity, Bem said. "It is hard to find a commercial coating these days that is still oil based. The earliest water-based coatings may not have been the equal of the oil-based coatings at the time, but today the quality of water-borne coatings is very high, in many cases higher than the oil-based materials they replaced."

REITER: Adapting innovation to quicker life cycles.

Beyond materials themselves, time to market is another important goal of R&D effectiveness. "We talk a lot about gate process and speed of gate, the launch and the preceding three to five years," Bem explained. "But there is also the matter of switching costs for customers. For every project we look back at the entry rate, what is driving and limiting the growth. How much training is required, the capital cost to customers to adopt, what tools are needed."

He also stressed that knowledge transfer is a core competency: "the ability to move knowledge around and past barriers. We try to create horizontals in the company, opportunities for networking. We have found that a lot of that depends on people being in the same place, which is difficult these days. People can't gather around the coffee machine or at networking events. We have put effort into finding ways to work around that until we can see each other in person again."

Returning to the question of returns, Bob Reiter, head of R&D for Bayer Crop Science noted that "the value proposition in agriculture is relatively straightforward. We are the biggest investor in the [ag] sector, investing €2.3 billion a year towards productivity, simplification, and reduced risk. Returns can be relatively easily calculated; prices in grain, vegetable, and fruit markets are widely reported. We are comfortable with our investment thesis."

Reiter noted that the return on research equation in ag is changing. "We will be getting paid differently because how farmers produce crops is changing. They are adjusting to climate change, and they are reducing overall inputs, both fertilizer and crop protection. Those will require new kinds of investment and a faster life cycle."

Still another external variable is regulation. Ag is almost as highly regulated as pharmaceuticals, "which can be a friend or a foe," Reiter said. He explained that current offerings could have new restrictions imposed, while at the same time, other regulatory changes could open new markets.

"In agriculture we always try to expand the use of our portfolio," said Reiter. "We might develop a new fungicide for French wheat farmers first, and then look at other crops and other geographies."

The biggest R&D opportunity for Reiter is the integration of the legacy Bayer ag chemicals business with the plant breeding biotech operations gained in the acquisition of Monsanto in 2018. "There have been different product pipelines and different R&D skill sets, but when we put the breeders together with the chemists, they find parallels. Then there is digital technology weaving through both. We are finding natural affinities within our research teams. They are helping each other optimize the discovery paths. We are encouraging disparate disciplines to come together."

R&D: Push or pull?

The other classic challenge for R&D is push or pull: use innovation to meet known needs in the market, or work from known strengths to expand into new areas. Ideally both can be achieved at the same time, such as Arkema's foray into wind-turbine blades, for which the company just won the 2020 Pierre Potier Prize in France. The prize recognizes initiatives in chemistry that promote sustainable development and the development of eco-responsible approaches. It is awarded by a jury of research, industry, and ministry experts.

Most blades are made of composite materials, a polymer matrix reinforced with fibers, usually glass but sometimes carbon. Thermoset resins, epoxies, polyesters, and vinyls are the most common polymers, but cannot be welded and cannot be recycled.

"We thought that was very odd, green energy components that cannot be recycled," said Christian Collette, vice president of R&D at Arkema. "After their service life of about 15 years, the blades are cut into chunks and sent to a landfill. That has not been a huge problem until now because there were only a few turbines 15 years ago, and the classic blades were 20 to 25 meters long. Now there are thousands of installations, and blades can be 50 to 60 meters on shore, and as much as 100 or 120 meters off shore. That is a large quantity of material, as much as 1 million [metric tons] of composites to recycle."

It would not have been overly complicated to replace thermosets with thermoplastics if it were simply a matter of material substitution. But the blade makers have achieved their designs and economies of scale with an infusion forming process that requires a liquid to flow around and bond to the fibers. That excluded traditional long-chain thermoplastics.

"Blade manufacturers are very conservative,

and did not want to change their process," said Collette, "so we developed a liquid thermoplastic acrylic that they could use in their same process. It has a very low viscosity, like water. And it can be recycled. There are not many polymers that start as a liquid and finish as a solid. There are even fewer than can be recycled by heating, and even fewer that can be recycled with no loss in material properties or quality. This is a real breakthrough."

Arkema was not a competitor in composites, but does have a long history in thermoplastic resins. "I am convinced you cannot succeed in domains where you are not legitimate," said Collette. "You have to know either the material or the market. Just having a good idea is not enough. You are never alone in having good ideas. We know thermoplastics, so even though we did not know composites, we were in a domain that we did know."

There are, of course, many different ways to measure the effectiveness or productivity of R&D. One common way is the percentage of turnover that is generated by products that are five years old or younger. "But that risks cannibalization," Collette cautioned. "You run the risk of putting in a lot of effort for the same return in sales, just substituting sales of new materials for sales of existing materials."

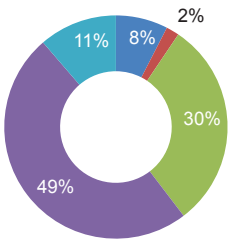
Instead Arkema tracks return on R&D annually, with a compounding factor built in. "We use a simple calculation," said Collette. "If I spend 3% of turnover on R&D, I expect to get back 3% in that year. We expect that a commercial material will last 5 to 10 years, so we get that 3% back over and over. Sometimes we are willing to invest more, sometimes less. We listen to the market. The market tells us when to take more risk."

Collette also noted another simple but effective way of monitoring R&D spending and helping to ensure solid returns. "There is no problem of where to start but when to stop. There is no shortage of good ideas or potential leads. If you have spent €12 million on a development project that has not yielded any results, then the strong tendency is to spend €1 million more because it would be a pity to waste that €12 million. But that €12 million is already gone. Don't explain that, explain why then next €1 million should be spent. Don't throw good money after bad."

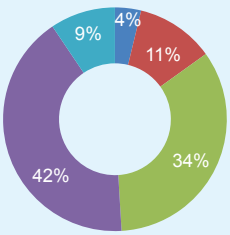
In helping to determine where to spend those next euros, Arkema relies upon its supply chain for insight. "As a materials company we are far from the end user. We make a resin that is used to make a blade that is sold to an installer that is used to make electricity. Our partners know the end-use markets and we listen to them." ■

CW-Argo Product Innovation & Value Management Survey

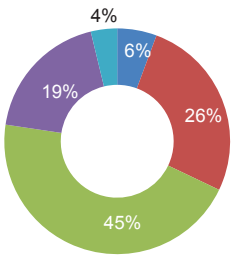
How satisfied are you with the financial return of your product Innovation and R&D Investment?



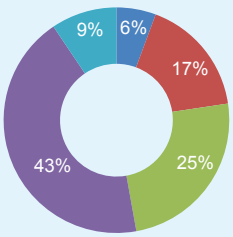
How satisfied are you with the number of projects delivered by your product innovation or R&D organization to drive revenue growth?



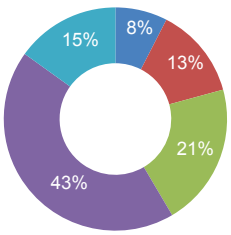
How satisfied are you with the time to market for new products?



How satisfied are you that your organization selects the best projects to provide the business growth you need?

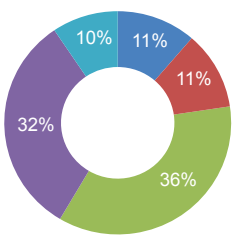


How satisfied are you that your product innovation and R&D organization is aligned with the needs of the market?

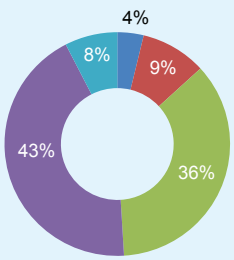


Very dissatisfied
Dissatisfied
Somewhat satisfied
Satisfied
Very satisfied

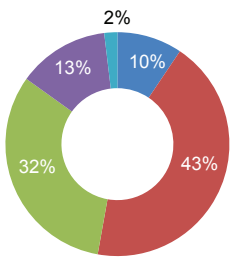
How satisfied are you that your metrics ensure your product innovation and R&D process is effective?



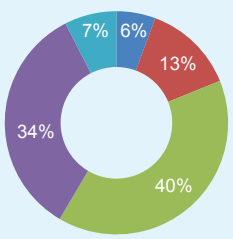
How satisfied are you with the overall efficiency of your product Innovation/ R&D process?



How often over the last five years have you cancelled or abandoned a project after it's been started due to technical issues or because it did not fit with the plan?



How has the rate of new product introductions changed over the past five years?



Very dissatisfied
Dissatisfied
Somewhat satisfied
Satisfied
Very satisfied

Never
Rarely
Intermittently
Frequently
Always

Significant decrease
Decrease
Flat
Increase
Significant increase

CW-Argo Product Innovation & Value Management Survey

Chemical Week teamed up with operations improvement firm Argo Consulting (Chicago, IL) to survey 53 chemical industry innovation and research & development executives to measure satisfaction with production innovation and value management execution and processes. The survey was conducted between 25 September and 16 October.

Source: *CW*