The Difference Between Research and Development

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The already unclear lines separating research from development are getting even blurrier as more companies allocate some part of their R&D budget to take on riskier projects, and invest in the necessary infrastructure to manage these riskier activities. New products are now being launched out of recently formed "Innovation" organizations", and more are coming from existing "Advanced Development" organizations.

Figure 1: The Continuum of Research and Development

Challenges of "Anywhere" R&D

Several factors have complicated matters for industry observers trying to stay abreast of what might be coming to market by simply paying attention to product development pipelines. These factors include:

- The changing corporate approaches described above.
- The desires of developers to bring solutions to market, not just pieces of a solution.
- The globalization of R&D that has, in effect, decentralized R&D.
- Naming conventions for organizations that differ by industry and country.

The jury is still out as to whether today's approaches to R&D will prove more productive than historical approaches. Historical approaches to pre-product development generally restricted the scope of activities to reduce uncertainty and improve the predictability of key enabling features, capabilities and technologies—and then turned those enablers over to product development.

Traditional "Analog" R&D

R&D is a continuum—highly analog rather than digital in its construct. In the 20th century, R&D could generally be segmented into four categories: Basic Research, Applied Research, Advanced Development and Product Development. "Skunk Works," perhaps a fifth category, is a discussion for another day.

In **Basic Research**, discovery targets are broad. Scientists and researchers generally look for capabilities that have some efficacy with an articulated broad market or customer-based need. Some Basic Research is truly blue sky, but that has been on the decline the past few decades as few can afford it. Basic Research often just rules out things that won't work and identifies inventions that might work.

Applied Research generally has a more specific target. It usually focuses on a known problem, business opportunity, or an application area where economic or social improvements are possible. Applied Research generally starts off by taking enablers that might work and attempts to narrow them down to the possible and likely feasible solutions.

Advanced Development generally takes these possible and likely feasible solutions and further reduces the risk in hopes of culling out the best alternatives to deliver to an expressed target for a capability or feature to incorporate into products. Downstream manufactured cost considerations start to come into play as a culling consideration. Mentioned earlier, some advanced and innovation organizations actually bring the entire product to market.

Finally, **Product Development** invents what's needed and necessary "now" and packages both the form and function of all feasible and risk-reduced features and/or capabilities into products planned for release to the marketplace. Venn diagrams of each of these four historical R&D categories always overlapped, but the overlaps have grown in cadence with the growth of innovation emphasis this past decade.

In short, research and advanced development organizations historically didn't bring products with full form and function to market. Instead, they specialized in experimentation and analysis, combined with breadboards and brassboards to demonstrate feasibility. Form and function was the job of Product Development.

Professionals in these pre-product development organizations were largely senior scientists and engineers who specialized in discovery and in narrowing-down feasibility issues. The knowledge of manufacturing capabilities and constraints, packaging, logistics, costing and other "product launch" disciplines were almost exclusively in the realm of Product Development. Today, the lines of organization purpose and demarcation aren't as clear.

"Analog vs. Anywhere" R&D

The idea that any organization can launch a product has advantages. They include:

- Healthy competition between precut-releasing organizations.
- Broadening the skill sets of all developers.
- Keeping the entire development community close to the market and customer needs.
- And perhaps adding flexibility to the management of development capacity.

On the other hand, there are also some disadvantages. The decline of specific subject matter experts may reduce the depth of company capabilities over the long term. When advanced or special innovation organizations get all the sweet projects, it sows dissatisfaction in the rest of the product development community. This is analogous to the way many feel when asked to exclusively focus on sustaining engineering or maintenance rather than new products. This can lead to unproductive time, often in the form of politicking. As well, some managers subtly alter or over represent their functional expertise to attain preferred projects. This can lead to duplication of staff, or projects over the heads of the people currently in the organization. The companies that are breaking from the analog continuum of research to development must remain vigilant to the possible downsides of change.

An "Analog vs. Anywhere" Example

Hard to internalize the historical R&D continuum? Let's take the example of a self-piloted robotic lawn

mower. Lawn mowers are the realm of Product Development after decades of designing and producing them. Some advanced work might be necessary if one is trying to get better lift from the blade to push clippings into the collection bag. Some advanced work might be necessary for engines that have to operate regularly in extreme conditions, and/or with changing regulations on fuel chemistry. This past decade, significant advanced work has been necessary to develop all-wheel turning/steering for riding mowers. But, compared to those examples, a self-piloted lawn mower requires advanced work on just about every subsystem of the mower platform.

Energy management, torque in a scaled down size, handling the mower, fail-safing while it is running and piloting are just a few of robomower's challenges. Piloting is a great example to make the point. Steering robomower isn't as easy as the robotic vacuum cleaner that changes direction when it bumps into something. The vegetable garden and flower bed might get half mowed before "robo mower" bumped into anything hard enough to redirect it; and that wouldn't be good. The same applies for pets and curious children to say the least. Advanced development organizations are still culling among feasible alternatives to define the edges of yards and set the redirection of the mower. Impact sensing, infrared or heat sensing, current or magnetic sensing aka doggie wire, GPS, directly program the yard coordinates as part of user set-up, photograph or image-driven, and several others are all feasible alternatives. Can you imagine the project schedule if Product Development had to cull out the best piloting approach while designing the rest of the mower that is fully integrated with the piloting system? Applied Research and Advanced Development organizations could work for years to determine the most accurate and economical piloting technology for a robotic mower platform across the myriad of yard configurations and landscaping approaches before anything was ready for wheels and a blade.

Conclusions

Today, robomower might be brought to market from either an Advanced or a Product Development organization versus Advanced Development determining the best piloting technique and Product Development then bringing robo mower to market. As well, an entire robomower might be the responsibility of an Innovation Organization or Skunk Works.

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