OLIVER WYMAN

Research & Development

NEXT GENERATION R&D

TACKLING TOMORROW'S CHALLENGES

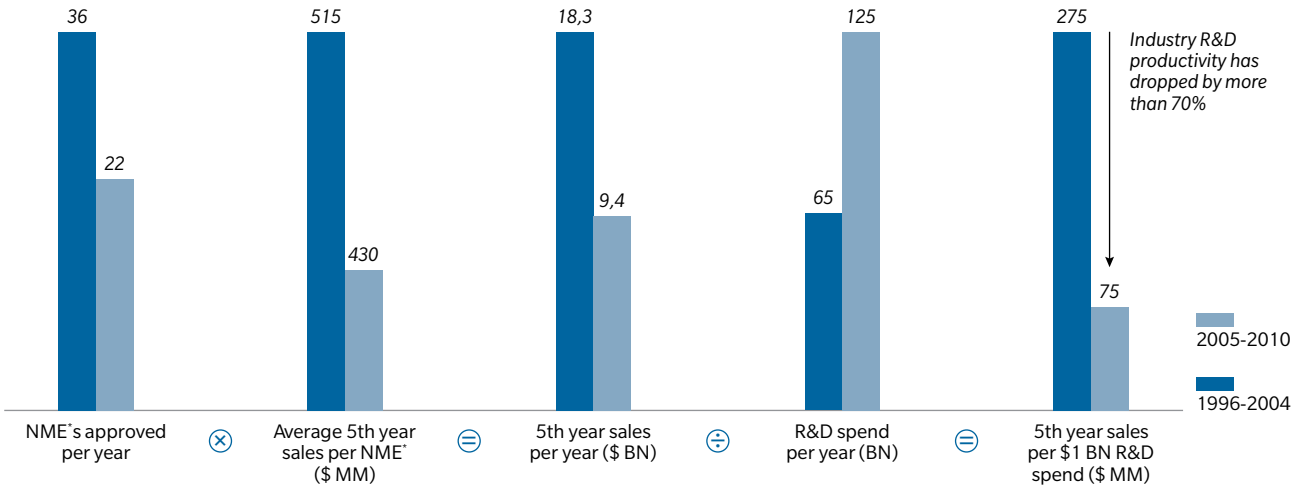
INTRODUCTION

Most senior executives consider innovation a top-three strategic priority, but half are unsatisfied with their current innovation model, according to a survey by *Business Week*. Oliver Wyman's long experience with R&D organizations in various industrial sectors suggests that many face similar challenges in the areas of innovation and product development, such as:

- **Changing product requirements**: Mature markets are saturated and faster-paced, while emerging markets are rising in importance – forcing companies to focus on differentiated solutions customized to local markets, with more products overall and faster cycles. The increasing role of electronics and software is also adding complexity to the development process.
- **Cost pressures**: Budget tightening has become the norm, thus developers must focus on designing "more with less" and "get it right" the first time.
- **Drive for results**: Increasingly, global R&D footprints are making coordination more difficult, but nevertheless essential for meeting CEO demands that R&D show investment returns. R&D organizations find themselves in an environment where it is more and more difficult to strike a balance among increasing output, reducing costs, and growing complexity. As an example, a recent analysis by Oliver Wyman shows that the ROI of the US pharma industry has dropped by more than 70 percent in the past 5 years (Exhibit 1).

The solution to meeting these challenges lies not in attempting to get more out of the same old R&D process, but in moving to a "next generation" R&D approach. Oliver Wyman recently benchmarked innovation leaders and found a common set of nine approaches to revolutionizing R&D, as described herein.

EXHIBIT 1: DECREASING R&D ROI – US PHARMACEUTICAL INDUSTRY EXAMPLE



* New Molecular Entity

Source: Drugs©FDA database, EvaluatePharma, Oliver Wyman analysis

FOSTERING NEXT GENERATION R&D

TOPIC	TRADITIONAL R&D	NEXT GENERATION R&D
1. Open innovation	NIH (not invented here)	**PFE (proudly found elsewhere)**
2. Market-centric innovation	Techno push	**Market pull**
3. Selective development	Wide portfolio	**Focused portfolio**
4. Transparency on R&D performance	R&D intensity	**R&D efficiency & effectiveness**
5. Agile & frugal	Wealthy R&D	**Value for money**
6. Globally connected	Centralized footprint	**Global network**
7. Collaborative	Organization silos	**Integrated cross-functional teamwork**
8. Technical focus	Administrative management	**Technical assessment**
9. Virtual development	Physical prototyping	**Simulation as a backbone**

1. OPEN INNOVATION: FROM NIH (NOT INVENTED HERE) TO PFE (PROUDLY FOUND ELSEWHERE)

Most companies recognize that their internal teams can't know everything – there is a constant need to be in contact with what is happening "outside" the company, to develop external antennae to capture new ideas from universities, suppliers, customers, and startups, as well as to develop new products faster through the use of external technologies. This "open innovation" process can take the form of funding research, workshops and roundtables, and various types of partnerships.

Successful innovators may have up to half of their new product portfolio developed with a significant share of outside input. Companies like P&G and Lilly have understood this for a few years now, and have made open innovation a pillar of their strategy. Their success has been enabled by strong top management support, an organization focused on overcoming resistance to change, and a thorough understanding of relevant technical aspects, such as intellectual property sharing and protection.

2. MARKET-CENTRIC INNOVATION: FROM TECHNO PUSH TO MARKET PULL

Industrial companies traditionally base their innovation on a techno-push model, driven by an engineer culture. However, as industries commoditize, putting the market and the voice of customer at the center of innovation becomes critical. Even in B2B businesses, innovative companies need to listen to weak signals from the market, and the voice of the customer, to maximize the rate of commercial success.

Carefully observing how customers use a company's products or services can be one of the best sources of potentially successful innovations. For this reason, most advanced industrial companies ensure their strategic marketing teams work closely with R&D, or even merge the two departments into a single entity. A key success factor among leading innovators is ensuring that the market intelligence unit closely monitors mega-trends and develops scenarios that can then provide solid directional indicators to advanced research teams.

3. SELECTIVE DEVELOPMENT: FROM A WIDE PORTFOLIO TO A FOCUSED PORTFOLIO

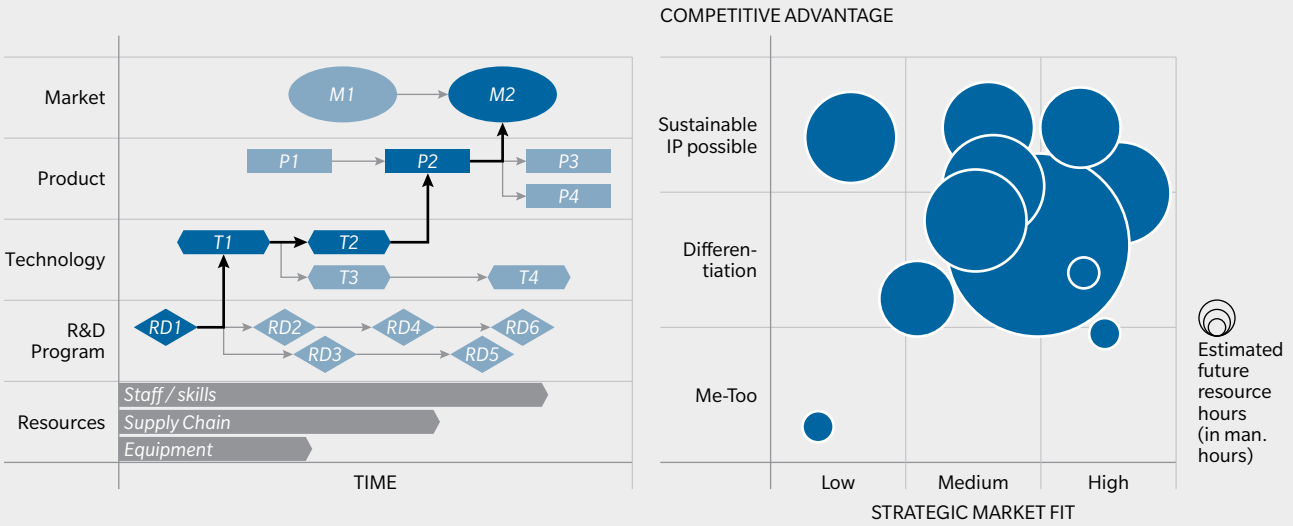
Ballooning project numbers seems to be a constant risk in R&D. Researchers can easily find new ideas to explore – but once projects are launched, they can be hard to stop. No one wants to risk killing "the idea of the decade." Innovation executives need to step back and take this risk, however, as concentrating resources on the best ideas is more likely to lead to success (see Case Study 1).

CASE STUDY 1
R&D PORTFOLIO REDEVELOPMENT IN GLOBAL SPECIALTY CHEMICALS

A global specialty chemicals business lagging behind its competitors asked Oliver Wyman to help it transform itself into an innovation leader so that it could achieve its ambitious growth targets. After selecting the company's most promising technological assets, a joint Oliver Wyman-client case team designed roadmaps to align all stakeholders on the target path from medium-term targeted products & markets back to required technology building blocks, R&D projects, and finally R&D resources.

Strategic marketing was reinforced to put client and market trend understanding at the heart of the innovation process and counterbalance a natural techno-push bias. An innovation committee involving both R&D and strategic marketing was created to review the consolidated research projects portfolio along several dimensions, enabling fact-based decision making about how to best allocate resources among projects. As a result, several non-strategic projects were killed and more resources were allocated to the most promising technologies, reducing their time to market.

TECHNOLOGY ROADMAPS AND PORTFOLIO MANAGEMENT



4. TRANSPARENCY ON R&D PERFORMANCE: FROM R&D INTENSITY TO R&D EFFICIENCY AND EFFECTIVENESS

Measuring R&D performance is complex. As opposed to manufacturing, R&D activities are non-recurrent, often producing intangible products (knowledge). Many companies struggle to set up the right KPIs to capture a true picture of their R&D performance. In so doing, they may end up with either KPIs that are micro-managed (lab level), or too aggregate, giving little sense of overall performance (e.g., percent of R&D vs. turnover).

Best-in-class R&D organizations develop metrics that focus on judging efficiency of process, not intensity of effort. They gauge the output of their "R&D factory" versus the resources they put in, and benchmark R&D against competitors. This process can sometimes shake up established beliefs, but it can also trigger a burst of awareness and the development of programs focused on increasing R&D efficiency (see example of automotive OEMs – Exhibit 2).

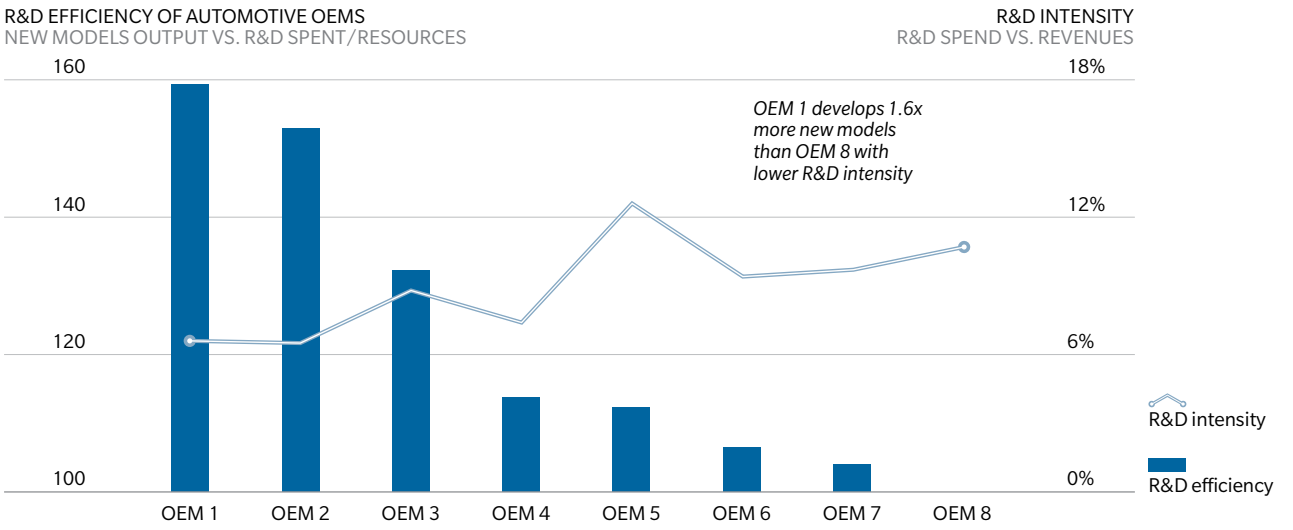
5. AGILE AND FRUGAL: FROM WEALTHY R&D TO "VALUE FOR MONEY"

"As soon as I want to launch a new project in this company, it's a minimum $X million bill and N people involved, even before my engineers start working on the first concept. We've lost common sense, it's terrible." Does that remind you of anything?

Many mature R&D organizations have built complex structures and processes that can mitigate risks well in a stable and growing economy. In turbulent economic times, however, these large organizations often prove less resilient, unable to trim costs and lacking the flexibility demanded by the market.

For their customers, whether internal or external, value for money has become critical. As a result, we expect to see an increase in outsourcing of development to more agile and cheaper start-ups, as well as growth in "internal start-ups" over the next few years. In addition, R&D that focuses on modular design, component re-use, and sharing across product lines is likely to become more common, as has been the case in the automotive industry (see Case Study 2).

EXHIBIT 2: R&D INTENSITY GIVES LITTLE INDICATION OF R&D EFFICIENCY



Source: Oliver Wyman benchmark of automotive OEM R&D productivity

6. GLOBALLY CONNECTED: FROM A CENTRALIZED FOOTPRINT TO A GLOBAL NETWORK

R&D projects are often spread over multiple locations and therefore require efficient distribution of work and effective coordination, despite numerous barriers (different cultures, time zones, IT, etc.). Developing common team platforms, effective cross-organizational exchange networks, and reliable communications systems are arguably among the biggest challenges faced by many R&D organizations.

There is no "one size fits all" solution to this issue. Co-location of project team members can be useful, at least during project launch, but is not always realistic. Running transverse experts networks sharing best practices in a specific domain can help. Ensuring teams have sufficient scale is also important, to enable efficient work and skills maintenance. Ultimately, strong project managers are the linchpin to mapping and navigating this complex environment. An R&D footprint appropriately sized to corporate goals should be the target, while mitigating the potential impact on people's motivation, and by consequence on a company's internal competencies, which are its biggest R&D assets.

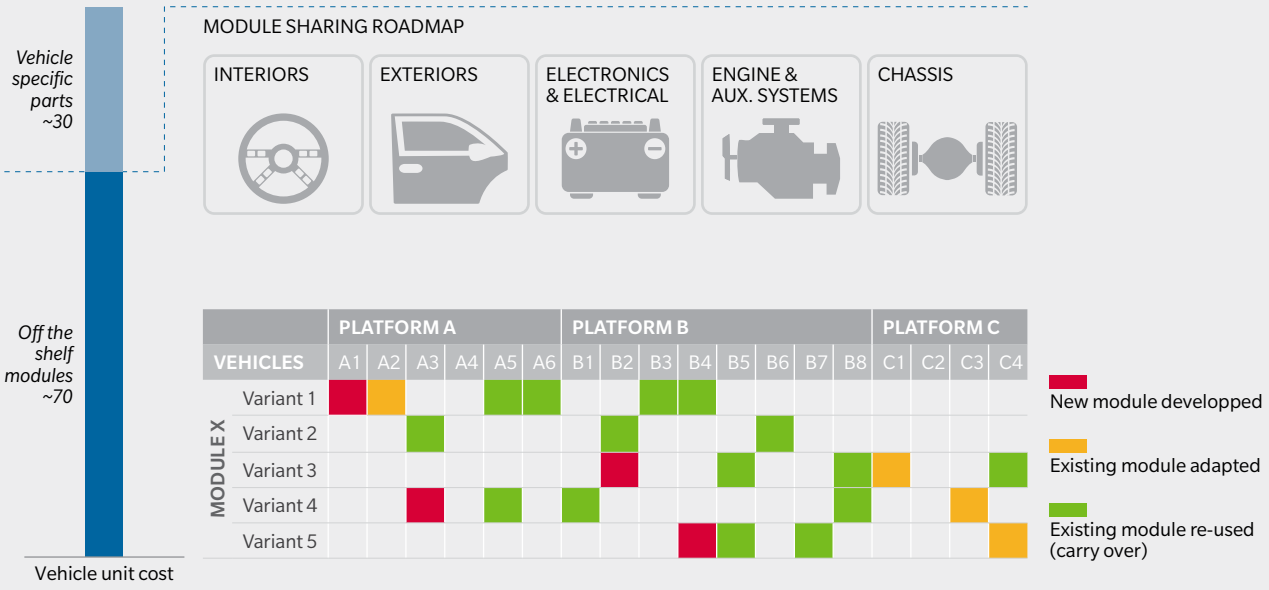
CASE STUDY 2

"MODULAR" R&D IN THE AUTOMOTIVE INDUSTRY

Oliver Wyman has supported several automotive OEMs in deploying a global modular design policy to increase their agility. Modular design involves increasing the level of component or sub-system carryover/carry-across between models. R&D expenses are shared and thus reduced, while customization of visible components is reinforced.

Deploying such a modular approach can be complex, as reusing existing parts will constrain new car design. Strong management is required to make such a process work, but the rewards can be worth it: up to a 20 percent reduction in R&D expenses and capex, with additional product cost reduction thanks to bigger purchasing volumes for components.

MODULARIZATION APPROACH



7. COLLABORATIVE: FROM ORGANIZATION SILOS TO INTEGRATED TEAMWORK

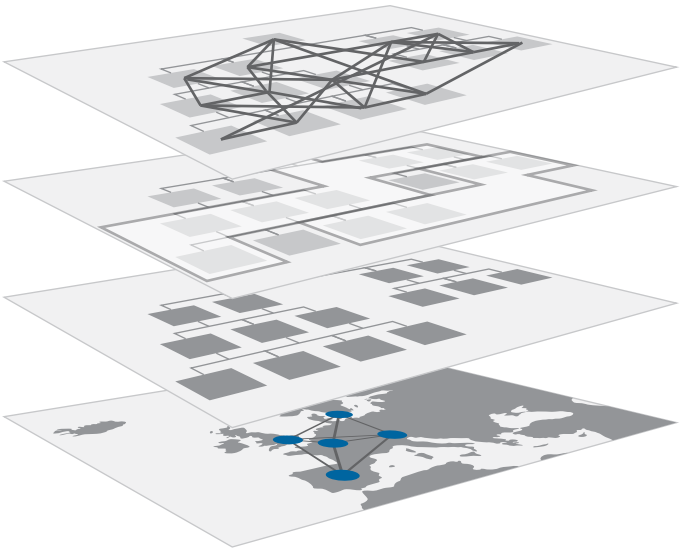
Our benchmarking found that the complexity of the R&D organization is often a top cause of R&D project problems such as delays and rework. Over the years, multiple dimensions have been introduced into R&D organizations to increase their delivery performance. Starting with a simple vertical organization split per core competency, most have adopted a 2D matrix model to incorporate a project/program dimension; some have developed a 3D matrix model to incorporate a product line dimension. But these multiple layers can create silos with inconsistent objectives, diluted responsibilities, and a cumbersome decision-making process (see Exhibit 3). In these organizations, no one sees the whole picture; project managers have full responsibility, but without empowerment.

To recover the agility these organizations once had generally requires reintroducing a simpler structure, with greater decision-making power at all levels (see Case Study 3). A company may already have some experience of doing this in emergency situations that it can draw on, e.g., when projects had to be put back on track urgently, forcing the temporary removal of organizational barriers and procedures, with team members mobilizing around a shared objective.

8. TECHNICAL FOCUS: FROM ADMINISTRATIVE MANAGEMENT TO TECHNICAL ASSESSMENT

With increasing pressure on development lead time and cost, there is a much greater focus in R&D organizations on planning and cost management in project reviews and on project manager accountability. Although this is a must, some companies have lost sight of the fact that

EXHIBIT 3: THE FOUR LAYERS OF R&D ORGANIZATIONS



LAYER 1 INFORMAL/RELATIONSHIP STRUCTURE	• Expert groups • Innovation related annual events/awards
LAYER 2 OVERLAYING PROJECT PROCESS STRUCTURE	• Cross functional projects/groups • International projects
LAYER 3 HIERACHICAL STRUCTURE	• R&D organization charts
LAYER 4 REGIONAL STRUCTURE	• R&D footprint

Source: O. Gassmann & M. von Zedtwitz, Oliver Wyman

developing a new product is first of all a technical activity, based on trial and error, even if executives prefer to listen to optimistic project managers rather than the technical experts who truly understand the whole picture.

Successful innovators (e.g., Toyota, Google) value and reward technical expertise and put technical mentoring/learning at the core of the R&D organization; hierarchical legitimacy comes from technical expertise. The most successful companies do not forget to listen to the voice of engineering while keeping in mind project management constraints (see Case Study 3).

9. VIRTUAL DEVELOPMENT: SIMULATION AS THE BACKBONE OF THE DEVELOPMENT PROCESS

There is huge and untapped potential to accelerate new product development with IT simulation tools. Many companies don't leverage these tools because they lack competence and experience in their use and don't fully trust the results of virtual testing, preferring instead the "real" prototypes or experimentation that can cost millions of euros or dollars.

Simulation, however, not only lowers validation costs but also allows new product design to be optimized earlier in the development process, thanks to multiple quick and cheap computer iterations. In a world of scarce resources, next generation R&D organizations will leverage the full power of numeric simulation to develop robust product designs more quickly and less expensively.

CASE STUDY 3
INCREASED COLLABORATION AND TECHNICAL FOCUS AT AN AEROSPACE ELECTRONICS EQUIPMENT SUPPLIER

Large aerospace development programs involve thousands of engineers at both OEMs and suppliers and can be incredibly complex to manage. Oliver Wyman assisted a large supplier in the turnaround of its R&D organization in order to cut development costs by 30 percent in three years. Major improvement actions included:

- A complex project organization structure was diluting responsibilities and creating unneeded intermediate layers. Oliver Wyman recommended a leaner project organization and governance rules, leading to better alignment between customer-facing project management teams under high time pressure and engineering teams
- Project staffing rules were improved to avoid excessive turnover of engineers between projects and give them the time to ramp-up on new projects and deliver results
- Engineers used to rush into detailed specifications work without a clear overall master plan, leading to fundamental inconsistencies and later rework. Instead, more "front-loading" was implemented on projects: a longer period with more resources was allocated to early phases to secure the product design and bring deliverables in at the right quality level
- The decision process was simplified (delegation, escalation rules) to deal flexibly and quickly with the inherent risks and uncertainties of large R&D projects and accelerate development

In addition to fixing these organization and project management issues, actions were taken to increase productivity in testing, engineering change request management and documentation, which accounted for 30 percent of total engineering activities.

A JOURNEY, NOT A DESTINATION

Evolving from a traditional to a next-gen R&D organization doesn't happen overnight. Innovation leaders usually take this journey step by step, as there are many challenges to change:

- Getting buy-in from all stakeholders in the process
- Gathering the resources to lead change
- Implementing changes without jeopardizing day-to-day operations
- Dealing with potential dilution of efforts and disappointing results

Once the changes desired in the R&D organization have been identified, a holistic strategy must be developed to achieve that transformation at all levels of the organization. Getting buy-in and ensuring change is as non-disruptive as possible can be best achieved by testing proposed changes through pilot projects, gathering feedback, and progressively deploying agreed changes. First users of transformative R&D processes can then act as ambassadors across the company to advertise the advantages and ease transition troubles.

Like any major transformation project, the success of such an initiative relies on ambitious objectives, full support of the C-suite, and strong engagement at all levels of the organization. Operational support of R&D teams is also needed to drive change and ensure engineers' motivation remains intact (see Exhibit 4).

EXHIBIT 4: THE PILLARS OF AN R&D TRANSFORMATION PROJECT

Source: Oliver Wyman

OLIVER WYMAN'S RIDE PLATFORM

Oliver Wyman uses its proprietary and comprehensive RIDE platform (Research Innovation & Development Excellence) to help clients to transform their R&D organizations and reach the next level of sophistication and performance. A broad set of proven tools and methodologies is applied to assess the maturity of an R&D organization and identify major levers for change.

At Oliver Wyman, we have been developing our know-how in the R&D performance sector for years and we have supported the transformation projects of multi-national companies in R&D-intensive industries like automotive, aeronautics, rail, pharma, chemistry, energy, and high-tech.

The RIDE platform was built based on this experience, relying on:

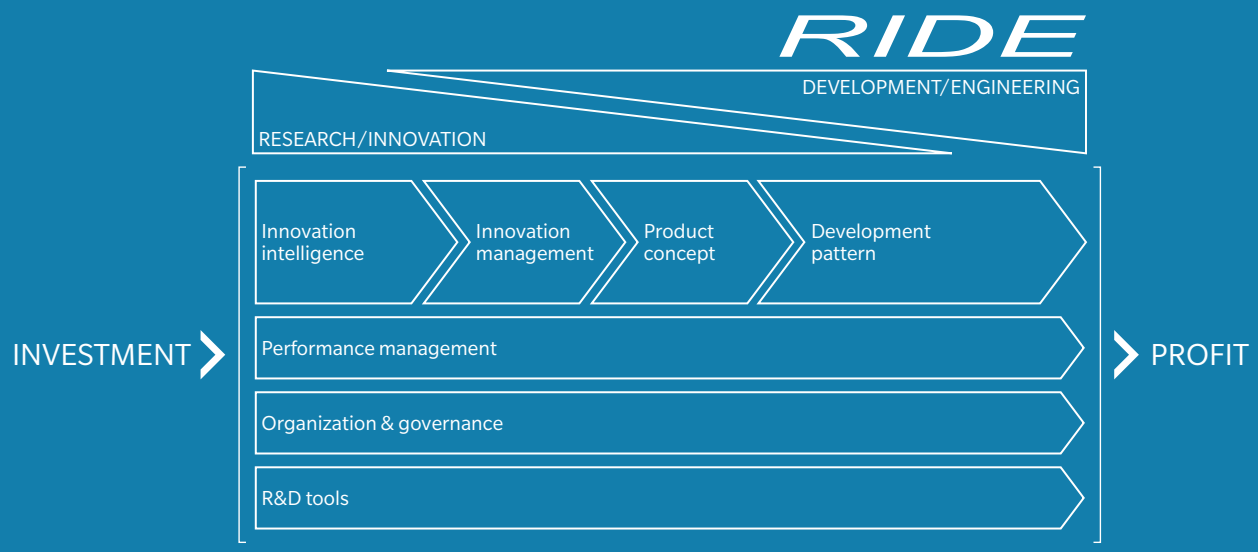
- Expertise contributing to innovation on R&D performance: performance diagnosis, benchmarks, tools and methodologies, potential savings quantification, prioritization criteria
- Experience in designing and leading major transformation projects
- Ability to involve and engage R&D teams
- Global footprint allowing us to support multi-national companies worldwide

By leveraging this knowledge, we have obtained significant results on all of the projects we have led:

- +50% innovation capacity
- 25 to 50% reduction of development lead time
- 15 to 30% R&D cost reduction
- 2 to 10% reduction in product cost

The tools and methodologies developed within the RIDE platform allow us to efficiently answer the R&D performance challenges faced by our clients. We are able to design a program tailored to your specific needs and to support you on your way to R&D excellence.

RIDE PLATFORM – RESEARCH INNOVATION & DEVELOPMENT EXCELLENCE
A POWERFUL PLATFORM TO BOOST R&D PERFORMANCE



Oliver Wyman is a global leader in management consulting. With offices in 50+ cities across 25 countries, Oliver Wyman combines deep industry knowledge with specialized expertise in strategy, operations, risk management, organizational transformation, and leadership development. The firm's 3,000 professionals help clients optimize their business, improve their operations and risk profile, and accelerate their organizational performance to seize the most attractive opportunities. Oliver Wyman is a wholly owned subsidiary of Marsh & McLennan Companies [NYSE: MMC].

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