Half of Your R&D Is Wasted – But Which Half and on What?

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When the reengineering wave of the 1990s hit R&D operations, Chief Technology Officers (CTOs) jumped to justify their companies' R&D spending levels, striving for functional efficiency, process effectiveness, and value for money invested. Companies began streamlining processes, sending developers closer to the market, and aligning R&D with business strategy.

Despite these efforts, R&D budgets keep rising, and top managers wonder if their companies are really getting good returns on their R&D investments. The pressure on CTOs to achieve better business results is increasing.

For most companies, the remaining sources of R&D waste are due to deficiencies in the way R&D operations relate to the market–not to how R&D groups work internally. This article outlines six areas of waste and how to address them. It demonstrates that the responsibility for getting more out of R&D goes beyond R&D itself and significantly involves Marketing Departments. The alignment of the two groups is critical to overall business success.

R&D's Quest for Efficiency and Effectiveness

Before addressing remaining sources of waste in R&D, it is only fair to acknowledge the efforts undertaken by R&D labs around the world to improve their companies' „return on technology." Most R&D operations have improved in both efficiency and effectiveness.

In their quest for *efficiency*–doing things right–R&D managers have:

• Systematically upgraded project management and extended the training of project leaders

• Streamlined project paths, milestones, and project reviews, introducing formal go/no-go decision points that are based on objective performance indicators

• Invested in new, efficient information technologies to accelerate their research, testing, or development processes

• Built communication networks and introduced videoconferencing and groupware, allowing teams to work together from remote locations, sometimes around the clock

In parallel, while striving for R&D *effectiveness*–doing the right things–many companies have introduced even farther-reaching changes:

• So that corporate R&D staff could get closer to the business and „feel the heat of the market," companies have transferred them into divisions and business units. Remaining central R&D labs have often been turned into business-funded contract-research organizations and, increasingly, new-business incubators.

• To synchronize the planning of successive generations of products and technologies, management has spread the use of product/technology road-mapping. In some companies, such as Motorola, road-mapping has become the primary tool for strategic dialogue between business and R&D management.

• To manage technological knowledge in anticipation of tomorrow's market demands, Chief Technology Officers or Chief Research Officers have started mapping competencies. This activity has led to a reassessment of the scope of their companies' technological activities and a surge in outsourced R&D and external technology-based alliances.

These changes have definitely boosted management's perception of R&D value, i.e., what the company gets for what it spends. However, the feeling remains that a company can't measure R&D as easily as it does its other investments, and thus the specter of the unknown „half-wasted" investment lingers.

In Search of Better R&D Waste-Tracking Tools

Most improvement efforts have been initiated by R&D in response to strong pressures from top management. R&D has generally done whatever it could to put its house in order, but R&D, generally, spends money in response to business challenges. Further improvements in R&D effectiveness will have to come from improvements in the business processes that steer and condition R&D activities, particularly the innovation process. And improving the innovation process requires the active involvement of other parts of the organization, starting with Marketing.

Let's assume that the innovation process can be split into two parts:

• Generating and selecting the *best ideas to address the right customer needs or wants,* and

• Developing and launching the *best solution to meet these needs and wants.*

The first part summarizes the *upstream* challenge in innovation, which some have dubbed the „fuzzy front-end“: choosing which projects to work on. The second part describes the *downstream* challenge: managing innovation projects effectively and efficiently.

Whereas most CTOs feel confident that they have improved the quality of their project management processes, few feel that their upstream processes are satisfactory. What are the remaining issues?

One of the most difficult challenges in almost every company is to decide which customer needs or wants to address. If you are a mobile phone manufacturer, should your R&D group work on handset miniaturization?

Low power consumption for extended battery life? Signal reception quality? Data transmission features and quality? New networking functions? A more user-friendly man-machine interface? Lower handset cost? Or all the above?

Should the advanced engineering group of a car manufacturer focus on further improving fuel economy? Developing systems for cleaner exhaust? Inventing altemative power-train technology? Designing obstacle-avoidance electronics? Or, improving crash-resistance? Here again the list could be extended indefinitely.

This issue *of where* to focus R&D resources continues to be one of the most difficult questions for most R&D managers. A recent poll of 100 European CTOs confirmed that linking technology and business strategy is one of the enduring technology-management challenges.

To arrive at a clear answer, management needs to provide R&D with the following four fundamental conditions:

• *A set of clear strategic guidelines* regarding where and how the company intends to compete in the long term, together with *unambiguous mandates* to R&D on which problems or opportunities it should be addressing and in what priority

• *A consistent commitment by business managers to these priorities and mandates over time,* to avoid resource-wasting, knee-jerk changes in priorities, often triggered by unexpected competitors' moves

• *Opportunities for R&D managers to get their own feel for the market,* to sense how these priorities evolve over time, and thus to become better partners and challengers of their business colleagues

• *Tools for enhancing the cross-functional dialogue with Marketing and improving priority-setting and decision-making;* these tools might include, for example, *technology/product road-maps, portfolio management techniques, Quality Function Deployment (QFD)* [1] *training, etc.*

Unfortunately, despite the many changes introduced in R&D over the years, these four essential conditions are often lacking, even in very large companies with ample resources. It is the absence of these conditions that generates at least *six types of wasteful R&D practices,* all linked to pursuit of the wrong agendas. In many cases, possible remedies are well known, but poorly implemented–if at all.

Waste Number 1: Technology Push. Waste occurs when R&D keeps working on an exciting technology for its own sake, searching for „supposed“ customer needs that the technology could possibly address. This push reflects an isolated R&D operation and a lack of dialogue between R&D and Marketing on the business relevance of new technologies. Exploring the potential of new technology is, indeed, always part of R&D's mission–but only a good dialogue with Marketing will allow R&D to know at what stage a „technology push“ becomes wasteful.

Remedies include:

• Asking R&D to prepare simple technology road-maps, identifying the technologies it sees as relevant to a given business, and to organize regular workshops with business management to discuss the potential impact of each technology.

• Adopting the „venture team“ approach early on, i.e., providing R&D funding for new technology development only for a very short, exploratory first phase. To invest in the technology past that point, a company can ask researchers to find themselves an internal business sponsor, typically a business unit manager or an internal venture capitalist. Underlying this approach is the belief that it would be unwise to fund a project that R&D couldn't sell even to its colleagues from other functions. If a researcher cannot convince a Marketing colleague about the merits of his/her technology, how will he/she be able to sell it to customers?

Waste Number 2: Wrong Focus. Waste occurs also when R&D works on a low-priority problem–from the customer's point of view–simply because of a lack of guidance from Marketing or poor understanding of the customers. The root causes are similar to the technology push problem–a disconnect between Marketing, which supposedly knows what the customer wants, and R&D, which is not told, or doesn't believe what it is told! In some cases, of course, Marketing may have misjudged the market.

The main remedy to this problem is a massive dose of „market immersion." For example, a company might send teams of two–typically a marketer and an R&D group or project leader–on a series of open-ended, exploratory customer visits. Have them also call on noncustomers and competitors' customers, rather than just on friendly customers.

Waste Number 3: Tunnel Vision. This third cause of R&D waste is more frequently found among manufacturers of intermediate products, such as materials, packaging, or components, that sell „business to business." R&D is too busy working on the „right problems" of direct customers to be aware of the possibly different needs of its customers' customers, or end-users down the chain. This makes the organization dependent on the insights of its direct customers. When these first-line customers miss opportunities, they trigger R&D waste upstream. This short-sightedness generally pervades the whole organization (not just R&D), which thinks only of those who pay their invoices as their true customers.

Some industries, such as performance polymers (exemplified by DuPont) have managed to overcome this myopia. To convince customers to adopt its revolutionary new products–think of the legendary „Kevlar" fiber–DuPont has gone very far downstream to identify and promote applications for its products. DuPont often knows more than its customers about end-user applications and requirements. Many other companies would benefit greatly from extending their own vision downstream.

A traditional market immersion, such as the one described above, will broaden the field of vision of the R&D/Marketing team, provided it is purposefully extended down the chain–to the customers' customers–or sideways to opinion leaders and product prescriptors. To have a business impact, joint exploratory fieldwork must lead to a strategic discussion and agreement between Marketing and R&D. Both groups need to clearly identify where the conflicts are in the demands of different actors in the customer value chain, and they should agree on optimum tradeoffs between these demands before setting clear priorities.

Waste Number 4: Cure-All. Waste can occur when R&D feels compelled to work on all possible customer needs, wants, and problems at the same time, without much sense of their relative importance or priority. As a result, R&D generally spreads its resources too thinly to meet any need fully or innovatively. This problem may reflect the business's inability to prioritize among possible customer benefits and an unwillingness to help focus the work of R&D. All factors become equally important and Marketing falls into the „best-of-the-best specifications trap."[2]

One remedy is to launch a formal process to review and refine the company's product strategy.[3] Both Marketing and R&D need to spend quality time discussing and agreeing on priorities regarding where to compete (in terms of product or market segment focus) and how to compete (in terms of product range and priority attributes), directed by market demands, customer preferences, and the company's capabilities.

Waste Number 5: Unaffordable Solution. This waste is the consequence of an overenthusiastic R&D team trying to respond to an important customer need, want, or problem, but without much sense of the economics of the effort. As a result, R&D develops a solution to the customer's problem, typically through the innovative deployment of new technology, but not at an acceptable cost. Ultimately, the company is confronted with a dilemma: either provide the benefit to the customer at a subsidized price or abandon the technology. This problem occurs whenever Marketing does not set economic boundaries to its wish-list or fails to follow up through cost/performance tradeoffs with R&D.

The remedy combines several measures:

• Sensitize R&D to market economics and create a „cost-aware" culture in R&D and a natural sense of leanness, fostering an instinct for simple, cost-effective solutions. This is typically achieved through formal training programs, exposure to customers, and a change in R&D performance appraisal systems (celebrating cost breakthroughs as much as performance).

• Reinforce the process by which target costs are established and enforced, beginning at the start of the project. In the engineering sector, target costs are often unbundled into subtarget costs for key systems and components, down to elementary parts. This „design-to-cost" approach provides useful boundaries for R&D.

• Introduce a constructive process for project reviews, aligning Marketing and R&D in the search for optimal and cost-effective solutions. Often, the process is enriched when outsiders (for example, a design review team, a committee of experts or technical consultants) participate in the reviews.

Waste Number 6: Search for Irrelevant Perfection.

This wasteful practice occurs whenever R&D continues working on the right problem–but goes beyond the current demands of customers. That is, R&D has solved a problem to the customers' satisfaction but continues to search for an even better answer–while the customers have shifted their focus onto other issues.

One of the remedies recommended above–the adoption of a regular product strategy process–is very effective to prevent the „perfection" problem. The process should be enriched with a regular review of customers' perceptions of what constitutes value, for example along the lines of a Kano diagram.[4] When Marketing and R&D get in the habit of conducting such reviews jointly, they can often detect early on the level beyond which working on a particular attribute leads to diminishing returns in customer satisfaction–hence to R&D waste.

The six sources of R&D waste are listed in Exhibit 1, together with selected remedies.

Strengthening the Marketing-R&D Interface

As you can see, there is a common theme–as well as a question–behind these six R&D wasteful practices.

Exhibit 1

The Six Sources of R&D Waste and Selected Remedies

Proposed Remedies \ Source of R&D Waste	Technology push	Wrong focus	Tunnel vision	Cure-all	Unaffordable solution	Search for perfection
Tools/process for a formal dialogue with Marketing	Technology road-mapping	Formal tradeoff process		Product strategy	Design-to-cost, Project review	Product strategy, Kano diagram
Joint Marketing/ R&D market immersion raids	Joint venture teams	Joint exploration visits	Downstream end-user visits			
R&D training programs					Cost awareness	Customer preference modeling

The Common Theme: To ensure that R&D devotes its efforts and resources to the right customer issues, it needs *a lot more insight as to where the market is heading.* Such insights can only come from the personal exposure of R&D leaders and senior developers to the market, and from numerous constructive debates with Marketing in an honest and mutually challenging spirit of „equal partnership."

The Question: Is Marketing mentally prepared and functionally equipped to play that role? Does Marketing see it as a business enrichment necessity? As a function, Marketing needs to fill the role R&D expects it to play: that of an astute navigator, capable of charting alternative market routes and leading the company down the most attractive and secure ones. To do this, Marketing needs to align its time horizon with R&D's, i.e., to think much more about the long-term. In most companies, Marketing is subject to so many short-term pressures that this navigator role cannot be satisfactorily fulfilled. So, why not set up an Advanced Marketing capability, paralleling the roles of Advanced Engineering or Advanced Development? It could be a source of insights to anticipate and master the future.

[1] *Quality Function Deployment (QFD), also known as „The House of Quality" approach, is a formal methodology enabling R&D or Engineering to derive a set of prioritized and quantified technical parameters on which to focus their work, starting from a hierarchy of customer preferences provided by Marketing. It also highlights unambiguously the tradeoff to be made between conflicting attributes (see: „The House of Quality," by John R. Hauser and Don Clausing,* Harvard Business Review, *May-June 1988, pp. 63 to 73).*

[2] *„Avoiding Marketing's Best of the Best Specification Trap," by Milton D. Rosenau, Jr.,* Journal of Product Innovation Management, *September 1992, pp. 300 to 302.*

[3] *„Developing a Product Strategy" by Jean-Philippe Deschamps, Prism, second quarter 1993, pp. 25 to 41.*

[4] *The Kano diagram is a tool that characterizes the competitive impact of different categories of product attributes, including performance attributes, threshold attributes, and excitement attributes.*

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