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## A New Innovation Framework

“The boundaries between the firm and its environment have become more permeable.”

—*Wikipedia on Open Innovation*

### Overview

Current employment strategies usually rely on some rational compromise between hiring people with skills that are needed immediately and hiring people with skills that will likely be needed in the future. A more open approach to innovation promises access to “smart people” that are outside of your organization. But most strategies fall far short of effectively tapping that external crowd. A new framework for innovation should position leaders to understand both *why* and *how* to extract value external to their organization. A framework will be posited in lieu of the traditional innovation approach of stage-gate management. That new framework is designed to subdivide projects into modules, not stages—modules that are more amenable to sharing within a network of resources and among a variety of innovation approaches.

The human resources department, along with the innovation functions, in a company practicing Challenge Driven Innovation recognizes their broader role in accessing talent. They realize that

effective management of this resource involves *both* internal and external persons that can effectively contribute. They appreciate the fact that internal experts better understand the nature of the problem or need, that they comprehend “local” limitations and implementation concerns. But they also know that many times the best minds for a given task lie outside the walls of the organization and they know the most appropriate mechanisms to find, enroll, and use those resources.

## Open Innovation’s Unique Potential

Arguments for open innovation often seem to hinge upon sentiments similar to those once expressed by technology investor Bill Joy of Sun Microsystems: “Most of the smart people work for someone else.” You can certainly agree to the truthfulness of this declaration. Most of the people a company would label “smart,” do work somewhere else. But this simple observation does not provide any guidance on what to do about that fact. Rather, you should ask the question, “What does the practice of open innovation, the tapping of smart people who don’t work for you, do for your business that closed innovation cannot?” Answers to that question would likely start with arguments for how open innovation better manages diversity and risk sharing.

Recall Damon Runyon’s comments that opened the first chapter: “The race is not always to the swift nor the battle to the strong, but that’s the way to bet.” For most organizations, the act of hiring is an act of betting, and the smart money will be the selection of “the swift and the strong.” In a business hiring case, “swift” and “strong” are interpreted in the context of the skills and disciplines being sought. You want to recruit and hire the strongest lawyer, the swiftest chemical engineer, and the strongest C++ programmer you can find.

But Runyon correctly argues that the race might be won otherwise. And history shows its complete support for that contention. Was it not an Augustinian monk, Gregor Mendel, who laid the foundations of

genetics? Was it not an academically unemployable patent clerk, Albert Einstein, who shredded all assumptions about space time? Was it not a bookseller's apprentice, Michael Faraday, who discovered many of the elements of electromagnetism? No one is disputing the raw intellect of these contributors. One is merely acknowledging the likelihood that they all would have failed the employment criteria in biology, cosmology, and telecommunications, respectively, even just before their seminal breakthroughs. In many cases, in a highly specialized world, someone from another discipline, such as a physicist solving a biochemistry problem, is the one who grabs the brass ring, or wins the race.

Yet, the hinted-at, alternative employee recruitment strategy is completely untenable. Yes, the heat exchanger problem in a production plant *might* be best solved, not by a chemical engineer, but by a residential furnace technician, an automobile repair man, or a computer chip designer—or for that matter, an archaeologist, a veterinarian, or a maid. But so what? Surely there is no intention to hire all six of these individuals...just in case. And even less intention of hiring the other 60 qualifications who *might* have been speculated on in this paragraph. To do so would be an act of lunacy. Enter open innovation.

The merit of accessing talent from outside the prevailing disciplines is recognized. Stan Davis and Chris Meyer, in their book *Blur*, suggest as one of “50 ways to blur your business” that you challenge the proclivity of Ivy League groupthink by hiring a “trade school grad with a guitar and a tattoo.”<sup>1</sup> But, of course, capriciously hiring an “unqualified” cadre would be an abuse of resources. On the other hand, contracting with them may indeed offer some viable alternatives. And this latter approach holds an even greater likelihood of a favorable outcome if this work, or their contributions to it, could be done in parallel, with value assigned to the contribution only *after* the fact. Could that heat exchanger problem have been worked on simultaneously by the chemical engineer, the furnace technician, the auto repairman, AND the chip designer? And, after the fact, could the heat exchanger owner have reviewed the results and elected to pay

for outcomes as opposed to efforts? Suddenly a “guitarist with a tattoo” is not only a challenge to our way of thinking but a viable way to *actually* get creative work done.

In this scenario, you can see the role open innovation potentially plays in both diversity and risk-sharing: The contributors assume the risk that their contribution may not be deserving of post-facto compensation commensurate with the effort undertaken. If this were the only way open innovation was designed to work, it would probably fail. But risk-sharing business models that provide access to diversity and self-selection mechanisms enable many of these benefits to be achieved in a fair and equitable environment. So much so, that any organization that relies exclusively on the employment mechanism for accessing talent is guilty of under-serving its stakeholders.

## **A Rational Compromise**

It was this central constraint of employment “bets”—the limitation that closed innovation was performed by those that had been interviewed, selected, and recruited even before the task was known—that led Eli Lilly to its original founding of InnoCentive and other open innovation systems. Lilly wanted access to a greater diversity of approaches than it made sense to acquire through hiring the many, many new employees that would have created that diversity internally.

Many times the work to be carried out in an industrial setting is unlike any specific work an employee has ever done before. How then is qualification determined in order for work to be appropriately assigned? It is usually done on the basis of broad skill sets. That is to say that computer programmers are assigned to learn and write in a new language. MBAs are assigned to manage something they’ve never managed before. Solid state physicists are asked to invent better hard drive materials. And marketers are asked to develop campaigns for products they only just discovered even existed. All of

these are somewhat non-ideal. The employees assigned are roughly, but not ideally, qualified. They are what might be referred to a rational compromise.

## Exploring Problem-Solving Diversity

Consider instead the well-publicized story of Goldcorp. Goldcorp owned mining rights on about 55,000 acres near Red Lake in Northern Ontario. The founder and chairman at the time, Rob McEwen had listened to the many perspectives on how and where the gold might be found in greater quantities, yielding a higher overall mine productivity. While Rob understood that a deep geological science lay at the root of these conclusions, the variables were never perfectly controlled and the conclusions were based on assumptions and models as much a part of tradition as they were of rigorous objectivity. McEwen wanted to take a new tact. He proposed that the geological survey data be freely given to anyone seeking it in exchange for their hypotheses on where gold might be more prevalent. To the person(s) providing the answer that best panned out for Goldcorp's efforts, they would award \$575,000 in prize money. The survey data was shared with over 1,000 groups and individuals who were interested in tackling the effort. Proposals came from all around the world and from many individuals outside the mining industry, and certainly from many who were not even trained geologists. The winning entry was a collaborative effort by two groups from Australia: Fractal Graphics, in West Perth, and Taylor Wall & Associates, in Queensland. The graphic methods they employed provided an entirely new perception of the data and lead the Red Lake mine to become the most productive gold mine in history.

Most innovation leaders appreciate that, for sufficiently complex problems—as most of the interesting ones are—“solution space,” the matrix of all possible solutions, is usually too vast for a complete search. But, none of that suggests that innovation can't be much better than it is—that it can't be greatly improved with a new approach.

It's that potential for improvement—evident in the contrast between what was produced via the Goldcorp approach and what gets produced under classical, serial, commercial assignments—that suggests the need for a new innovation framework and mechanism for rationally engaging in open innovation. A greater diversity of approaches to problems in commercial, philanthropic, or government endeavors would likely yield superior solutions, greater economic viability, and shorter innovation cycles—all of which would ultimately benefit both shareholders and customers. These are the issues that presently drive the adoption of open innovation by the most successful innovators.

## Risk Sharing

As previously stated, open innovation can do (at least) *two* things that closed innovation cannot. The first is to effectively exploit diversity, and the second is to share risk. The point has been made of the manner in which open innovation enables the effectiveness of greater diversity. This important topic is one we will continue probing in Chapter 4, “The Long Tail of Expertise.” At this juncture, a bit more should be said about the sharing of risk. It is beyond the intended scope of the book to go into great detail about the complex subject of risk management. But, as mentioned in the introductory chapter, within the innovation endeavor, risk rears its head in the form of: financial risk, having to pay for things before success is assured; technical risk, some ideas don't actually work; and execution risk, it would have worked, but the endeavor was done ineffectively.

In a closed innovation system, all of these risks are borne *solely* by the innovating organization. It must pay for projects whether they ultimately succeed or fail. In an open innovation system, these risks may be shared with partners enabling their more effective management and permitting risky portfolios to be increased in size—the

same budget will pay *half* the costs for *twice* as many projects—providing diversification and lowering the risk of the portfolio yielding an excessive number of failures.

Even more significant than simply the sharing of risk is the observation that risk itself is asymmetrical. That is, the amount of risk offloaded by one party may be considerably greater than the amount of risk the other party assumes.

In the incubation phase of InnoCentive, some pointed out that the assumption of risk by the solver community was unsustainable. The solvers, collectively, would not, and could not, continue to experiment at their own risk, especially not on behalf of a well-funded and successful commercial entity. At some point, economic speculation goes, it had to all balance out and you couldn't get any more risk-taking out the system than was commensurate with the return that was available. It didn't really matter who the participants were, internal or external, but the asymmetry of risk, fueled by non-cash utilities, effectively obviates this concern and allows a network to assume more risk than the expected return would predict. Let's be more specific.

The likelihood for solver engagement was assessed during a prelaunch roadshow, as the founders met with various potential solvers. During a meeting with Professor Tom Wandless at Stanford University, the overall idea was outlined, and Professor Wandless was asked if he might, under *any* circumstances, be willing to participate. His response was that he had grave doubts about whether he would ever even *consider* altering his research endeavors in response to a posted challenge. But, he then added that one of his ongoing research interests was the design of new synthetic routes to dehydroamino acids. He said that if one of the posted challenges needed such an effort, he might be willing to “put their compound in my table.” By this he meant that he would consider adding an example to a table of examples in the work he was already doing. He added that, if a bounty *was* posted for the solution, he would be willing to cash the check. He was saying that a posted challenge, looking for new ways to make

dehydroamino acids was work he would be undertaking anyway, and it would be of little inconvenience to add to his efforts the specific research that the challenge-posting company was “off-loading.” In essence, you aren’t taking on more risk if you were going to do the work (or something closely akin to it) anyway.

A second way in which the off-loaded risk is of different magnitude than the assumed risk by individual solvers is related to the assignment process. The risk of innovating in a corporate setting must take into account the issue raised earlier: that task allocation is inefficient and involves compromises—compromises that raise the financial risk as failures accumulate and raise the execution risk as non-ideal executors contribute to false negative conclusions. In some open models, the persons tackling the problem self-select which helps further obviate the non-ideal assignment of tasks. For these reasons and others, individual researchers and small contract firms are often more than willing to accept some risk and work without a *guarantee* of payment. This creates innovation opportunities via external efforts that are simply *impossible* with closed innovation approaches alone.

## Innovation Marketplaces

Given the posited strong advantages of open innovation in diversity and risk sharing, why is the vast majority of ongoing corporate research still carried out internally? It is a question delved into more deeply later in the book. Setting aside, for the moment, the substantial issues of cultural change and institutionalized processes, one significant factor is simply closed innovation’s ready availability: because it’s there. Historically, open innovation projects have been prefaced by the need to locate a partner, to negotiate with that partner, and to transfer existing know-how—the very transaction costs that hold corporations in place and which were discussed in the preceding chapter. The new business models and “innovation

marketplaces” are lowering those costs and creating an environment in which open innovation will soon dominate. They are doing this by better search procedures, templated agreements, intellectual property commons (where people freely give away their know-how without charge), and intellectual assets and commodity exchanges. Bear in mind that in a connected world, many things are potentially commodities that were specialized contracts in the past—for example, Internet bandwidth, novel molecules, or logo designs. In the process, these changes—and exchanges—are creating new and unfamiliar roles for the internal researchers, technologists, designers, and innovators—new roles that will also call for a new process framework for innovation.

## Historical Stage-Gate Processes

This global market and capabilities shift prompts speculation as to how an organization’s innovation framework and processes may evolve in accord with these broad changes. The current dominant paradigm for internal innovation is the **stage-gate process**. Closed innovation is an inherently serial process. (You try and fail, and try again, until it is good enough, or you abandon the effort.) As this process has been subjected to the scrutiny of corporate efficiency, it has been architected as a linear and ordered sequence of major stages separated by gates. The gates are usually characterized by performance criteria used to determine a project’s readiness to enter the next stage, or precipitate a termination decision. These periodic checkpoints serve to elicit conscious decisions from the organization, and give attention to project performance, to minimize wasteful spending on false positives and to ensure that successful projects, clearing the last stage and launched into the marketplace, will perform as expected and with appropriate returns on the research investment.

Depending on the sector, and actually, even the individual project, the stages and gates through which the project travels may

differ slightly. For a typical circumstance, imagine five stages and four gates, with the final gate being the project's admission into production and the marketplace. Although the words will frequently differ, a representative series of stages might be perceived as: idea, validation, proof of concept, prototype, and production. This arrangement is well-suited for an internal, serial process, with gate point checks and balances on viability and returns, and will undoubtedly survive to some degree even as open innovation is more fully exploited.

Alone, the stage-gate process fails to either effectively manage or fully capture the opportunities presented via “full” innovation: open plus closed. In an environment where both modes of innovation are practiced, would this stage-gate mechanism still dominate? After all, open innovation can be decidedly parallel, and that is a feature that *should* be exploited. Stages and gates manage cost containment by setting gate criteria such that projects that become too risky, too likely to fail, are terminated before more money is spent on their development. But in open innovation, when those high-risk costs are assumed, or at least shared, by others, it is less critical that termination criteria be prematurely applied by passing through frequent gates or decision points.

Although one would never argue for throwing out some of the distinctive benefits of the stage-gate paradigm, you might argue for its cohabitation alongside other project paradigms to organize the open innovation process. The alternative framework put forward at this time is **Challenge Driven Innovation, CDI**, which shares DNA with the modularity processes, earlier described by Carliss Baldwin and Kim Clark of Harvard Business School.<sup>2</sup> In CDI, a portion of the larger project is formulated as a challenge, in which a “challenge” essentially represents the problem statement for a block of work that can be modularized and in most cases rendered “portable.” That is, such a block of work can be outsourced or insourced as an integral unit. The central processes to this framework are those of dissection,

channel distribution, and integration. The remainder of this chapter describes this methodology and its implication for redefining the organization focused on innovation, and most specifically for redefining the internal skill sets and tasks that have to be altered in the post-open world. This section wraps up with a hypothetical example from the world of medicines development along with real-world examples consistent with this approach.

## Seven Stages of Challenge Driven Innovation

Because the stage gate framework is so generalizable, it might be tempting to read the following as nothing more than a renaming of the stages. Try not to do so. These may be overlapping and iterate. But most important, the activities generally associated with the stage-gate mechanism are almost entirely conducted between activities number 4 and number 5, where the default channel is to conduct the work internally.

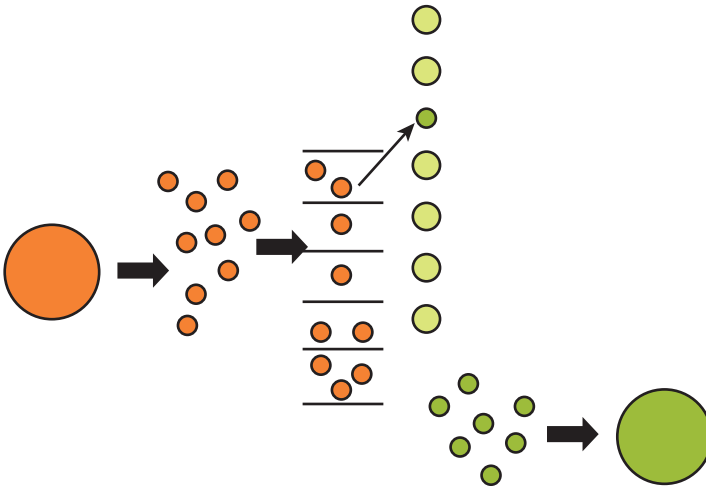
1. **Idea gathering:** The open front-end of the innovation development funnel. It is the gathering of more opportunities than you have the capacity to manage so that the most promising can be selected for moving forward.
2. **Filtering:** The selection of projects best-suited to development and marketing by your organization. The culling of projects that either fail to meet targeted returns or do not fit strategically with corporate objectives.
3. **Dissection:** The decomposition of a large, complex project into discrete modules. These modules are larger than individual tasks but considerably smaller than the overall project itself. They are of a scale and properties that can be made modular in the sense described by Baldwin and Clark (referenced earlier); that is, they can be executed according to recipe or end product specifications. They can be made portable and placed as an

integral body of work to be executed either internally or externally. Each of these modules of an innovation can be characterized as a problem statement or “challenge.”

4. **Channel distribution:** The placement of the above work units, or challenges, into the appropriate innovation channels. Innovation channels include, but are not limited to, contract research organizations, academic projects and grants, joint ventures, and of course, internal efforts. Much more will be said about these channels and how to select them in Chapter 5, “The Selection of Appropriate Innovation Channels.”
5. **Evaluation/confirmation:** The receipt of the completed challenge modules from the channels to which they were distributed, and the comparison of results against specifications and performance criteria.
6. **Assembly and integration:** The reassembly of the individual challenge modules into a functional whole that is ready for market.
7. **Launch:** The launch of the new product, concept, or service into the market place.

The schematic in Figure 3.1 illustrates the central portion of this framework, namely: dissection; channel distribution; and evaluation and assembly.

Idea gathering is not so much the act of looking for ways to tackle a specific project, but rather an ongoing collection of what the projects or products might be that should enter the innovation framework. Filtering is simply the rejection of some of those ideas based on how well or poorly they fit with the organization’s core mission, or lack of adequate market interest to justify the effort. Projects that passed through the filter are then dissected, that is, broken into subprojects—a subproject being a collection of work, larger than a single task, but considerably smaller than the overall project.



**Figure 3.1** Dissecting a large project, distributing sub-projects into appropriate innovation channels and reassembling the completed and evaluated segments into a whole for market launch.

Channel distribution involves the selection of an appropriate innovation path for each of these subprojects, the introduction of the subproject into that channel, and the monitoring of progress. Chapter 5 discusses each of ten distinct innovation channels and the criteria by which they would be selected. Appropriate channel selection is critical to making the CDI framework effective, given the distinct qualities of the various open innovation channels available. Even with ten specific channels identified, it is still possible to mix and match and independently select funding mechanisms such that the choices grow combinatorially. The scope of possibilities has been constrained in both this chapter and Chapter 5 for the sake of a clear discussion.

Evaluation/confirmation is an activity associated with the receipt of the work product from one of the innovation paths or channels. It may be that the channel selected produces multiple options or ones that may need some adaptation. During assembly, options are selected, and the subprojects from the innovation channels are integrated as a complete project. And finally, each assembled project is launched into production and the marketplace.

It is hard to point to a good example of an entire innovation portfolio, being developed and managed like the one being described. However, the individual elements are more than evident in current organizational strategies, such as Li & Fung's "orchestration" (see the case study in Chapter 2, "The Future of Value Creation"), Procter and Gamble's "Connect and Develop" (see the case study in Chapter 6, "The Challenge Driven Enterprise"), Eli Lilly's "FIPNet" (see the case study in Chapter 5), or Prize4Life's approach to Lou Gehrig's disease (see the case study in Chapter 8, "The Challenge Driven Enterprise Playbook"). Furthermore, some examples employing elements of this innovation approach are cited and discussed later in this chapter.

## The Future of Work and the Workplace

In 1999, Stan Davis and Christopher Meyer authored *Blur: The Speed of Change in the Connected Economy*.<sup>3</sup> Yes, it's true the business world was abuzz with the concept of new business models. But few pundits could ground this change in the business practices and strategies of the staid brick and mortar industries that had dominated for decades. Oh sure, you had quips like "clicks and mortar," but most of the discussion centered on who'd win: Amazon or Barnes and Noble? While conceding that the world of manufacturing and supply chains might buy differently, through online exchanges, many executive suites also felt a certain kind of immunity from the craziness. Was "eBay" going to produce automobiles, or was it going to discover new medicines? Davis and Meyer argued that the changes were deep and were going to touch business in many ways. It's a shame that the subsequent "dot-bomb" served to reinforce these executive biases of immunity. Since those days of wild swings in the NASDAQ, a lot of rethinking has been done and the implications of connection may be just as profound as originally advertised, with no natural business immunities to be found.

In their book, *Competing in a Flat World*, authors Victor Fung, William Fung, and Jerry Wind speak generally of the dissolution of

corporate walls. Their comments apply across all organizational activities and include those activities associated with innovation. The authors state, “What the discipline of management was to the old vertically integrated, hierarchical firm, network orchestration is to the company working in the flat world. It is an essential capability for this world, from orchestrating virtual networks such as Wikipedia and open-source software to delivering hard goods through global manufacturing.”<sup>4</sup>

The drivers for this change are not only organizations seeking greater efficiency; there is also a push-pull dynamic involving the desire of individuals to engage globally while maintaining their present local residence. In his book, *The World Is Flat*, Thomas Friedman calls this social phenomenon, “Globalization 3.0,” and describes it as follows, “...around the year 2000 we entered a whole new era: Globalization 3.0. Globalization 3.0 is shrinking the world from a size small to a size tiny and flattening the playing field at the same time. And while the dynamic force in Globalization 1.0 was countries globalizing, and the dynamic force in Globalization 2.0 was companies globalizing, the dynamic force in Globalization 3.0—the thing that gives it its unique character—is the newfound power for individuals to collaborate and compete globally.”<sup>5</sup> This dynamic social force is operating independently of the organizational strategies of your firm. It would be ignored at your ultimate peril.

In addition to the social *push* of Globalization 3.0, and the *pull* strategies of orchestration, the transformation underway is further assisted by technological advances. According to a monograph published by Harlan Cleveland and Garry Jacobs for the World Academy of Art & Science: “Everywhere in the world, in varying ways, information science and information technologies are accelerating the pace of change and rendering unusable familiar methods of organizing and governing that were developed for societies with clearer boundaries, more limited information flows, more stability and predictability.”<sup>6</sup> MIT Sloan School of Management professor Thomas Malone summarized these changes in his book, *The Future of Work*.

Malone says, “...we are in the early stages of another revolution—a revolution in business—that may ultimately be as profound as the democratic revolution in government... New information technologies make this revolution possible. Dispersed physically but connected by technology, workers are now able, on a scale never before even imaginable, to make their own decisions using information gathered from many other people and places... For the first time in history, technologies allow us to gain the economic benefits of large organizations, like economies of scale and knowledge, without giving up the human benefits of small ones, like freedom, creativity, motivation, and flexibility.”<sup>7</sup>

Without a clear example of a present-day ideal (although ALL the pieces are currently present in the business ecology), it is necessary, to hypothesize just what such a future innovation entity might look like. For purposes of contrast, the present state of predominantly closed innovation is described and then the points of difference are highlighted.

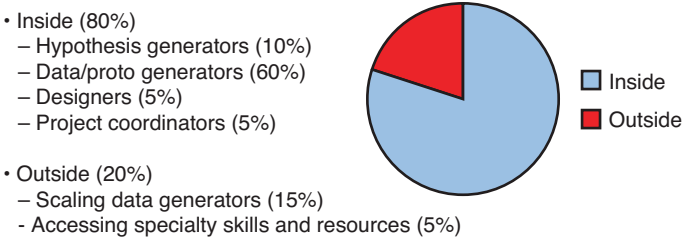
## **Innovation Tasks: Internal and External**

Using the familiar 80/20 rule, you could say that present day commercial innovation is carried out with an estimated 80 percent internal resources and 20 percent external ones. As it actually turns out, this is a bit of an exaggeration in favor of external activity. In 2003, the percentage of R&D work carried out externally was reported by the National Science Foundation as only 5 percent.<sup>8</sup> In the subsequent five years, that number essentially doubled to 12 percent.<sup>9</sup> Few leaders engaged in innovation will have any reason to doubt either that magnitude nor the direction of change. The vast majority of innovation work is still carried out internally; but, you can see a steady increase in the use of external or open innovation approaches. To further understand this internal/external split and to contrast it with a proposed future state, you need to also look at what the typical

activities are, for both the 88 percent spent internally and the 12 percent of innovation budgets spent externally. (It should be noted that the actual percentages reported by the NSF are skewed slightly upward by the pharmaceutical industry, which owns a fairly large proportion of the national R&D budget, roughly 20%, and which conducts clinical trials at academic and other external research centers comprising about 25% of their total R&D budget. This is pointed out in the second NSF report referenced.)

These R&D-specific figures are useful to gain some perspective—and the emerging market capability measured in hundreds of billions is worth at least some attention from corporate leadership across the pertinent sectors. But, recognize that there are many innovation activities not captured by the NSF fractions. Some functional areas, charged with innovation, may make virtually no use of open innovation—while others, like marketing have a long history of using external talent agencies to build innovative marketing campaigns.

Breaking these internal/external figures down further, the internal innovation activities consist predominantly of what is designated “data generation,” as this is the dominant activity of most research or innovation endeavors, whether they are basic in nature, late-stage product oriented or even the time-consuming activities of iterative design testing or focus group conduction and evaluation. This is probably two-thirds of the time and dollars spent internally. A smaller fraction is given to hypothesis or idea generation, and the remainder to the design of studies and experiments, and to overall project coordination. Although the numbers are meant to be estimates, and account for a wide range of sectors and objectives, some more detailed suggestions for how this activity is distributed are shown in Figure 3.2. The external innovation effort is presently focused primarily on overflow data generation—work beyond the company’s capacity to handle—which Figure 3.2 refers to as “scaling data generation.” And a smaller, but likely substantial, portion of external innovation is to access skills, tools, and resources not available internally.



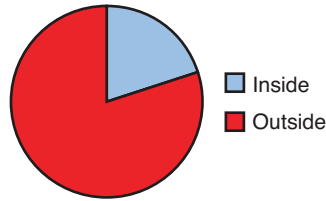
**Figure 3.2 Present day division of innovation activities between internal and external resources.**

In the new innovation framework discussed, this 80/20 distribution of activities flips and becomes a 20/80 distribution, with 80 percent of the effort carried out *externally*, as shown in Figure 3.3. A key point to note, in comparing Figures 3.2 and 3.3, is the change in skills required for the internal effort in a more open innovation model. Internally, much of the work consists of monitoring and evaluating those activities placed externally into appropriate innovation channels. It also requires skills in project dissection, channel orchestration, and reassembly—skills generally not demanded within a closed innovation world and for which training is lagging. As before, a substantial amount of the overall effort is expended on data and prototype generation. But this work is almost exclusively the province of external innovation. The judgment-based activities of hypothesis generation and design are also performed predominantly externally. This enables the innovation orchestrator to tap the diversity of the external world to generate design and hypothesis *options*, which are then evaluated and selected by internal personnel.

The radical change suggested for internal innovation capabilities is going to be met by substantial barriers. It is for this reason that you might be tempted to observe that it may be newly created organizations, or not-for-profit endeavors, that first manifest the full implementation. After all, they typically have much smaller internal staffs who are anchored—and more importantly already successful—in historical practices. In fact, the greater resistance can be expected by

the best of performers; they *succeeded* in an old framework, why risk changing that?

- Inside (20%)
  - Project dissectors (3%)
  - Orchestrators (3%)
  - Assemblers (4%)
  - Evaluators (10%)
- Outside (80%)
  - Hypothesis generators (10%)
  - Data/proto generators (70%)
  - Designers (5%)



**Figure 3.3 Future division of innovation activities between internal and external resources.**

## Not-for-Profit Organizations

With a growing innovation marketplace, it is easy to imagine that for some special health-care sectors, the not-for-profit model might conceivably succeed commercial entities by introducing and delivering certain goods and services under more globally affordable and sustainable conditions. This application of open innovation is already being proved out in neglected diseases, as we will see in the examples that follow and the Prize4Life case study at the end of Chapter 8. Foundations have, to a greater degree, acted as “orchestrators” versus their commercial counterparts, which most often cast themselves in the role of “doer.” Historically, many not-for-profit foundations have seen their role, through orchestrating, as primarily stimulator and educator rather than producer. In today’s world, those orchestrating foundations have the capability to locate the innovation and production tools to convert intention to actual products and then exploit openly sourced supply chains to deliver final products to those in need.

Ultimately, the for-profit versus not-for-profit distinction is a bit contrived. Both economic models reside on a spectrum of means for

acquiring operating capital. When viewed this way, it is easy to imagine that ultimate success in an open framework will reside in mixed utility models, which employ a combination of capital sources, both philanthropic, through donations, and commercial, through sales. A lengthy discussion of the mixed-utility model lies outside this book's scope. But it is hoped that not-for-profit organizations are attending to the organizational transformation, contained in this text, with the same attention as their commercial counterparts. It is also hoped that not-for-profits recognize the role that non-cash utilities play in facilitating risk-sharing in the open innovation model. Not-for-profits are frankly better positioned for several reasons, to immediately capture this motivation, and the fruits of it, in the near future.

## **Open Medicines Development: Early Steps**

Although much of the foregoing may feel a bit abstract, this discussion of a new, open, innovation framework finishes by creating a simple example. The example is drawn from the sector that often lives on the boundary between commercial and philanthropic activities, even today—that is, the discovery and development of new medicines for diseases around the globe. While taking no issue with the success or motives that have driven the advancement of medicine by commercial entities, it is still recognized that some nations (and their populations) lack the economic resources to pay for the treatments that might be effective against the diseases that most often claim their citizen's lives. And even in well-developed economies, rare diseases receive less attention from large commercial organizations. This is because the struggle to develop medicines for these diseases require no less investment or effort, while the absence of a large, wealthy market for these drugs effectively *ensures* a lesser return. For these reasons, for-profits and not-for-profits have existed side-by-side in the world of medicines for the past century. If ever there were a sector ripe for a more open innovation model, and the mixed-utility entity, it is hard to imagine one better suited.

Pharmaceutical research is one of the best-funded research programs on the planet. And yet a seeming paradox exists. Funding for this research by the United States federal government exceeds \$50 billion per year, and allowing for inflation, it has persisted at high levels for decades. Without question, some of the finest minds in this technical discipline reside in government research labs and academic posts throughout the world. And yet, even by analysis of the funders themselves, this enormous noncommercial effort brings few drugs directly to the taxpayers who fund it. That is not to say that the fundamental research studies carried out in these laboratories are not of enormous value in laying the technological framework for the discovery of medicines and their development primarily by commercial entities. The point is not that taxpayer dollars are wasted. Rather, the nature of the tasks, their careful integration, and the divergent cultures of basic and applied research, led to a dominating commercial corporate form that, for all the reasons discussed in Chapter 2—the management of transaction costs—historically yielded the most productive engine. But in an era of low-cost search, online collaboration, electronic transactions, and global engagement, those same forces are likely to yield a different organizational structure.

Put simply: If good science was all it took, Harvard would already be the world's most successful drug company. But diseases need pharmacological hypotheses; they need biological models; they need lead molecules; they need structure activity relationship studies, and much more. The drug candidates that spring from such early studies need analytical methods; they need efficacious formulations; they need manufacturing processes; and again, much more. The end products, the medicines that show safety and efficacy, need production facilities, quality assurance, and an efficient supply chain to reach patients around the world. Could this enormous spectrum of activity be carried out in a government, academic, or a not-for-profit organization as readily as it is in a commercial firm? Historically, probably not. But in today's connected economy, in the Open Innovation Marketplace...?

The innovation framework discussed in this chapter could bring effective medicine producing capability within the realm of all these institutional structures: government, commercial, and non-profit. That is not to say that they would *choose* to do so, but that the orchestration of innovation through dissection-channel-assembly does substantially lower the barrier to entry. Lower barriers typically bring a greater diversity of approaches, in this case ultimately resulting in new treatments and lower costs. A couple of unusual examples have already emerged.

The first is the uniquely governmental role of national defense as applied to therapeutic countermeasures for biological warfare attacks. Accept for now that the difference between treating a naturally occurring disease and one delivered by “weaponization” of infectious agents is subtle at best. “Biological warfare countermeasures” are “medicines.” When these efforts were substantially refreshed following the events of 9/11, and the subsequent anthrax scare, new websites were created by the National Institute of Allergy and Infectious Disease, NIAID, that managed the product development portfolio in an unprecedentedly transparent manner. The development of these countermeasures, orchestrated by the federal government, involved the open disclosure and management of this research, and the specific stage it was in, via a public website. It might be suggested that the effectiveness of this approach was probably hampered by the attempts to shoehorn the work into classic stage-gate paradigms. Further, insufficient effort was made to redefine the orchestration, dissection, etc., skill sets and roles of those who served to advance the therapies within the NIAID. In spite of possible criticisms, the “drug development portfolio” of countermeasures was openly disclosed and enabled specialized researchers to readily assess the “state of the art” of any given countermeasure, and to independently determine how they might potentially contribute. In recent years, there seems to have been a decision to retreat from this open public view of progress. The pages, where the countermeasure projects immediate

status were disclosed, have been deleted and the original URLs are redirected to web pages talking in broader generalities. Nevertheless such early efforts are commended and stand in stark contrast to the secrecy with which drug development portfolios are usually guarded.

A second example, of early efforts by noncommercial entities for the orchestration of therapeutic development, is a foundation known as “Nathan’s Battle.” This foundation was established by the parents and friends of a young boy, Nathan, suffering from a rare, fatal, neurodegenerative disorder known as Batten’s Disease. Nathan’s parents come from a small business family outside the pharmaceutical industry. But, they have become sufficiently knowledgeable, with the aid of advisers, to try to tackle a problem of this magnitude through online solicitation and orchestration of the effort of others.

A portion of the Nathan’s Battle website lists scientific and clinical efforts, and solicits specific needs that would enable the foundation to continue progressing the studies. When last checked, some specific needs included: “...a Good Manufacturing Practices facility to produce clinical grade virus vector for us to be used in the toxicity testing and in the clinical trial,” “...a hospital to host our clinical trial as the center for the inter cranial injections and clinical evaluations. Stanford has tentatively committed to be a potential site but the FDA would like for us to have at least two sites to eliminate any bias in the test results,” and “...anyone involved in these fields (enzyme replacement, gene therapy, stem cell therapy, Neurotrophic factors).” The “call to arms” ends with this statement: “At this point who you know makes a huge difference. Remember we are all just six people from everyone.”<sup>10</sup> Not only are they using the crowd, but they’re using the crowd to search the crowd.

In the coming years, these early examples will pale. Already, there are not-for-profit organizations such as the Myelin Repair Foundation and the Institute for OneWorld Health building research capabilities that rival commercial pharmaceutical companies and managing their portfolios with a new public transparency. We see open innovation efforts such as Lilly’s FIPNet (see the case at end of

Chapter 5, “The Selection of Appropriate Innovation Channels”) or the “Chorus model”<sup>11</sup> for tapping in to external resources for clinical designs at both the project and study level. There are collaborative efforts to identify malaria and tuberculosis treatments through the online sharing of data via Collaborative Drug Discovery. And the authors are aware of many more technologies, capabilities, and not-yet-public startups pursuing the discovery and development of new medicines via orchestration of the global network of research, patient advocacy, and clinical experiences.

Considering the potential that exists, these early examples may all be correctly viewed as “baby steps” but are as crucial to winning the marathon as any world-class runner’s first hesitant steps were.

## **Case Study: How NASA Expanded Its Innovation Framework to Find New Solutions to Old Problems<sup>12</sup>**

A radio frequency engineer from rural New Hampshire contributed the best solution to a public challenge issued by NASA’s Space Life Sciences Directorate. This is a clear example of what Aneesh Chopra, Federal Chief Technology Officer, describes as “...a notion that in our society, knowledge is widely dispersed. And if knowledge is widely dispersed, how do we capture the insights from the American people?”

Chopra also said, in the speech titled “*Rethinking Government*,” to a live audience at the 2010 Personal Democracy Forum, “A semi-retired radio frequency engineer living in rural New Hampshire was able to share his idea on how to address this problem, and it so blew away the others whose ideas were under consideration that NASA reported it exceeded their requirements! No complicated RFP, the need for lobbyists, some convoluted processes, etc. Just a smart person... (who) was paid a modest \$30,000 for his insight.”<sup>13</sup>

In 2005, NASA had to make choices about how to support the Constellation Program, an ambitious program to take humans back to the moon for months at a time. It was designed eventually to take people to Mars, on missions longer than two years, requiring unprecedented preparation and planning in exchange for a wealth of understanding about space and basic survival.

“We experienced a 45% reduction in R&D budgets during the process of getting Constellation up and running,” said Dr. Jeff Davis, Director of the Space Life Sciences Directorate (SLSD) at NASA’s Johnson Space Center in Houston. “We knew those resources weren’t coming back and we thought to ourselves, we can’t get this done by just doing 45% less, we need to approach this whole program in a new way.”

Realizing it must redefine its program within resource constraints, Jeff and his team (some 160 civil servants and 800 contractors) opened their minds to new ways of imagining work, resourcing, and even innovation itself.

“Early the next year, in 2006, we ran a visioning exercise that outlined four possible future scenarios,” he said. “We selected the one that focused on forming alliances to leverage our internal work. We then wrote a strategic plan in 2007 and conducted a benchmark study focused on forming alliances. In our study, we found that alliance forming organizations routinely scored high in measures of their ability to produce innovations.”

Later, after Davis and his team took a course at Harvard Business School titled “Leading Change and Organization Renewal” (LCOR), the SLSD began its pursuit of open innovation in earnest. To begin, the SLSD reviewed the gaps in its research and development portfolio and ran a portfolio mapping exercise designed by Prof. Gary Pisano at Harvard Business School on “the four ways to collaborate.”

Davis said, “We had pretty complete coverage in the quadrant labeled ‘hierarchical and closed’—but we quickly learned that if we

wanted to close the gaps in our total innovation program, we needed to better leverage external innovation platforms.”

“It was,” he said, “a thorough process of defining our entire body of work, evaluating which pieces we wanted to keep inside versus outside, defining gaps, and finally assessing which innovation model made sense for each gap area. But you have to take it *that* seriously, and do the homework or you’ll miss opportunities. This has been a four-year journey for us. Then, in 2010, the Office of Management and Budget published guidance on using prizes to stimulate innovation, and we realized our efforts were aligned with an overall strategy of the Federal government.”

Davis and his team had become aware of InnoCentive through the Harvard course and shortly thereafter NASA began a pilot program with InnoCentive (one of three overall that included Yet2.com and TopCoder), the Waltham-based innovation marketplace, to run seven “high-value challenges” that NASA felt would benefit from the “innovation mall” model of open collaboration.

Participants from around the world, 579 of them, took a close look at the “Data-Driven Forecasting of Solar Events” challenge on InnoCentive’s website. The problem was finding a suitable method to more reliably predict the particle storms originating with solar events. These storm’s particles can be a hazard to spacecraft and astronauts above the earth’s atmosphere. They also impact weather. Fourteen complete proposed solutions were submitted. After reviewing them, NASA issued a success award to Bruce Cragin, a semiretired radio frequency engineer.

Cragin holds a bachelor of science degree in engineering physics and a doctorate in applied physics. He has 15 years experience in plasma physics basic research and another 13 years of industrial experience as a radio frequency engineer.

The challenge was “right in the ‘sweet-spot,’” Cragin said, “Though I hadn’t worked in the area of solar physics as such, I had thought a lot about the theory of magnetic reconnection. Also, the

image analysis skills I acquired in the 1980s, while looking into something called the ‘small comet hypothesis,’ turned out to be very useful.” As with many novel ideas, the fusion of skills and specific experiences enabled Cragin to see the problem and propose a solution that had escaped others focused primarily on the discipline of solar physics.

And as Cragin “daisy-chains” these cross-disciplinary approaches, he notes that the work he did on the NASA challenge, “focused my attention on predictive modeling. That led to another challenge involving maize genetics to which I also submitted a solution, and became a finalist. The computational tools acquired in that work are now being applied in two additional challenges, both genetics-related.”

“The NASA employees who write, run, and evaluate our challenges are converts and advocates of open innovation because they get good results,” said Dr. Jennifer Fogarty, Space Life Sciences Innovation Lead.

Davis, who is leading this transformation, didn’t always find the going easy. Many of those who prospered under an old framework of innovation emerged initially as skeptics. For example, some wondered how can you solve a major solar physics problem without years of steeping in solar physics research and study? However, the fruits of this effort are becoming increasingly apparent to his organization and to NASA as a whole. Leaders such as Davis are mapping the frontiers of innovation as they map the frontiers of space. Davis said: “Other disciplines in NASA are now considering conducting challenges based on our experience. Our experiences with open innovation have created an opportunity for us to be thought leaders in this practice; our early experiences show that open innovation is faster and more cost-effective than some traditional problem-solving tools. We’re now working on a decision framework to determine how newer and older problem-solving methods work best together. And, there’s a real element of fun and participation to it. It changes how you think.”