



THE
POWER
OF **PRIZES**

Incentivizing Radical Innovation

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U.S. CHAMBER OF COMMERCE FOUNDATION

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INTRODUCTION

Prizes are among the most effective—and overlooked—tools for incentivizing breakthrough solutions to the thorniest problems we know. They have existed since the dawn of man. As modern civilization has grown, prizes have become a tool for incentivizing progress. Yet it has been only in the past few centuries that we have come to view prizes institutionally, channeling human nature toward valuable endeavors.

Prizes are wrapped up in a quest for prosperity and economic growth, which, in turn, depend on the development of new ways of working, living, and thinking—in short, innovation. What we invest in innovation, however, often falls short of what would be justified by the social benefit. Innovators know that, absent external incentives, they at best gain only 2% of the total value of their work. The rest goes to other producers and consumers.¹

We need to incorporate more market gain into the personal incentive to innovate. Intellectual property does so by rewarding innovators with ownership of their work and a share of its value over time. Prizes also act as incentives by aiming to bring forward a share of future gains from innovation into the present, often while releasing ownership of the work to the public.

Prizes work by having a particular entity define a problem and then offer a reward—cash or otherwise—for a solution. Whichever party achieves the proscribed goal receives the reward. In theory, prizes can be applied to a wide range of goals in the marketplace. What often sets prizes apart is that they are applied to opportunities, both large and small, where a breakthrough seems within reach with just the right “kick.” By blending public aims with private initiative, prizes are able to “tap a primitive urge to win, and to be seen winning,” to make great things happen.²

This report examines the potential of prizes, beginning with their surprising past. Along the way, we see their unique qualities as well as review the evidence of their effectiveness. We then shift to best practices for implementing prizes. Knowing when and how prizes work best matters as the range of current applications and future possibilities continues to increase. Knowing what’s conceivable is not the same as realizing what’s ideal for prizes—there are particular applications that actors in this space should focus on. This paper



presents an entirely new model for prizes, combining the crowdsourcing of inquiry and ideas with the crowdfunding of reward. Finally, we recommend steps to take to push prizes to a higher place in the order of American innovation.

What makes prizes so compelling today is how greatly they seem to contrast with our stagnant times. Growth has slowed to a trickle, while pools of talent slowly dwindle. We live on the innovation frontier with vast possibilities; yet all we clearly see is a present that seems humbled by the past. Where moon shots once lit up our skies, we're left gazing down at our smartphone's soft glow. Prizes open the imagination to what's unseen.

A SHORT HISTORY OF PRIZES

*"Sons of Atreus, you other well-armed Achaean warriors, these prizes lie set out here for a contest among the charioteers."*³
—Homer

Homer's *Illiad* sets out one of the first descriptions of prizes in history. We see Achilles atop a funeral pyre, calling on his men to compete in honor of Patroclus, whose death he would glorify through sport. He proclaimed prizes of gold and horses, and "once Achilles finished speaking, swift charioteers rushed into action," for they were "keen to win."

We may be long past the time of Greek myth. But in more modern history we have seen prizes spur action in surprising ways, none more so than with the great European contests of the 18th and 19th centuries. The British Longitude Prize, set out in 1714 with a first-place award of £20,000 (nearly \$4 million today), aimed to address the problems of navigation that bedeviled the Royal Navy once its ships lost sight of land.⁴ The empire's brightest minds, including Sir Isaac Newtown, were spurred by the prize to try to solve for longitude within 30 nautical miles. None of these vaunted academics succeeded. It was not until an unknown clock maker invented a highly precise chronometer some years later that the prize was won. In the meantime, a remarkably advanced cottage industry had emerged to conduct longitudinal research, far exceeding in investment what the prize would have covered, while drawing the pen of Jonathan Swift to mention the quest in *Gulliver's Travels*.⁵

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A few decades later and across the English Channel, the French established a number of breakthrough prizes. Among them was a purse of 2,400 livres for the development of artificial alkali, such as soda ash and potash, which are essential inputs for the glass, soap, textile, and paper industries.⁶ The winning process, later named after its inventor Nicolas Leblanc, led to significant growth in the inorganic chemical industry. A reward of 12,000 francs was later offered by Napoleon for a food preservation method that would help feed his army.⁷ The solution ultimately established the canning process and an entirely new industry with it.

In 1820, the French Academy of Sciences used the funds of a private donor to establish the Montyon Fund for incentivizing radical solutions to medical challenges.⁸ The endowment ultimately awarded hundreds of thousands of francs for a slew of innovations, including to a young Louis Pasteur, who later used the funds to subsidize his groundbreaking study in microbiology.

Over the course of the 18th century alone, prizes funded more than twice as many scientific efforts than were paid for by grants.⁹ And things were just getting started. “The early 20th century saw an even greater burst of prizes for breakthroughs in transportation and civil aviation, financed by newspapers and others.”¹⁰

The 1911 Schneider Cup Prize came quickly on the heels of the Wright Brothers’ first flight to encourage further advances in civil aviation. Militaries soon began pouring immense sums into aerodynamics and engine design as the Cup became a more established series of competitions stretching over two decades.

Then the Orteig Prize came into being. The winner, a shy, young Minnesotan named Charles Lindbergh who, in the words of F. Scott Fitzgerald, “seemed to have nothing to do with his generation,” made a nation pause and dream of greatness. In 1927, Lindbergh claimed the \$25,000 prize of a wealthy hotelier for making the first nonstop, solo flight from New York to Paris.¹¹ A waiting crowd instantly mobbed him, and in the ensuing years Lindbergh turned this spotlight on a rapidly developing civil aviation industry.

Lindbergh’s moment proved to be the high point for prizes, as a rising tide of government largesse soon swamped prize funding and relegated it to obscurity. Moreover, increasing amounts of research money were going to large-scale projects in the national security sphere, which had little need for the publicity that prizes brought. It was not until the late 1970s that private



funding of research and development (R&D) began to break away and rise above the levels of federal support.¹²

After decades had seemed to cool any enthusiasm toward prizes, Peter Diamandis attempted to reignite the space. His Ansari XPRIZE began in 1995 with a \$10 million award to the first privately funded firm whose spacecraft could lift three people 100km skyward twice in the space of two weeks.¹³ In 2004, a team led by aviation pioneer Burt Rutan claimed the prize and soon licensed its technology to the newly created Virgin Galactic, the brainchild of billionaire Sir Richard Branson. All contestants combined spent more than 10 times the sum of the prize in order to claim it. And the publicity surrounding the race to space proved priceless.

What was almost as incredible was that XPRIZE got off the ground at all.¹⁴ Diamandis had unsuccessfully pitched more than 200 executives to find a title sponsor, eventually signing with a skeptical aerospace insurer whose policy would pay out in the event of a successful spaceflight. Only later did software entrepreneur Anousheh Ansari offer to pay the insurance policy and thus secure her name atop the prize. The rest, as they say, is history. XPRIZE capitalized on its first success with a subsequent prize for \$10 million in genomics, followed by many more in the years after.¹⁵

By the 2000s, large amounts of private capital were available to a growing range of innovative endeavors, proving to be a fertile ground for the further development of prizes. Moreover, governments were searching for new ways to fund applied research beyond the simple grant-making framework. Due to the large amounts of development funds available in the defense space, this was the natural point for innovation challenges to form.

In March 2004, the U.S. Defense Advanced Research Projects Agency (DARPA) held its first "Grand Challenge," with 25 finalists attempting to navigate 200 miles of treacherous California desert over 10 hours using autonomous ground vehicles.¹⁶ While the first contest provided no winners, the second, more difficult Grand Challenge in October 2005 had four teams that reached the finish line within the 10-hour window.

Back in the private sector, foundations were established to channel research funds toward social goods. Two in particular stood out: The Methuselah Foundation,

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established to discover anti-aging methods,¹⁷ and Sir Richard Branson's Virgin Earth Challenge, a \$25 million prize for the invention of a commercially and environmentally viable method of removing atmospheric greenhouse gases.¹⁸ Others set up included the Cheap Access to Space prize by the Space Frontier Foundation, the Feynman Prize from the Foresight Institute, and the Mo Ibrahim Prize for Good Governance.¹⁹ Not only that, but corporations began to see the value in prizes, most notably Netflix, whose \$1 million prize for a more effective movie recommendation system proved to be the "steal of the century."²⁰

Prizes are an idea whose time has come again.

WHAT ARE PRIZES?

*"Daring ideas are like chessmen moved forward;
they may be beaten, but they may start a winning game."
—Goethe*

Prizes inspire innovative activity in pursuit of relevant problems. The sponsor defines the challenge and terms of success. The innovator, in turn, assumes the cost and risks of research and development, while enjoying relative freedom in finding a solution. Significantly, anyone can compete and win on a level playing field—the only thing that matters is performance. Prizes democratize problem solving.

The fundamental question for prize participants is, Why compete at all? It is easy to think that winning the prize purse holds the first and greatest reward for competing. But this is not so. Nonmonetary incentives, such as prestige or the opportunity to learn, are often just as compelling, alongside the possible market value of the innovation.²¹ If not for these factors, we would not see contestants investing more in pursuit of a prize than they actually stand to receive in reward. Prize purses mostly serve to get innovators to the point of action—to meet their "natural investment threshold."²²

For incentivizing innovation, both intellectual property and prizes are kinds of pull mechanisms that reward the successful accomplishment of specific end goals, contrary to the push of grants that subsidize specific research activity.²³



Contestants are drawn toward investing their time, energy, and capital toward particularly knotty goals without sponsors articulating beforehand how they should be met. This is in contrast to ex-post “recognition prizes,” such as the Nobel Prize, which simply acknowledge notable past achievements.²⁴

Prizes don’t emerge from vacuums. They act as leverage to encourage capital to be invested according to measurable benchmarks. Quite often these funds begin dispersed across public and private sectors and are only brought together once a prize is announced and teams form to compete.²⁵ As we saw with the Ansari XPRIZE, these investments often exceed the size of the cash prize and go on to craft brand new industries.²⁶ A successful prize contest will generate spillover benefits in publicity and prestige that overwhelm the value of the prize itself.

The prominent, democratic nature of prizes can stimulate a high degree of competition, often from surprising corners. Contestants range from companies and academics to entrepreneurs and garage-bound tinkerers. Sponsors are able to tap into these diverse pools of creativity and reserves of fresh ideas that they may not have been able to previously identify. As Bill Joy of Intel famously remarked, “No matter who you are, most of the smartest people work for someone else.”²⁷ Prizes are a mechanism for widening the talent pool in pursuit of solutions.

Prizes then are marked by boldness and tempered by reality, while avoiding the prescriptive focus that marks grant programs. No wonder the solutions are often just as unexpected as those in pursuit of them.

MAJOR PRIZE PLAYERS

- *Foundations*—identify and sponsor prizes as well as organize research.
- *Universities*—organize research initiatives.
- *Companies*—identify and sponsor prizes as well as support winners.
- *Investors*—back competitors as well as winners.
- *Government*—identify and sponsor prizes.

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DO PRIZES WORK?

“Prizes are one tool, and great when applicable.”
—Reed Hastings, CEO of Netflix²⁸

As significant as prizes have been in history, few researchers have examined their effectiveness.²⁹ We know two downsides for sure: Prizes have important limits in their application and harbor some very real costs. Yet by asking basic questions to determine success, we also see that prizes achieve their billing of incentivizing innovation.

Prizes are no substitute for long-term basic research. It is simply too hard to know what success looks like without being well on the way to achieving it. Indeed, “inventors will have ideas for new technologies that no prize sponsor will have thought of in advance.”³⁰ As Tim Harford of the *Financial Times* points out, “Even a \$100 zillion prize wouldn’t buy you the next Internet—it’s just too disruptive a concept.”³¹

Rather, prizes must struggle to identify true market failures to tackle, and then they must set the appropriate parameters and goals for the contest.³² It can be difficult to find the right incentives to match the prize’s goals.³³ Establishing a reward can prove especially arbitrary because of a lack of information. Patents, in particular, are unencumbered with these challenges.

Moreover, prizes can be laden with hidden costs. They have a tendency to lead to duplicative efforts, with contestants holding on to critical information only to counterproductively adopt similar methods and ideas. As a recent report describes, “Otherwise productive competitions turn wasteful when contestants, once they have decided to pursue the prize, find other contestants also in pursuit and choose to match their spending, with no corresponding rise in the aggregate odds of success or quality of the outcome.”³⁴ By presupposing a particular level of success too, prize sponsors “give no incentive for incremental improvements at higher (or lower) levels of success, so give no information about performance that could have been achieved using more or less ambitious goals.”³⁵

Staffing expenses and fundraising needs can also be a hidden challenge for both sponsors and participants. The investment in labor and time to reach



potential supporters is great, as is the burden of maintaining sufficient levels of publicity. If contestants especially are not careful, they may find that their fundraising efforts slow down the essential work of research as well as leave them vulnerable to economic downturns.

More broadly, prizes may threaten true market competition with their artificial form, thus diverting valuable resources toward less efficient ends.³⁶ Additionally, the constructed nature of the competition opens it up to temptations of favoritism (and even unintended incompetence) during the selection process.

Yet even for these challenges, prizes remain worthwhile endeavors. Prizes infuse the spirit of competition into efforts bent on addressing market failures and adding to public knowledge. Problems that were once ignored are given new life within a market-driven framework. Or consider the spillover effects alone. The human-powered Gossamer Albatross, which won the Kremer Prize in 1979 for its flight across the English Channel, helped demonstrate and lead to the adoption of DuPont's Kevlar composite and many other now vital synthetic products.³⁷

We can ask three questions in looking for evidence of a prize's success:

1. Does it lead to innovation?
2. Does it kick-start industry?
3. Does it generate spillovers?

A recent study offers the most substantive case for prizes leading to innovation. It reviews nearly 2,000 prizes awarded by the Royal Agricultural Society of England (RASE) over the period 1839–1939.³⁸ Those who won the prizes were much more likely to receive and renew patents, and doubling the prize purse led to upward of a 33% increase in patented innovations.³⁹ Even those who lost their contests cumulatively received more than 13,000 patents.⁴⁰ As one British journal remarked in 1867 about the RASE prizes, "It is indisputable that these competitive trials have done, and are doing, much to raise agricultural engineering to the highest standards of efficiency and economy."⁴¹

A more recent study of the crowdsourcing platform Innocentive found that its community of problem solvers succeeded in winning 30% of the prizes offered. These were hundreds of challenges that quite often had stymied the

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research labs of leading companies and nonprofits.⁴² According to Innocentive, roughly 85% of the 1,700 external-facing challenges that it measured were successful, with credit going to its methodology and approach.⁴³

Return on investment is a central part of fostering sustained innovation. To that point, Peter Diamandis of XPRIZE estimates that innovation contests return somewhere between 10 and 40 times their initial investment.⁴⁴ Moreover, a recent report on Shell's Springboard Prize, a contest for finding innovative business ideas in low carbon technology, found that it boasted a return on investment of between 200% and 900%, if return is measured according to the spending and investment by competitors and the expense of managing the competition.⁴⁵ Still, it remains unclear what causes this variation in return, and there is much work to be done to comprehensively catalogue the costs versus the gains for prizes throughout history. Only 23% of the prize sponsors surveyed by McKinsey annually evaluated the impact of their prizes.⁴⁶ Moreover, we need to ask just how much investment is being undertaken in industries that use prizes beyond what would have been the average.

As for whether prizes can kick-start the formation of a new industry, we need only refer to the previously cited example of XPRIZE (though there are others). With the advent of Virgin Galactic after Burt Rutan's successful space flights, additional firms have moved into the space tourism market to compete for what has gone from being a nonexistent market to a projected \$1 billion industry by 2022.⁴⁷ Private investors have already poured well more than \$1.5 billion into the industry⁴⁸, and Rutan's company, Scaled Composites, was later sold to aerospace and defense firm Northrop Grumman.⁴⁹

Prizes can also rejuvenate existing markets and industries. The Super Efficient Refrigerator Program (SERP) offered a \$30 million prize in 1992 as a golden carrot incentivizing the creation of a highly efficient, CFC-free refrigerator design.⁵⁰ A year later, Whirlpool was announced as the winner for making a design that was over 25% more efficient than what federal standards required then. Similarly designed refrigerators now make up a third of the U.S. market, and each consumes half as much electricity as typical units did prior to 1993.⁵¹

While numerous anecdotes are available on the ability of prizes to jump-start industry creation or rejuvenation, there is little research available that offers a systematic account of market creation or the consumer benefit derived from it.



Similarly, no comprehensive study exists of the spillover effects from prizes. And again, the example of Whirlpool’s successful refrigerator design applies. The company created a system known as ExacTrack to monitor the sales of its efficient refrigerators, in keeping with the SERP program’s requirement that contestants be able to track 25% of the units sold and shipped.

The system proved highly successful not just for Whirlpool but also for the utility companies that were partly sponsoring the SERP program, as they now had a mechanism to monitor appliance location and energy usage as well as “provide critical data to identify regional markets, identify behavior in those markets, and identify sales.”⁵² DuPont also gained in reputation from the successful flight of the Gossamer Albatross; in fact, it went on to back other solar-powered flights due to the success of its original sponsorship.⁵³

PRIZE ADVANTAGES

- Is open to any participant or idea
- Fosters originality
- Incentivizes private work for public good
- Avoids bureaucratic entanglements
- Encourages additional effort
- Promotes research
- Demonstrates feasibility
- Diffuses ideas
- Shifts risk
- Leverages key resources
- Publicizes and inspires
- Opens up new markets or revitalizes old ones
- Only rewards success

While the successes of prizes outweigh their downsides, if this tool for innovation is to spring into wide use, we need more systematic accounts of their effectiveness and better ways to measure return on investment. This is especially true as the prize industry—both public and private—looks to expand and considers how best to effectively deliver on sponsors’ investments.

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WHAT ARE THE BEST PRACTICES TO FOLLOW?

*“We cannot solve a problem by using the same kind of thinking we used when we created them.”
—Albert Einstein*

Prizes can successfully spur innovation. But what are the ingredients for success? What’s in the DNA of successful prizes?

As with any initiative, success begins with a clear mission and a vision. What are we building toward? Rather than treating prizes as one tool to apply as needed, they must be viewed as integrated solutions to ongoing innovation challenges. If the prize is treated simply as a one-off effort, the result will be only hit-or-miss innovation.⁵⁴

Once we know where we are going and why, it becomes essential to make the prize program align with the strategic goals of the sponsoring or managing entity. Problems must become integrated into the broader work of the organization, recognizing that even finding a solution represents only the halfway point of what is to be achieved. Prizes then become something more like basic product lines that coalesce with the work of sponsors and participants as well as point to areas of future expansion. Particularly for private sector firms, there needs to be an already broader vision and program in place that prizes can be incorporated into.

A properly integrated prize should incorporate feasible, but far-reaching, objectives that are universally understood. Grasping the broader goals helps define clearly articulated challenges. That often means, at least on the practitioner level, knowing when to ask the right questions to articulate the problem in a clear and concise way. Simpler is better when it comes to prizes. It is far too easy to lose sight of the broader goals when they are mired in the complex rules and byzantine measuring systems that come with poorly defined objectives.

Moreover, the goals of the prize must be, as McKinsey articulates, “measurable and achievable within a reasonable time frame.” Being measurable is an offshoot of having a reasonably specific and clearly defined problem to tackle. Be too specific and you’ll forestall creativity—be too



vague and the prize becomes a popularity contest among a limited pool of entrants.^{55, 56} Having a clear measure of success is important. Similarly, to be accomplished in reasonable time, the prize must offer an achievable, yet difficult, target while leaving open-ended the means for achieving it. Anywhere between 2 and 10 years is considered sufficient time for prizes.⁵⁷

Prizes, once available, must be public and open to all. This increases the odds of success and, as *The Economist* notes, “can inspire solutions that are hard to find in industry.”⁵⁸ There can be particular criteria for entrance, but only insofar as they do not deny the potential for a relatively large number

CONTEST DECISION BASICS

- Is open to any participant or idea.
- Fosters originality.
- Incentivizes private work for public good.
- Avoids bureaucratic entanglements.

Source: Lee N. Davis, “Should We Consider Alternative Incentives for Basic Research? Patents vs. Prizes.”

of participants. Quite often the exclusion is self-enforced due to the risk and costs being borne by the contestants.⁵⁹

Successful prizes clearly specify the terms of the reward and make a credible commitment to follow through. There must be no ambiguity on the prize, as it helps contestants to weigh their chances against the amount

of time and money they will spend in pursuit.⁶⁰ This, in turn, encourages the leveraging of further investment and offers a valuable signal of performance for contestants.⁶¹

The size of the prize purse, if in the form of a monetary reward, should be based on the contestant’s likely cost of innovation, size of the future market, possible societal benefit, and likelihood of success.⁶² Whether it is a large prize is not what matters as much as whether it is *large enough*. As Davis points out, “If the amount is too low, then firms would not be willing to undertake the necessary R&D. If the amount is too high, it would exacerbate the costs of the prize system (particularly favoritism and resource duplication).”⁶³

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It is important to recognize that we cannot take the discussion of the prize purse too far though, as one author notes: “In our case studies, the winning inventors saw prizes as one of a range of possible inducements to engage in innovative activity. Where prizes suited their purposes, they competed for them, but rarely was the prize the motivating factor.”⁶⁴

More experimental targets may require more finely tuned prize structures and incentives. For instance, offering multiple prizes may encourage more participation in “riskier” endeavors, since the likelihood of a single contestant claiming a prize would increase. More advance support for the teams or a longer development period may also act as incentives when facing particularly difficult innovation challenges.⁶⁵

One additional consideration for prize designers—and among the most important—is the degree to which the sponsor will receive any IP rights resulting from the contest.⁶⁶ In the case of the Netflix Challenge, the company kept the IP and become the sole “buyer” of the winning entry.⁶⁷ But for those prizes that aim for an independent end market after the prize competition has been completed, ensuring that contestants receive at least a degree of intellectual property is vital.

Beyond the consideration of prize sums, there’s an intangible aspect to prizes that cannot be ignored. They must not only incentivize through reward, but they also must capture the imagination of many. Cutting through the noise with a mix of continuous publicity and high-profile, prestigious contests not only inspires more effort by the contestants but builds into their end market afterward.^{68, 69}

It’s here where XPRIZE’s example is notable, becoming a basic template for both public and private sectors in pursuing developing prizes:

- Identify a goal that represents a breakthrough in a particular area.
- Research the problem in consultation with experts and board members.
- Find sponsors—preferably from the private sector.
- Identify teams, ideally bringing with them a variety of perspectives.
- Announce a substantial prize with great fanfare.
- Generate maximum publicity.
- Encourage outside investment—upward of \$100 million for the Ansari XPRIZE.
- If successful, award the prize purse and intellectual property to the winner.



For XPRIZE and other successful sponsoring firms, the final step of awarding the winner is merely the first stage of developing a substantial market for the innovation that's been gleaned.

WHAT ARE THE EMERGENT AREAS WHERE PRIZES ARE BEING APPLIED?

“To teach that a comparatively few men are responsible for the greatest forward steps of mankind is the worst sort of nonsense.”
—Henry Ford, Founder, Ford Motor Company

The market for innovation prizes has grown dramatically over the past decade. Still, it's surprisingly difficult to know for certain just how large the space is. McKinsey's 2009 report on philanthropic prizes boasts the most accurate, if not the most up-to-date, data yet. According to the consultancy, the current prize sector is sized somewhere between \$1 billion and \$2 billion, with cumulative prize purses having tripled during the 2000s to \$375 million.⁷⁰ Viewed over the span of the past four decades, prizes have enjoyed a 15-fold growth in value—much of the funding is from the private sector.

Since the time of McKinsey's report, there has been a massive rise in the government use of prizes, particularly with Congress' passage of the America COMPETES Act in 2009.⁷¹ Whereas in previous years only the National Aeronautics and Space Administration (NASA) and the Department of Defense enjoyed the authority to commission and implement prizes, now every federal agency can assume the lead role in sponsoring a prize.^{72, 73} By 2013, Challenge.gov had opened up to feature a one-stop shop of more than 250 prizes from across more than 50 federal agencies.⁷⁴ Prizes are limited to \$50 million awards, but most developed so far have totaled under \$10 million.⁷⁵

NASA, the Department of Defense, and the Department of Energy remain the public sector leaders when it comes to applying prizes to their pursuit of innovation.⁷⁶ Each of them boasts a track record, remarkable in itself due to the newness of their respective prize programs, at establishing ambitious goals in areas that would benefit from novel inquiry—and tracking their implementation and effectiveness.

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The Center of Excellence for Collaborative Innovation at NASA, for instance, takes the agency's lead role in designing, implementing, and evaluating prizes, as well as in coming up with more collaborative, open-source models.⁷⁷ DARPA is continuing its track record of technology competitions with the disaster-response Robotics Challenge, which, as *Aviation Week* describes, is "so complex that to compete requires large, multidisciplinary teams."⁷⁸ Beyond these other "big 3" agency prizes, the Department of Health & Human Services commissioned a \$5 million Investing in Innovation (i2) initiative that's aimed at igniting health IT advancements.⁷⁹

Governments in other countries are getting in on the act, including Canada's nearly \$100 million prize for agricultural innovations and the United Kingdom's \$1.5 million Big Green Challenge for reducing carbon emissions.⁸⁰ The European Commission has developed a massive €80 billion research and innovation funding program known as Horizon 2020, in which prizes will play a significant role. The Scottish government created the annual Saltire Prize in 2007, awarding millions of Scottish pounds every year for a wide range of business and technological innovations; in fact, the fund's design is modeled after the XPRIZE.⁸¹ And beginning in 2004, the European Satellite Navigation Competition has rewarded more than 170 teams out of more than 3,500 registrants for its innovative ideas to improve global satellite navigation systems.⁸² Even on a cross-national scale, the Gates Foundation's five-nation strong, \$1.5 billion advance market commitment (AMC) for pneumococcal vaccines—where the sponsors agree to subsidize the first large orders—has accelerated vaccine production and rollout since its announcement in 2007.^{83, 84} Many more could be mentioned, especially from across Asia, but the point remains that prizes are growing well outside the borders of the United States.

While the public sector has moved more energetically into the prize space, traditional approaches toward incentivizing innovation have remained. Prizes continue to function as a complement to other funding mechanisms, such as grants, and incentive structures, such as patents. Not only do prizes appeal to a relatively narrow range of problems, but there is only so much money that can be applied to particular challenges and government foreknowledge in order to fund the price tag at all. Tim Harford says that "to become a significant alternative to grants and patents, prizes will have to become very large indeed—large enough to cover, on average, all of the likely research expenditures of all those hoping to win."⁸⁵ Is that likely or even desirable? The answer, it appears, is a firm no.



“No single institution solves all problems,” says Alex Tabarrok, a professor at George Mason University. “Patents, innovation prizes, patent buyouts, and advance market commitments all have their place. The key is to match problems to institutions.”⁸⁶

WHAT ARE THE NEAR-TERM POSSIBILITIES FOR PRIZES?

“We keep moving forward, opening up new doors and doing new things, because we’re curious ... and curiosity keeps leading us down new paths.”
—Walt Disney, Founder, The Walt Disney Company

Many of the challenges that remain for prizes eventually fall into two categories: the complex, multifaceted problems requiring large, cross-disciplinary teams and the need for discrete, small-scale advances that are especially primed for crowdsourced solutions. It is hard to identify in advance specific problems that could be tackled in the future, but the outlines are already emerging for the greatest near-term applications of innovation prizes.

Some areas ripe for innovation are not best suited for prizes. Perhaps the technologies and markets exist, and all that’s needed is sustained investment. Other realms have been subject to spending that would overwhelm even the most generous prize—what’s needed here are large, competitive marketplaces to form.⁸⁷ Generally, it must be reiterated that patents and grants remain foundational methods for incentivizing most forms of innovation. Patents, in particular, work well for “long shot research areas with low aggregate possibilities of success.”⁸⁸

Nevertheless, there are some realms in which more applied research and greater amounts of experimentation may yield crucial gains in innovation. Prizes work best for areas with clear intermediate opportunities for success in nascent markets. We may not get an expedition to Mars from prizes, for instance, but we can kick-start private space tourism. We may not cure cancer through a prize, but we can find novel ways to fight malaria in the world’s poorest countries.

Prizes, moreover, enable us to incentivize innovation in a way that reduces the tendencies of funders to pick favorites, which yields to their self-interest, or pay for output, which is inherently uncertain. The British Longitude prize

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offers a note of caution though, because the government withheld its award for decades due to the unexpected nature of the winner as well as because one of the members of the prize selection board was pursuing his own solution.⁸⁹ Nevertheless, prizes throw an unflattering light on these common forms of cronyism and for that alone are worth pursuing.

Finally, prizes enable—at least for the problems worth applying them to—for those pursuing innovation to avoid messy forms of bureaucracy in the public and private sectors. Prizes can attract fresh interest from those who would otherwise be put off by, say, burdensome procurement regulations. These structures favor large organizations that can divert the necessary resources to navigating them. This is important because “independent innovators account for a substantial number of breakthrough innovations.”⁹⁰

For large, complex challenges—the first sort we will see addressed in the years ahead—similarly great incentives will be necessary. Nonmonetary incentives will be required to sufficiently raise the stakes of the contest enough to attract a diverse range of competitors, but a degree of up-front research funding may be needed as well. Ultimately, XPRIZE’s Peter Diamandis believes that we will see a rise in “megaprizes,” totaling \$100 million or even \$1 billion in the years to come.⁹¹ This doesn’t seem too surprising in light of the billions already devoted to medical AMCs.

One of the most obvious fields for prizes remains in the realm of space exploration. With XPRIZE’s continued work and NASA’s established presence in fostering private sector initiatives, we are likely to see much more done to advance the boundaries of inquiry. A recent report sees the public sector leading the way in investing about \$100 million annually over the short term, while devoting upward of 2% to 3% of NASA’s budget to space prizes over the longer term.⁹²

In the area of medicine, we have already seen how the Gates Foundation’s AMC initiative has kicked-off the wider introduction of vaccines. Currently, the United States’ share of vaccine AMCs totals between \$3.7 billion and \$4.1 billion. Expect to see similar AMCs being developed for HIV/AIDS, malaria, rotavirus, and more—afflictions that bedevil the poor or relatively small groups of people.

In agriculture, the problems come down to efficiency in output—how farmers can do more with less. Genetically modified crops, specifically, have already



made a profound influence on developed country farming through various crop enhancements, but they are only now beginning to be introduced into developing countries, where the need is for disease- and drought-resistant

PRIZE APPLICATIONS

- Solving important problems.
- Resolving externalities.
- Reducing innovation risks.
- Inducing creativity.
- Implementing widespread solutions

Source: Lee N. Davis, "Should We Consider Alternative Incentives for Basic Research? Patents vs. Prizes."

crops. Many of the most exciting gains in the West come from either making more gains through genetic enhancements or finding more productive ways to plant, maintain, and harvest crops.

For energy advances, there's still a great demand for efficiency gains in transportation, indoor climate control, and beyond—especially as concerns over climate change grow—as well as in curbs on emissions. Prizes tackling efficiency and climate

challenges are estimated to total \$100 million to \$200 million over the short term.⁹³ Nuclear waste disposal is another likely application, because there are growing questions over the safety and sustainability of aboveground containers.

Prizes are also coming to the social sciences, engaging with behavioral changes and educational needs.⁹⁴ It's here where we are likely to find smaller, more niche prizes to, say, find better ways to track student and teacher performance. With increasing prevalence, learning is also going online for both K–12 and college students. Prize investments for new educational technologies are estimated to be roughly \$100 million over the short term.⁹⁵

No matter the realm in which prizes are applied in the years to come, the most remarkable advance may well be how normal they become. That may pose challenges for creating publicity (though within very specific communities these prizes will be sufficiently attention grabbing), but it will do wonders for establishing prizes within an institutional framework for spurring innovation.

We will likely see a greater trend in the outsourcing of research and development as companies look to balance scarce resources with greater

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needs for innovation. Similarly, we will see more reasons for growth in public-private partnerships as agencies look to leverage greater investment and outsource activities such as public relations.

Prizes are ideal for decentralized and outsourced research, especially through their flexible incentives and adaptability to changing innovation needs. Lee Davis, a professor at the Copenhagen Business School, summarizes the potential for companies in particular:

A major theme in the technology management literature concerns the puzzle of how to utilize scarce R&D resources to maximize corporate R&D returns. This literature ignores the possibilities for augmenting existing R&D efforts with prize contests, in a sense “outsourcing” R&D. Through designing contests aimed at noncore R&D activities, a firm can draw on outside resources while reducing internal R&D overheads. Such a strategy might not yield significant R&D savings, but, depending on the nature of the contest design, give the firm’s R&D managers access to a wealth of informative material which otherwise might not be obtainable, even should the prize never be awarded.⁹⁶

While much of the prize literature tends to focus on public sector prizes, it’s in the private sector where we are likely to see a diverse range of structures and applications arise. A much wider variety of applications and actors exist in the private marketplace, all while the increasing scope of technological gain increases the reward from innovation.

WHAT ARE THE NEW APPROACHES FOR PRIZES?

“The best opportunities now lie where your competitors have yet to establish themselves, not where they’re already entrenched.”
—Paul Allen, Co-Founder, Microsoft Corporation

This section explores two alternative approaches for prizes that are coming to the fore today and discusses a new model that deserves further exploration.

Cash-strapped governments looking to achieve good in society are often bereft of options. They are left cutting social programs that either address clear market failures or have minimal civil society equivalent. Social impact bonds (SIBs) are a prize-like mechanism that can offer an innovative solution.⁹⁷



Initially developed in the United Kingdom as part of a prisoner rehabilitation program, SIBs work through intermediary organizations connecting “investors, governments and service providers to set expectations on outcomes for social services programs.”⁹⁸

Governments only pay when the desired social outcomes, such as greater school classroom attendance or HIV prevention, are achieved. The risk is assumed by outside private sector investors. The payout consists of the savings generated from the improved outcomes. In this way, the government is able to direct resources more efficiently toward improving communities, saving taxpayers money, and incentivizing civil society’s development. Whether the government should assume such a role or if it is tackling the appropriate social goals is beyond the scope of this paper.

One firm that has caught the most attention for its work with SIBs is Instiglio. Launched in 2012 by students at Harvard’s Kennedy School, it has quickly set about working with governments and NGOs abroad to create a marketplace for SIBs.⁹⁹ The Kennedy School’s own Social Impact Bond Technical Assistance Lab has partnered with the state of Michigan, among others, to implement well-run SIBs targeting “pressing social problems.”¹⁰⁰ On a much larger scale, President Obama’s 2012 budget called for “pay for success” bonds, with \$100 million being allocated to pilot programs in federal agencies or major cities.¹⁰¹

KEY STAKEHOLDERS FOR SOCIAL IMPACT BONDS

- *Nonprofits*—those that can scale up and implement the social service.
- *Governments*—entities supporting and coordinating the bond issuances.
- *Investors*—philanthropies and impact investors.
- *Intermediaries*—community-based organizations that manage the SIBs.
- *Evaluators*—includes advisers to the nonprofits and independent auditors.

Source: McKinsey, “From Potential to Action: Bringing Social Impact Bonds to the U.S.”

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While SIBs remain promising, they are still effectively unproven tools for incentivizing more innovative and efficient mechanisms for delivering social goods. For instance, while SIBs are paid out from future savings, it's unclear how accurately these sums can be determined in advance. In addition, little study has been given so far on how effective SIBs are relative to the social programs they may be supplanting.¹⁰² Finally, McKinsey notes where SIBs cannot be effectively applied "for all program areas, governments, or investors; they aren't the easiest way for direct service providers to fund expansion; and they're not a source of free money that can be used to subsidize government coffers."¹⁰³

These limitations help make the case of continuing to run SIBs through a battery of pilot programs that subject them to rigorous, sustained evaluation.

While SIBs are geared toward helping communities, a new prize structure is looking to tap into a community's pools of knowledge. Open-source prizes crowdsource solutions to a slew of challenges that were once on the receiving end of more individual, closed-source inquiry. They allow for rapidly accessing the world's cognitive surplus to match ideas with the needs of people. The problems tend to be smaller, the participants more diverse, and the platforms more decentralized than with traditional prizes. It is an approach that fundamentally acknowledges that where those on the periphery of a discipline may be best placed to solve problems.

Crowdsourced innovation remains a nascent field. Nevertheless, firms such as Innocentive are administering open-source inquiry because, well, there's a demand for it. Research-driven firms may find themselves with leftover capacity once particular projects are done. Rather than shuttering labs or laying off staff, these firms can apply those resources toward solving other's problems on a platform like that of Innocentive.¹⁰⁴ Or a single technical problem may bedevil a company enough to contract with a prize platform to find a solution, but not enough for it to hire new staff to address it. Nonprofits can use prizes to test ideas without having to raise too generous sums of money. Companies may also want to leverage the Internet for more long-term R&D projects. They would essentially be connecting to a "human cloud" of distributed inquiry, just as consumers use Google's network of global servers to store documents and type in search queries.¹⁰⁵



Innocentive's main offering is basically an exchange platform where one's challenges meet the crowd's solutions in return for cash awards. The problems are narrow and the solutions incremental, all of which lend to the application of specialist knowledge. There's a call on the firm's website to "model the functional molecular networks in a cancer cell" with a \$100,000 prize, all the way down to "mechanisms to enhance solver collaboration & teamwork" for \$3,000 (with 186 "solvers" working on it as of November 2013). On average, some 400 to 500 solvers take part in Innocentive's challenges.

Yet Innocentive's platform may simply be the beginning of crowdsourced innovation. If we are sourcing talent from across the world, why not tap into the crowd's funding? And if the crowd can provide solutions and capital, why not have the world set the challenges? Combining crowdsourced inquiry with crowdfunding—what I will call "crowdprizes"—offers a novel approach to pursuing innovation.

Crowdfunding platforms are expected to raise \$5.1 billion in 2013, an 81% rise over 2012.¹⁰⁶ Few prize contests, however, tap into these funds. And Innocentive alone reaches more than 13 million solvers through its network and its partnered networks.¹⁰⁷ This represents a fraction of those presently involved in crowd-related activities, which as a group shows traits that benefit the prize space, such as innovative behavior and a personal identification with the projects.¹⁰⁸

Except for BigLeap, a new crowdfunding site aimed at finding solutions to social problems, few routes exist for the average person to pledge his or her resources to prize contests. Moreover, people already participate in crowdfunding to connect to greater purposes, engage with rewards, and creatively display their work—all of these factors are baked into the nonmonetary incentives of prize contests.¹⁰⁹

Crowdprizes begin with a simple online platform—a marketplace where ideas, solutions, and funding are offered and rewarded. The platform's owner sets the terms of the marketplace and makes sure that it functions smoothly. Successful prize competitions earn the site's operator a cut of the winnings, which, in turn, helps promote crowdprizes and their winners.

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With a platform established, crowdprizes follow four steps:

- 1. Articulating the problem:** Individuals propose challenges that they think are worth engaging with. The crowd offers refinements to the challenge and the criteria for success for a set period of time before the prize is finalized.
- 2. Generating the prize purse:** The crowd “bets” on the probability of success. The funds offered by the crowd—in small shares if the advance is likely, large if unlikely—are held in escrow as a pledge that then forms the prize purse. Individuals commit to spending their pledge only in the case of success.
- 3. Competing for a solution:** As the prize purse accumulates, the incentive grows for the problem to be solved. While contestants can wait to see if the purse grows, more time means a greater potential that others will solve the idea and get a claim to part of or the entire prize.
- 4. Awarding the winner:** The contest ideally functions as a first-past-the-post-system, so that the first person or team to achieve the prize’s objectives takes the prize.

There are challenges facing any new approach—some more legitimate than others. Regulatory burdens are likely not one of them. There is no share of future profits being given that would run crowdprizes afoul of securities law. Rather, such a platform would be more akin to Kickstarter, which has proven its legality and value for some time now.

Crowdprizes’ greatest challenges center on igniting a crowd that’s large and diverse. There’s an unknown critical mass that’s necessary for the platform to sustainably churn through prize options, generate significant funds, and solve problems. And managing a crowd is notoriously difficult, especially today. New York University professor Clay Shirky believes, as the *MIT Technology Review* summarized, that “as commercial websites have risen to prominence, online life has moved away from open, self-governed crowdsourcing communities like the one that runs Wikipedia.”¹¹⁰ Neither are crowds good at posing questions both useful and strategic.



For these reasons, crowdprizes would need an active manager and moderator of their platform, one that recognizes their mission of fostering the aggregation of problem-solving knowledge, not collaboration. Moderating and intervening where clear market failures exist are crucial, though as with government, these deficiencies are not always clear or easy to address.

Fundamentally, crowdprizes should be seen for what they could be, rather what they are not. Crowdprizes work best for incremental, small-scale innovations, in contrast to solving complex problems requiring large funds and long timelines. They would not effectively inform a company's strategy nor ignite a new race to the moon. Instead, crowdprizes harness untapped brilliance and direct it toward small, surprising solutions.

Prizes have run the length of Western Civilization by igniting the spirit of inquiry toward productive ends. We should loosen the ties that bind an individual's capital and release it in a marketplace bent toward innovation. Crowdprizes have few limits beyond human nature.

HOW TO SPUR THE CREATION OF PRIZES?

***"Innovation is the central issue in economic prosperity."
—Michael Porter, Professor, Harvard Business School***

Among America's greatest priorities should be to foster a robust framework for innovation. Prizes complement this focus. Yet this country has heretofore placed prizes on some lower rung of priority—not ignored, but never elevated to a national priority. Blame path dependence, circumstances of history, or lack of prioritization, but the truth remains that we can and should value prizes more than we have in years past.

For one thing, the private sector suffers from a dearth of established prize brands. Beyond XPRIZE and Innocentive, there remain few well-known institutions that have effectively tied their identity to prizes. This is especially true for companies and nonprofits that could use prizes as one tool among many to further innovation. Perhaps one reason for the relative lack of an institutional private sector adoption of prizes is simple branding.

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Organizational brands are stories after all, and with prize programs, the conclusion remains sketchy from the outset. Another reason is simply baked into prizes—their application remains suitable for a relatively narrow range of private sector groups. Nevertheless, this should be even more of a reason for one large firm or nonprofit to pick up the mantle of prizes and run with it in order to introduce a greater competitive advantage.

Establishing prizes in the marketplace begins with three crucial measures. First, existing prize organizations, such as XPRIZE, should remain focused on their effective role as markets for innovative initiatives in cooperation with a diverse range of private sector actors. This will over time lend a significant degree of stability and credibility to prizes.

Second, new prize organizations should join the space to infuse a greater degree of competition—and not simply with one-off contests that are offshoots of other organizations. The great irony is that a space that fundamentally rests on competition should have so little between its sponsors.

Finally, firms that already place innovation and inquiry in their mission should allow prizes to work as a regular function for achieving their goals. They should simultaneously develop standardized approaches and measures of success. By taking these measures, prizes could become normal, established, and incremental—likely the best environment for them to succeed in the years to come.

Prizes should also become institutionalized in the public sector. The America COMPETES Act is the first step of many to making prizes a sustained presence in science and technology policy. As agencies look to implement more prizes, it behooves them to actively experiment in goals and approaches. The lessons learned will not only trickle toward the private sector, but they will sharpen the point of public inquiry. As Vijay Vaitheeswaran of *The Economist* says, “The very process of dreaming up challenges will sharpen up the bureaucracy’s approach to big problems.”¹¹¹ For government to get smarter on innovation represents an achievement in itself.



WHAT HAVE WE LEARNED?

“No idea is so outlandish that it should not be considered.”
—Winston Churchill

Prizes crown our basic human instincts to compete and place them on the path to prosperity. We want to win and be seen winning, reward in-hand and glory besides. The result is radical innovation that tames today’s greatest challenges.

Although prizes have a storied past, their future success is not guaranteed. We need to learn more about what makes them successful, for one thing, as well as encourage prizes to be just as innovative as their achievements. Leveraging the crowd’s know-how and wallet is one avenue worth exploring. The potential for prizes remains even greater in the hands of those with focused minds and concerted efforts.

History records prize after prize that wrestled with tough problems, hailed public and private sectors to its side, and found solutions in the unlikeliest of places. Never has there been a greater need for this innovation than today nor more capacity to invent if given the right tools.

With prizes, we can incentivize greatness.

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