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Using Innovation Prizes to Achieve the Millennium Development Goals

The idea behind prizes is rather simple: incentives matter. Offering the right incentives can lead to innovations that can change the world. The amount of money available for prizes has more than tripled over the last decade to an estimated $1-$2 billion, and the sector continues to grow rapidly.

Famous prizes, such as the Longitude Prize, the Orteig Prize, and Napoleon's food preservation prize (see text box on next page), provide powerful evidence of the enormous benefits that be achieved by people competing for prizes.

Although hugely popular a century ago, interest in prizes declined during the 1900s, replaced in large part with grant funding. Grants have been credited with establishing the research centers and institutes of excellence that have been behind much of the rapid rise in innovation over the last 100 years. However, after a century of grant-funding cycles that have become ever more deeply entrenched in the complex relationship between funders and recipients, the connection between grant funding and innovation leaves room for improvement

While grant funding regroups, the awarding of prizes is again proliferating, not only in terms of numbers but in ambition and aims. The rapid growth of information technology and social media are helping to fuel this proliferation. Most observers see 2004 as the start of this upward trend, as that is the year that Scaled Composites launched a reusable manned spacecraft twice within two weeks—a feat that won the company the $10 million Ansari X PRIZE. From 2004 to 2009, the number of prizes offering large incentives more than tripled across the globe.[1]

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Historic Prizes

The Longitude Prize was offered by the British government in 1714 for a simple and practical method to precisely determine a ship's longitude at sea. An unknown cabinetmaker, John Harrison, applied breakthroughs in materials science and mechanical engineering to calculate longitude, not by astronomy as expected but by accurately measuring the passage of time.

Nicolas Appert, the French inventor of airtight food preservation, won Napoleon Bonaparte's prize for food preservation in 1809. His system led to the practice of canning.

The Orteig Prize was first offered in 1919 and finally won in 1927 by Charles Lindbergh, who became the first aviator to fly nonstop between New York and Paris.

From governments to NGOs, corporations to private philanthropists, the global "prize industry" is on the rise. In September 2009, President Barack Obama released his Strategy for American Innovation, which called for federal agencies to increase their ability to promote and harness innovation by using policy tools such as prizes and challenges. At a "prize summit" held recently in London, there was a sense that society is on the brink of something new, something big, and something that has the power to change the world for the better.

In contrast to recognition prizes, which highlight past achievements, inducement prizes offer rewards for pre-specified scientific or technological achievements, such as the solution to a mathematical problem, a method of performing a particular function within given parameters, or the completion of a specific task. Importantly, these prizes tap into more than just financial motivation; they bring to bear strong intrinsic drivers, external resources, and increasingly networked groups of competitors to catalyze innovation around the question at hand.[2]

The question is, are prizes a more cost-effective way than other policy options to spur innovation? A growing body of work discusses the advantages and disadvantages of awarding prizes as compared to grants and patents, reaching the conclusion that some funds should be used to establish technology innovation prizes. However, there is little empirical evidence that prizes, grants, and patents actually spur innovation. There is even less evidence available to make quantitative comparisons of value for money or rates of return on investment. Moreover, the research that is available is inconclusive, and is further complicated by the issue of whether the purpose of awarding a prize is as a substitute for granting intellectual property rights, or a complement to them.

What has been clearly demonstrated is that prizes can produce materially different benefits from those obtained through grant-funding mechanisms. Grantors traditionally make awards based at least in part on prior experience and reputation, which tips the scales toward established innovators in a field. The meritocracy created by prizes has a greater tendency to attract novel participants and non-

traditional ideas. Furthermore, the media attention or "buzz" created by a prize can be a significant advantage in attracting follow-on funding, networking opportunities, and broader transformation of the market, not only for the winning team, but for all participants. For example, by July 2004, within a month of Scaled Composites' first space launch, the Ansari X PRIZE had registered three billion appearances of its name in newspapers, journals, and on websites. The Saltire Prize, although not due to be awarded until 2017, has already generated significant publicity. Scottish Development International, which is promoting the prize, says it has already attained value for money from the attention the prize has generated. The media attention surrounding the Saltire Prize has also played a role in helping government positively engage with coastal communities about off-shore power generation.

The issue, therefore, is not so much whether prizes provide more (or fewer) benefits than grant-funding mechanisms but that they provide different ways to stimulate innovation. Each way of stimulating innovation has a different function, and the focus should be on determining when and how to use grants, contracts, patents, or prizes to the best effect.

At a time when the effectiveness of aid targeted to help achieve the Millennium Development Goals is under increasing scrutiny, more innovative and cost-effective ways of delivering aid and promoting development are being considered. Interest is now growing in the use of results-based financing mechanisms, including cash on delivery, advance market commitments, results-based aid and financing, and prizes. The question is, are prizes an appropriate tool for helping to achieve the Millennium Development Goals?

THE LIMITATIONS OF PRIZES AND THE BROKEN INNOVATION CHAIN

When people talk about prizes, they tend to refer to some of the most famous, including Longitude, Orteig, and the Ansari X PRIZE. Each of these was effectively a market stimulator, because the technology developed in response to the competition was followed by broad-based industry development (Ansari, Orteig) or adoption (Longitude). These prize-winning technologies all had considerable commercial application that was unique to their time. Successful market stimulation prizes are credited with addressing all aspects of what Hansen and Birkinshaw call the innovation value chain, from ideation (the creation of ideas) through research and prototyping to product development, on to diffusion and uptake, and, finally, impact.[3] The market is critical to this success—that is, industry's desire to develop or adopt a given innovation.

However, not all inventions have a market waiting to develop or adopt them. There are a number of factors that affect the functioning of the innovation chain, including the strength of commercial markets; information and communication; the availability of credit; production, marketing, and distribution capacity; governance and the rule of law. Moreover, there are many contexts in which the innovation chain is weak or broken. All these factors can limit the ability of market stim-

Figure 1. The Innovation Chain

ulation prizes to lead to broad-based industry development and wider social benefits—including where the need is perhaps greatest.

Furthermore, not all prizes are created equal, and there is a wide range of prize constructs. The majority of current prizes seek out specific ideas and inventions rather than stimulating an entire market. Such prizes address only the early stages of the innovation chain.

Many authors talk about the benefits of prizes without making a clear distinction between the types of prizes or where they fall along the innovation chain. This is both confusing and problematic, as prizes are often unique, having different designs that achieve different aims and benefits; moreover, not all cited prize benefits are realized in equal measure across this diversity of tools.

It is important to look at the variety of prizes offered along the innovation chain, as this helps us understand the relationship that prizes may or may not have with uptake and impact, which are at the far right of the innovation chain. For the sake of simplicity, we group prizes into four basic types that fit along the innovation chain, from ideas to invention to commercialization to impact and uptake (see "Prizes along the Innovation Chain" below).

Prizes can increase the number of minds tackling a problem and bring out-of-discipline perspectives to bear. Backers of incentive prizes pay only for success, without having to predict in advance which team or approach is most likely to succeed. Additional benefits, which depend on the type of prize, include:

Stimulating private-sector investment that is many times greater than the cash value of the prize (market stimulation and idea awards)

Capturing the public imagination and changing the public's perception of what is possible (market stimulation and social prizes)

Getting funds quickly to start-up businesses and good ideas, with no strings attached (idea awards)

Incentivizing mass behavioral change (market stimulation and social prizes)

Post-prize leverage of commercial activity (market stimulation)

Among the prizes that aim to produce a social benefit, the Grainger Prize provides an interesting case study. Established soon after the award of the Ansari X PRIZE, the Grainger Prize for water purification systems had a number of intend-

ed benefits beyond attaining the technical goal: to engage with U.S. engineers and students in solving a global humanitarian challenge, to inspire the next generation of engineers with grand challenges, and to educate and engage the broader public in the humanitarian problem and in the role of engineers and engineering in solving it. Based on these aims, and the technical success of the winning filter, the prize can be considered a triumph. But there is another story behind the technological advances—one about the challenges of moving technology along the innovation chain from product development to impact.

The Grainger Prize was carefully designed with consideration of the commercialization of the winning technology. The aim was to keep the unit price and maintenance costs of any new product low enough to enable its widespread use. The prize criteria included low life-cycle cost, indications of how commercially viable the technology was, and manufacturability in the target countries of Bangladesh and India. Dr. Abul Hussam produced the winning Sono Filter, a household-scale water treatment system that removes arsenic from contaminated ground water found in many developing countries. For this invention, he received the $1 million prize, with no strings attached. Of his own volition, Dr. Hussam used the prize money to develop manufacturing and distribution infrastructure in Bangladesh, positively impacting the lives of over one million people.

Nevertheless, adoption of Hussam's technology has achieved only 1-2 percent of what is needed by the target markets. The water filter, while having significant human benefits, has yet to achieve diffusion or impact at scale. Those who need the filter simply do not have the means to buy it. On further reflection, we can see that the design of the prize primarily incentivized solutions at the ideas end of the innovation chain. Without structures and incentives in place to help catalyze the flow of ideas into the hands of users, wider market stimulation was not achieved.

Another example is found in a series of prizes funded by the Rockefeller Foundation and hosted on InnoCentive, an online commercial prize portal. The Rockefeller prizes sought solutions to specific human problems encountered by some the world's poorest communities. A highly successful rate of problem resolution was achieved, and the prize process proved to be highly effective in achieving "point solutions." However, the post-prize story tells the same tale of broken commercial markets and value chains. None of the winning solutions has achieved commercialization or been distributed at scale. The most successful winning solution, the Solar Task Light, has proven social and economic benefits—it provides light for education, health, and security settings, and savings against the cost of kerosene required to operate traditional lamps cover the price of the solar light in just three months. Yet, the beneficiary communities don't have the credit, information, or functioning markets needed to purchase the lights. Therefore, uptake is limited to ongoing philanthropic and donor schemes.

This is not a wholly unexpected outcome. The donor community that works with poor communities has been struggling for many years to achieve the uptake of research and social goods, and to build markets and strengthen value chains.

Prizes along the Innovation Chain

Idea Awards are prizes typically awarded for best new ideas, either for start-up businesses or solving social problems. Examples include ideas on how to solve social problems posted to the Ashoka Changemakers social network, and commercial challenges such as the Shell Springboard and Global Security Challenges. These awards not only encourage the further development of concepts early in the innovation value chain, they often help to develop the business and communications skills of those participating and promote inward investment.

> *The Global Security Challenges* "seeks to discover the creative capabilities of innovators in young companies, including university spin-offs that address public security needs." The prize has been running for five years, and principally looks for technology that has gone beyond the idea stage but is not necessarily fully developed; the scope is relatively broad.

Point Solution Challenges seek to broaden the reach of a specific research or development challenge to diverse external solvers. Examples include the numerous technical challenges that are run through open-innovation platforms, such as InnoCentive, TopCoder, Kaggle, and NineSigma.

Market Stimulation Prizes, also known as Grand Innovation Prizes, are large purse prizes intended to change the way we live by stimulating the development of innovation ecosystems and catalyzing new market growth. Examples include the X PRIZE, the Grainger Prize, and the ongoing Saltire Prize.

> *The Grainger Prize* was a $1 million incentive launched in 2005 for "the development of a community or household-scale water treatment system to remove arsenic from the contaminated groundwater found in many developing countries."
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> *The Saltire Prize* (2008-2017) offers a £10 million prize (approximately $15.5 million) to be awarded to "the team that can demonstrate in Scottish waters, a commercially viable wave or tidal stream energy technology that achieves the greatest volume of electrical output over the set minimum hurdle of 100 GWh over a continuous two year period using only the power of the sea."

Christine Eibs Singer, in a 2011 article in *Innovations*, further explains broken social capital markets and the need to connect the dots along the value chain.[4]

So what does this mean for prizes? Although successful proofs of concept exist, it cannot be assumed that merely running a prize at any given point along the innovation chain will necessarily have an impact. This is especially true for social goods, where industry's role is limited or absent and commercial returns are hard to capture, regardless of the potential social gain. The prize promoter, whether commercial or philanthropic, will require mechanisms for moving solutions toward full commercialization.

Social Prizes are also often known as participation prizes. These competitions work around the diffusion and uptake end of the innovation chain and are designed to engage with and benefit communities. In many cases, benefits accrue simply from participants taking part. In others, social impact can help to encourage the diffusion of knowledge, behavior, or technologies through a social network. Examples include public-sector community engagement prizes, such as the Big Green Challenge run in the UK and the Nirmal Gram Pursakar in India.

The Nirmal Gram Pursakar, which started in 2005 and is ongoing, provides an incentive scheme to help stimulate the government of India's Total Sanitation Campaign. The program incentivizes Gram Panchayats, Blocks, and Districts (local councils) to achieve 100 percent sanitation coverage, and offers a highly prestigious award and a financial prize of between INR 50,000 and INR 500,000 (approximately $900-$9,000), depending on population

THE FUTURE: PRIZE INNOVATIONS NEEDED TO ACHIEVE THE MILLENNIUM DEVELOPMENT GOALS?

Entrepreneurs we have spoken with from Kenya and Ghana have explicitly indicated that the prize process has the potential to help identify, and thus invest in, overlooked innovators from locations where innovation is currently weakest. More than grants or contracts, which tend to favor incumbents because performance must be predicted ex ante, prizes are the ultimate meritocracy. By leaving the field of potential participants open and paying rewards on the basis of performance, they identify excellence regardless of previous experience or pedigree.

In the developing world, where private investment in research and development was as low as 2 percent in 2000, receiving just 5 percent of global research and development spending, prizes that are designed to foster, source, and catalyze both indigenous and globally distributed innovators can help to bring down both technical and market risks, attract external capital, and draw attention to problems long hidden from broader public view.

More weight must be given to the commercialization and uptake end of the innovation chain if we are to successfully address the human development challenges facing millions of the world's poor. Prizes are a tool to address market failures, and as such have the opportunity to be applied to failures at the uptake and impact end of the innovation chain, as well as around ideas and invention. However, prizes that address commercialization and uptake are rare; a few market stimulation prizes for commercially viable goods and social prizes provide an indication of what can be achieved. It is here that the future of prizes is the most exciting and where the real innovation is now needed.

One way forward is to blend various instruments. Portfolios of incentives can be designed with the full innovation chain in mind. Where innovation chains are

weak, innovators may have a greater need for up-front financing, For example, John Harrison, who solved the Longitude Prize, received numerous grants from the prize promoters over many years before he finally solved the problem. Similarly, emerging or fledgling markets may need additional support in order to develop, as may social goods where economic markets fail to flourish. Support may be needed from enabling policy environments to promote inward investment, as well as from commitments to commercially support weak markets, such as through advance market commitments.

William Masters presents alternative prize modalities to help address issues of uptake where capturing commercial value from the innovation is difficult, as in agricultural research and development, due to the self-pollinating nature of crops and a highly commoditized marketplace.[5] To maximize the social benefit in this scenario, Masters promotes "proportional prizes" that are paid out relative to increases in farm yield. These types of prizes have yet to be trialed at scale, and continued innovation and testing of new prize approaches is needed. There are early indications—for example, from the Nirmal Gram Pursakar in India and the Big Green Challenge in the UK—that social prizes can be used to stimulate mass behavioral change with some of the most marginalized members of society. This archetype appears to have particular utility when tackling poverty, as the huge numbers of people in need necessitate large networks for engagement and distribution. Innovation in the context of social prizes is typically not about new technology but about enhancing the transfer of existing technology, behaviors, or processes into the mainstream.

While prizes continue to proliferate around ideas and invention, they also should do so around commercialization, scale, and uptake. As Christine Eibs Singer says, the expansion of what is working is innovation. Innovation that helps empower local market-based entrepreneurs with appropriate mechanisms for finance can also help to move from invention to impact. This is where innovation has the greatest opportunity to change the lives of millions, and where prizes, bolstered to support the full innovation chain, hold the greatest promise.

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