



Literature review of innovation prizes and their use for social/ development objectives

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¹ Consortium comprises Harewelle International Limited, NR International, Practical Action Consulting, Cranfield University and AEA Energy and Environment

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1. Description of enquiry

Background

DFID is exploring the use of innovation prizes (sometimes called X-Prizes) to stimulate investment in environmental/climate technologies for development. The Secretary of State announced our intention to partner with the X Prize Foundation in his recent speech on climate change and we will be scoping this work over the next few months. As part of the internal process of approving a Concept Note we are keen to have a quick literature review done on innovation prizes, focusing in particular on where they have been used to advance social or development goals.

Scope of work

This work should cover a broad range of innovation prizes, both internationally-focused and national/regional. It should look to source as wide a range as possible on the topic, including academic articles, consultancy reports, information from the X Prize Foundation and other proponents, and media articles. A number of background papers/reports/articles are attached - some describing the proposed X Prize 'platform' that DFID is exploring.

Outputs

The consultants should prepare a short report summarising the main findings of the literature, along with a presentation to be delivered to DFID in a 1.5-hour meeting.

2. Literature review of innovation prizes and their use for social/development objectives

2.1 What is an Inducement Prize?

Technology inducement prizes have been used for centuries to encourage innovation; one of the most famous early inducements prizes was the “Longitude Prize” of 1714 awarded to a watchmaker who found a way for ships to identify their longitude not by the stars as expected, but by measuring time. This highly successful prize was followed by many others, including Napoleon Bonaparte’s 1800 food preservation prize which resulted in the advent of canning as we know it, and the Orteig Prize in the 1920s which Charles Lindberg won by flying from New York to Paris in 1927.

The idea behind inducement prizes is really simple: incentives matter. The larger the potential reward, the greater the incentive. Inducement prizes do this by offering rewards for pre-specified scientific or technological achievements, such as the solution to a mathematical problem, a device or method to perform a particular function within given parameters, or the completion of a particular task.

Throughout the 18th and 19th centuries, European governments used prizes to reward inventors and stimulate desired innovations. Over time, however, prizes fell out of favour, and were eclipsed by other innovation policies, including *ex ante* grants and intellectual property. Most technology inducement prizes today are funded privately; government prizes still exist, but they are relatively few and far between.

The report by McKinsey (2009) recognises that the simple division between “recognition” and “inducement” prizes is over simplified and identifies 6 types of prize architecture²:

- **Exemplar prizes** are prizes that recognize past general achievement in a field. Other types of prize may be more effective to trigger future innovation.
- **Point solution prizes** aim to reward solutions for a particular well-defined problem. This type of prizes is well suited for online idea marketplaces.
- **Exposition prizes** help identify and promote a broad range of promising ideas and practices. An example is to encourage employees of a firm to propose creative ideas and reward the best ones.
- **Network prizes** build and strengthen networks and communities by organizing problem-solving communities that can deliver more impact than individual efforts.
- **Participation prizes** create value during and after the competition through their role in encouraging participants to change their behaviour or develop new skills that may have beneficial effects during and beyond the competition.
- **Market stimulation prizes** try to establish the viability of a market to address a potential market failure.

This literature review focuses on the range of Inducement Prizes which provide rewards, both financial and reputational, for the achievement of predetermined achievements, most often achievements that would not have been accomplished otherwise.

Government-supported prizes have a niche role in supporting and rewarding innovations that “are publicly valued but not privately marketable.”³

² McKinsey2009 “and the winner is...”

2.2 The pros and cons of prizes compared to other aid modalities

Using prizes and challenges has a number of benefits, they: ⁴

- Can establish an important goal without having to choose the approach or the team that is most likely to succeed
- Allow sponsors to pay only for results
- Can highlight excellence in a particular domain of human endeavour to motivate, inspire, and guide others
- Can increase the number and diversity of the individuals, organizations, and teams that are addressing a particular problem or challenge of national or international significance
- Can improve the skills of the participants in the competition
- Can stimulate private sector investment that is many times greater than the cash value of the prize
- Can attract more interest and attention to a defined programme, activity, or issue of concern
- Can capture the public imagination and change the public's perception of what is possible.

The diversity of participants is of particular interest. A Harvard Business School professor, Karim Lakhani, made a study of 166 recent prize competitions and concluded that “Problems that have a high degree of technical uncertainty benefit the most from diversity [of entrants]. **Winners are often technically and socially marginal**, as evidenced by the multitude of awards over the centuries beginning with the watchmaker who won the Longitude award”.⁵ Technological innovations, by their nature, often come from unforeseen sources and perspectives⁶. When it comes to innovation, expertise is not always an advantage. Indeed, in some cases those with less expertise may be in better position to identify solutions to difficult problems⁷.

That prizes can stimulate private sector investment is evidenced by the Ansari X-Prize which successfully launched the first commercial space craft, the prize was \$10 million, yet is said to have stimulated over \$100 million in private investment by teams seeking to win the prize. The GoldCorp Challenge started in 2000 with a goal to identify “where the next 6 million ounces (of gold)” would be found, unleashed not just geologists and mineral experts, but computer programmers, applied mathematics experts, systems engineers and others, and

³ William A. Masters, 2006 “*Prizes For Innovation In African Agriculture: A Framework Document*, version 2.0”

⁴ The Case Foundation Conference Report 2010 “Promoting Innovation: Prizes, Challenges and Open Grantmaking”

⁵ The Case Foundation Conference Report 2010 “Promoting Innovation: Prizes, Challenges and Open Grantmaking”

⁶ William A. Masters, 2006 “*Prizes For Innovation In African Agriculture: A Framework Document*, version 2.0”

⁷ Karim R. Lakhani, et al., 2006 “*The Value of Openness in Scientific Problem Solving*” Harvard Business School Working Paper

demonstrated a dramatic success: “Our costs went down 80%, and our production went up 900%”⁸.

A number of papers discuss in some detail the advantages and disadvantages of prizes versus grants and patents, and come to the conclusion that funds should be diverted to the creation of technology innovation prizes. A number of reasons are given by Adler in his paper “Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization”. First, he states, decisions about projects or efforts to fund are centralized, limiting the range of promising ventures that may receive funding and increasing the risk that research funding will not result in useful technological innovations. Second, with *ex ante* grants, the government pays for research and development (R&D) whether or not the R&D produces anything of value in return. Third, traditional grant funding is more subject to political pressure and may create negative incentives among researchers. Allocating grant money effectively requires the grant-making entity to pick “winners” and “losers,” something government has rarely done well.⁹

Adler points out that in the US federal investment R&D expenditures tend to be less productive than private sector investments. One reason for this is that federal agencies tend to reinforce “risk-averse, parochial views” about what sorts of technologies are worth funding. As a result, noted one Department of Energy official, “Government R&D dollars will tend to flow to marginal ideas.” Government R&D funding often goes to support relatively mature technologies rather than those projects more likely to spur needed innovation. Federal R&D money rarely produces commercially-viable technologies or dramatic technological innovation. Prizes, on the other hand, may “attract teams with fresh ideas who would never do business with the federal government because of procurement regulations”. While innovation requires risk taking, politically controlled agencies have a difficult time accepting failure and terminating programmes, substantial political pressure to continue R&D programmes remains long after it is clear they have failed.

Prizes do not create the same incentives among reward seekers as government research grants may among grant seekers. Specifically, those seeking government grants may have an incentive to exaggerate the potential of their project and, once funding is obtained, may have an incentive to divert resources and slow the rate of achievement so as to lay the groundwork for obtaining future grants. Prize money, on the other hand, is only paid out if someone fulfils the preset conditions and is available to all comers, irrespective of their political influence or institutional connections.

Conventional explanations for why prizes dropped out of favour point to *ex ante* (grant) funding of research making it easier to build and maintain larger research facilities and maintain equipment; grant funding also reinforced the gradual professionalization of scientific research. More recent research has challenged this stating that researchers and scientific societies alike preferred grants because direct grants “make life easier for the government bureaucrats” who oversee support for scientific research, as well as for “the scientists who received them.”¹⁰

⁸ The Case Foundation Conference Report 2010 “Promoting Innovation: Prizes, Challenges and Open Grantmaking”

⁹ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

¹⁰ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

In relation to patents or Intellectual Property Rights (IPR), prizes provide a similar reward structure without the offsetting welfare loss from monopoly prices.¹¹ While much of the relevant academic literature discusses prizes as a potential substitute for patent protection, the two need not be mutually exclusive.

Counter arguments against prizes include the potentially significant drawback that researchers must obtain funding for their research in order to compete, which is of particular concern when wanting to include developing world nationals and non-governmental organisations. This concern may justify retaining traditional grant-based funding for basic research and for particular types of research. It does not, however, undermine the broader case for prizes¹².

In addition prizes, more so than government grants, may lead to duplication of effort; however supporters of prizes note that duplication of effort is pervasive in the private marketplace, as multiple firms compete to develop the same products. One value of the patent system, that prize systems do not provide, is the added incentive for commercialization of an innovation. In order to avoid this potential problem, prize specifications can include criteria to ensure potential marketability.

Another negative factor is that by specifying a particular threshold for achievement, prize contests give no incentive for incremental improvements other than crossing that threshold, and prize results give no information about performance that could have been achieved using more or less ambitious goals.¹³

All in all the argument for the introduction or growth of the prize industry is strong, however nearly all papers highlight the importance of getting the prizes right. Significant investment is required during the prize design stage to overcome a number of issues, including:

- High value prizes can sometimes distract individuals from more important activities
- Increasing use of prizes can lead to overlapping objectives and “too much noise” for the market to be effective
- Prizes must strike the right risk/reward balance to encourage competition
- Understanding stakeholders and their motivations to compete
- Appropriate criteria for winning – objective success criteria are essential.

2.3 Who is using prizes?

“The outlook for prizes is strong” (Bays 2010). “Recent growth of social media technologies has led to a renaissance of prizes and challenges amongst the private and philanthropic sectors” (Jean Case, Case Foundation)¹⁴.

An in-depth report on prizes by McKinsey in 2009 identified more than 60 new prizes of more than \$100,000 since 2000. The total funds available from large prizes have more than

¹¹ Brian D. Wright, 1983 *The Economics of Innovation incentives: Patents, Prizes, and Research Contracts*, 73 AMER.ECON. REV. 691;

¹² Jonathan H. Adler (2010) *Eyes On a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*

¹³ WA Masters, B Delbeq 2008 “Accelerating Innovation with Prize Rewards, History and Typology of Technology Prizes and a New Contest design for Innovation in African Agriculture”

¹⁴ The Case Foundation Conference Report 2010 “Promoting Innovation: Prizes, Challenges and Open Grantmaking”

tripled over the last decade to surpass \$375 Million. Since 1991 78% of new prize money has been dedicated to inducement style prizes.

Prizes are gaining momentum not just in the private and philanthropic sectors but most recently by donors including the World Bank and Government in the US. In September 2009 President Obama released his Strategy for American Innovation, calling for agencies to increase their ability to promote and harness innovation by using policy tools such as prizes and challenges, this was followed in April 2010 by the White House hosting a summit on “Promoting Innovation: Prizes, Challenges and Open Grant Making”.

There are a considerable number of publications regarding the use of prizes in 2010 alone, all promoting the benefits of prizes as having a part to play in driving innovation (see bibliography). This is backed up by increasing media interest regarding innovation prizes - in 2010, articles relating to prizes can be found in Reuters¹⁵, the Washington Post¹⁶, The Economist¹⁷ and The New Scientist¹⁸.

A large number of private firms have used prizes to solve business problems as evidenced in the long list of prizes provided in the McKinsey report, including international corporations such as Sony, Google, Cosco, and Heinz resulting in a wide range of technological fixes from identifying gold deposits to flying to space. Motivations can be entirely company oriented, for example Netflix offered a \$1 million prize for improvements to the company’s Cinematch algorithm: the company was so pleased with the results that it has announced a second prize.¹⁹

The X-Prize demonstrated that spaceflight can be far less costly than the typical NASA mission would suggest, and generated a far greater return per dollar spent than the federal space programme. Due to the success of this prize, the X-Prize Foundation has launched the Automotive X Prize to encourage the development of vastly more fuel efficient vehicles and plans to roll out more prizes globally.

2.4 Are prizes effective?

“A long standing argument in the literature on incentives for innovation suggests that prize awards can be a powerful mechanism for accelerating technological development”²⁰.

An early report by the National Research Council lamented that owing to the limited experience with innovation prizes relatively little is known about how they work in practice or how effective they may be. This led to a research project looking at the data sets of prizes awarded for inventiveness by the Royal Agricultural Society of England (RASE) between 1839 and 1939. This study²¹ looked at the number of contestants that prizes attracted, what impact the prizes had on levels of patenting and the overall effect on technological development. The results show that prizes were:

¹⁵ James Pethokoukis article entitled “Why Washington should embrace innovation prizes” Reuters which promoted prizes as a way for cash strapped Washington to fund breakthroughs to drive economic growth

¹⁶ <http://www.washingtonpost.com/wp-dyn/content/article/2010/04/29/AR2010042902880.html>

¹⁷ <http://www.economist.com/node/16740639>

¹⁸ <http://www.newscientist.com/article/mg20827855.800-why-i-set-up-an-inventors-championship.html>

¹⁹ Jonathan H. Adler (2010) “Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization”

²⁰ Brunt, Lerner, Nichols; Norwegian Business School Harvard Business School 2008 “Inducement Prizes and Innovation”.

²¹ Brunt, Lerner, Nichols; Norwegian Business School Harvard Business School 2008 “Inducement Prizes and Innovation”.

- keenly contested
- that prize winners were significantly more likely to utilise the patent system after the show than non-prize winners, and that
- the largest spike in patenting occurred in the year of the show – approximately one year after the prizes were announced.

The overall conclusion of the study is that “*while administrative costs associated with a prize system may be high – and certainly the RASE did not consider prizes to be a profitable undertaking – our evidence suggest they are counterbalanced by substantial output effects. Based on almost a century of award data, we conclude that innovation inducements prizes do work*”.²²

An alternative method to quantify the success of a prize is to analyze the economic growth of an industry at three points in time: before the prize was offered, during the prize competition, and after the prize competition was won. The rapid growth exhibited by the aviation industry following Charles Lindbergh’s flight across the Atlantic Ocean is staggering. The profound effect that the Orteig Prize and X Prize have had on their respective industries is also easily noted. It can be concluded that prizes offer distinct advantages that are not present in traditional research funding mechanisms. At the same time, prizes alone may not be sufficient to replace completely these methods.²³

There are a number of positive spill-over effects to prizes: The 19th century Breant Prize offered for a cure for cholera that was never claimed, but “the existence of the prize encouraged work on other infectious diseases,” and led to some prize worthy discoveries.²⁴ A paper “How effective are Prizes as Incentives to Innovation”²⁵ identifies a need to investigate more closely the spill-over and reputation effects from prize activities which are indicated to be significant. Prizes are identified as having important positive externalities for their sponsors too. In a period where advertising, branding and trademark budgets are running into billions of dollars, it is clear that a well-advertised prize rewarding an innovator for a product or service widely acknowledged as being in the public interest can promote sponsor advertising. The paper concludes that “*Given that the incentives to enter a prize competition are much like those of entering a 19th century exhibition, it is quite likely that our prize systems have had a similar effect – they will change the direction of innovation. If this is true, and if welfare arguments for a specific prize contest are sufficiently strong, this “change of direction” argument is important justification for prize contest design.*”

The McKinsey report goes further to identify seven different ways in which prizes can act as agents for change, by:

- Identifying excellence
- Influencing public perception, including catalyzing market demand
- Focussing communities on specific problems – e.g Ashokas Changemakers
- Mobilizing new talent

²² Brunt, Lerner, Nichols; Norwegian Business School Harvard Business School 2008 “Inducement Prizes and Innovation”.

²³ A Schroeder 2006 The Application and Administration of Inducement Prizes in Technology

²⁴ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

²⁵ L Davis and JD Elsinor 2004 “How effective are prizes as incentives to Innovation?” Evidence from Three 20th Century Contests” Paper for the DRUID Summer Conference on Industrial Dynamics, Innovation and Development.

- Strengthening problem solving communities
- Educating individuals
- Mobilizing capital.

Beyond fairly simple views on measuring the success of prizes, few regularly measure impact²⁶ and many questions remain about their effectiveness at creating societal benefit. EV World, a publication dedicated to sustainable transportation²⁷ criticised the Automotive X prize for failing to engage any of the existing automotive industry which could have significant implications for long term uptake of the technology.

2.5 Prizes for social and development goals

In their publication “Innovation, Sustainability, Development: A New Manifesto”, the STEPS centre puts forward the belief that a radical shift in how we think about and perform innovation is required if we are to achieve the Millennium Development Goals. Innovation means new ways of doing things; this includes not only science and technology, but – crucially – the related array of new ideas, institutions, practices, behaviours and social relations that shape scientific and technological patterns, purposes, applications and outcomes. They promote “a new politics of innovation”²⁸.

At the heart of this shift in the global innovation agenda is a greater respect for cultural variety, regional diversity and democratic accountability; promoting innovation that really works for currently marginalised people and jeopardised environments. They argue that targeted scientific and technological solutions - ‘silver bullets’ - can be rolled out and applied at scale. In particular, new philanthropic and public private investments have massively expanded the scope for addressing challenges that were once neglected because addressing them was seen as unprofitable. Growth in demand among relatively low income groups near the ‘bottom of the pyramid’ worldwide presents a massive – and still under-recognised – opportunity for innovation processes linked to small businesses to foster more equally-distributed economic growth.

The STEPS²⁹ manifesto recommends specific funding allocations to support experimentation in niches, and networking and learning across these, involving the private sector, community groups and individual entrepreneurs. In order to help democratise the process of innovation they recommend that procedures are established to involve end users of science and technology – including poorer and marginalised people – in the allocation of funding. *They recommend that incentives for the private sector to invest in forms of innovation geared to poverty alleviation, environmental sustainability and social justice – such as advance purchase agreements, **technology prizes** or tax breaks – are enhanced.*

A World Bank Report in 2007 “Unleashing India’s Innovation” proposes “dissemination of success stories of techno-entrepreneurs and other innovators through publicity, prizes, and public recognition for cases that exemplify how knowledge has been turned into wealth or used to improve welfare.”³⁰ It also recognises prizes as a useful mechanism to encourage inclusive innovation.

²⁶ McKinsey 2009 “and the winner is..”

²⁷ <http://www.evworld.com/currents.cfm?jid=146>

²⁸ STEPS 2010 “Innovation, Sustainability, Development: A New Manifesto”

²⁹ STEPS 2010 “Innovation, Sustainability, Development: A New Manifesto”

³⁰ World Bank 2007 “Unleashing India’s Innovation

Papers on prizes for social and development goals fall into 4 main categories, i) prizes for agricultural innovation particularly in relation to Africa, ii) prizes for technical innovation related to Energy and Climate Change Mitigation iii) a stand-alone paper which discusses prizes as a mechanism for institutional and macro-economic change and iv) prizes for medical research (not covered in this review).

Agricultural Innovation in Africa

Agricultural technologies that create value are very diverse and often quite hard to predict. A funder may believe that disease resistance, drought tolerance, fertilizer response, yield variability, product quality, storage losses or other characteristics are particularly important, but the feasibility and performance of a breakthrough in any area remains unknown until it is actually observed on farms. Agricultural productivity relies on interactions among dozens of useful species, against a myriad of biological, physical and social constraints. Even blockbuster breakthroughs, such as semi-dwarf wheat, hybrid maize, or transgenic sources of insect resistance, require endless localized adaptation.³¹

The Centre for Global Development prepared a paper in 2010 which looks at market failures in innovation and in developing countries. It makes the case that market failures exist in typical IPR approaches in certain situations, in particular when R&D costs are high but market demand for new technologies is uncertain. This is a situation that often arises in developing countries that are small and poor, meaning that innovation adapted to their special needs may not generate sufficient profit to attract private-sector investment. Agriculture also presents greater challenges due to the self pollinating nature of crops making it difficult for inventors to enforce patents and recoup their costs. This leads to governments relying on direct funding of R&D. Private investment into R&D in developing countries is recorded as being as low as 2% in 2000, with just 5% of global R&D being in developing countries.³²

In Africa despite some progress in recent years the adoption of improved crop varieties remains well below the levels in most other developing regions. Reasons for the rejection of new technologies³³ ultimately relate to new technologies not meeting the market test of benefits large enough to offset additional costs. Traditional R&D has focussed on “push” mechanisms for the supply of R&D; in the paper by Elliot, the case is made for enhancing “pull” mechanisms that pull in

Wheat, rice and maize, which are also widely grown and consumed in rich countries account for most of the staple grains consumed in South and East Asia. In Sub-Saharan Africa, those grains account for just under a 3rd of calories consumed, while sorghum and millet, along with starchy roots such as cassava make up another third. This means that private seed companies have little incentive to invest significant sums in developing improved crop varieties because the expected market would be too small to recoup the costs.

Source: Elliot 2010 Pulling Agricultural Innovation into the Market

Reasons for the rejection of new technologies:

- Did not yield benefits under unfavourable weather conditions, especially drought
- Unavailability of an introduced technology
- Did not match farmers' priorities or meet their preferences (e.g., for taste)
- Inputs associated with technology too expensive
- Increased labour requirements not commensurate with benefit
- Lack of available markets where the farmers' products achieve attractive prices”

Norwegian University of Life Sciences, 2009, p. 16.

³¹ WA Masters, B Delbecq 2008 “Accelerating Innovation with Prize Rewards, History and Typology of Technology Prizes and a New Contest design for Innovation in African Agriculture

³² Elliot 2010 Pulling Agricultural Innovation into the Market, Centre for Global Development

³³ Elliot 2010 Pulling Agricultural Innovation into the Market, Centre for Global Development, referencing a study done under Norwegian Agency for Development Cooperation funding Tanzania

the private sector by guaranteeing payments for technologies which meet specified criteria when they are delivered. Five potential mechanisms that involve donor funding to stimulate innovation are detailed as:

- Advance market commitments
- Patent buyouts
- Prizes
- Proportional prizes
- Best entry tournaments.

Of these patent buyouts, prizes and best entry tournaments all share the weakness that they are likely to be “winner-takes-all” which could undermine broad access to and adoption of the technology if the winner has a monopoly over production. For this reason the Centre for Global Development advocates Advance Market Commitments (AMCs) and proportional prizes which reward incremental innovation, free donors from having to pick winners in advance and pay only for results.

The two mechanisms may be used in conjunction with one another, for example, a proportional prize might be used to identify innovations that produce the largest productivity gains in a particular area, and then, if demand is still too uncertain for the private sector to invest, an advance market commitment could be designed to provide incentives to scale up prosecution and more broadly disseminate the results.

Because of the under-developed state of rural markets in many poor countries, donors will have to pay very careful attention to supply chain issues and distribution channels. Also due to the smaller private sector, at least in Africa, donors may need to encompass public research institutions. “African agriculture is a good candidate for implementation of proportional prizes.”

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A proportional prize

In the scheme proposed by William Masters donors will set an overall prize amount which would then be divided among applications who would compile comparable evidence using indications and showing the impact of their innovation. (For further information see Masters 2008)

Advance Market Commitment

Typically an up-front guarantee to buy a certain number of a technology at a price high enough to cover R&D and start-up production costs. The supplier would have to agree to continue supplying the product at a price that just covered production and a “reasonable mark up”.

Energy and Climate Change Mitigation Prizes

The potential for prizes in relation to climate change mitigation is discussed in Newell and Wilson’s paper³⁵. A number of market imperfections impede the development of technology for climate change mitigation through grant or IPR approaches. First, the benefits of developing a new technology or product do not accrue only to its discoverer. Rather, they spill over, benefiting society and other firms; this is the inverse of the pollution externality problem, where the benefits are concentrated in the polluter and the environmental damages are diffuse. Second, the impact of a technological advance tends to be positively associated with the extent of its adoption, which means that the innovating firm’s returns are contingent on factors beyond its control, including government policies. The paper discusses the

³⁴ WA Masters, B Delbeq 2008 “Accelerating Innovation with Prize Rewards, History and Typology of Technology Prizes and a New Contest design for Innovation in African Agriculture

³⁵ R Newell and N Wilson 2005 “Technology Prizes for Climate Change Mitigation” Resources for the Future Discussion Paper 05-33

economics, design and implementation of prizes and concludes that “*there is considerable evidence that technology prizes have a role to play in the portfolio of inducement mechanisms available to spur climate change–related technological advances. An examination of the economics of prizes revealed that they have conceptual advantages that support increasing their role in certain cases. There are almost 300 years of evidence on their successful implementation. These factors underlie the already growing resurgence of interest in using inducement prizes to increase research into public goods. In addition to these broad reasons for considering prizes, there also appear to be compelling reasons specifically related to climate change.*”

This argument is supported by Adler³⁶ who also expresses the opinion that prizes can be particularly important to spur investment in technological innovations that would be of primary benefit to low income consumers and people in developing nations. Few profit-seeking firms are likely to make significant investments in serving such markets. As he states, this problem has been observed in the agricultural context, where neither governments nor private firms have invested significantly in developing technologies or techniques of particular use to widely-dispersed, low-income consumers in developing nations. Similarly, not many firms see massive profit opportunities in developing low-carbon energy options for developing countries, yet the welfare benefits from improved energy efficiency and a less carbon-intensive development path in much of the world could be quite substantial.

Whatever their drawbacks in other contexts, technology inducement prizes are particularly well suited for climate change policy³⁷ as there is no way for the inventor of a new means of reducing GHG emissions to capture the social benefits such an invention could generate.

A National Science Foundation report concluded there are “many possibilities for employing innovation inducement prizes to overcome technical and scientific challenges in low-carbon energy supply, demand, and storage technologies.”

The dominant innovation policy tools have their merits. They also have significant limitations, particularly for inducing more than incremental technological advance. In the climate change context, grants, regulatory controls, and intellectual property are likely to be insufficient to generate desired levels of invention, innovation, and diffusion. Traditional government research subsidies have produced relatively little in this area. Patent awards provide insufficient incentive for the development of climate-friendly technologies³⁸.

On February 2, 2007, Richard Branson announced the “Virgin Earth Challenge,” a \$25 million prize for the development of “a commercially viable design which results in the removal of anthropogenic, atmospheric greenhouse gases so as to contribute materially to the stability of Earth’s climate.” The Virgin Earth Challenge’s \$25 million bounty was the largest technology inducement prize in history. Former Vice President Al Gore and noted ecologist James Lovelock both endorsed the effort.

Jonathan Adler³⁹ notes that no private individual will solve the climate challenge single-handedly, and while \$25 million may be the largest inducement prize ever offered for a

³⁶ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

³⁷ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

³⁸ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

³⁹ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

technological innovation, it is a small fraction of what the U.S. government spends annually on energy and climate-related technological research - spurring the technological innovation necessary to stabilize atmospheric concentrations of greenhouse gases will take far more. Nonetheless, inducement prizes are a promising tool for climate change policy.

Adler suggests⁴⁰ that *“Instead of doling out billions to researchers in the hope they will invent something that will help solve the global warming challenge, the government should offer substantial rewards to those who invent or develop technologies that solve particular climate related problems.....Whatever their faults in other contexts, prizes are particularly well suited to the climate policy challenge.”*

Institutional and macro-economic change

In a fascinating paper by William Butterfield⁴¹ the argument is presented that existing aid delivery modalities reinforce poor development performance by propping up weak institutions and lessening the immediate need for both economic and political reform. The paper claims that suggestions by others (as detailed in this paper), to use prizes to promote innovation to increase agricultural productivity in the developing world, do not go nearly far enough and that a prize system should be expanded to include improvements to general macro and micro economic indicators.

A strong argument is made that since donors know what it is they want to achieve but have not yet figured out how best to concentrate efforts at achieving it, a system of prizes would shift the informational requirements onto agents who are better informed about how to overcome their own complex political constraints. Once results were achieved, the prize money would be largely untied and would flow directly into government coffers. The prize system would therefore specifically target money toward the political elites in charge of policy and reward them directly. In this way the World Bank and other donors could act as the outside enforcer of an implicit agreement between political elites and the general public to make welfare enhancing reforms.

Butterfield recognises that potential problems exist with this approach, as risk is shifted onto the agent, and that a focus may be put only onto observable outputs at the expense of non-incentivised aspects, but doesn't consider either overly problematic – he suggests that financing is less and less of a problem as developing country governments have increasingly easy access to private finance on top of their own budgets (though no reference or evidence is provided for this) and that the concept of “risk” is limited as high costs are unlikely for governments to figure out the best way to solve institutional and policy problems.

It is noted that the prize system is likely to be unpopular both with recipient agencies and with donor organisations due to a dramatic change in role and potential reduction in power.

An example of how such an institutional reward system might work is given below:

⁴⁰ Jonathan H. Adler (2010) Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization

⁴¹ Butterfield WM, 2006 “Facilitate Institutional Development, Win a Prize – How the World Bank and other donors Could Help Overcome Barriers to Growth”

Table 1: Example Indicative Institutional Reward system

Avg. time*avg. cost to start a business	Initial Award	Sustained 2 years since award	Sustained 5 years since award
20% improvement from initial benchmark	US\$ 100 million	US\$25 million	US\$10 million
25% improvement from new benchmark.	US\$ 200 million	US\$50 million	US\$20 million
25% improvement from new benchmark.	US\$ 500 million	US\$75 million	US\$35 million

2.6 Developing world examples of prizes for social and/or developmental gain

There have been / are a number of contests held in the developing world, for the developing world, for development gain. No literature has been identified that looks at the long term impact and success of these programmes, and much remains to be learnt about the efficacy of solving developmental or social problems using prizes. In India the National Research Council Development Corporation has researched open innovation⁴² and crowd sourcing⁴³, promoting these approaches to help companies match a problem or need for a solution to a number of solvers; in addition the experience of “Changemakers” in utilising these approaches is significant. Further impact assessment based on past prize experiences in the developing world could provide some useful lessons for future prize funding. The McKinsey report identifies a large number of international prizes open to all and key programmes in the developing world from which lessons for development can and should be learnt include:

The Energy Innovation Contest – this is funded by several donors (IADB, GTZ, Korean Government and GVEP International) with the aim of championing novel ideas for improving energy efficiency and expanding access to renewable energy in Latin American and Caribbean countries. <http://events.iadb.org/calendar/eventDetail.aspx?lang=en&id=512>

Ashoka’s Changemakers uses an open source “discovery framework” to frame a set of social problems, such as access to water or sanitation, focusing the problem-solving efforts of a growing community of social entrepreneurs. It focuses on building a space for people to come together to tackle social problems and tracks not only the number of submissions by participants but the number of conversations that take place on the website for each competition, both during and after the competition. <http://www.changemakers.com/>

Other examples of prizes from India, that may bear relevance, include but are not limited to:

- Paragon 100 Foundation for Youth Social Entrepreneurship in Asia; <http://www.paragon100.asia/index.php/about>

⁴² Open Innovation is the paradigm that assumes firms can and should use external ideas as well as internal ones

⁴³ Crowd Sourcing is the act of out sourcing task, promoting user driven innovation and co-creation

- Entrepreneurship Cell at Indian Institute for Technology; <http://www.knowafest.com/2010/11/business-plan-competitions-conducted-by.html>
- Metamorphosis 2011; <http://www.isb.edu/metamorphosis/PrizeMoney.html>
- Eureka India; <http://www.ecell.in/eureka/#/stories>
- National Social Entrepreneurship Forum – Social plan B competitions; <http://www.yourstory.in/entrepreneurs/social-entrepreneurs/4214-yashveer-singh-founder-national-social-entrepreneurship-forum>
- IGNITE, national competition in India for School Children; <http://www.icbse.com/2010/ignite/>

2.7 Key lessons and points

During the Case Foundation Conference 5 do's and don'ts for prize development were identified:

- The problem to be solved must be clear and well defined, with clear, measurable and objective results – “everyone should be able to tell when someone has won” (Charlie Brown formerly executive director of Ashoka Changemakers)
- Agencies must make sure authority and budget are in place
- Challenges should be open and transparent. Do not underestimate the effort it will take to remain fair
- Prizes don't have to be money
- Use the public for the right purpose. “The public is good at generating ideas. It is not clear that they are good at choosing winners” (Professor Lakhani, Harvard Business School)

There is evidence also that a prize that is too small will fail to stimulate sufficient investment, but a prize that is too high will waste resources⁴⁴.

Thomas Kalil, quoted in the McKinsey report argues that “[sponsors] should not look at a prize in isolation, but [should instead] look at a portfolio of instruments and efforts of which prizes are a part”. Prize givers should work to extend a prize's impact by using the full portfolio of other instruments such as traditional grants, service programmes, convenings or infrastructure investments.

Successful prizes

In Prizes the neglected Innovation Incentive (2006) Juri Saar looks at 5 different successful prizes in the 18th, 19th, 20th and 21st centuries, and 5 find key similarities:

- Clearly defined monetary rewards
- Well defined in terms of problem definition and conditions for entry
- Large target markets for the innovation
- Participation was not limited
- Extensive publicity campaigns
- All solutions came from non traditional and unexpected quarters

2.8 Challenges

During the Case Foundation Conference⁴⁵ a number of challenges that attendees expected to face when bringing prizes into their own agencies were identified, these included:

⁴⁴ Marlynn Wei, *Should Prizes Replace Patents? A Critique of the Medical Innovation Prize Act of 2005*, B.U. J.SCI. & TECH.

- *Authority:* There is no cross-agency authority for prizes and challenges.
- *Intellectual property:* In the case of new technical solutions, who will own the intellectual property? How will this be delineated?
- *Embracing failure:* Some initiatives may fail. How will we handle this?
- *Promoting change within:* For many offices, using prizes and awards to further policy goals is an uncomfortable idea. How will we drive this change internally?
- *Administration:* How will we ensure we have the capacity to administer this competition?

⁴⁵ The Case Foundation Conference Report 2010 “Promoting Innovation: Prizes, Challenges and Open Grantmaking”

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