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The Promise of Incentive Prizes
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Email: editor@ssir.org

The Promise of Incentive Prizes

Jeff Ubois interviews **Thomas Kalil** of Schmidt Futures (a philanthropic initiative founded by Eric and Wendy Schmidt) about how calls to solve big problems through competitions can, when done right, galvanize innovation.

How did you first get interested in the role that incentive prizes can play in stimulating innovation?

In the late 1990s, I was working for President Bill Clinton on his National Economic Council and happened to read a book called *Longitude*. This book described a series of prizes offered by the British Parliament in the 18th century to encourage the development of methods for precisely measuring the longitude of a ship at sea. The British Parliament was motivated to pass this legislation because of some tragic maritime disasters and the need for increased navigational accuracy to complete longer ocean voyages.

I thought this was a really interesting idea and was able to get the National Academy of Engineering to do a study on prizes. This study made an important distinction between "recognition" and "inducement" prizes. Recognition prizes—like the Nobel Prize—provide rewards to people for something they have already accomplished. Inducement prizes are designed to encourage individuals or teams to accomplish a specific goal that no one has achieved yet.

I was also able to help get DARPA the authority to support incentive prizes. Beginning in 2004, DARPA used this authority to advance the development of self-driving cars. A team led by Sebastian Thrun, then director of Stanford University's Artificial Intelligence Laboratory (SAIL), won the competition in 2005, and Google recruited Thrun to lead their self-driving car effort.

What did you do to advance the government's use of incentive prizes when you joined the Obama administration?

Thomas Kalil is chief innovation officer for Schmidt Futures. He was the deputy director for technology and innovation for the White House Office of Science and Technology Policy and senior advisor for science, technology, and innovation for the National Economic Council.

I was able to work with Congress to pass legislation in 2010 that gave every federal agency the authority to support incentive prizes of up to $50 million. Prior to the passage of this legislation, Congress had given DARPA and NASA prize authority, so other agencies assumed that that implied that they didn't have prize authority.

I also recruited a series of experts in open innovation to the Office of Science and Technology Policy, including Robynn Steffen from Yale Law School, Cristin Dorgelo from the XPRIZE Foundation, and Jenn Gustetic from NASA. They built a vibrant community of practice of federal program managers that were experimenting with incentive prizes and worked with the General Services Administration to launch Challenge.gov—a one-stop shop for federal prizes and challenges.

This was part of a broader effort within President Barack Obama's Strategy for American Innovation that we called the "innovation tool kit" that included dozens of different approaches to solving problems—including open data, citizen science, human-centered design, evidence-based grantmaking, and multisector collaborations.

What is the argument for increased use of incentive prizes?

I am a strong believer in Joy's Law: "No matter who you are, most of the smartest people work for someone else." So you are usually going to be better off if you make it easier for people outside the boundaries of your organization to know (a) what problems you are trying to solve and (b) how they can get involved.

PHOTOGRAPH COURTESY OF THOMAS KALIL

I also believe that a well-designed incentive prize can enable the sponsor to:

- Set a goal without having to decide in advance which team or approach is most likely to be successful
- Pay only for results
- Leverage investment that can exceed the value of the prize purse
- Shine a spotlight on a problem
- Encourage fresh approaches by reaching beyond the "usual suspects"
- Change people's views about what is possible

Having said that, it is not always the right approach to solve a given problem, and it is certainly not a substitute for more traditional funding mechanisms, such as grants or contracts.

Prizes have been criticized for pulling more time and energy from a field than they return to it. Were there any specific situations from your time in the White House when you argued against issuing a challenge of some kind?
There were definitely instances where:
- Agencies had not thought hard enough about the problem statement or the victory conditions.
- The amount of money they had for the prize purse was inadequate, given the resources required to solve the problem.
- The agencies were really running a traditional grant competition but just calling it a prize competition.
- They had not thought about what they would do after the competition in the "post-award" phase.

How did the government's use of incentive prizes evolve?
As of July 2018, agencies have sponsored more than 840 incentive prizes. Over time, agencies became willing to sponsor prizes that are larger, more ambitious, and more important.

For example, DARPA is sponsoring a $10 million prize for a team that can launch payloads to orbit, with no prior knowledge of the payload, destination orbit, or launch site, and accomplish that goal twice within days. This could dramatically expand access to space, with important applications in Earth observation and global communications.

The National Institutes of Health is funding a $20 million prize competition to improve the diagnostic technology needed to rapidly identify antibiotic-resistant bacteria and to distinguish between bacterial and viral infections. This is an area where innovation is desperately needed. The British government has estimated that by 2050 the cost of failing to address antimicrobial resistance could be $100 trillion and 10 million casualties every year.

Some agencies began to explore a broader set of tools called "market shaping" for accelerating the development of innovations that have a high social return and a low private return. For example, drug companies have little or no incentive to develop vaccines for poor people.

In an initiative that will save the lives of seven million poor children in developing countries over the next 20 years, five countries and the Bill & Melinda Gates Foundation pledged to purchase millions of doses of a safe and effective vaccine against pneumococcal diseases such as bacterial pneumonia.

This is called an advance market commitment, which is essentially a purchase order for a product that doesn't yet exist. Some government agencies are using milestone payments, which provide companies with payments for intermediate progress toward a given goal.

I think it is unfortunate that the government is accustomed to making financial commitments that are contingent on failure but views making financial commitments that are contingent on success as exotic. The federal government has more than $2 trillion in loan guarantees on its balance sheet (financial commitments contingent on failure, such as bankruptcy), but hardly any financial commitments that are contingent on success, such as advance market commitments, milestone payments, incentive prizes, or "pay for success" contracts.

Ideally, more organizations and sectors would have the capacity to (1) identify unmet needs, (2) develop performance-based specifications for effective solutions to those problems, and (3) provide the incentives where needed that would motivate teams to develop these solutions.

You were also active in the Obama administration's efforts to identify and pursue "Grand Challenges." How are they different from incentive prizes?
A Grand Challenge is an ambitious but achievable goal that can help address some major economic, societal, or scientific problem, and that also has the potential to capture the public's imagination.

Historical examples include President John F. Kennedy's decision to put astronauts on the moon, and the Human Genome Project. This project not only sequenced the human genome but drove down the cost of doing so from $100 million to $1,000.

The Obama administration launched several Grand Challenges. For example, the BRAIN Initiative is designed to dramatically increase our understanding of how the brain encodes and processes information by developing the tools needed to study the brain in action. The US Department of Energy supported SunShot, an initiative to make solar energy as cheap as coal by the end of the decade. USAID is supporting several Grand Challenges for Development, including one to reduce newborn and maternal mortality in the first 48 hours after birth.

A Grand Challenge is an ambitious but achievable goal (the "what"), and an incentive

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prize is a particular tactic for solving problems and promoting innovation (the "how").

To what extent did the Obama administration use Grand Challenges to stimulate partnerships?
To achieve the goals of the BRAIN Initiative, President Obama explicitly called for an "all hands on deck" effort that involved not only government agencies, but companies, research universities, foundations, nonprofits, and patient groups. For example, the Kavli Foundation played a critical role in the agenda-setting that led to the BRAIN Initiative, and the Kavli Foundation, the Allen Institute for Brain Science, and the Howard Hughes Medical Institute made significant commitments to support research that would advance the goals of the BRAIN Initiative.

Why do you think there is a case for a more systematic effort to identify Grand Challenges?
In general, I would like to see a "moon-shot culture"—where more individuals and organizations are involved in the identification and pursuit of ambitious goals.

I think it is particularly powerful to link the attainment of a compelling goal with a "why now" story. In some cases, something has changed about the world (e.g., technological progress,

fundamental scientific advance, institutional or business model innovation) that makes the previously impossible possible.

Done right, combining the ambitious goal with a "why now" story can create a positive self-fulfilling prophecy. As President Kennedy observed, "By defining our goal more clearly, by making it seem more manageable and less remote, we can help all peoples to see it, to draw hope from it, and to move irresistibly towards it."

The first step would be a more concerted effort to identify goal statements that have these characteristics in a broad range of domains—such as health, education, economic and social mobility, energy and climate, sustainability, science and technology, the future of space exploration, etc. The second step would be to identify the coalitions of companies, research universities, nonprofits, foundations, investors, government agencies, and other actors that would have the ability to achieve these goals.

An exercise like this would be timely, given the growing number of wealthy families that have signed the Giving Pledge. Some of them may be looking for an ambitious goal that they can embrace, in the same way that Bill Gates wants to eradicate polio and Yuri Milner wants to send a spacecraft to another star.

Formulating goal statements is hard! Were there some things you learned about how to do that effectively that you can share?
One of our partners on innovation was Steve Blank, a serial entrepreneur who worked with the National Science Foundation on the development of the curriculum for its Innovation Corps (I-Corps) program based on the "lean startup" methodology. Steve and his colleagues also created a course called Hacking for Defense, which encouraged agencies in the Department of Defense to describe problems they had that could be tackled by multidisciplinary teams of graduate students. He found that the agencies needed feedback on their problem statements— often because their original formulations were overly prescriptive. They not only described the problem but also outlined the technical approach that they thought would be necessary to solve it. One pedagogical resource that Steve created is an annotated set of problem statements with descriptions of what makes them good or bad.

Another dimension that is hard to get right is the "too hard versus too easy." There have been some large-scale incentive prizes that failed because industry was making more

progress than people expected, and the prize was overtaken by events.

I think that people who do a lot of problem definition have developed some useful heuristics. For example, Schmidt Futures is supporting a project by Karim Lakhani and the Laboratory for Innovation Science at Harvard University to capture and share their "lessons learned" from working with many different types of scientists on open innovation.

Does an emphasis on moon shots narrow the range of potential participants?
Absolutely not. Some universities are empowering students to organize their research, coursework, service-learning, international experiences, and entrepreneurial activities around one of the Grand Challenges identified by the National Academy of Engineering. I'd like to see more universities allow students to "major in a discipline but minor in a problem." Faculty, students, and practitioners could identify the coursework and experiential learning that would position students to become changemakers and make a contribution to an important problem at home or abroad.

Researchers are also developing tools that enable individuals to get involved in really challenging scientific problems, such as mapping the brain.

"Minor in a problem" is useful for both institutions and individuals, and for the rapid learning that is necessary to do prize administration well. Did you find prizes reorganized expertise or produced new knowledge in the federal system in useful ways?
Civil servants that used open innovation often learned that reaching beyond the "usual suspects" definitely had value. For example, USAID supported a Grand Challenge on Ebola to develop better protective equipment for health-care workers that are treating infected patients. The team of the winning entry included a wedding dress designer! They figured out how a health worker could easily remove the suit without the contaminated exterior ever touching the wearer's skin, while making the suit cooler and lighter.

What do you see as the similarities and differences between the work that you have done on incentive prizes and Grand Challenges, and the growing interest in "big bet" philanthropy, as exemplified by MacArthur's 100&Change program?
I definitely see a strong connection between Grand Challenges and big bet philanthropy, given the focus on making measurable progress

on an important goal, such as improving the early childhood education of Syrian refugees or reducing newborn mortality in Africa. I think the 100&Change model empowered nonprofits, universities, and social enterprises to pursue more ambitious goals, which is the essence of moon-shot thinking.

Someone once observed that if private capital markets worked the way that philanthropy does, when FedEx talked to private investors, they'd be told, "I'm willing to provide 10 percent of what you need, but only if you use it to buy delivery trucks in Detroit." I think it is more useful for philanthropists to ask partners, "What would you think is needed to accomplish your goals? What would you do if you weren't limited by the resources currently under your control?"

There are also some important differences. In most cases, government-initiated Grand Challenges started with a definition of the problem (e.g., make solar energy cheaper than coal), as opposed to the open-ended call that MacArthur issued.

Are there areas where you think that these approaches (incentive prizes, market-shaping, Grand Challenges, big bets) are underutilized?
There are certainly classes of problems that both the private sector and the government underinvest in.

For example, the private sector tends to underinvest in solutions for problems faced by low-income communities because of their low purchasing power. Silicon Valley venture capitalists are not throwing money at startups that are trying to help the 36 million adults in the United States that are reading at the third-grade level or below.

It's also the case that the US government makes significant investments to harness science, technology, and innovation for some national goals (national security, health, space, energy, basic science) but not others (e.g., promoting economic and social mobility, reducing the intergenerational transmission of poverty).

An interesting thought experiment would be to imagine that one of the agencies with the responsibility for promoting economic and social mobility had a research arm like DARPA. What goals would it set? How might it use incentive prizes and big bets to achieve them? For example, if the Department of Labor had a research and innovation arm, it might seek to reduce the time for non-college-educated workers to gain an in-demand technical skill from years to months, leveraging advances in AI-based digital tutors that model the one-on-one interaction between an expert and a novice. ⊗