

Science Policy Research Report: The Use of Innovation Prizes in Government

Luciano Kay

Institute for Social, Behavioral, and Economic Research

University of California Santa Barbara

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Innovation prizes

“... a proven way to increase innovation for the public, private, and philanthropic sectors.” (The White House, 2016)

- Prizes, contests, and grand challenges
 - Generally ambitious, tackle challenging problems and can involve significant research & development (R&D) efforts
 - Not “ideation” or business plan competitions, not online submission systems
 - Built-in requirement to develop technology
 - Sizable monetary rewards generally capture public, media attention
- Notable examples
 - Longitude Prize for a method to measure longitude at sea (early XVIII Century)
 - Ansari X Prize for private suborbital flight (1996-2004)
 - DARPA Challenges for autonomous robotic vehicles (2004, 2005, 2007)
 - NASA Centennial Challenges (2004-today)

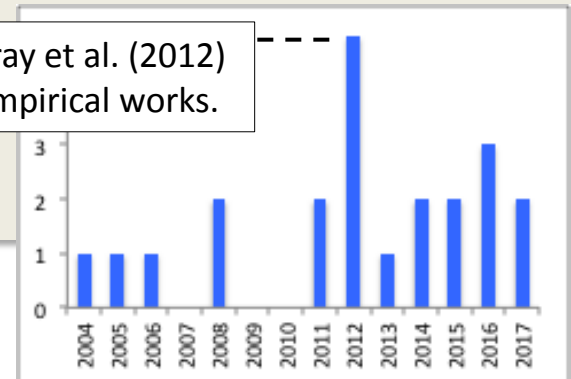


Government prizes (and empirical scholarly work)

- XVII to early 20th Century prizes – “Historical Prizes”
- 1990s prizes, for example:
 - \$1 million Rockefeller’s Prize for STD Test
 - \$10 million Ansari X Prize
- Consideration of federal prizes
 - 1999: Workshop to Assess the Potential for Promoting Technological Advance through Government-Sponsored Prizes, National Academy of Engineering
 - 2004: President’s Commission on Implementation of U.S. Space Exploration Policy, “Aldridge” Commission
 - 2007: Committee on the Design of an NSF Innovation Prize, National Research Council
- 2004: Government agencies such as NASA and DARPA start using prizes
- 2010: America COMPETES Reauthorization Act
- 2010: Challenge.gov launched
- Legislation
 - Medical Innovation Prize Fund Act (2005)
 - Science Prize Competitions Act (2015)
 - 21st Century Cures Act (2015)

Scholarly works included in this synthesis

Reference: Murray et al. (2012)
identifies two empirical works.



Between 2010 and 2016, 80+ federal agencies awarded more than \$150 million in prizes (Gustetic, 2015).

This synthesis

Focus: empirical evidence on innovation prizes (*in government*)

- Pre-defined inclusion and exclusion criteria (Littell et al., 2008)

1. Data gathering

- 1st round: seed literature from author's research
- 2nd round: citing publications, new keyword-based search
Thomson Reuters Web of Science and Google Scholar
- Final set: 23 scholarly, empirical *research works* and *syntheses*
Journal articles, conference papers, book chapters, books, policy reports

1. Analysis

- Coding (QSR International's Nvivo) into five themes
Opportunity, Design, Governance, Outcome, Evaluation
- Assessment of methods, data sources, claims, research focus
- Cross-referencing, tabulation and synthesis

1. Report writing

- Concrete evidence-based findings
- Recommendations



Seed literature sources:
NSF SciSIP- and The IBM Center for the Business of Government-funded research, other work of the author (Kay, 2011a, 2011b, 2012a, 2012b; Conrad et al., 2017)

Findings on prizes (examples)

OPPORTUNITY

1.1. The opportunity to use prizes depends on their focus along the process of technology development.

1.2. The economic context of competitions affects the effectiveness of prizes.

DESIGN

2.1. The appropriate combination of prize rewards (monetary and non-monetary) can maximize the efficacy of a prize.

2.2. Contestant motivation varies across types of entrants and over time as the competition unfolds.

GOVERNANCE

3.1. Prize entrant activities draw significantly on external resources.

3.2. Prize adaptation during runtime increases the chances of prize success

OUTCOME

4.1. Prizes can induce/accelerate innovations over and above what would have occurred anyway.

4.2. Prizes benefit both sponsors and entrants regardless of whether

EVALUATION

Importance of objective-driven design for evaluation.

It is unclear what the appropriate metrics and points of evaluation

Table 4. Types of sources of empirical evidence on prizes

Type of source	Relative value	Potential issues	Select examples
Direct	High	Ill-designed data gathering instruments Coverage	Participant observation In-person or phone interviews with entrants Questionnaires applied to/surveys of entrants
Experts	Medium	Bias Coverage	Interviews with prize experts Interviews with industry experts in prize technologies
Documentary	Medium/Low	Context influence Bias Reliability Coverage	Other literature Online sources (e.g. entrant's website) Historical accounts, observation by third-parties

Source: synthesis author.

What we know

(some key points)

- “Prizes work”, can induce R&D activity, but...
 - We need to distinguish benefits (e.g. publicity, raised awareness) v. objective-driven design (cf. Gustetic et al., 2015 on NASA’s prizes)
- Prizes are complex, knowledge-intensive and resource-intensive
 - Require understanding of the mechanism, industry knowledge
 - “Sponsors pay only for solutions” but...
- Uncertainty is inherent to prizes in every stage
 - Design, governance and outcomes
 - High-risk, potentially high-payoff
- Prizes complement, co-exist with other incentives
- Influence of the context (economic, industrial, policy)

What we don't know

(some key points)

- Evidence still limited, incomplete
Example: motivations vary across prize entrants (e.g. Kay, 2012a; Vrolijk & Szajnfarber, 2016), but we do not know what incentives are best in each case.
- Sometimes vague, other times contradictory
Example: whether knowledge diffusion is inherent to prizes (e.g. Davis & Davis, 2004) or should be promoted (e.g. Nardi et al., 2016).
- Lack of primary, reliable data sources
Only 3 scholarly works focus on Challenge.gov! (e.g. Desouza, 2012; Mergel & Desouza, 2013)
- In terms of two research thrusts we should pursue:
 - Theory building, models and constructs
 - Key topics
 - “Evaluation”, the overlooked theme
 - A list of topics: *prize portfolios, series of prizes, others*

Concluding remarks

- Prizes can become a tool in the portfolio of government agencies, but considering the existing empirical evidence, prize programs should remain *exploratory* and *experimental*.
- Why do we use prizes in government while we have so little empirical evidence?
 - “Prizes work”
 - Benefits v. objective-driven design
 - We might actually not account for failures
 - Current prize programs might be inefficient
 - Competition is a powerful drive
 - Innovation in innovation policy
 - Three phases:
 - Re-discovery (1990s-2005)
 - Exploration (2006-2015)
 - Understanding (2016-present)

Thank you

Luciano Kay, Ph.D.

luciano.kay@ucsb.edu

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