# COMPETITION-BASED INNOVATION

## THE CASE OF THE X PRIZE FOUNDATION

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**Abstract:** The use of competition-based processes for the development of innovations is increasing. In parallel with the increasing use of competition-based innovation in business firms, this model of innovation is successfully being used by non-profit organizations for advancing the development of science and technology. One such non-profit organization is the X Prize Foundation, which designs and manages innovation competitions to encourage scientific and technological development. The objective of this article is to analyze the X Prize Foundation and three of the competitions it has organized in order to identify the challenges of competition-based innovation and how to overcome them.

**Keywords:** Radical innovation, breakthrough innovation, competition-based innovation, innovation competition, modularity, X Prize Foundation

A recently developed approach for creating radical or breakthrough innovations is taking clear shape: competition-based innovation. In competition-based innovation, innovations are created by engaging entities or individuals to submit solutions for specified challenges within a stipulated time frame. Then, the best solutions are selected and rewarded by the organizers of the innovation competition. Competition-based innovation is not a new concept (MacLeod, 1971), but the Internet and other advances in information technology have made its use significantly easier and consequently more widespread (Kalil, 2006). The currently popular concept of open innovation (Chesbrough, 2003) has helped to focus the attention of scholars and practitioners on competition-based innovation. Similar terms used to describe competition-based innovation are design competition, idea contest, innovation contest, innovation jam, and tournament-based innovation (Adamczyk, Bullinger, & Möslein, 2012).

Some scholars have argued that modularity is necessary in order to create innovations based on ideas obtained from external experts (Baldwin & Henkel, 2014; Henkel, Baldwin, & Shih, 2013). In the modular approach, the original problem is partitioned into smaller sub-problems, termed modules (Baldwin & von Hippel, 2011). Each module is then separately presented as a challenge in an innovation competition. One drawback of modularity is that protecting intellectual property rights can be more difficult for the innovator, and imitation can be easier for competitors (Ethiraj, Levinthal, & Roy, 2008). An alternative approach to modularity is the unitary approach. When this approach is used in competition-based innovation, the original challenge is submitted to external experts without partitioning it into smaller modules.

Because of the strong belief in the requirement of modularity, competition-based innovation has not been frequently used to achieve breakthrough innovations. Only recently have successful examples of competition-based innovation in advancing the development of science and technology challenged the traditional belief in the value of modularity. One of the pioneering organizations founded to design and manage innovation competitions to advance scientific and technological development is the X Prize Foundation.

The objective of this article is to show how competition-based innovation can be used in creating breakthrough innovations. We describe the X Prize Foundation and three innovation


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competitions organized by the Foundation. Based on the X Prize Foundation case, we discuss how innovation competitions should be designed in order to support successful breakthrough innovation.

## X PRIZE FOUNDATION

The X Prize Foundation is a USA-based organization established in 1996. The Foundation was established in cooperation with several large companies, including Cisco, Google, Nokia, Qualcomm, and Shell Oil. Its mission is to bring about "radical breakthroughs for the benefit of humanity" through incentivized competition. The Foundation organizes high-profile competitions that motivate individuals, groups, companies, and organizations across all disciplines to develop innovative ideas and technologies to overcome challenges that restrict humanity's progress. According to the CEO of the X Prize Foundation, each competition aims to tackle previous failures and to create a new approach to achieve breakthroughs once thought to be impossible. The duration of competitions ranges from a few years to a decade. The first competition, for example, started in 1996 and ended in 2005. X Prize rules allowed contestants to retain the intellectual property and other commercial rights related to their inventions and discoveries. Further, competitions are based on unifying principles so modularity is not a relevant issue to the X Prize Foundation.

The X Prize Foundation is widely recognized as a forerunner in facilitating prize competitions that motivate innovators to solve pressing challenges facing the world. The Foundation's vision is to dramatically change the innovation spectrum by presenting an alternative to traditional modes of innovation. It organizes competitions in five categories: education, global development, energy and environment, life sciences, and exploration. So far, the X Prize Foundation has successfully completed four competitions, has cancelled one, has four that are active, and has approximately a dozen in the development stage. The X Prize Foundation organizes two types of competitions: the X Prize and the X Challenge. In the X Prize competition, an award of $10 million or more is rewarded to the first team to accomplish a task specified by the Foundation. In the X Challenge competition, a prize of up to $2.5 million is given for the solution of a well-defined technical problem for which there is no known solution. The aim of both competitions is to bring breakthrough technical or behavioral solutions to the market. The competitions stimulate innovation through tapping into the competitive and entrepreneurial spirit of the contestants.

The X Prize Foundation has completed four competitions: Ansari X Prize, Progressive Insurance Automotive X Prize, Wendy Schmidt Oil Cleanup X Challenge, and Northrop Grumman Lunar Lander Challenge. The Archon Genomics X Prize was cancelled in the middle of the competition process. The four active projects are Google Lunar X Prize, Qualcomm Tricorder X Prize, Nokia Sensing X Challenge, and Wendy Schmidt Ocean Health X Prize. To better understand the process of competition-based innovation, we briefly describe an example from each category.

### The Ansari X Prize

The Ansari X Prize was announced in 1996 and was the first competition organized by the X Prize Foundation. The name of the competition was changed from its initial name following a multimillion-dollar donation from the Ansari family. The competition offered a $10 million cash prize to the first non-government organization that could build and launch a reusable three-passenger vehicle into space, reaching over 100 kilometers in altitude, and repeating this feat twice within two weeks. The closing date for the competition was January 1, 2005 (Hoyt & Phills, 2007).

The competition received extensive press coverage. Eventually, 26 teams from seven different countries entered this competition. It is estimated that the participating teams allocated a cumulative total of $100 million in their development work for winning the prize (Brunt, Lerner, & Nicholas, 2012). The participating teams were from all around the world, ranging from hobbyists to corporate-backed groups. One-third of the teams were new startups, formed specifically to go after the prize, another third were already working towards

spaceflight, and the final third came from different fields to try to win the prize (Hoyt & Phills, 2007).

SpaceShipOne, a USA-based aircraft design company, won the competition after eight years of work. SpaceShipOne made an agreement with Virgin founder Richard Branson to supply the new vehicle to Virgin Galactic, which aimed to develop a business selling trips to space. Even though the idea of space tourism was not new, the X Prize competition changed attitudes towards space tourism and gave new belief in its potential. The first-ever tourist space trip was made in 2001 with a price tag of $20 million. Although some people are willing to pay a hefty price for a space tour, high costs are still a major hindrance for this business. The Ansari competition shows the high potential of space tourism since the price of space tourism is expected to come down significantly.

**Archon Genomics X Prize**

Two years after completing the first Ansari competition, the X Prize Foundation announced its second competition on October 4, 2006: the Archon Genomics X Prize. The Archon Genomics X Prize was a competition awarding $10 million to the first team that could sequence 100 human genomes in 30 days. One hundred centenarians (people who are over 100 years old) around the world were expected to donate samples of their genes for each contestant in this competition. The objective was to provide valuable new insight about human longevity. It was expected that breakthrough innovations and technologies on genome sequencing would be attained and that these would lead to improved medical diagnosis and treatment. With a $25,000 fee, a legal entity could register for the competition by May 31, 2013. The formal competition period was from September 5, 2013 to October 5, 2013. The award ceremony was scheduled to be held on October 31, 2013. Several external research organizations collaborated with the Foundation to develop the validation protocol. Researchers were expected to produce valuable clues of human longevity, impacting future healthcare. Thus, the Archon Genomics X Prize competition was expected to bring breakthrough innovations and technologies on genome sequencing and, consequently, a radically new approach to personalized medicine.

After careful consideration, however, the Foundation decided that this competition was not incentivizing technological changes. Many companies, meanwhile, were able to sequence genomes at low cost and in a few days. Hence, the Archon Genomics X Prize was cancelled just before entering a master team agreement. Yet, this competition resulted in two valuable outcomes: (1) collection of blood samples and creation of cell-lines to preserve the DNA of over 100 centenarians whose genomes will be sequenced and put into the public domain and (2) creation of a validation protocol, the first analytical tool for assessing the overall quality of whole genome sequences (Diamandis, 2013). Thus, the global genomics community benefited tremendously, though the participating X Prize teams were highly disappointed.

**The Google Lunar X Prize**

This is a space competition sponsored by Google. The competition looks for a privately funded space flight team which will launch a robotic spacecraft that can land on the moon and travel on its surface for more than 500 meters and send images back to earth. The competing teams have to have at least 90 percent of their funding from private sources. This challenge offers prizes totaling $30 million. The first successful team will receive $20 million, and the second most successful team will receive $5 million. Teams can earn additional money by performing more than the basic required tasks. These additional tasks include travelling on the surface of the moon at least ten times as much as the minimum requirement of 500 meters, capturing images of the Apollo program hardware, and verifying the recently discovered water ice on the moon. Furthermore, a $1 million award may be given to teams that make significant progress in promoting ethnic diversity in the fields of science, technology, engineering, or mathematics. A company named Space Florida has offered a $2 million bonus to teams that launch the mission from the state of Florida. If this competition turns out to be a success, the world will witness a new frontier of discovery on the surface of the moon.

The Google Lunar competition will end when all necessary prize requirements are fulfilled or at the end of 2015. However, the closing date of this competition has been changed three times. Initially, it was at the end of 2012 with an offer of $20 million to the first successful team. After that, the deadline was moved to 2014 and, finally, to the end of 2015. The registration for the Google Lunar X Prize was closed at the end of 2010, and 25 teams registered for the competition.

## MAJOR CHALLENGES AND HOW THE FOUNDATION HAS OVERCOME THEM

The X Prize Foundation has faced many challenges in a variety of areas. We discuss the major challenges and how the Foundation has dealt with them.

### Financing

Financing mega prizes is challenging for the X Prize Foundation since it does not have its own budget for prizes. It needs to find a sponsor for each competition. The CEO has approached approximately 200 CEOs and CTOs in the past five years in attempts to secure financing. Despite many setbacks, the CEO did not give up and took a creative approach to funding. With an aerospace insurance broker, he negotiated a multimillion-dollar policy payment against a $10 million payout if space flights were successfully made by January 1, 2005. The underwriters were convinced that no one could make it. Anousheh Ansari, an Iranian-born software entrepreneur from Texas, then agreed to pay the insurance premium, and the competition became the Ansari X Prize. The Archon Genomics X Prize is funded by philanthropists Stewart and Marilyn Blusson. The Google Lunar X Prize is sponsored by Google. Thus, the X Prize Foundation has been able to attract funding from philanthropists, an insurance policy paid for by a philanthropist, and large companies.

### Competition Design

Designing an innovation competition involves a lot of work and many tough decisions. On one competition, the Foundation spent about a year developing a set of competition rules that could be easily understood and verified. Also, the Foundation set a requirement that it should organize all competitions at minimum cost, implying that money and other resources should not be wasted. Lastly, setting a time frame for a competition is a design challenge. The Foundation must work with appropriate scientists and other experts to settle on a specific time frame because, ideally, it is desirable not to have to change deadlines during a competition.

### Attracting Contestants

Breakthrough innovations need visionary and creative people. Traditional research funding favors those who have solid credentials and successful track records. This, however, may inhibit thinking outside the box. To overcome such problems, innovation competitions need to attract individuals and teams outside the problem area so that they bring different ideas, perspectives, and ways of thinking to the competition (Jeppesen & Lakhani, 2010). The Foundation has been quite successful in this regard. For example, it restructured its board of directors, inviting top-notch entrepreneurs and visionaries such as one of the founders of Google and of Pay Pal to provide guidance and help make decisions.

### Trust

Building trust with all stakeholders is a key condition in competition-based innovation. For example, the contestants take a big risk when they start to invest their resources in development work, so contestants must have confidence that the competition organizer will not change the nature of the competition while it is in progress and will have the means to pay the winner. By successfully organizing multiple competitions, the X Prize Foundation has been able to gain the necessary credibility and trust.

### Competition Visibility

Visibility of a competition is important. The ability to attract funding and advance an innovation depends largely on visibility. One of the competitions organized by the Foundation, the Progressive Insurance Automotive X Prize, had over 12 billion media hits, providing large and positive visibility to the field of competitors, their financial backers, and the prize sponsor.

### University Alliances

The X Prize Foundation has initiated close collaboration with several universities. Research on competition-based innovation has helped to further develop the innovation competitions organized by the Foundation. University cooperation has also attracted more talent to participate in the competitions.

## LESSONS LEARNED: HOW TO DESIGN COMPETITIONS FOR BREAKTHROUGH INNOVATION

### Funding Sources

The X Prize Foundation's way of organizing competition-based innovation has expanded the potential sources of funding for breakthrough innovation. An imaginative example is that one of the X Prize innovation competitions was funded by an insurance policy. The Foundation has also been successful in attracting funding from philanthropists. Some of the innovation competitions have been funded by large companies without the companies getting any direct return from their investments. All of these are alternative ways to bypass the traditional sources of funding for breakthrough innovation.

### Patenting

Traditionally, in innovation competitions, there have been two ways to deal with the intellectual property rights of inventions. One has been that the contestants have been required to give the intellectual property rights to the competition organizer. Another approach is that the innovations have been made public without any protection of intellectual property rights. The X Prize Foundation has implemented a third way: each contestant has been able to keep the intellectual property rights to its innovations. Consequently, the X Prize Foundation's system has turned out to be very motivating for contestants, as the winners of the Foundation's competitions have received the monetary prize and been able to patent their inventions. At the same time, the winning innovations have received a lot of publicity which has enhanced the commercialization process.

### Resource Allocation

Competition-based innovation characteristically increases resources that are allocated to solve challenges. In the competitions organized by the X Prize Foundation, the solvers' total allocation of resources significantly exceeded the total value of the prizes. The contestants bear the costs of developing their solutions, whereas only the winning solutions are rewarded. Contestants must calculate the risks associated with a competition and decide if they want to participate. Thus, self-selection plays an important role in competition-based innovation.

### Staging

The X Prize innovation competitions have shown that it is usually advantageous to organize the competition in stages. At certain stages, teams are eliminated from the competition so that the most promising teams can get more and better support. Another staging consideration is that premature rewarding may not bring forward full solutions.

### Cooperation between Contestants

A downside of innovation competitions is that they lead to duplication of effort when various contestants work on the same challenge. It is not clear how much sharing of information between the contestants there should be during innovation competitions or how cooperation might enhance solutions. However, post-competition collaboration among the contestants is an option to accelerate breakthrough innovation.

### Diversity of Participants

Innovation competitions with mega prizes, like those organized by the X Prize Foundation, are a way of attracting contributions from people in different sectors. Such competitions can offer a large number of potential solvers from across the world an opportunity to participate and utilize their expertise. The X Prize competitions have had interdisciplinary and cross-national teams participate.

### Media Coverage

Innovation competitions typically garner significant media coverage. The organizers intentionally try to attract media attention. This is advantageous because when more people become aware of the competition, the number of contestants in the competition increases accordingly. Also, innovation development does not end when the winners of the competition are announced. Breakthrough innovations have a long way to go before they become widely utilized in society, and positive media coverage can help in the market penetration of the final products and services.

### Contestant Motivation

For contestants, the incentive to participate in innovation competitions is the prize money, but the motivation of contestants can be very broad. In the case of competitions organized by the X Prize Foundation, motivations have included positive public attention, media coverage, the desire to show that one is able to solve the problem, and testing the limits of one's personal abilities. In order to create and sustain the motivation of contestants, certain factors are important to keep in mind. The rules of the competition and the selection of winners must be clear and fair, with no disputable issues. Selection of the winner should be done without delay. Contacts to companies that potentially can commercialize the breakthroughs should be established, even prior to the competition if possible.

### Risk and Commercialization

Innovation development inherently bears risk and uncertainty, and developing breakthrough innovations is associated with even higher degrees of risk and uncertainty (Teirlinck & Spithoven, 2008). In comparison to other forms of innovation development, breakthrough innovations take longer to develop, and the market analyses associated with the commercialization process are more challenging (McDermott & Handfield, 2000). The X Prize Foundation's innovation competitions have produced several products of high potential, but developing those into commercial products has been challenging.

## CONCLUSION

The X Prize Foundation case provides insight into how competition-based innovation can be used to create radical or breakthrough innovations. Many scholars have argued that modularity is necessary in order to create breakthrough innovations based on ideas obtained from external experts. The X Prize Foundation's competition-based process, as illustrated with three of its examples, shows that a unitary approach can work equally well.

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