

Managing Open Innovation Challenges—Key Questions for Success

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1. Purpose

This document contains checklists of key questions for managing Open Innovation (OI) Challenges. It is intended to help program management offices (PMOs) responsible for initiating, planning, executing, and closing challenges within their organizations. It provides PMOs and their teams with an overview of challenges, a framework of the various phases of a challenge, and key questions/guidance PMOs should consider to ensure success.

2. Background

Challenges are a mechanism to connect creative minds and expertise via crowdsourcing. They are a way to “bring the world to bear” to help solve complex problems through open competition so that a broader set of ideas and solutions can be presented to the government. Challenge organizers engage with external sources of knowledge such as individual entrepreneurs, students, experts, small firms, etc., by inviting them to submit interesting solutions for challenge problems that satisfy certain criteria within a defined timeframe. When an organization identifies a problem to solve or a specific goal it wants to achieve with the assistance of members of the public, it can hold a prize competition or challenge. In an open challenge, the organization invites interested members of the public to submit potential solutions to the problem. The organization evaluates the resulting proposals and provides a monetary or non-monetary award for those that meet specific criteria and are selected as winners (Government Accountability Office 2016).

Organizations can leverage various strategies to increase the value of their products and services. The MITRE Corporation (MITRE) made a deliberate decision to embrace OI as a strategy to help solve some of our sponsors’ critical needs. As a not-for-profit corporation that operates seven federally funded research and development centers (FFRDCs) for government agencies, MITRE is in an ideal position to host challenges. We do not market or manufacture goods, and we have no financial investment in the results. Our goal is to work with industry, academia, and entrepreneurs to find solutions that benefit all stakeholders and provide our federal sponsors with the capabilities they need to be successful in their missions. Working across a wide range of government agencies gives MITRE a broad view into the challenges these agencies face, including the cross-cutting challenges that agencies have in common. We select our challenge topics based on this knowledge, looking for gaps that need to be filled.

3. MITRE Challenges

MITRE has completed four challenges since 2011. MITRE and our government sponsors support the challenge model as a proven approach to quickly and efficiently gather new ideas to address a specific problem, drive technical innovation, and accelerate learning. Designing and managing challenges requires hard work, and many promising practices for conducting challenges have begun to emerge. A successful challenge organizer will invest resources in design, set rules, manage the effort, celebrate winners, publicize the effort, award attributes that reinforce the strategy, and invest in post-prize activities that convert the award’s results into longer-term societal impact (McKinsey & Company, 2009).

Multicultural Name Matching Challenge

The Multicultural Name Matching Challenge, launched in 2011, was MITRE's first external competition. The challenge was inspired and modeled after the Netflix Prize—in which participants were asked to improve the recommender movie algorithm. Netflix gave participants test data sets, which they ran through their algorithms and submitted to Netflix for scoring. The Multicultural Name Matching Challenge focused on evaluating matching systems for multicultural names. This domain was chosen for two reasons. First, name matching has a broad applicability, ranging from the support of screening and credentialing services to disaster relief, benefits distribution, and fraud prevention. Second, MITRE has previous experience in evaluating person name matching software and an infrastructure for carrying out those evaluations (Miller, et al., 2012).

Countering Unauthorized Unmanned Aircraft Systems (C-UAS) Challenge

In response to our government sponsors' needs to quantitatively assess the capabilities of commercial unauthorized unmanned aircraft systems (UAS), MITRE hosted the C-UAS Challenge in 2016. The market for commercial and hobbyist small unmanned aircraft systems (sUAS, under 5 lbs., which are colloquially referred to as micro-drones) has increased exponentially over the past few years. From delivering packages to surveying disaster areas, these systems have many positive uses. As with all new technology, however, people are also finding ways to use it for nefarious purposes, such as scouting for police in a neighborhood and delivering contraband, including weapons. The MITRE Challenge team realized that one challenge could not meet the wide-ranging needs of all our sponsors, so we focused on common requirements and gaps. To that end, we sought solutions that could: (a) detect sUAS during flight and determine which were threats based on a geographic location and flight trajectory, and (b) interdict sUAS that were perceived as threats by forcing them to be recovered in a safe area (The MITRE Corporation, 2017).

Unique Identification of the Internet of Things (IoT)

With the explosive growth of Internet of Things (IoT) devices and their highly diverse and potentially modifiable characteristics, it is becoming difficult to accurately identify what devices (rogue or planned) are on various networks and to determine when a device joins, leaves, or is replaced in the environment. MITRE's 2017 IoT Challenge sought to find a simple, affordable solution that can fingerprint devices within an IoT network of interconnected devices.

There were three critical perspectives regarding the importance of this Challenge. The first was the network administrator who needs to know what is on a network to maintain the network. The second was the operational user who needs to determine if their IoT is allowing an adversary to uniquely identify them. This could become very important to military or law enforcement operations. For example, could a warfighter be fingerprinted because of an IoT device while in home station and then later be detected in an area of operation? The third was the attacker or adversary. From the attacker's perspective, understanding if an unexpected addition or modification could be detected by the network administrator could be key to the attacker's campaign (Schwefler, 2017).

Strengthening Eligibility Verification for Federal Benefit Programs

In 2019, MITRE executed the Eligibility Verification Challenge to motivate creative inventors to find ground-breaking approaches to solving the problem of improper enrollment in federal benefit programs. In 2017, federal agencies spent about \$141 billion on "improper payments," which are payments from federal benefit programs that—due to fraud or error—should not have been made or were made in the wrong amount. The total has gone up 33 percent since 2013. To spotlight the problem, the 2018 President's Management Agenda listed "Getting Payments Right" as one of its 14 Cross-Agency Priority goals.

The goal of the Challenge was to identify innovative, cost-effective concepts to help government agencies improve verification of eligibility, thereby better protecting funds and making it easier for agencies to fulfill their missions by focusing resources where they are most needed. Seeking concepts that would help make the eligibility determination processes more rigorous and data driven—while at the same time efficient, user-friendly, and protective of privacy—the Challenge featured a scenario with a hypothetical federal agency, a hypothetical benefits program, and real-world program eligibility characteristics requiring verification. Challenge participants were required to address these characteristics by creating a conceptual framework that could enable effective eligibility verification for this hypothetical benefits program.

4. Application

While there are many case studies offering advice on how to design and manage a challenge, each challenge has different goals and outcomes, so the planning and management of each is unique. While each challenge is different, challenges do have many common elements, phases, and steps from which a work plan can be constructed and project management methods can be leveraged.

The MITRE challenge PMO has gained significant experience managing our challenges and has created an OI challenge framework (Zaharee, Champney, Nanez 2017) to help others understand the overall process. As we planned and executed our 2019 Eligibility Challenge, we leveraged the framework and expanded it to include checklists reflecting challenge activities, steps, key questions, and guidance to ensure a successful challenge.

The goals of the checklist are for users to learn the various components of a challenge, understand the roles needed to execute a challenge, and use the questions and respective guidance to contribute to the successful management of a challenge. The questions are intentionally short to ensure they are quickly comprehended, actionable, respectful of a PMO's rapid operations tempo, and modular for easy navigation. The checklists are designed primarily to support idea generation challenges, but they are also applicable to a broad range of contest types, as defined in Table 1.

Table 1. Challenge Types

Type	Description	Source
Analytics/Algorithm Optimization	Analytics, visualization, and algorithm challenges focus on finding better ways to interpret or communicate data. The outcome of an analytics challenge is to obtain the best-in-	www.challenge.gov

	breed optimized code, test scenarios, documentation, and/or approach analysis.	
Design	Creative design and multimedia challenges can help capture, communicate, and project a concept or aesthetic that would be difficult to achieve with a grant or contract.	www.challenge.gov (IdeaScale 2016)
Entrepreneurship	Entrepreneurship or business plan challenges are competitions used by government, universities, and private sector organizations to help train and equip entrepreneurs, as well as launch their ventures.	www.challenge.gov (Gusteic, et al. 2015) (Kay 2011)
Hackathon	A design sprint-like event in which computer programmers and others involved in software (SW) development, such as graphic designers, interface designers, project managers, and others, collaborate intensively on SW projects. A themed hackathon is one in which the projects are confined to a specific problem, such as food sustainability or returning citizens. A civic hackathon is a gathering of technologists for a few days or weeks to build civic-themed software.	(Headd 2011) (Leckard 2012) (Tauberer 2014)
Idea Generation	In idea generation (also called ideation), an organization asks external participants to submit ideas to address a specific issue or problem. An ideation challenge supports new ways of understanding and framing problems, new processes to solve problems, and innovative implementations as solutions to problems. Organizations reach out to the ecosystem in search of innovation ideas, which are then further developed in-house.	www.challenge.gov (GAO 2016) (Burton and Blosch 2016)
Open Data	Organizations mobilize participants to share, explore, and analyze publicly available data sets, and to use the data to conduct research, design data visualizations, or create web and mobile applications and websites that help people access and use the data.	(Mihm 2014)
Opinion Seeking	Opinion seeking challenges are used to improve a product or service. Soliciting the opinions of customers, prospects, or the public will provide ideas for process improvement.	(IdeaScale 2016)
Scientific	Scientific challenges seek to promote understanding for a problem, solution, or outcome using empirical or measurable evidence-based practices.	www.challenge.gov
Software	In a software and application development challenge, an organization asks solvers to create a SW application to solve an existing problem or draw attention to potential uses of available datasets.	www.challenge.gov
Technology	Technology demonstration and hardware challenges seek prototypes, minimal viable products/services, or fully developed solutions to catalyze and demonstrate breakthrough technical innovations.	www.challenge.gov

The checklists in this document are designed to support the various roles within a challenge PMO and project team. Establishing a dedicated team with clear roles and responsibilities is critical to managing a successful challenge. Staffing a team depends on the type, duration, and size of the challenge. For purposes of these checklists, suggested PMO and project team roles are listed in Table 2.

Table 2. Challenge Team Roles

Role	Description
Program Management Office	
PMO Administrator	Oversees the success of the challenge. Provides input on prize design and administration.
PMO Subject Matter Expert (SME) – Finance	Determines the cost of operations, collects operational data, guides cost analysis, and recommends actions by analyzing and interpreting financial data.
PMO SME – Risk Management	Ensures risks are identified and managed so the competition achieves its business objectives. Sets realistic expectations so leadership can make informed decisions and balance limited resources while meeting priorities.
PMO SME – Communications (Comms.)	Conducts outreach efforts for potential participants and partners and to raise awareness of the goals, progress, outputs, and outcomes of the challenge. Includes senior communications principal, public relations, social media, and web designer to create a consistent look and feel for the contest.
PMO SME – Legal Counsel	Provides advice regarding which legal authorities govern the team’s ability to stimulate innovation, acquire goods/services, conduct research for the public good, or work with private organizations for mutual benefit. Includes intellectual property (IP) management—determining which party/parties in a collaborative relationship own the rights to the innovative products that are developed.
Core Program/Project Team	
Program Manager	Interfaces with the PMO to ensure appropriate levels of resources and staffing, and with agency partners to gain and sustain their participation. Works closely with the project leader and team leader to structure the technical content of the challenge. Depending upon the size of the challenge, this role may be fulfilled by a project leader.
Project Leader	Responsible for project management of the competition. Ensures a smooth transition from design through launch to post award.
Forward Facing Communications	Works in parallel with the PMO SME—communications, program manager, and project lead. Implements collaboration site for teams, tracks status (registration, participation agreement, etc.) of participating teams, actively engages with teams, and is the primary voice for all team correspondence.
Project Research Analyst	This role researches potential solutions, develops strawman solutions, identifies data and information resources, and helps the project administrator vet participants.
Internal Challenge SME	A person(s) who is an authority in a particular area or topic related to the competition. For purposes of the MITRE Eligibility Verification Challenge, the lead technical expert had a background in payment integrity and served as the program manager. Ideally there will be at least two domain experts in each critical competition area.
Internal Technical SME – Evaluation/Judging	A person with strong domain experience in establishing evaluation criteria, administering criteria, and weighing and scoring results. Participates in formal evaluations of the proposals—reviews submissions, ensures compliance with submission requirements, reviews responses against evaluation criteria, assigns weights to each category, and administers the evaluation/scoring process.
External Technical SME – Judging	Participates in formal evaluations of proposals—reviews submissions, ensures compliance with submission requirements, reviews responses against evaluation criteria, assigns weights to each category, and scores each submission. Optional role but suggested when partnering with outside organizations.
Technical SME – Other	Multiple SMEs may be needed intermittently throughout a challenge.

Role	Description
Partners	Federal agencies (or other organizations) that share similar issues and have an interest in the outcome of the challenge. Engage in various strategic roles in design and execution, such as shaping the challenge, sharing information about agency-specific issues, and acting as judges for the competition. Augment challenge efforts by conducting outreach/publicity.
Additional Resources to Consider	
Logistics	For live competition exercises, manages arrangements for site and ensures a smoothly run event without outside interference, distractions, or situational factors that give team(s) an unfair advantage or interfere with successful completion of the competition or recognition of the winner(s).
Portal Development Team	Responsible for either developing or outsourcing a platform for participants to register, submit participation agreements, and post responses to the challenge. Will require a mechanism for algorithm-based responses for data-intensive competitions.
Research Librarian	Conducts market research of the types of individuals and organizations likely to participate in the challenge.
Events Management	An events coordinator is recommended for challenges that result in hosting a formal presentation with participants and guests. An events coordinator is responsible for logistics including room setup, invitations, reservations, decorations, entertainment, catering arrangements, and marketing.

5. Challenge Framework

A challenge framework defined by Zaharee, Champney and Nanez (2017) (Figure 1) describes the elements of managing a challenge, such as resources, activities, outputs, and outcomes. Resources include human and financial resources required to support the challenge. Activities include all action steps necessary to produce program outputs, which are the products/services provided to the challenge stakeholders. Outcomes are changes or benefits resulting from the challenge. The checklists that follow focus on the activities section of the framework, where the most management time is spent. They offer key questions to consider when preparing, developing, conducting, awarding, and transitioning a challenge.



Figure 1 Challenge Framework

6. Checklists

The following checklists outline activities involved in planning, managing, and executing a challenge. The checklists are presented in five phases—Prepare, Develop, Conduct, Award, and Transition the challenge. Each provides steps, suggested resources, key questions, and guidance to successfully manage a challenge.

Table 3. Phase I – Prepare for the Challenge

Step	Resources	Key Questions	Guidance
a. Get to know challenges	PMO Team	What type of challenge does the organization want to run? What legal authority does the organization have to execute a challenge? Are there any regulations or governance supporting or preventing the organization from executing a challenge? Can non-US citizens participate? Are non-US citizens eligible for the challenge prize?	Do not reinvent the wheel. Instead, borrow templates and other artifacts from past challenges. Organization should have steadfast guidance on who will own the IP regardless of the type of challenge. Document team process/lessons learned as the challenge progresses to share with the next challenge team.

Step	Resources	Key Questions	Guidance
		Who will own the IP?	
b. Identify Goals & Outcomes	PMO Team Program Manager Project Leader	What is the purpose of the challenge? Why should the organization host the challenge? What is the desired outcome of the challenge? Why is this challenge important to our stakeholders? What are some possible solutions to the problem?	Challenge design can vary greatly depending on the primary outcomes an organization wants to advance, such as: research advancement, operational integration, external use, education/public outreach, state-of-the-art advancement, enabling a product to be brought to market, creation of new companies, etc. It is important to identify the goal and outcome early in the planning stage to avoid scope creep.
c. Define the Problem	PMO Team Program Manager Project Leader	What problem is your organization trying to solve? How will your organization define the problem statement? Who owns the problem? Who is impacted by the problem? Does the problem focus on the ultimate impact desired by the organization? Does the problem allow for a variety of solutions? Does the problem take into account context and constraints?	The problem statement should be very clear and concrete; get input from stakeholders; this drives the whole challenge. Meet with internal SMEs and internal/external stakeholders to refine problem statement and obtain stakeholder validation. There is no such thing as over socialization at this stage. If the problem is not well defined, the participants may not be able to provide applicable solutions.
d. Build Team	Program Manager Project Leader	What talent is needed internally? What talent is needed externally? What partnerships are needed internally? What partnerships are needed externally? What role will partners have? Should part of the management and infrastructure be outsourced to a third party?	Establish a PMO team consisting of comms., legal, risk, finance, oversight, etc. SMEs are needed throughout the process for various efforts. Identifying SMEs is an evolving process. They can be part time or full time, depending on the phase/step of the process. Decide if anything should be outsourced. Assess-third party options for managing contests. (Antons, et al)
e. Set Prize Level	PMO Team Program Manager Project Leader	What is the budget for the prize money? What type of funds can be used for prize money? How many prizes will be awarded? What are the success criteria for the participants? Will there be non-monetary incentives?	The prize should be commensurate with the level of effort required to accomplish the goal of the competition. Consider non-monetary incentives such as identifying excellence, influencing public perception, focusing communities on specific

Step	Resources	Key Questions	Guidance
		What aspects will be subjectively judged vs. objectively?	problems, mobilizing new talent, strengthening problem-solving communities, educating individuals, mobilizing capital (McKinsey & Company, 2009). Consider different prize types—exemplar, exposition, network, participation, market stimulation, point solution (McKinsey & Company, 2009). Maximize the objectivity of the judging. Subjective judging creates risks for the organization conducting the challenge.
f. Estimate Budget/Resources Needed	PMO – Finance Program Manager Project Leader	What budget and resources are needed to initiate and plan the challenge?	Funding should be set aside before challenge execution to flesh out the specifics and level of effort to plan and manage the challenge.
g. Create Project Plan and Set Milestones	Program Manager Project Leader	When is the challenge expected to begin and end? Are there any concerns for staging and timing of the challenge (i.e., holidays, company roll outs, mergers, etc.) How will the project be managed?	Identify the resources and activities required to run the challenge, the length of time needed, and major milestones. Create high-level project plan. Consider a dedicated project leader role for the team.
h. Make the Case	Program Manager Project Leader	What information do the PMO and project team need to inform stakeholders so they can approve the challenge, budget, and resources?	Develop messaging and presentations for stakeholders and partners.

Assuming a successful outcome of Phase I, in which stakeholders and partners have been briefed on the intent of the challenge and overall plan, the PMO and project team execute Phase II—Develop the Challenge (Table 4). In this phase, the project plan, resources, and key milestones are reassessed and updated.

Table 4. Phase II – Develop the Challenge

Step	Resources	Key Questions	Guidance
a. Design the Challenge	PMO team Program Manager Project Leader	What is the cost of managing the challenge? Should management of the challenge be outsourced to a third-party vendor or partner? What IP will need protection? What materials, training, or sample data are needed?	Set scope; determine target audience; determine participant rights; create submission template; create competition rules; and establish judging criteria, awards, and timeframe. Review initial project plan. Verify assumptions, timeframe, and cost—is the plan realistic?

	Various SMEs		Consider what outcomes the organization wants after award, such as change levers, awareness, societal benefit, follow-on contract with winner.
b. Set Rules of Play and Submission Requirements	PMO Legal Program Manager Project Leader Forward-Facing Comms	<p>What should be in a participation agreement?</p> <p>Should all participants submit a participation agreement?</p> <p>Who can participate? Are any groups ineligible?</p> <p>Does the solution require interaction between participants?</p> <p>How should the participant IP rights be protected?</p> <p>Can participants see each other's submissions?</p> <p>Can participants collaborate with each other for the solution?</p> <p>What information should be asked for in a submission template?</p> <p>How will the team communicate with participants?</p> <p>How will participants submit their solutions?</p> <p>Is a training dataset required to participate? If so, how will it be generated?</p> <p>Should any groups/participants be excluded from participating due to conflicts of interest?</p>	<p>It is imperative all participants have access to the same information at the same time. The perception of fairness is very important.</p> <p>Look for examples of submission/registration forms and participation agreements from previous challenges. Be aware that the forms vary depending on the type of challenge and outcomes.</p> <p>All marketing and sample documents and communications should be publicly released.</p>
c. Determine Evaluation and Judging Criteria	Internal Technical SME – Judging and Evaluation	<p>What are the contest rules for the award?</p> <p>What criteria will be used to select the winners?</p> <p>Will judges be internal and/or external?</p> <p>Will the submission acceptance review be automated (algorithm) or selected manually with rating scales?</p> <p>What will be the rating scales (subjective)?</p> <p>How will the rating scales be administered?</p> <p>What does a strawman submission look like?</p> <p>Will consensus among the judges in the ratings be required?</p>	<p>Collaborate with partners/agencies to determine what they consider important in a solution.</p> <p>Ask SME(s) to identify rating scale/scoring matrix.</p> <p>Ensure evaluation and judging criteria are reviewed by risk management and legal SMEs to ensure objectivity. The process should be transparent, well-communicated, and clearly explain how the evaluation will take place.</p> <p>An ideation challenge is subjective in nature and requires human judges to determine whether solutions answer the challenge.</p> <p>Use the strawman solution and rating scales to demonstrate how evaluations should be conducted.</p>

			<p>Leverage the government acquisition process as a best practice.</p> <p>Use both full AND consecutive days to familiarize judges with criteria and cadence.</p> <p>Allow extra time if consensus among judges is required.</p> <p>Limit criteria to 5-6 of the most critical topics to evaluate.</p> <p>Each submission should be separately evaluated based on the merit of each proposer.</p> <p>Consider weighting the evaluation criteria based on their importance.</p>
d. Develop Comms Plan	<p>PMO SME – Comms</p> <p>Forward-Facing Comms</p>	<p>What message does the organization want to convey about the challenge?</p> <p>Who are the target audiences for the various messages and what are the best communication channels for them?</p> <p>What is the timing for specific audiences? For example, reach out to university students before summer break.</p> <p>What does the organization want the audience to do as a result of the communications?</p> <p>How far in advance should the challenge be introduced to target audiences?</p> <p>How will outreach and publicity be managed?</p>	<p>Consider who the target audience is. Are university students the right audience, can they afford (time and money) to participate? Is the anticipated end solution something that is practical for an individual contributor, small business, etc.?</p> <p>All communications will need to be publicly released. Build in time for the approval process.</p>
e. Identify Participants	Project Team	<p>Who is the intended target audience?</p> <p>Who might participate in the competition?</p> <p>Who might directly or indirectly influence participants to get involved?</p> <p>Who should participate—what characteristics should they have?</p>	<p>If a third party is used, the vendor will have a database of potential solvers to target.</p> <p>Leverage LinkedIn/social media to identify potential parties.</p> <p>Recognize who the broader range of stakeholders could be (state, local, etc.) to help engage participants.</p> <p>Research potential organizational contacts.</p> <p>Contact your organization’s resource librarians for affinity or professional organizations to target.</p> <p>Implement a vetting process to confirm participants are not fictitious or bad actors.</p>

At this point of the challenge, the PMO and challenge project team should have completed all background work and preparation needed to launch the challenge. Phases I and II are

time consuming, and organizations should plan on several months to complete them. As the challenge emphasis shifts from Phase II to Phase III, there will be less oversight from the PMO challenge team, and the project team will manage the day-to-day operations.

Table 5. Phase III – Launch the Challenge

Step	Resources	Key Questions	Guidance
a. Implement Comms Plan	PMO SME – Comms Forward-Facing Comms	How will challenge be advertised? Where will the challenge be advertised? How will participants ask questions about the challenge? How will your organization respond to crises? What role will federal agencies/partners have as part of the communication roll out?	All interested parties should be informed about the challenge at the same time. Maintain a communication plan and update it as the challenge evolves. Keep the participating teams engaged during the challenge. Prepare announcements for partner agencies to disseminate. Create a centralized external collaboration space to share documents and FAQs with participants. Create a centralized collaboration space for the internal team’s artifacts.
b. Execute the Challenge	Project Team	How will “the unexpected” be handled? What are the risks (technical, reputational, timing, etc.) to the challenge?	Challenge is broadly announced, and information is provided to interested parties. Consider a series of webinars to explain the challenge and have federal agency/partner participation. Conduct webinars for initial launch and follow-on for engagement. Keep external collaboration site timely and up to date with FAQs and reference materials. Identify potential risks to the challenge and periodically check assumptions and mitigations. Create a process for handling/responding to issues. Be prepared to make quick decisions to adjust the challenge.
c. Solicit Participants and Encourage Submissions	Project Team	What mechanism will be in place to capture questions and provide responses to participants? How will participants be encouraged to register, submit a proposal, and participate in the challenge?	Attract and engage participants throughout the launch and review of submissions. It is important not to respond to inquiries individually; instead, place answers in FAQs to ensure that the playing field is level – i.e., everyone gets the same information at the same time.

d. Accept Sign-ups and Solutions	Project Team	How will registrations and solutions be reviewed? How will the organization distinguish between legitimate and bad actors?	Verify companies and individuals once they submit agreements. For challenges with government agencies, suggest verifying using SAM.gov in addition to the Health and Human Services Office of Inspector General’s List of Excluded Individuals and Entities (LEIE).
e. Manage Judging	Internal Technical SME – Evaluation/ Judging	Who are the judges? What training do the judges need to be successful?	Rating scale should be a Likert scale of 1-10 vs. 1-5. The more detailed scale is used to better differentiate the final winner. Train judges about the rating scale and the evaluation criteria. The judges should have training 1-2 weeks prior to review sessions so that the criteria are fresh in their minds. Create a strawman proposal and use it to train the judges.
f. Select Winners	Project team	How will the judges select, collaborate, and/or compromise on their selections?	Judges should submit ratings one day before the review meeting. The judging SME should compile and have a coding scheme for the ratings. Judges meet in person to review submissions and gain consensus on final ratings. In meeting, share all ratings and have judges discuss how/why they scored. Have a scribe at each session to document key consensus points for each criterion. This information will be used to communicate the winner(s). The participation agreement should state that the challenge team has full discretion on awarding prizes and does not have to justify selections.

Phase IV includes announcing and awarding the prize(s).

Table 6. Phase IV – Award the Prize

Step	Resources	Key Questions	Guidance
a. Announce Winners	PMO SME – Comms Project Team	What is the public relations plan to announce and celebrate the winners? Can the organization give an award to a non-US individual or team? How will participants be notified? Will a formal event be held announcing winners and	Consider how the announcement will be made. Consider what to communicate if not enough quality ideas were submitted. What will be emphasized?

		<p>personally giving them prize money? Who from the host organization should attend? What senior leadership involvement is needed?</p> <p>Will all participants be considered “finalists” and be asked to come to an event where the winner will be announced? Or will the winner be notified in advance and other teams invited?</p> <p>Who does the prize award get sent to, and how (mail or direct deposit)?</p>	<p>Consider what to communicate if the highest scored submission does not meet minimal criteria. Confirm budget.</p> <p>If monetary award, recommend team captain receives the check and distributes money to team members.</p> <p>If finalists are asked to present, meet with each one to tell them they are a finalist and give them instructions for their presentations. Conduct dry runs via phone. Be familiar with each submission to ensure key points are discussed.</p>
b. Provide Feedback	Project Team	How will feedback be provided to teams?	Consider offering conference calls with each finalist to discuss strengths and weaknesses of individual submissions.
c. Reward Winners	Project Team	What awards will be given?	Consider both monetary and non-monetary rewards. Consider a large award and several smaller awards.
d. Present Awards	PMO Team Project Team Corporate Events Manager	<p>Purpose</p> <p>How will the conclusion of the event be of maximum value to all potential stakeholders?</p> <p>What does your organization want to achieve by holding this event?</p> <p>How will success be measured?</p> <p>What is the available budget for the event?</p> <p>What will be presented to winners—plaque, money, large printed non-cashable check, etc.?</p> <p>Will the award be purchased or created internally?</p> <p>Event</p> <p>When will the event be held? Day or evening?</p> <p>Where will the event be held?</p> <p>Target Audience</p> <p>Who is the target audience?</p> <p>In addition to the winners, who should be invited?</p> <p>Will there be speakers, if so who?</p> <p>Who are the guests—internal and external?</p> <p>How many people will be attending?</p> <p>Will there be exhibitors? If so, what is the set-up plan? Are power and monitors needed?</p> <p>Will foreign nationals attend?</p>	<p>Consider having the event in a large venue and tied to a broad, important context to draw in the maximum audience. For example, MITRE’s Benefit Integrity Challenge aligned with the President’s Management Agenda (PMA) Cross-Agency Priority (CAP) Goal #9, <i>Making Payments Right</i>, as a full-day event covering multiple aspects of the CAP Goal, of which one was the Challenge.</p> <p>Consider an in-person event to present awards. Invite stakeholders.</p> <p>Hosting a large event with both internal and external guests takes time and resources to plan, manage, and execute. An events coordinator should be brought onto the team to manage this effort.</p> <p>The challenge itself is not likely to reach the desired outcome – next steps will be needed – make those part of the overall strategy.</p>

		<p>How many escorts are needed? Will escorts be team members and/or corporate security guards?</p> <p>Will winners' travel be reimbursed?</p> <p>Will non-winners be able to attend the award event?</p> <p>Communications What will be publicly announced and what communication channels will be used?</p> <p>Logistics What logistics are needed for the event—food, venue, tables, power, etc.?</p> <p>What will the invitation look like and how will it be sent?</p> <p>Will the event be catered? If so, internally or externally?</p> <p>What is the preferred room set up?</p> <p>What are the audio/video needs?</p> <p>Is a technical writer needed to help with scripts?</p> <p>Is a graphic designer needed for signage?</p> <p>Is photography needed?</p> <p>Do handouts need to be printed?</p> <p>What needs to be coordinated via public release?</p> <p>Registration—how will registration be handled? Is there a fee?</p> <p>What forms of identity/badges are needed for guests?</p> <p>Will outside press be attending?</p> <p>Follow up What will be the “next steps” after the event is over?</p>	
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At this point in the challenge the winner(s) have been selected, notified, and communicated. The emphasis shift from Phase IV to V, Transition, is to document the challenge, share lessons learned, and implement the engagement plan (if any).

Table 7. Phase V – Transition

Step	Resources	Key Questions	Guidance
a. Document the Challenge	Project Team	<p>What was the process framework?</p> <p>What processes are unique to the challenge?</p> <p>What information should be shared internally vs. externally?</p>	It is a best practice to document both the process(es) and results of the challenge. A process document should be available for internal use for future challenge project teams and PMOs to leverage. A document depicting the results of the challenge should

		What information should be shared with sponsors/partners?	be made available for sponsors and partners.
b. Manage Solutions	Project Team Partners	Is there a goal for engagement after the challenge is completed? How will the organization continue to engage with participants?	The project team should plan in advance for managing solutions. Encourage agencies, participants, and partners to continue to be engaged. Follow up short- and long-term with sponsors.
c. Engage Community	Project Team Partners	What role does the organization play in driving impact? What should the organization do to encourage social engagement?	
d. Share Best Practices	PMO Team Project Team	What was planned? What happened? What was the variation between planned and actual, and why? What did work? What did not?	Document best practices and lessons learned so they can be shared with future challenge project teams and PMOs.

7. Lessons Learned

The MITRE Challenge PMO has gained substantial experience managing four major challenges. We have reflected on our processes and recognize the following five key lessons learned in managing challenges.

1. Begin with the end goal of the challenge in mind

Start by asking how your organization will mature the invention generated by the challenge. Goldhammer, et al. (2014) identified that the various outcomes challenge organizers commonly seek fall along two dimensions: 1.) developing ideas, technologies, products, or services, or 2.) engaging people, organizations, and communities. For the first dimension, decide what your organization will do with the tangible outcome (i.e., a list of new ideas, a prototype, etc.). For the second, think about the role your organization will play after the challenge—community engagement, raising awareness, mobilizing action, inspiring transformation, etc.

One of the goals for MITRE’s Multicultural Name Matching challenge was to advance the state of the art in identity resolution. MITRE and our sponsors were interested in knowing who had the best set of identity attributes to evaluate either multi-attribute identity matching or identity resolution, as well as whether there were other areas in which data-driven evaluation could be combined with automated calculation of metrics to run similar challenges in other domains.

MITRE’s C-UAS challenge was dual purposed. As a technical challenge, we were looking for a working prototype to counter sUAS. Thus, we required a white paper followed by live-fly exercise to demonstrate capability. Equally as important was bringing the C-UAS community together with our sponsors. Our sponsors participated in the live-fly event and actively engaged with the participating teams, learned about their capabilities, and expanded their C-UAS network. Now that we have brought together a community, we want to continue to harness the C-UAS community’s energy to accelerate the pace toward

fieldable and environmentally appropriate solutions (The MITRE Corporation, 2017). The end of the challenge should not be the end of the innovation effort. When designing a challenge, organizations should think about engagement for follow-on efforts. As a lesson learned, we underestimated how successful this challenge would be. After award, multiple stakeholders wanted to continue working collaboratively with MITRE to extend this effort. We time-boxed the challenge and no longer had available resources so, unfortunately, we could not capitalize on these opportunities.

For the IoT challenge, we were looking to attract a range of innovative solutions from globally diverse participants while bringing together challenge participants and government agencies. We had a robust communication plan with a heavy social media presence and prize incentives (i.e., \$50,000 cash prize, public recognition of the winner) to attract teams. As a result, we received 369 requests for information, and 131 global teams participated. The winning team and two runner-up teams were invited to our facility to give a presentation and were introduced to interested sponsors.

Eligibility verification for many benefits programs has been a major hurdle for years, and agencies have not been fully successful in such verification. New approaches are required to strengthen eligibility verification so, in alignment with the PMA, the Strengthening Eligibility Verification for Federal Benefit Programs Challenge sought fresh ideas from a diverse group of stakeholders and contributors. An ideation challenge, in particular, is a great way to entice innovators to work in the government space and provide creative concepts. With that in mind, the overall goal of the challenge was to identify innovative, cost-effective concepts that government agencies can use to improve verification of eligibility for federal benefit programs. The challenge sought concepts that would help make the eligibility determination processes more rigorous and data driven, with due consideration for efficiency, user friendliness, and privacy.

2. Have a dedicated PMO governance team

Resources include governance, labor, funding, and time. Contest organizers should establish effective governance and leadership. The type of governance model established sets the tone for the cooperation and coordination among the team, while leadership establishes its vision and purpose (Wynn & Bradley, 2015). OI competition governance issues that may need to be addressed include ownership and decision rights, issue escalation, organizational structure, resource commitments, and termination rights and conditions (Marcello et al., 2015). Building a team with clear roles and responsibilities is critical to managing a successful OI contest.

The breadth and scope of the MITRE challenges produced a large network of stakeholders whose activities needed to be synchronized, reviewed, and communicated. A MITRE PMO was established under the corporate technology office to provide advice and oversight to the challenge teams. The PMO included subject matter expertise in managing challenges, legal, finance, risk, and enterprise communication.

While all domains were important, there were some clear best practices and lessons learned from our corporate communication staff. All four MITRE challenges benefited from working with both a web designer and a communications specialist. Having these team members work together to create a consistent look and feel for the challenge site and communication materials was effective in developing a “personality” for each challenge.

This included everything from a color scheme and communications for the challenge sites, to publicity materials and creation of “the MITRE Challenge Squad” persona. This persona served as the principal point of interaction between interested external parties and participating teams. All external communications were directed through a service email account that was monitored by all members of the project team, any of whom could respond under the persona. All of this served to create a cohesive experience, both for parties who were interested and for our challenges’ participants (Miller, et al., 2012). Communication lessons learned came principally in the form of timing—allowing ample time for development and release of communication materials, coordinating and synchronizing outreach to recruit participants from a given demographic, and reserving ample resources to accomplish follow-on and wrap-up communication activities necessary after the closing of each challenge. (Miller, et al., 2012).

Feedback from participants revealed that the challenges were well thought out, well communicated, and professionally managed.

3. Make risk management an ongoing conversation

Challenges, by nature, shift risk from prize sponsors to competitors by only paying for successful achievement of a defined goal (McKinsey & Company, 2009), but this is only one aspect of risk management. Once a challenge is launched, organizations must identify and mitigate execution risks. Risk management is identified as “the continuous process of assessing risks, reducing the potential that an adverse event will occur, and putting steps in place to deal with any event that does occur.” (Government Accountability Office, 2005). MITRE’s challenge PMO believes that a risk management component positively impacts how challenges are managed and improves the effectiveness and efficiency of how challenges are awarded. Risk should be considered early on and be an ongoing conversation. The focus should be on meeting the challenge objectives while executing the day-to-day activities. To get a common understanding, consider the following questions:

- What are the objectives?
- What will prevent us from meeting the objectives?
- What activities are next?
- What are we most concerned about?

4. Manage participating teams well

The IoT challenge generated many lessons learned regarding soliciting, communicating, and managing participating teams. The first is not to underestimate the number of participating teams. At the beginning we were concerned there would not be enough participants to conduct a successful competitive challenge. If the marketing plan works, be prepared to manage more teams than originally anticipated! Second, be prepared for teams to join after the launch date. Registrations continue after launch, so be prepared to execute multiple phases of the challenge simultaneously. Third, decide how to fairly communicate with teams. An important factor of a challenge is maintaining a level playing field. Think about how to communicate with teams to ensure fairness. Also, carefully consider how responses to questions will be returned. Timing, guarantee of delivery, and security are all considerations. Lastly, protect the mailing addresses of teams. When sending out mass

mailings, always use the BCC line. One mistake could be costly to your company's reputation.

5. Pay attention to legal considerations

"Involve someone from legal early – and keep them on the team" is a direct quote from the National Aeronautics and Space Administration's (NASA) case study on grand challenges (Glieberman, et. al., 2013). NASA recommends getting a dedicated legal expert involved early in the process as a partner to identify legal concerns up front and mitigate issues as they emerge. A core design question early in the process is to determine participants' rights. Marcello, et al., (2015) stated that it is imperative to define at an early stage how new, jointly created IP will be owned and legal rights maintained. McKinsey & Company (2009) identified the following questions to consider with your organizations legal department:

- What are the rules for existing IP and for IP developed during the competition?
- Are there legal issues to address such as agreements, confidentiality, indemnification, media rights, etc.?
- Will there be sponsors for the award, process, or competitions?

Lessons learned and best practices for the MITRE PMO legal staff were as follows:

- Before launching a challenge, an important consideration is the formality of the agreement—whether it will require contractual or trust-based agreements. We decided to have participants sign agreements. While this will likely limit the final number of teams that decide to participate, it is a good indicator to determine who is serious about participating.
- Consider leveraging a centralized server to disseminate information across participating teams. To participate in the IoT and Eligibility challenges, teams were asked to register via the MITRE Partnership Network (MPN). The portal account provided a secure mechanism to send and receive information with teams. The permissions in MPN ensured teams could not see each other's information while providing folder options to share information with all teams.
- It is important to build trust with the challenge participants. Some participants who considered submitting a proposal to the C-UAS challenge were concerned about IP protection. Our team approached this as a good-faith effort. We decided specific legal IP agreements were required and did not review submissions until all IP agreements were signed.
- In MITRE's first challenge—Multicultural Name Matching—we learned that information security cannot be overemphasized. Challenges that are widely publicized will draw some unintended activity. It is a difficult to balance between information security best practices and the desire to provide a good user experience with a low barrier to entry. While we wanted the widest possible pool of appropriate participants, we also needed to validate entries for legitimacy.

Future work

OI has become a popular strategy in both private and public sectors. As we capture and share our experience in managing challenges, we hope our sponsors and others can benefit

from our experience, this report, and designing their own challenges to harness public innovation to address specific problems, drive technical innovation, and accelerate learning.

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