

Casting a Wide Net for Innovation: Bringing Interdisciplinary Collaboration to Real World Problems

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ABSTRACT

Federal agencies are seeking new ways to innovate, procure and enhance enterprise capabilities. Competitions are one tool that federal agencies can use to drive innovation and solve mission-centric problems—whether technical, scientific, or creative. In this paper we present an examination of several approaches to foster open innovation through challenges and competitions in support of key business operations in the workforce. We highlight specific examples of their use in “real world” environments and provide an assessment of applicability, benefits and challenges for implementation in large organizations.

Keywords: Continuous Innovation, Challenge-Based Acquisition, ChBA, Competitions, Gamification

1. INTRODUCTION

In this presentation, we discuss the utility of bringing interdisciplinary collaboration to real world problems. Modern organizations are facing similar and diverse challenges every day [2]. They are coping by:

- Leaders setting sound strategic visions;
- Utilizing Infrastructures and test-beds for information sharing, experimentation & prototyping;
- Embracing interdisciplinary sources that are open to the communities (such as government agencies, academia, subject matter experts (SMEs) etc.)

The objective is to have a rich set of innovative interdisciplinary resources at our disposal to utilize in meeting the business and innovation goals of an organization.

This could result in diverse partnering and teaming arrangements and for creating new ways of thinking. Considering recent Government guidance for increased

use of challenges and prizes to develop new tools and approaches to improve open government [12], we examine several approaches to foster open innovation through challenges and competitions in support of key business operations in the workforce, and we highlight specific examples of their use in “real world” environments [9].

2. BACKGROUND

In past conferences, we discussed approaches to foster open innovation, including the use of crowds and social media to leverage and utilize interdisciplinary sources for continuous innovation [2, 3].

We defined the meaning of the term “Interdisciplinary”...within the context of education and training disciplines. Specifically in this context, the term Interdisciplinary involves researchers, students, engineers and teachers with the goal of connecting and integrating several academic schools of thought, professions, or technologies - along with their specific perspectives - in the pursuit of a common task [6, 7]. We highlight:

- The most common barriers to true innovation, as well as Technologies & trends that we believe, will fuel the spark of innovation in the near future.
- Several approaches to foster open innovation, including the use of crowds and social media for continuous innovation.
- The crowd-sourcing model and its potential value applied to commercial and government environments.
- The perils of “Group Think” associated with these approaches.

Additionally, we found that Interdisciplinary sources are available and leveraged every day, and they are becoming ubiquitous. New technological trends and approaches, when taken together, offer unprecedented access to

information, people and even group sentiment, offering new ways to collaborate, connect producers to consumers to investors, and ultimately to innovate. We also discovered that large enterprises that can adapt to using new approaches have a golden opportunity to foster new approaches for open and continuous innovation success by:

- Embracing culture change,
- Fostering business model change for new innovation,
- Adapting to new & enabling technologies,
- Creating tipping points in public opinion and social attitudes,
- Leveraging shifts in policy and regulation,
- Acknowledging the emergence of new business models, and the disruption resulting from unpredictable events

In order to optimize success, the goal for these organizations is to have a rich set of innovative interdisciplinary resources at their disposal to utilize in order to meet business objectives.

3. THE POWER OF THE CHALLENGE

Federal agencies are seeking new ways to innovate, procure and enhance enterprise capabilities. Casting a wider net to tap into interdisciplinary sources to encourage partnering and teaming to help bring talent and innovation to solving hard problems is one way to enhance innovation.

Traditional acquisition processes often require a deep understanding of requirements and a profound knowledge of the potential solutions that are available in the market place [11]. These traditional approaches used within the Government are very cumbersome. In fact, the Government Acquisition process was designed for large weapon systems development, not software systems. For example, a typical acquisition length is 5 – 10 years. Traditional methodologies such as this are considered to be “heavy weight” and can be characterized by:

- Up-front planning
- Formal documentation
- Linear phase approaches (requirements, design, test, integration, user delivery)
- Plan driven

As a result, these approaches typically have demonstrated a high rate of failure with respect to IT projects as they are often delivered late, over-budget, or do not satisfy requirements. As a result, organizations are investigating

the use of Agile software development acquisition processes. The key difference between agile development and a more traditional approach, is that agile is an incremental, iterative and collaborative approach, with no distinct stages of the development lifecycle.

As part of the agile initiative, competitions and challenges are one tool that federal agencies are using to drive innovation and solve mission-centric problems—whether technical, scientific, or creative. Challenges are everywhere. Some organizations have chosen to conduct Challenge-based Acquisition (ChBA) performed in a contest-like manner to encourage greater innovation and private sector participation.

At its core, the use of ChBA, allows the government to communicate its needs through challenges that are analogous or identical to a desired capability. Then, industry would respond to the challenges without extraneous constraints. In turn, these challenges can abstract away irrelevant concerns and can in many cases be substitutes for loose requirements. The basis for ChBA can be found in the application of game theory, or “gamification” [10]. Gamification is the use of game thinking and game mechanics in non-game contexts to engage users in solving problems.

4. EXTENDING INNOVATION IN THE WORKFORCE

An example of innovation in the workforce is highlighted by a Government project using challenges as part of seeking new ways to acquire capabilities.

The Tactical Assault Light Operator Suit (TALOS), is a vision to integrate science and technology capabilities into an integrated suit that better protects a warfighter and/or first responder. The intent is to accelerate the delivery of these innovative capabilities to the warfighter. Prior studies and analysis have determined a number of technical challenges exist that require improvements in equipment for future missions, such as 1) balancing the trade space between weight, protection, power, mobility, 2) cost, and 3) system component integration. A TALOS suit would comprise layers of smart material, sensors, communications radios and other capabilities for better enabling and protecting soldiers during combat situations [16].

In this example, the Government is seeking innovations from industry, academia, individuals, and Government Labs capable of providing the design, construction, and testing of TALOS related technologies. It is an interactive process designed to assess the viability of technologies

while simultaneously refining user requirements. They are using Google hangouts, monster garage “hackathons”, and technology workshops to motivate the entire community to team and work together throughout the innovation process. As solutions mature, the most viable options will be selected as the reference implementation for acquisition

There are several key characteristics associated with workforce innovation that are illustrated in this example. The first characteristic that stands out is motivation. There needs to be a good business reason or challenge to solve that motivates stakeholders. It is ok to have loose requirements or a vague idea at the start, allowing for requirements to emerge over time. However, once that need is determined, there needs to be commitment. Senior Leadership needs to embrace and own the problem and seek to provide resources and set the tone for innovation. In the TALOS example, the government leadership had the motivation of protecting warriors, and it became the commanders’ number one priority for innovation from the Science and Technology communities. The motivation was so strong that he approved the use of non-traditional acquisition approaches to solve the challenge.

Another characteristic is collaboration, which emphasizes open information sharing, transparency and ultimately the exchange of intellectual property (IP) across the stakeholders to the Government. For TALOS, the government opened the challenge to anyone who desired to participate, as long as they agreed to openly share with other participants and allowed the Government to control the IP involved. This motivated the use of open technologies and approaches.

Another characteristic is Teaming, with emphasis on Diverse Stakeholders Working Together, experts from interdisciplinary domains and skills, and often motivated to self-form teams combined of Industry and Academic participants. TALOS has well over 46 interdisciplinary teams competing in the challenge. The government utilized tele-presence and distributed collaboration environments like google hangouts to tap into experts.

Another key characteristic is having an open environment, setting the right tone and atmosphere to encourage innovation. TALOS encouraged innovation through having a Garage Demonstration Atmosphere, with an Informal Setting, and a Mindset of its “Ok to Fail in order to succeed.”

Finally, agile engineering methodologies are very important for such continuous innovation. Some key ways TALOS embraced agile are:

- Storyboarding and Concept Designing
- Early Prototypes
- Continuous Integration
- Evolving Technology Baseline
- Various Levels of Technical Maturity

There are many examples in literature of organizations using challenges and competitions [4]. In this section, we provide several examples based on our personal experience of using such methods in support of key business operations in the workforce, specifically in the Government or our own organization, MITRE.

Specifically, some additional areas where extending innovation in the workforce can be helpful include:

- **Innovation:** seeking to spark new ideas to hard problems.
- **Acquisition:** seeking new ways to acquire capability.
- **Capability Assessment and Evaluation:** Assessing user experience or functional utility and readiness of products and capabilities.
- **Hiring Qualified Employees:** seeking new approaches for finding and evaluating high quality candidates, conducting interviews and hiring to build corporate talent pipelines.

The first example highlights innovation in a Government initiative to support projects seeking to spark new ideas to hard problems. Challenge.gov is a government challenge framework administered by the US General Services Administration (GSA) and based on the commercial Challengepost.com technology [13, 14]. Challenge.gov is a collection of challenge and prize competitions, all of which are run by more than 50 agencies across federal government. These include technical, scientific, ideation, and creative competitions where the U.S. government seeks innovative solutions from the public, bringing the best ideas and talent together to solve mission-centric problems. It is designed for agencies to host crowdsourcing contests that solicit ideas and concepts from the public.

Our next example of innovation is the use of Federal Summits. The summit allows Government, Industry, and Academia to discuss solutions to challenges in a domain, allowing for an information exchange of thought leaders and domain experts. These collaboration sessions aim to document the best practices and recommendations for the given challenge area from a commercial perspective, and the results will also drive academic research and curriculum. Mobile and Cloud Computing are current examples.

The following example highlights a Government project using challenges and open innovation as part of seeking new ways to acquire capabilities. Specifically, a Government Intelligence Community Sponsor is using challenge events to acquire new capabilities as part of a source selection process. By using challenge events, vendors can show that they understand and can demonstrate the capability sought by the Government. Vendors are asked to prove the technical applicability and user functionality of their solutions to fill the Government need based on the outcome of the challenges. The overall challenge itself is typically compromised of one or more events that exercise various aspects of a solution, such as an Interfaces, Usability and Security. In this example, the Government plans to use an Interface Challenge to perform a Technical Assessment of the vendor's ability to successfully integrate their solution into a Government's virtual test environment, and demonstrate their technical ability to integrate and perform necessary functionality based on the criteria established by the government. The Government will then conduct a Usability Challenge focused on evaluating a User Assessment of a vendor's ability to demonstrate their solution in the Government's virtual test environment while proving operational capability through user driven scenario based execution. The intent of the Usability Challenge is to determine if the solution is functionally relevant, performs efficiently and is aesthetically appropriate from a user perspective based on predetermined user scenarios. The use of commercial cloud services and formal usability testing methods will be used to capture user experience. The results from all events will be used to evaluate and select the new capabilities to go on contract.

An example of supporting capability assessment and evaluation is the use of challenge events by a Government Sponsor to assess user experience or functional utility and readiness of products and capabilities. Robotics Challenges (e.g. DARPA, JIEDDO, MITRE Underwater Autonomous Systems) and warfighter workshops are examples [1, 5, 8].

Finally, as an example of supporting the hiring process, we highlight MITRE's Cyber Capture the Flag (CTF) competition, a corporate initiative aimed at adopting new approaches for seeking and evaluating high quality candidates, conducting interviews and hiring to build corporate talent pipelines [15]. Using gamification as a hands-on interview will enable potential employers, especially within MITRE, to quickly identify top talent in the field of cyber security, allowing the corporation to maintain its high standards for hiring. The CTF is an annual nationwide cyber competition for high school and college students, where teams compete to solve realistic cyber problems in order to gain ranking in the game.

Student performance is measured throughout the game and used as part of the evaluation process. Top teams and students win scholarships, training and intern job offers. The use of this system to hire talented, knowledgeable employees would greatly increase the Assured Computing core competency area of the organization.

5. RETROSPECTIVE

In this section, we briefly discuss our assessment of potential benefits and challenges associated with utilizing competitions and challenge events in the work environment.

The potential benefits of challenge-based initiatives in the workforce include:

- **Interdisciplinary Effects:** Creating something new by crossing boundaries, and collaborating across them.
- **Focus:** Encourages government understanding of sought capability.
- **Innovation:** Communicates need without constraining solutions.
- **Verification:** If you don't see it, you don't buy it.
- **Synergy:** Incentivizes Industry participation and engages the user community.
- **Fairness:** Levels the playing field; exposes capabilities not promises.
- **Competition:** Harnesses the energy of the challenge for procurement of solution or talent.

There are also several challenges to innovation, related to idea generation and solution development, sponsorships and funding, scalability, customer outreach, competition and timeliness. Understanding these patterns and challenges will help organizations to better prepare for considering new approaches to open innovation, and promoting a culture of awareness for creativity.

6. CONCLUSIONS

This paper presents an examination of several approaches to foster open innovation through challenges and competitions in support of key business operations in the workforce.

As we have discussed previously, Interdisciplinary sources are becoming ubiquitous. These technological trends and approaches, taken together, offer unprecedented access to information, people and even group sentiment, offering new ways to collaborate,

connect producers to consumers to investors, and ultimately to innovate.

In summary, there are several key points to consider related to the implementation of such approaches:

- Immediate access to Operator feedback could save countless engineering hours developing technically feasible but operationally invalid options
- Very quick turn visualization in near commercial products, foam, artist's drawings, 3-D graphics has been shown to accelerate communication and validation of ideas
- Open and diverse participation means no authoritative opinion – all considered
- While the rapid prototyping and collaboration events may not solve all problems, it gives the government first hand understanding of what is known and what is not known

We have seen our customers take the plunge into challenge-based procurement. In some cases such as TALOS, it makes a lot of sense since the general concept of the procurement is so complex and the solution space is widespread. Other customers have found ChBA processes to be more complex than expected. We have found that there is no “best approach” to ChBA. Ultimately, the correct course of action will be dictated by the program/project in question. It becomes an assessment of the tolerance to technical scrutiny that will have to be weighed against the need for innovative solutions.

7. REFERENCES

[15]1] MITRE Strategy for Challenge-Based Acquisition in the Government, The MITRE Corporation, <http://www.mitre.org/capabilities/acquisition-effectiveness/acquisition-initiatives/challenge-based-acquisition>.

[2] Cherinka, R. and J. Prezzama, *Emerging Trends, Technologies and Approaches Impacting Innovation*, International Multiconference on Engineering and Technology Innovation, IMETI 2013.

[3] Cherinka, P. Wahnish, J. Prezzama, *Fostering Partnerships between Industry and Academia to Promote STEM at the Secondary Educational Level*, EEET Plenary Presentation, July 2012.

[4] Cohen, L., *To the Point: Leverage the Power of the Collective Without Getting Lost in the Crowd*, Gartner Symposium/ITxpo presentation, 21-25 October 2012.

[5] Defense Advance Research Projects Agency (DARPA), www.darpa.mil.

[6] Griliopoulos, D., *The Madness of Crowdfunding*, Maximum PC Magazine, pp 45-51, March 2013.

[7] Howe, Jeff, Crowdsourcing, Why the Power of the Crowd is driving the Future, <http://www.crowdsourcing.com/>.

[8] JIEDDO Robotics Rodeo Challenge, 2012, http://www.army.mil/article/83762/Robotics_Rodeo_highlights_advances_in_life_saving_technologies/.

[9] Kickstarter Online Funding Platform, www.kickstarter.com

[10] Sloane, P., *A Guide to Open Innovation and Crowdsourcing: Advice from Leading Experts*, Kogan Page Publishing, 2012

[11] Weatherly, Richard PhD and Wydler, Virginia, Challenge Challenge -Based Acquisition: Stimulating Innovative Solutions Faster and Cheaper By Asking the Right Questions, 13 August 2012

[12] Zients, Jeffrey D., Deputy Director for Management (OMB), *Guidance on the Use of Challenges and Prizes to Promote Open Government*, 8 March 2010.

[13] US Government Challenge.gov online competition website for challenge and prize competitions, www.challenge.gov.

[14] Commercial challengepost.com online competition website for challenge and prize competitions, www.challengepost.com.

[15] MITRE Capture the Flag Competition (CTF), The MITRE Cyber Academy Website, The MITRE Corporation, 2014, www.mitre.cyberacademy.org.

[16] TALOS - Tactical Assault Light Operator Suit - July 2013 Demonstration Recap, <http://www.youtube.com/watch?v=ePI9TC2ySUY>.

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