INSPIRE: Expanding Open Innovation Methods to Complex Engineered Systems

[1]Department of Engineering and Systems Engineering
zszajnfa@gwu.edu; avrolijk@gwu.edu
http://www.seas.gwu.edu/~zszajnfa

PI: Zoe Szajnfarber[1], co-PI: Hila Lifshitz-Assaf[2] and GRA: Ademir Vrolijk[1]

[2]h@nyu.edu

POP:08/01/2015-7/30/201; NSF Grant #: CMMI-1535539

Motivation

- High level policy language directs Federal Agencies to increase their use of prize competitions (and "open" more broadly)

The logic: In a world of widely dispensed knowledge, prizes and challenges are an essential tool for every agency's toolkit. As the co-founder of Sun Microsystems Bill Joy once famously said, "No matter who you are, most of the smartest people work for someone else." This fact calls for a fundamental shift in the way an institution solves problems. Prizes and challenges are part of the solution. (challenge.gov)

- While open innovation methods have proven extremely valuable in SOME areas:

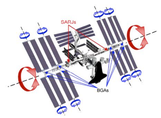
X-prize   Longitude prize

- Existing tools can not work for every problem and current plans extend beyond the scope of existing experience; particularly with respect to complex engineered systems

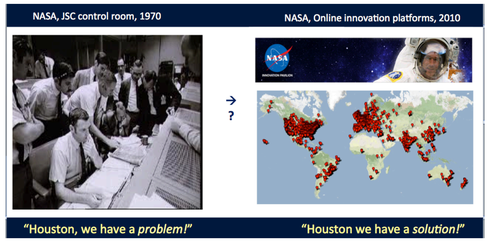
Objective: Generate knowledge about how open innovation methods can be made applicable to complex systems through appropriate upfront decomposition

Research Questions

1. **Solution quality: How does the extent of problem decomposition effect a) the ability for external solvers to contribute and b) the quality of solutions received?**

From picking a prizeable problem   To picking the prizeable parts of any problem

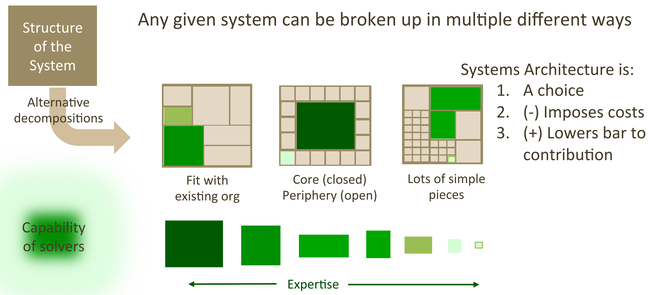
2. **Capturing the solution's value: How can organizations overcome adoption challenges for open innovation methods?**

From "problem solver" 

To "solution seeker"

Decomposition Can Expand Open

In general: higher level of decomposition increases scope for external contributions. Governed by complex interaction among costs of decomposing and aggregate benefit through prizes.



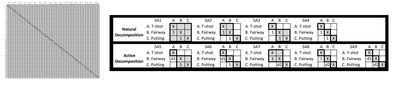
Illustrate scope of potential benefits with toy model: Golf Tournament

System Description:

x18

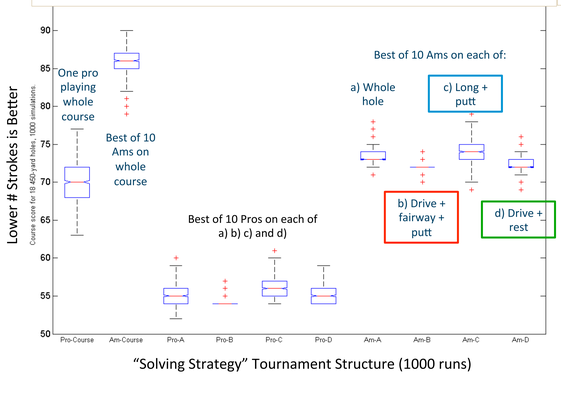
Simplifying assumptions:
1-D course, no sand traps, three stroke types, all holes are the same.

Architecture alternatives include: Whole tournament, independent holes, best ball etc.

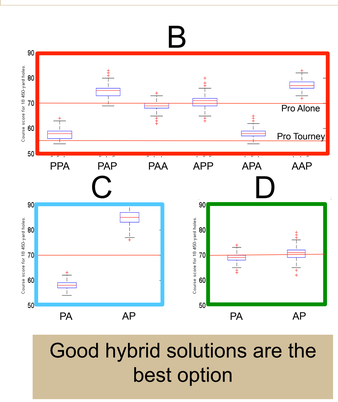


Performance model: gradient in skill differential between pros and amateurs on different parts of the game.

All closed (pro) vs. Variants of Open



Hybrid options



Good hybrid solutions are the best option

Adoption Barriers

Open challenges the way new knowledge is created

	Standard R&D Process	Open Innovation Process
Boundaries of the knowledge creation process	Clearly predefined & Selectively permeable	Undefined & Constantly permeable
Illustration:		
Participants	Experts (from within and outside the organizations)	Anyone (anyone can join and leave any time, participants can remain anonymous)
Spatial dimension	Geographically concentrated	Widely geographically spread, unbounded, virtual
Temporal dimension	Long [3-5 years]	Short [3-6 Months]
Nature of process	Organizational process, negotiations based	Distributed virtual process
Level of hierarchy	Very hierarchical	Hardly any hierarchy, self- selection based
Level of control	High Control on the knowledge produced	Low control on the knowledge produced
Resources	Heavy resources	Relatively light resources
Legal Relationships	Contractual relationships and Clear Intellectual Property regime	Minimal online consent contracts and Unclear Intellectual Property regime

"Oh, this is a whole different way of doing business"

Challenging knowledge boundaries, in turn, challenged the professional identity

*"People come here to **innovate**… so it becomes quite **a slap in the face** when we see opportunities to use yet2.com and innocentive… it's extremely frustrating. The feeling of people… is now **"What value am** I?"*

….

*"I've been attracted to places that allow you to access a problem, come up with a plan, and execute the solution… **To be able to think and solve greater problems, if I can't do it at NASA, what is keeping me from going somewhere else**?"*

Clear hero figure: the "problem solver"

vs.

Unclear hero: the web?

Ongoing Work

- Running open innovation field experiment: challenging multiple combinations of subproblems for a system that is also under development at NASA.
  - First data set linking attributes of subproblem to capability and willingness to contribute.
  - Empirical validation for model under development.
- Elaborating toy model to be more representative of a physically complex system.
  - Need to add link to incentive size.
  - Developing theory on now to combine different levels of expertise to solve complex engineering problems
- Continuing to analyze qualitative field data. exploring the different cross boundary problem reformulation processes and their impact on successful distributed problem solving.