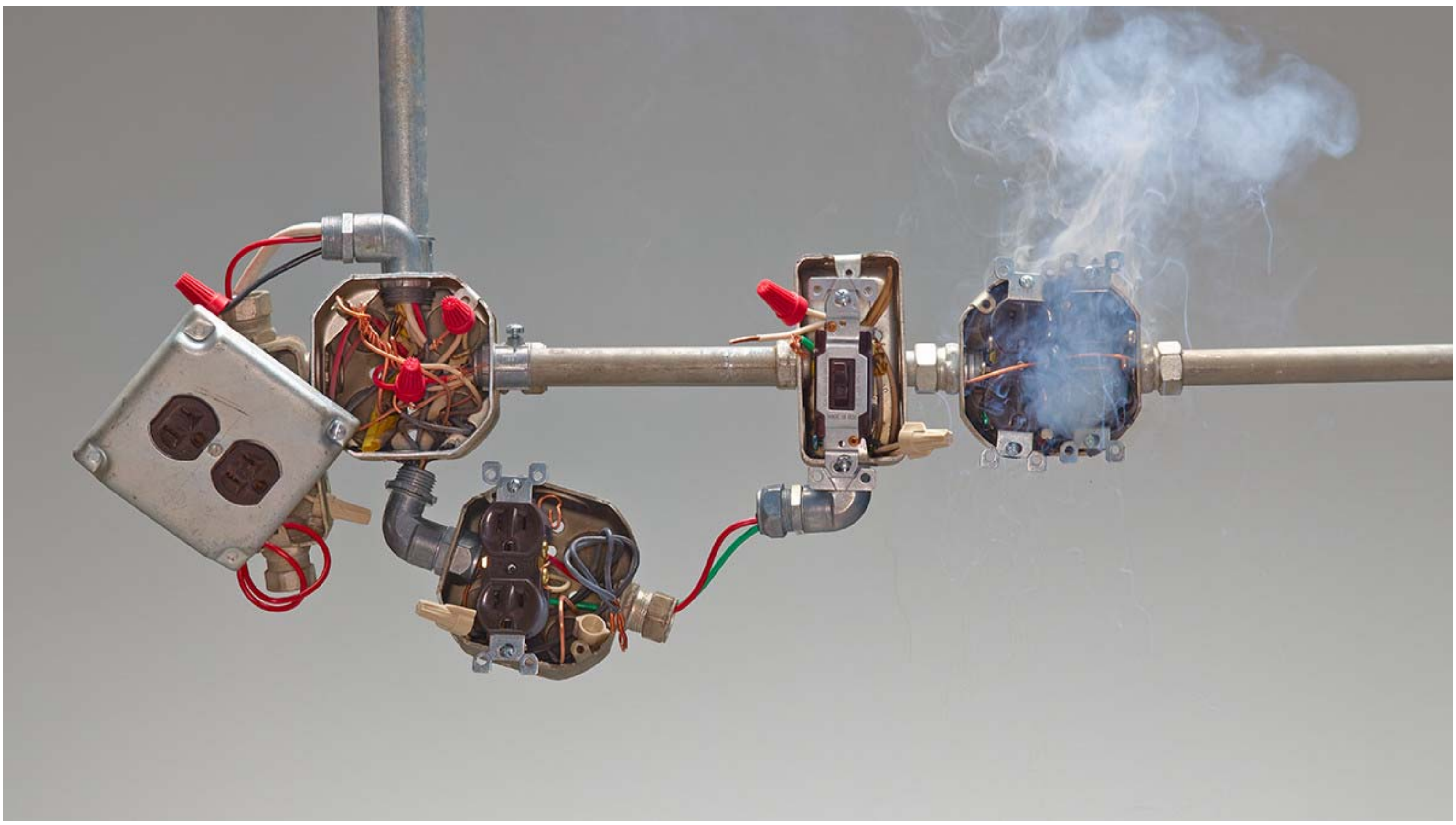
Harvard Business Review

RESEARCH & DEVELOPMENT

A Study of NASA Scientists Shows How to Overcome Barriers to Open Innovation

by Hila Lifshitz-Assaf, Michael L. Tushman, and Karim R. Lakhani

MAY 29, 2018



DON FARRALL/GETTY IMAGES

Open innovation processes promise to enhance creative output, yet we have heard little about successful launches of new technologies, products, or services arising from these approaches.

Certainly, crowdsourcing platforms (among other open innovation methods) have yielded striking solutions to hard scientific and technological problems—prominent examples being the Netflix predictive recommendation algorithm and the approach to reducing the weight of GE jet engine brackets. But most R&D organizations are still struggling to reap the very real rewards of open innovation. We believe we've hit on an important hidden factor for this failure and that it holds the key to a successful integration and execution of open innovation methods.

We conducted an in-depth, three-year study at NASA's Space Life Sciences Directorate to closely track the opportunities and challenges involved with open innovation in an incumbent R&D organization over time. Over the course of one year, we observed as NASA took a two-track approach to solving 14 strategic problems: The organization used both the traditional collaborative R&D model led by its own experts, and also open online innovation platforms led by crowds of non-domain experts.

The second approach led to relatively speedy solutions to three of the challenges and was particularly successful in the challenge of predicting dangerous solar storms, where it produced a breakthrough within a mere three months. But bringing the open-source solutions to life proved more challenging. Some of the directorate's scientists and engineers resisted the new approaches, citing process, budget, and procedural issues. The managers were able to solve those challenges, yet the tensions remained.

It took us months to realize what was going on here: The most resistant scientists and engineers saw open source methods as a fundamental challenge to their professional identities. They defined themselves as "problem solvers," but open innovation crowdsourcing platforms didn't let them play that role; instead, they had to frame problems for someone else to solve. "I've always been attracted to places that allow you to be able to think and solve greater problems," one scientist told us, "If I can't do it at NASA, what is keeping me from going somewhere else?"

By contrast, there were other scientists and engineers who perceived the open methods as an opportunity to enhance their role and capabilities. As some engineers described it, this transition was a shift from thinking "the lab is my world" to "the world is my lab." They argued for the need to let go of the "how" of their work and refocus on the bigger "why." They called on their colleagues to shift their professional identities from "problem solvers" to "solution seekers."

These identity dynamics are often hidden from managers and difficult for them to shape. We therefore remained at NASA for two more years in order to understand how managers can influence the way innovation professionals perceive their role and integrate open innovation methods. We saw that it is vital to refocus engineers and scientists on the higher purpose of their work—at NASA, this meant focusing on the bigger mission of getting to Mars—and reframing the open innovation method as a tool that enables R&D professionals to achieve their mission faster. As one scientist put it, "At the end of the day, it's about the *big* agenda versus the personal one. Science is about finding the truth!"

More practically, our research showed us that managers should encourage and reward solution seeking. In every successful R&D organization there are hero stories about problem solvers; these need to evolve to celebrate the innovators who find solutions in creative ways. These are the innovators who should get the spotlight and the resources. And rather than incentivizing only patents or publication, offer financial recognition to those who embrace the solution-seeking mindset.

It is important to communicate that innovation is not only about having an innovative technology or science; it is also about innovating the actual process of innovating. As Einstein famously said, "We cannot solve our problems with the same thinking we used when we created them." There is no one process that fits all scientific and technological problems. The more experimentally R&D professionals think and behave, the easier it will be for them to adopt fundamental changes in the way they do their work.

Hila Lifshitz-Assaf is an Assistant Professor of Information, Operations, and Management at New York University's Stern School of Business. She is also a faculty associate at the Berkman Center for Internet and Society at Harvard University.

Michael L. Tushman is the Paul R. Lawrence MBA Class of 1942 Professor of Business Administration at Harvard Business School and director of Change Logic, a Boston-based consulting firm specializing in innovation, leadership, and change. He is the co-author, with Charles O'Reilly, of of Lead and Disrupt, (Stanford University Press, 2016). You can follow him on Twitter at @MichaelTushman.

Karim R. Lakhani is the Charles Edward Wilson Professor of Business Administration and the Dorothy and Michael Hintze Fellow at Harvard Business School. He is also the founding director of the Harvard Innovation Science Laboratory.

This article is about RESEARCH & DEVELOPMENT

(+) **FOLLOW** THIS TOPIC

Related Topics: MOTIVATING PEOPLE | DEVELOPING EMPLOYEES | COACHING | SOCIAL PLATFORMS

Comments

Leave a Comment

POST

3 COMMENTS

Gary Riccio 5 months ago

The work of the authors and Dr. Jeff Davis (NASA-JSC) stimulated important discussions in the components of NASA that are addressing human exploration of space. If nothing else, it was an informative perturbation that revealed subtleties in the organizational impedance to change at NASA. As Herminia Ibarra would remind us, identity at work is both an impediment to change and a proper focus for change.

It should be noted that a significant percentage of the human health and performance research in this component of NASA is extramural, conducted largely within the halls of academe. This context ostensibly is required to ensure that taxpayers are funding people and ideas vetted by established systems of peer review. The intramural research inside NASA is judged by the same criteria and cultural values. The incentives of *individual* recognition (e.g., patents or publication) borrowed from this context outside the government have a powerful influence on the spirit of the place in government laboratories. The problem is that government scientists should be incentivized primarily to pursue use-inspired research (what Stokes referred to as "Pasteur's Quadrant") that necessitates different kinds of incentives.

Anyone who works in a use-inspired research environment sooner or later discovers the difficult truth that, unlike in academe (a) one *must* continue to adapt and extend one's expertise often across disciplinary boundaries to address the highest priorities of their government unit at the time; and (b) one *must* self-organize with others one may not have worked with in the past and who's perspectives on science may be frustratingly unfamiliar. It is a kind of self-sacrifice and agility that is at once painful and rewarding. Yet, if incentives are adopted wholesale from a community with different needs (e.g., academe), it is unlikely that the right kind of research will be conducted. This is a difficult balance for leaders at NASA who must ensure both quality and relevance.

The intellectual agility and collective intelligence that use-inspired research requires is another lens through which to view open innovation. On this view, the relevant identity is neither that of a "problem solver" nor a "solution seeker" although it contains elements of both. We need scientists who believe they are needed to help determine what questions we should be asking. The connections with business innovation could not be more direct. Stakeholder disintermediation and continual interaction with them must come first. Unprecedented stakeholder needs will be as vague and ambiguous as the scientist's a priori assumptions about them, and there will be multiple stakeholders whose needs and interests are not completely aligned. Problem definition is job #1 for a use-inspired scientist, and it is as challenging as any given problem within their prior subject matter expertise.

Open science is a potential engine of innovation that can be as useful for identifying problems as for identifying solutions, perhaps more so. In the former, one is looking for a conversation in which there is an opposition of ideas and the opportunity for crystallization of different perspectives rather than looking for someone who can provide a solution. NASA needs something more like scientific dialectic than commoditized buying of science and technology from a wider range of sources. The purpose of openness should be to seek minds outside one's own organization with whom one can plausibly engage in what Susan Scott has referred to, in a business context, as fierce conversations over time.

In science, fierce conversations occur in dialectic that requires a commitment to relationships, ones that may be uncomfortable if not existentially threatening to a hard-earned identity. This requirement implies that open innovation cannot be like fishing. It must be selective. The follow-through is as important as the seeking. One must be ready to develop intellectually with a diversity of others and work arduously with them in a kind of developmental collective intelligence, something that by definition one could never achieve alone. The result always is a new set of questions and new ways of looking at the old questions. We "selectively forget that past," as Vijay Govindarajan would put it, and we often do so in an evolutionary process, as Martin Reeves would suggest, in which certain aspects of the past just become irrelevant to a new environment for the organization.

These are some of the directions where NASA's journey from open innovation can lead. NASA is sure to lead many government agencies in this vision of science. It need not forget the peer review that ensures quality as in academe, but it needs its own model, its own culture, and its own incentives if humans are to venture into deep space and do something productive there.

REPLY 2 0

JOIN THE CONVERSATION