had already been known by other scientists. The criteria for measuring success should either be collected only at the conclusion of the program to see if the projects fulfilled their "long-term strategic plans" that the GRPA makes them set and get rid of the annual reports that force scientists to edit their work for the short-term, or we need a criteria that can measure the impact that the results of a research program have had on other scientific endeavors. I think you scientists mentioned a "network analysis" with "nodes" as a way to measure this?? Maybe we then start to look at all of the scientific communities interactions as a system and say that the further discoveries made by the new research programs that were inspired by the original research programs should also count towards the original program's level of success? I am at a loss as to how we could derive simple metrics of success from this system, though. The criteria would have to be more than the quantitative amount of other research programs it inspired because it would have to also measure the quality of the research for the potential benefits it has to humanity… All in all, I've confused myself.

Scientific research could be considered successful if it

- challenges assumptions and offers new knowledge
- interrogates what is known with novel questioning
- offers new perspectives onto what is known

Overall, I think GPRA can be good if we change the metrics by which we evaluate "performance" and "results". Something closer to the criteria used above would work even in the single year timelines established by GPRA since success isn't zero-sum but rather based on overall progress towards the above goals. As implemented, I think GPRA is bad because it tries to implement a sort of business-minded approach to organizations that might fundamentally be inoperable as businesses.

- Did the research lead to new knowledge (either negative or positive results)?
- Did the research lead to other questions? If so, do these questions expand the field in their topic (or are these new questions only limited to this specific research question)?
- Are the research procedures used sound, ethical, and safe? Do the procedures make for efficient use of the resources provided?
- If publicly funded: Does this research or the outcome of this research serve in the interest of the public good? Is the program able to effectively communicate their research/results to the public at large?
- Is the program managed is such a way as to promote cooperation, well-being, and free inquiry among its researchers? Are decisions made at all levels in a manner that addresses researchers' concerns quickly and without fear of reprisal?

The positive side of the Bayh-Dole Act might be that it incentivizes more people to get involved in federal research which benefits American society. This would have changed the way that universities thought about federally funded research from something that they wouldn't get much out of to something that could have direct benefits for the university, researchers, and for sustaining the continuation of their work with the royalties made. An unintended consequence of this is that universities might now forever equate science with technology, and only be motivated to pursue research into things which could hold commercial value for them. Now that science can be profitable, there is not as much incentive to value expanding scientific knowledge for its own sake.

I think that the intentions were good, i.e. trying to give some sort of economic benefits to universities, but there are also some possible drawbacks. Over time, it might cause universities to prioritize supporting research projects and hiring staff that would work on patent-able results from research. Additionally, a large but subtle problem may be that universities would get more competitive and private about their projects if they know another group is working on a similar project they intend to patent. This doesn't follow the spirit of science, which should be more collaborative, or at least competitive in a more friendly and productive way.

I think that Bayh-Dole probably got a lot more universities interested in profitable research, and probably began favoring funding STEM research over other disciplines, but I do not have data to support that. If I were a university administrator when Bayh-Dole went through, I would have changed my hiring criteria to emphasize research, with extra points to anyone who could whip up some neat gizmos.

As I understand, prior to the Bayh-Dole Act, the government automatically retained rights to federally-funded innovations unless the federal contractor or inventor could show that retaining ownership was in the interest of the public and only some agencies allowed for retaining ownership via simple notice. After the act, Universities were able to retain ownership of innovation rights with simple paperwork from *all* federal agencies and were thus incentivized to maximize the number of patents it could bring to market. Overall, I think the act was a horrible solution to a real problem with federal policy. Instead, the Bayh-Dole Act should have aimed to implement a uniform, efficient method of tech transfer.

But, as far as obstacles for scientists becoming advocates, I can think of a few. I agree with the article that any scientist that takes an off-normal stance on a political issue, and I would also add science issues, runs the risk of losing credibility among scientists if they go public with it. I would guess that this results from most of the other scientists having the same fears, so they create a sort of self-fulfilling prophecy of punishment for advocacy.

According to the article, the primary obstacle seems to be the perception from other scientists. I think this primarily stems from a lack of understanding/concern by scientists (broadly) as to the role of science in the public. If science has no role in the public or vice-versa (as some scientists might believe), then *any* foray by one field into the other is seen as just that, a generally harmful incursion. If we believe science has a role in the public (or that the public interest should inform science), then we must conclude that scientists (as the creators, maintainers, and distributors of scientific knowledge) should not only be encouraged but are morally obligated to contribute toward relevant public discourse.

Scientists are obsessed with deliberate thought and truth and to advocate for anything is to take action from opinion. To be vocal as an individual in society is perhaps against the doctrine of science. A scientist, we imagine, is an individual insofar as they inhibit their subjective inclinations. They drive towards objective fact, as difficult a process as that can be, and mediate the limitations of human ignorance. Advocates are vocal and their business is built from jargon. They are clever with ignorance. They two are occupations opposite of the other.

A career of a scientist is built by his or her credibility and to take the chance on one's opinion, or to be judged as doing so, is a risk a scientist may find unreasonable. This is problematic since scientists have the tools and resources for some of the better opinions. Fellow scientists it seems inhibit each other from science. An image of scientists fearful of expressing their opinions reminds me of dystopian fiction. It is ironic that those with the most knowledge are inhibited to share its wisdom for the sake of their own career and credibility.