Innovating for Success: Enhancing Science Commercialization through Experimentation

Essay

This essay explores how policy experimentation can enhance the effectiveness of science commercialization efforts. Despite growing initiatives to bridge research and industry, many promising innovations fail to reach the market due to cultural, structural, and resource-related barriers. Experimentation — particularly through randomized trials — offers a powerful yet underused tool to test, refine, and scale interventions at different stages of commercialization support. Drawing on the Innovation Growth Lab's work, including the University–Industry Impact Accelerator, the essay illustrates how experiments can improve programme design, validate assumptions, optimise outreach, and measure impact. And while implementing experiments can present challenges, such as limited sample sizes or data constraints, these are often manageable with thoughtful planning. Research institutions, funders, and policy actors ought to embrace experimentation as an iterative learning process that reduces risk, improves outcomes, and builds a stronger evidence base for innovation policy.

May 2025

Authors:
Sara García Arteagoitia, Rob Fuller

The journey from scientific discovery to commercial success is fraught with uncertainty. Despite numerous scientific breakthroughs, translating these innovations into marketable products and services often encounters significant obstacles. Efforts to promote commercialization and foster university–business collaboration have grown, yet these initiatives frequently face challenges such as misaligned goals, cultural differences, and limited resources. Navigating the complex landscape of intellectual property, funding, and regulatory requirements further complicates the path from lab to market. As a result, many promising scientific discoveries struggle to achieve their full commercial potential.

However, our understanding of the factors driving successful commercialization is limited. In recent years, scholars in the innovation field have made significant efforts to improve our understanding of the challenges and enablers of science commercialization, typically using qualitative case studies or observational data (Battaglia et al., 2021; Fini et al., 2020; Organisation for Economic Cooperation and Development, 2019). Despite these efforts, our understanding of the effectiveness of the different types of tech transfer activities undertaken by research institutions is still limited.

"Our understanding of the effectiveness of the different types of tech transfer activities undertaken by research institutions is still limited."

The NEXT project sought to change this, by promoting the use of policy experiments to test approaches to overcoming the challenges in science commercialization. In the course of this project, the Innovation Growth Lab (IGL) – working together with researchers from the Barcelona School of Economics, Nesta and Esade – developed a handbook that explores the challenges in this area and sets out proposals for experiments that could address them. Concurrently, IGL set up the University-Industry Impact Accelerator, in which three project teams working to advance science commercialization at different organizations received training on experimentation and were guided through the process of designing experiments to address particular challenges they were facing.

In this chapter, we introduce the concept of experimentation and explore its application in advancing science commercialization. The first section describes experimentation and highlights its value as a policy tool. The second section discusses how experimentation can provide insights at various stages of commercialization support interventions, from programme design to implementation. The third section addresses common barriers to running policy experiments and offers strategies for overcoming these challenges.

"Experimentation can provide insights at various stages of commercialization support interventions, from programme design to implementation."

The Power of Experimentation

We take 'experimentation' to mean using a structured approach to learning from the implementation of a policy or programme. This involves setting out specific questions that stakeholders wish to examine and putting in place systems that will generate evidence addressing those questions.

Taking an experimental approach to programme development means testing programmes initially at a small scale, ensuring that processes are put in place to learn from the implementation, and using the insights generated to improve the design or implementation as the initiative is scaled up. New programmes or policy initiatives often fail to have the expected impact because of relatively minor design or implementation problems that are only encountered when the initiative is launched. Taking a gradual, iterative approach instead ensures that these mistakes are made and lessons are learned while piloting at a small scale when only low levels of resources have been committed. Once any initial implementation difficulties have been ironed out and the intervention is being delivered as expected, a more formal evaluation method can be used to investigate whether the intervention is having the desired impacts or to optimize those impacts to improve its effectiveness over time. Using an approach like this enables organizations to reduce the risk of delivery failure and failure to achieve the expected results – implying significant savings in time and resources that would otherwise be devoted to an impactful programme.

"Taking an experimental approach to programme development means testing programmes initially at a small scale, ensuring that processes are put in place to learn from the implementation, and using the insights generated to improve the design or implementation as the initiative is scaled up."

The experimental ideal, however, is to randomly assign units – whether individual people, businesses, research groups, or other entities involved in the programme – to different forms of the intervention, or sometimes to a control group that does not receive an intervention at all. Random assignment makes it unlikely that there are any systematic differences between the groups and ensures that those assigned to various forms of intervention are similar on average, both in terms of obvious, observable characteristics (such as gender, age, and qualifications) and more subtle, unobservable traits (such as motivations, experience of entrepreneurship, attitudes to risk, and so on). This implies that, as long as the sample size is sufficiently large, any differences in outcomes between the groups can be confidently attributed to the interventions being tested.

Given that the experimental method is fundamental to progress in many areas of science, it is perhaps surprising that randomized experiments have only occasionally been

applied to science commercialization. Experiments have been carried out to investigate how to increase researchers' engagement in commercialization efforts (Sormani et al., 2022) or whether innovation vouchers can promote collaborations between businesses and external knowledge providers (Bakhshi et al., 2015; Balabay et al., 2019; Cornet et al., 2006; Kleine et al., 2020). However, given the rapid growth in recent years of the use of randomized experiments in other areas of innovation policy and public policy more generally (OpenAlex, n.d.), there is clearly much potential for randomized experiments to improve the effectiveness of interventions at the university–business interface.

"Given that the experimental method is fundamental to progress in many areas of science, it is perhaps surprising that randomized experiments have only occasionally been applied to science commercialization."

Pathways to Experimentation

There are several points at which a programme or initiative aimed at supporting science commercialization may benefit from incorporating experimentation into its development.

An experimental approach can be used to explore the assumptions on which a programme is based. For example, successful implementation of a programme may rely critically on assumptions about the willingness of the target group – whether researchers, businesses, or others – to take part and might need to be validated before rolling out a large intervention. An illustration of this comes from one of the projects developed in the University–Industry Impact Accelerator, which involved providing training to academic researchers on knowledge exchange. In the course of a pilot that involved offering the training at three universities, the number of researchers who signed up for the training was lower than had been expected. This led the project team to refocus their efforts on how to encourage fellow researchers to participate in the training before running a randomized experiment to test its impact.

Experimentation may also be used to test the mechanisms through which an intervention is expected to take effect. For example, it can be used to probe the motivation of potential participants and test how to induce a bigger response from them. Such randomized experiments will often involve comparing alternative forms of messaging for outreach efforts – for example, testing whether researchers are more likely to respond to messages that emphasize the potential benefits to their own careers or to wider societal benefits when encouraging them to sign up for a programme to engage with businesses (akin to Ganguli, 2021).

Alternatively, organizations may have already developed a programme and wish to test whether it is leading to the intended results. The most straightforward approach to this is

to compare the participants to a control group who have not – or, not yet – had the opportunity to participate in the programme (as in the innovation voucher experiments: Bakhshi et al., 2015; Balabay et al., 2019; Cornet et al., 2006; Kleine et al., 2020). However, for larger programmes with several components, the potential for learning from experiments like this may be limited. An all-or-nothing comparison will not provide any insight into the relative contribution of the different components of the programme towards the impact achieved – and, if the results are disappointing, it cannot be known which of the activities should be strengthened. For this reason, one approach sometimes taken in other fields is to combine an experimental evaluation of the overall impact with a comparison of differences in the type of support or the depth of support provided (e.g. Anderson & McKenzie, 2022; Dalton et al., 2021).

Often the key motivation is not so much to test the overall impact of a programme, but rather to optimize its effectiveness. For example, in the context of a training programme, those involved in implementation may have questions about the right type of content, the best format for interactions, or the length of the programme. A particular question that has increasingly arisen in recent years is how the effectiveness of training delivered online compares to that delivered in person – an important consideration, given that making events available online often means that a wider range and larger number of participants can be reached at substantially lower cost.

Another of the projects supported under the University–Industry Impact Accelerator serves to illustrate how experimentation can be used to optimize a programme. A research institute had developed an integrated proof-of-concept programme of funding, training and mentoring for researchers to support them with the commercialization of specific technologies they had developed. As a new initiative, it was clear that small-scale piloting was essential before being gradually scaled up over the coming years. But the limited number of eligible technologies also meant that carrying out a randomized evaluation of the overall programme would not be feasible in the near future. Instead, the implementers decided to test approaches to reaching out to potential private-sector partners, something that was expected to be a particular pain point. The institute therefore designed an experiment in which potential partners are randomly allocated either to be approached by the researcher themselves or by a technology transfer officer from the lab. Tracking the number of responses from businesses and the number of initial meetings secured will allow the organization to assess which of these approaches should be used when the programme is scaled up.

Finally, it is possible that the design of the programme is clear and the implementers are confident that it has the expected impact, but the challenge lies in making potential participants aware. For example, it may be that the target group are difficult to reach or have only limited time or bandwidth to devote to exploring new initiatives – something that is true both of many academic researchers and many small businesses. If so, experimentation can be used to optimize outreach efforts or improve conversion rates from initial expressions of interest to committed participation.

The third experiment designed under the Accelerator dealt with the issue of outreach optimization: it involved encouraging STEM graduates to sign up to participate in a traineeship programme that would give them experience working within big science organizations such as CERN. As a new initiative within an already well-established general traineeship programme, one of the key concerns for the national innovation agency was that students would not learn about the opportunity through their existing networks, and – even if they heard about them – would not feel they understood enough to invest in making an application. The agency therefore decided to test whether investing more efforts to reach out to and discuss the opportunity with students would result in a higher rate of applications from qualified candidates. The experimental design involved giving final-year students in randomly selected engineering and physics courses the opportunity to participate in a webinar about the traineeship programme, comparing them against students in the other courses who received information only through email.

Overcoming Challenges in Experimentation

Implementing a randomized experiment is not always a straightforward process, and there are often hurdles that need to be overcome to put one in place. However, these barriers are often less significant than might be imagined. Some of the common challenges in implementing policy experiments include sample size, outcome definition and measurement, data collection and research ethics.

"These barriers [to experimentation] are often less significant than might be imagined."

Any quantitative analysis of the outcomes of an experiment requires a sufficient sample size – whether of researchers or businesses reached by the interventions. The sample required depends on many factors (not least, the size of impact that the experimenter would like to be able to detect), but is typically in the dozens or hundreds. If the programme or initiative is not being implemented at this scale, then it is unlikely that a randomized experiment or another quantitative analysis method will generate meaningful results. Nevertheless, there may still be potential for experimenting with particular elements of the programme, like the research lab above that turned its proof-of-concept programme evaluation into an outreach optimization experiment.

Quantitative analysis is also only possible if it is clear what the expected outcomes of an intervention are, and if data can be collected on these outcomes. Setting up an experiment typically requires dedicating some time at the design stage to thinking through the expected outcomes, often by drawing up a 'theory of change' or a diagram of the channels through which the intervention is expected to act. It is not necessary for there to be a complete consensus about which of the outcomes is the most important or most likely since multiple outcomes can be monitored. However, the implementers need to broadly agree on how to conceptualize the outcomes.

Once agreed upon, the desired outcomes have to be turned into numerical measures that are amenable to quantitative analysis. This is increasingly becoming less of a barrier, given the continued adoption of machine learning methods that allow for quantitative measures to be derived from textual or other kinds of qualitative data. In many experiments, a bigger question is about how to ensure that participants in the experiment provide the data needed for analysis.

Once the outcomes have been identified, collecting data can present several challenges in itself. Rates of response to surveys are often very low, particularly when addressed to busy audiences such as academics or businesses. However, it is often possible to find alternatives to survey data that can be used to assess the outcomes of an intervention. One approach is to use data generated in the course of delivering the intervention – for example, tracking whether participants have completed an online training programme, or using their responses to quiz questions built into the interface. Another option that is increasingly being employed is the use of public data sources (such as patent filings) or to generate data from information a business or researcher posts to their website or social media accounts.

Finally, an important question sometimes raised in setting up an experiment – particularly one involving a control group that will not receive support – is about the fairness of excluding participants from interventions that are intended to have positive effects. When it is clear that an individual or a business would benefit from the intervention being tested, this certainly becomes a concern. But implementing organizations often face budgetary or capacity constraints that mean they cannot include all the eligible participants in their programmes. In these cases it may be inevitable that some of those who have the potential to benefit from participation do not have the opportunity; if so, including a random element in the selection is less controversial. More commonly, however, it is not known how well an intervention works or whether it leads to the desired outcomes at all. In this case, there is no *ex ante* reason to believe that individuals would be advantaged or disadvantaged from being allocated either to participate or to a control group. Given how little is known about effective ways to promote university–industry collaboration, this leaves many types of intervention open to experimentation.

Conclusion

There is still much to learn about how to improve the effectiveness of science commercialization efforts. The existing examples of experimentation in this field – including the three designed as part of the University–Industry Impact Accelerator – show that experimentation is feasible and beneficial to tackle those challenges. And while designing and executing experiments may not always be straightforward and requires upfront planning, much can be transferred from experiences in other areas of innovation policy (Edovald & Firpo, 2016).

“Embracing experimentation as a continuous process encourages ongoing improvement and adaptation, leading to progressively better commercialization outcomes.”

As organizations and individuals increasingly engage in experimentation, they will become more adept and confident in its application. Even preliminary experiments with smaller, less critical aspects of a programme can provide significant learning opportunities to the programme and organization, and help scale programmes up successfully. Embracing experimentation as a continuous process encourages ongoing improvement and adaptation, leading to progressively better commercialization outcomes.

References

Anderson, S. J., & McKenzie, D. (2022). Improving business practices and the boundary of the entrepreneur: A randomized experiment comparing training, consulting, insourcing, and outsourcing. *Journal of Political Economy*, *130*(1), 157–209. https://doi.org/10.1086/717044

Bakhshi, H., Edwards, J. S., Roper, S., Scully, J., Shaw, D., Morley, L., & Rathbone, N. (2015). Assessing an experimental approach to industrial policy evaluation: Applying RCT+ to the case of Creative Credits. *Research Policy*, *44*(8), 1462–1472. https://doi.org/10.1016/j.respol.2015.04.004

Balabay, O., Geijtenbeek, L., Jansen, J., Lemmers, O., & Seip, M. (2019). *Het langetermijneffect van innovatievouchers voor mkb-bedrijven op bedrijfsresultaten*. https://www.bedrijvenbeleidinbeeld.nl/site/binaries/site-content/collections/documents/2019/10/13/gecombineerd-gebruik-financieringsinstrumenten-kopie/Het+langetermijneffect+van+innovatievouchers+voor+mkb-bedrijven+op+bedrijfsresultaten+rapport+definitief.pdf

Battaglia, D., Paolucci, E., & Ughetto, E. (2021). The role of Proof-of-Concept programs in facilitating the commercialization of research-based inventions. *Research Policy*, *50*(6), 104268. https://doi.org/10.1016/j.respol.2021.104268

Cornet, M., Vroomen, B., & van der Steeg, M. (2006). *Do innovation vouchers help SMEs to cross the bridge towards science?* https://www.cpb.nl/en/publication/do-innovation-vouchers-help-smes-cross-bridge-towards-science

Dalton, P. S., Rüschenpöhler, J., Uras, B., & Zia, B. (2021). Curating local knowledge: Experimental evidence from small retailers in Indonesia. *Journal of the European Economic Association*, *19*(5), 2622–2657. https://doi.org/10.1093/jeea/jvab007

Edovald, T., & Firpo, T. (2016). *Running randomised controlled trials in innovation, entrepreneurship and growth: An introductory guide*. Innovation Growth Lab. https://innovationgrowthlab.org/guide-randomised-controlled-trials

Fini, R., Rasmussen, E., Wiklund, J., & Wright, M. (2020). Moving ideas from lab to marketplace: A guide to research. *Entrepreneur and Innovation Exchange*. https://doi.org/10.32617/421-5e344b2776e50

Ganguli, I., Huysentruyt, M., & Le Coq, C. (2021). How do nascent social entrepreneurs respond to rewards? A field experiment on motivations in a grant competition. *Management Science*, *67*(10), 6294–6316. https://doi.org/10.1287/mnsc.2020.3793

Kleine, M., Heite, J., & Huber, L. R. (2022). Subsidized R&D collaboration: The causal effect of innovation vouchers on innovation outcomes. *Research Policy*, *51*(6), 104515. https://doi.org/10.1016/j.respol.2022.104515

OpenAlex. (n.d.). *Search for title & abstract includes 'randomized\randomised' and topic = 'Entrepreneurship and Business Innovation'*. Retrieved August 29, 2024, from https://openalex.org/works?page=1&filter=title_and_abstract.search%3Arandomized%7Crandomised,primary_topic.id%3At10058

Organisation for Economic Cooperation and Development. (2019). *University–industry collaboration: New evidence and policy options*. OECD Publishing. https://doi.org/10.1787/e9c1e648-en