



what works centre for
local economic growth

Toolkit Policies to encourage co-location of researchers

What are they and what do they aim to do?

Policymakers use different methods to help encourage the generation and diffusion of new ideas, from research grants and tax incentives to public procurement. One important subset of these policies involves encouraging the co-location of researchers, entrepreneurs and/or established firms, so that they can share access to expensive equipment, forge links, or simply observe – and learn from – each other. Collaboration is becoming increasingly important in academic research, and facilitating collaborations may be an important effect of these programmes.¹

We have already published toolkits on incubators and accelerators, which are essentially ‘co-location’ policies aimed at entrepreneurs and startups.

This toolkit looks at interventions that encourage the co-location of researchers – aiming either to increase research output, improve commercialisation of ideas, or both. This family of policies includes supporting science parks, provision of key scientific infrastructure, building-level co-location, and encouraging temporary co-location (e.g. attending conferences, and the networking that goes along with this). Studies

¹ See, for example: Jaffe, A. (1989). Real Effects of Academic Research. *The American Economic Review*, 79(5), 957-970, and Jones, B. F. (2009). The Burden of Knowledge and the “Death of the Renaissance Man”: Is Innovation Getting Harder? *The Review of Economic Studies*, 76(1), 283-317.

typically look for impacts of these interventions on a range of outcomes, including collaborations, academic publications, patents, etc.

We focus here on evaluations of policies that specifically encourage co-location with the objective of increasing the quantity and/or quality of scientific output. This is distinct from a much larger set of academic studies that either describe researcher location patterns or compare outcomes between more and less densely concentrated groups. In what follows we point to a few example studies from this literature.² Compared with this broader literature, the eight studies we focus on provide stronger evidence of the causal impact of specific ‘interventions’.³ We think this evidence is more practically relevant for policymakers in designing specific interventions.

Things to consider

- Can co-location raise the quality of research? Two studies suggest that inducing researcher proximity can improve the quality of research output. Both studies suggest that increased collaboration is one of the main channels through which this happens.
- What mix of activities should be encouraged? Five studies suggest that spillovers may exist between researchers in different academic fields or commercial sectors, but that the greatest positive effects of co-location occur for similar activities.
- What counts as co-location? The (limited) available evidence suggests that science park co-location impacts positively on firm-level patenting of research, but that spillover effects may die away rapidly with distance. This is consistent with our toolkits on incubator and accelerator programmes, in which we report generally positive outcomes for firms co-located in the same building or room.
- What about ‘temporary co-location’? Two studies suggest that temporary co-location (such as conferences and workshops) can also be effective in inducing collaboration and thus innovation. These studies suggest that careful conference design, including structuring interactions between participants, may be important.
- Should policies be targeted at particular types of researcher? The limited evidence we have suggests researcher type can matter, although more research is required here, especially as existing evidence refers only to temporary co-location.
- Should policy try to prevent the break-up clusters of researchers? One study finds that previously collaborating labs that are separated continue to collaborate in the future, although the quality of research suffers with separations.

² Studies 8, 9, and 10 are discussed in Box 1 in the Evidence Annex.

³ A common problem with the ‘correlations’ approach it leaves open the possibility that researchers who are more productive (in the first place) choose to locate closer to other researchers. In many studies of this kind, then, observed differences in research outcomes may be more to do with the type of researcher that typically collocates than any effect of the co-location.

How effective are they?

We found seven OECD evaluations that met our quality standards, three of which are from the UK.

Co-location within university campuses or buildings can have a positive effect – both on the probability of research collaboration and on subsequent research quality, according to two studies (1, 2). Study 2 looks at research office layout and finds that ‘walkability’ between researchers makes them more likely to collaborate. A more robust study (1) finds that researchers in laboratories that became randomly collocated were more likely to collaborate, the labs were more likely to research similar topics and cite more of the same research. Separation of previously collaborating labs did not lower the future probability of collaboration, but did lower the quality of research and resulted in labs researching divergent topics and citing different research. This suggests that distance increases search costs that partly determine research partnerships, but that collaborations are persistent.

Spillovers may exist between researchers in different academic fields or commercial sectors, but the greatest positive effects of co-location occur for researchers and firms undertaking similar activities. The evidence that supports this finding is quite diverse and more research is required. Two studies (3, 7), on science parks, find positive effects on patenting both within and across industries for firms in the park. Another study (5) on researcher co-location and activity around the UK’s Diamond Light Source Synchrotron, finds the strongest positive effects on research output that directly uses Diamond, although weaker effects are also found for related research. Two studies (4, 6) that look at temporary re-locations find bigger collaboration effects on researcher pairs in similar fields.

Co-location in science parks is associated with higher firm-level patenting but spillover effects may die away rapidly with distance, according to two studies (3, 7). Spillovers are found both within sectors and across different industries. One of these studies (3) suggests that positive spillovers within science parks operate over very small scales, disappearing for firms that are located more than 240 metres from one another inside a science park.

Attending the same conferences has a significant impact on the likelihood of future collaboration – especially if in a similar field, according to two studies (4, 6). The ‘temporary co-location’ effect is bigger where researchers are junior (rather than senior), at least one female (compared to both male) and for non-presenters (as opposed to presenters). The stronger of the two studies (an RCT) suggests that having previously collaborated increases the ‘event effect’ – but the other study says the opposite. We have no clear evidence whether prior collaborations are more or less likely to lead to future collaborations. However, studies on research lab breakup suggest that prior collaboration patterns matter a lot.

Co-location around new major science facilities leads to an increase in scientific output, according to one UK study (5). This study finds that increased scientific output in a 25km zone around the new Diamond Light Source Synchrotron in the UK was mainly driven by an increase in the number of researchers around the facility, rather than increased productivity of individual researchers.

Is co-location cost effective?

None of the studies provides cost-effectiveness information.

Annexe: Evidence on co-location of research

How secure is the evidence?

This toolkit summarises high quality ex-post (i.e. after introduction) evaluations of the effect of interventions that increase researcher proximity. This toolkit does not consider evidence based on qualitative or case study methods. Instead, we focus on evaluations that identify effects that can be attributed, with some degree of certainty, to the co-location intervention. This toolkit does not consider the broader literature on general research proximity for reasons discussed in the 'What is it and what does it aim to do?' section. However, a few examples from this literature are examined in Box 1, further down.

We looked for evidence on policies (or in some cases, circumstances) that brought academic and/or commercial researchers closer together and the effect on research/commercialisation outcomes. We focused on evidence from the OECD, in English. We considered any study that provided before-and-after comparisons or cross-sectional evidence that control for differences between affected and unaffected researchers. We also included more robust studies that compared changes to researchers with a control group, or that used a source of randomness of researcher proximity to estimate a causal effect. See the following: www.whatworksgrowth.org/resources/the-scientific-maryland-scale/. In summarising the evidence, we place greater emphasis on studies with stronger methods.

Using these criteria, we found eight studies that looked at the effects of co-location of research on research or commercialisation outcomes. Three of these examine UK co-location (two on science parks, and one on a major new scientific facility), three US (two conferences, and one within-building study), and one France (a within-campus study). One of these studies was implemented as a Randomised Controlled Trial (RCT) and, therefore, represents the highest standard of evidence (SMS 5). One uses a natural experiment that results in quasi-random re-locations of science labs (SMS 4). Two studies examine before-and-after changes in outcomes for colocated researchers/areas against a control (SMS 3), and three studies examine cross-sectional differences in outcomes for colocated researchers/firms against a control group (SMS 2).

The evidence

Co-location within university campuses or buildings can have a positive effect – both on the probability of research collaboration and on subsequent research quality

Study 1 (SMS 4 – lab pairs) evaluates the impact of co-location of research labs within a university campus on scientific collaboration in France. The study exploits a natural experiment whereby scientific labs at the Jussieu campus in Paris were relocated due to asbestos removal. It finds that researchers in laboratories that became randomly colocated as a result were 3.7 to 5.7 times more likely to collaborate than non-colocated laboratories. They also began to work on more similar topics and cite more of the same references. A negative separation effect for previously colocated labs was not observed for the probability of collaboration. However, while separating labs are able to sustain collaboration, they do generally start to work on different topics and to cite different research. Finally, conditional on collaborating, colocated labs produce research that is 1.36 times more likely to result in papers in the highest quartile by citation count, whereas the opposite effect is observed for separations.

Study 2 (SMS 2 – researcher) evaluates the relationship between the geographic distance between researcher offices and scientific collaboration in the US. The study uses data on researchers based

across two university buildings from 2006 to 2010. It calculates each researcher's "functional zone", which corresponds to the most likely walking areas (e.g. from the office to the lifts). The study finds that a 100-foot increase in path overlap for a pair of researchers increases the likelihood of their collaboration by 19.8 per cent, and increases their likelihood of obtaining a shared research grant by between 22.8 and 33.4 per cent. Similarly, a 100-foot increase in the straight-line distance between the pair's offices decreases the likelihood of collaboration by between 25.5 and 36.1 per cent, as well as decreasing the likelihood of obtaining a joint grant.

Spillovers may exist between researchers in different academic fields or commercial sectors, but the greatest positive effects of co-location occur for researchers and firms undertaking similar activities.

Study 3 (SMS 2 - firm) evaluates whether geographical proximity within a leading UK science park is related to firm-level innovative output (measured using patents) for the firm in similar sectors. The study uses firm-level data from 2000 to 2014 that contains precise geographical location within the Cambridge Science Park. The study finds evidence for positive spillover effects: any given company's patent applications are positively associated with the number of companies located close to it in the Park. Positive effects are found both for firms in the same industry and in different industries (by three-digit SIC code). The positive effect is found only up to a walking distance of 0.15 miles (or 240 metres), suggesting externalities are highly localised in this context.

Study 4 (SMS 5 – researcher pairs) evaluates the impact of the co-location of researchers during a research conference on scientific collaboration in the United States. To do this, the study randomly assigned researchers in medical science attending the Advanced Imaging Symposium to different break rooms with different peers. It finds that researcher pairs allocated to the same break rooms were 70 per cent more likely to collaborate after the event than pairs allocated to different break rooms. The study performs a heterogeneity analysis to understand whether this effect differs by researcher characteristics. It finds that the average effect appears to be driven by researchers that specialise in the same field. For same-field pairs, same break room allocation increases the likelihood of collaboration by 276 per cent, whereas for different-field pairs the effect is insignificant overall.

Study 5 (SMS 3 – regional) evaluates the impact of researcher co-location around a new major science facility in the UK. More specifically, it analyses whether areas located near the Diamond Light Source Synchrotron published more academic studies than areas farther away. The study uses data on academic publications and author counts by geographical area—Travel to Work Area (TTWA)—over the period from 2000 to 2010. As a counterfactual, the study makes comparisons to publications and author counts around a runner-up site for the facility. The study finds that Diamond results in an additional 8.36 academic studies per year in the areas with 25km of the facility, compared to areas within 25km of the runner-up site. The study reports that there is an increase in the number of studies for research that directly uses Diamond and research that does not use Diamond but is in a related field, although the effect is larger for Diamond research. For Diamond research, the positive effect is driven by a combination of an increase in the total number of authors (presumably driven by relocation) and an increase in author productivity. However, for related research, the increase is driven purely by author count.

Study 6 (SMS 3 – researcher pairs) evaluates the impact on collaboration for researchers attending the same scientific conference in the United States. The study uses data on a sample of researchers who attended the Gordon Research Conference from 1992 to 1995. It matched these researchers to

peers that did not attend the conference but were otherwise similar in terms of field of study, publication history, collaborations, and experience. It then analysed whether the conference led to a change in who the researchers chose to collaborate with, compared to the control group. The study finds that for conferences attendees, collaborations with other attendees increased by 40.8 per cent compared with collaborations with matched non-attendees. The study finds the effect is strongest for researcher pairs in similar compared with dissimilar fields.

Study 7 (SMS 2 - firm) considers the relationship between science parks and the commercialisation of new products and services in the UK. To this end, firm-level data for 1992 is used, comparing firms located in science parks with observationally equivalent firms located elsewhere. The study finds that firms located in science parks have more new patents and commercialise more new products and services than other firms.

Study 8 (SMS 3 - firm) assess the role of Catalan science and technology parks on the growth of firms using data on 170 firms located in 12 Catalan parks ('in-park'), as well as 7190 firms located elsewhere ('out-park'). The study uses a quantile regression framework with in-park and out-park firms matched to account for selection bias on observables. Being located in a science or technological park only increase performance (measured by sales and number of employees) of high-growth firms, while the results point to negative effect for low-growth firms. The results are heterogeneous with respect to the type of park being stronger in case of science parks than for technological parks.

Co-location in science parks is associated with higher firm-level patenting but spillover effects may die away rapidly with distance

See Studies 3, 7 and 8 discussed above. The finding of the effect of distance comes from study 3.

Attending the same conferences has a significant impact on the likelihood of future collaboration – especially if in a similar field.

See Study 4 above. Previous collaboration appears to increase the effect. For researcher pairs that have previously collaborated, same break room allocation increases the probability of collaborating again. Thus co-location in this context appears to lead a rekindling of dormant ties. Finally, the study finds that same break room allocation is particularly fruitful for pairs that have at least one woman, for whom the effect is a 161 per cent increase over the average collaboration rate.

See Study 6 above. Effects are also stronger for researchers who have never published together before, who are junior (rather than senior), and who are non-presenters (rather than presenters). The study also finds that the quality (measured by ten-year citation counts) of publications is positively impacted by attending the same conference and that the researchers are more likely to cite each other if they attend the same conference.

Co-location around new major science facilities leads to an increase in scientific output

See Study 5 discussed above.

Box 1: Examples of evidence from general proximities literature

Evidence from the general proximities literature finds that smaller geographic distance is associated with improved research productivity and commercialisation activity

Study 9 (SMS 2 – researcher) considers the link between the geographic distance between laboratories and scientific collaboration in France using laboratory-level data from 1992 to 1997. The study's unit of observation is the laboratory pair and the 'treatment variable' of interest is the geographic distance, in kilometres, between the pair's laboratories. The study finds that geographic distance decreases the likelihood of collaboration (measured as the number of co-authored studies, as a proportion of all collaborations within the sample).

Study 10 (SMS 2 - localities) evaluates whether having university departments nearby is associated with an increase in the number of R&D establishments, using UK postcode-level data for 2000 to 2003. The 'treatment variable' is a dummy that takes the value of one for a given band of distance between the postcode and the nearest university (located within 10 kilometres, or within 10 to 50 kilometres). The study considers the impact of different types of departments - biology, chemistry, medicine, materials science, chemical engineering, computer science, and physics on the number of R&D departments in eight different sectors: pharmaceuticals, chemicals, machinery, electrical machinery, TV and radio equipment, vehicles, precision instruments and aerospace. The study finds that an extra chemistry department within 10 km increases pharmaceutical R&D establishments by 65 per cent, while an extra material sciences department increases chemical R&D establishments by 17.8 per cent and decreases aerospace establishments by 37.4 per cent.

Study 11 (SMS 3 – inventor) evaluates the impact on joint patenting of the geographic distance of inventors working at private research institutes or universities in the UK using data on all patents attributed to UK-based inventors from 1978 to 2010. The unit of observation is the inventor pair. Given that the study exploits a panel dataset, it is able to control for inventor fixed effects. In this case, the 'treatment variable' is the geographic distance between the pair. The main outcome variable is a dummy that takes the value of one if the pair received a joint patent. The study finds that geographic distance significantly decreases the probability of obtaining joint patents, implying that proximity is an important factor in generating joint patents.

Evidence Reviewed

Ref No.	Reference
1	Catalini, C. (2017). Microgeography and the direction of inventive activity. <i>Management Science</i> .
2	Kabo, F. W., Cotton-Nessler, N., Hwang, Y., Levenstein, M. C., & Owen-Smith, J. (2014). Proximity effects on the dynamics and outcomes of scientific collaborations. <i>Research Policy</i> , 43(9), 1469-1485.
3	Helmers, C. (2017). Choose the Neighbor before the House: Agglomeration Externalities in a UK Science Park. <i>Journal of Economic Geography</i> .
4	Boudreau, K., Ganguli Prokopovych, I., Gaule, P., Guinan, E. C., & Lakhani, K. R. (2012). Co-location and scientific collaboration: evidence from a field experiment. Harvard Business School Working Paper Number 13-023.
5	Helmers, C., & Overman, H. (2016). My precious! The location and diffusion of scientific research: evidence from the Synchrotron Diamond Light Source. <i>The Economic Journal</i> .
6	Chai, S. (2014). Temporary Co-location and Collaborative Discovery. Working paper, Harvard University.
7	Siegel, D. S., Westhead, P., & Wright, M. (2003). Assessing the impact of university science parks on research productivity: exploratory firm-level evidence from the United Kingdom. <i>International Journal of Industrial Organization</i> , 21(9), 1357-1369.
8	Arauzo-Carod, J-M., Segarra-Blasco, A., & Teruel, M. (2018). The role of science and technology parks as firm growth boosters: an empirical analysis in Catalonia. <i>Regional Studies</i> 52(2), 645-658.

Examples of Evidence in General Proximities Literature

9	Mairesse, J., & Turner, L. (2005). Measurement and explanation of the intensity of co-publication in scientific research: An analysis at the laboratory level (No. w11172). National Bureau of Economic Research
10	Abramovsky, L., & Simpson, H. (2011). Geographic proximity and firm–university innovation linkages: evidence from Great Britain. <i>Journal of Economic Geography</i> , 11 (6): 949-977.
11	Crescenzi, R., Nathan, M., & Rodríguez-Pose, A. (2016). Do inventors talk to strangers? On proximity and collaborative knowledge creation. <i>Research Policy</i> , 45(1), 177-194.

This work is published by the What Works Centre for Local Economic Growth, which is funded by a grant from the Economic and Social Research Council, the Department for Business, Energy and Industrial Strategy, the Ministry of Housing, Communities and Local Government, the Department for Work and Pensions and the Department for Transport. The support of the Funders is acknowledged. The views expressed are those of the Centre and do not represent the views of the Funders.

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