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Creative Industries Radar

Mapping the UK's creative clusters and microclusters

Josh Siepel, Roberto Camerani, Monica Masucci, Jorge Velez Ospina, Patrizia Casadei, Martha Bloom

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Executive summary

This report introduces a new experimental approach to understanding the clustering of UK creative industries businesses. By using data from the websites of 200,000 creative industries businesses and organisations, we identify creative 'microclusters' at the street, neighbourhood, and town level. We then explore the UK's creative clusters and microclusters in greater detail through a representative survey of 976 creative industries businesses. The report makes several key findings:

- We identify 709 creative microclusters in the UK, a significant number of which (247) are found outside the 47 clusters which have been identified in previous research at the commuter 'level'.

- We confirm that companies within creative clusters rely on their proximity to other creative firms for access to skills, knowledge and customers. But in the pre-COVID-19 period this did not translate into faster growth.

- The benefits of being in a creative cluster are generally the same for companies both inside and outside microclusters. The primary additional benefits for companies in microclusters relate to access to knowledge.

- The case is very different outside established creative clusters: there, companies in microclusters were more likely to have grown and have had ambitions for high growth, and have taken advantage of proximity to gain skills, knowledge and customers more than those outside microclusters.

- Whether or not they were in established clusters, companies in microclusters outside London and the South East are more likely to view access to external finance as a barrier to growth.

- On this basis, we suggest that investment in programmes like Creative Scale-Up that support microclusters may be useful both in terms of the present Government's levelling-up agenda and the creative industries' recovery from COVID-19.

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Introduction: Clusters and microclusters in the UK's creative industries

Creative clusters play a vital role in the UK's creative industries. Geographical agglomeration, the phenomenon that drives clustering, can provide a number of benefits to companies, including proximity to a skilled workforce, clients and suppliers, supporting institutions, and more 'soft' factors such as information sharing, knowledge spillovers and innovative culture.[1] There is extensive evidence about the levels of clustering in creative industries in the UK, and clusters have been widely targeted as a basis for policy.[2]

Our understanding of creative clusters is, however, based on foundations that are not always completely understood. Traditional approaches to clustering point to agglomeration economies that come from companies being in close geographic proximity. But how much proximity is necessary? How do we define a cluster? How large must a cluster be before the benefits manifest themselves? The PEC's recent review of the literature on creative clusters[3] shows that there is considerable variation in the units of analysis used in measuring creative industries concentration. These vary from whole regions, to the city/town, down to the neighbourhood level. However, much of the previous research on this topic has been conducted at the commuting area level.[4] In the UK, the official commuting area is the Travel to Work Area (TTWA), defined as an area where at least 75 per cent of the resident economically active population works and where at least 75 per cent of the workforce lives. There are several advantages of mapping clusters at TTWA level, including the fact that they are self-contained economic areas and are contiguous. However, disadvantages include that they are based on urban areas and their commuter hinterland, meaning they are less suited to mapping rural clusters, and because they are large they can mask smaller clusters of activity.[5]

In this report, we aim to explore the clustering of creative industries firms at a finer geographical level than has been previously examined. Recent academic research has begun to point to the importance of so called micro geographies – within neighbourhoods, streets, or sometimes within buildings – for innovation.[6] We show that these 'microclusters' of geographically concentrated creative firms make up an important element of the UK's creative geography, and – importantly – that companies located inside microclusters appear to have different characteristics than those outside

microclusters. In particular, we find that companies in microclusters outside the South East and London are particularly likely to perceive access external finance as a barrier to growth. We also find that companies in microclusters located outside the UK's established creative clusters[7] appear to be more growth-oriented and benefit from their proximity to other creative firms in a similar way to companies in established clusters.

We identify microclusters using scraped web data. Scraped data has a number of advantages that make it a useful complement to the official data more commonly used in studying creative clusters.[8] Working with data science startup Glass.ai, we used scraped data from over 200,000 websites of creative industries organisations that listed an address at which their company could be contacted.[9] The organisations captured include businesses, charities, and individuals with websites listing addresses in a given area. These data provide an insightful complement to other (particularly official) data sources; while the scope of scraped data is limited in that it does not capture all operating businesses (only those with web sites), it does allow us to capture the activities of businesses in ways that traditional measures may not capture. Using a spatial clustering algorithm we identified those places that have higher concentrations of creative industries organisations than would normally be seen in surrounding areas (see the methodology section for more details about our approach). This allowed us to identify 709 creative microclusters across the UK. When we think of microclusters, we might think of cultural districts, or neighbourhoods, concentrated in quite small areas, with high numbers of creative businesses, for instance Soho in London, Salford Quays in Manchester or the North Laine in Brighton. Indeed, some cities may have many microclusters – we identify well over 200 creative microclusters in London alone. Microclusters can also be identified in towns, rural areas or villages with higher than expected concentrations of creative businesses.

We combine our analysis of microclusters with results from the Creative Radar survey, a survey of a representative sample of UK creative industries businesses that was carried out from January to March 2020. We surveyed 976 creative organisations about their activities, growth plans, innovation activities and relationship to their clusters. By first identifying whether companies were located in microclusters, and then combining this with survey data, we were able to identify differences between companies inside and outside microclusters in the UK.

2

Where are the UK's creative microclusters?

We initially aimed to identify the areas where creative industries businesses are geographically concentrated.[10] There are a number of ways this may be done. One widely used approach involves the calculation of location quotients, which capture the relative share of creative industries businesses (in this case) divided by the overall share in the nation as a whole.

To demonstrate this, Map A in Figure 2.1 shows the UK's travel to work areas (TTWAs)[11] with location quotients (LQs) above 1, which indicates particular levels of concentration (clustering) of creative industries businesses. Using this measure, 40 out of 228 TTWAs in the UK show LQs greater than one (indicating a relative strength). London and the South East of England show the largest areas of concentration, with Reading, Brighton and London having the largest location quotients (ranging from 1.8 to 1.7). An alternate, more nuanced approach is used in Nesta's previous research,[12] which combines the use of location quotients with indicators of rapid growth within those clusters, resulting in a list of 47 TTWAs identified as creative clusters.[13]

While measures using TTWAs and similar geographical units have their strengths, they can also obscure more nuanced concentration patterns due to their relatively large geographical catchment (for instance, most unhelpfully, London, Birmingham and Manchester are each considered to be their own TTWAs). In particular, they may under-count concentrations of creative industries businesses in areas (for instance in rural areas) without higher average levels of creative clustering. To address this, Map B in figure 2.1 shows the location of creative microclusters across different TTWAs. These microclusters are drawn from a concentration measure that detects areas where companies are concentrated based on their specific spatial location, rather than the average numbers of businesses in a particular TTWA.[14] Clusters, in this case, are represented by a high density of creative firms in the same space.[15]

Comparing maps A and B makes it clear that creative microclusters are distributed across all of the UK's regions and territories, including in a number of regions and areas that might not typically be considered to be creative hotspots. This can be particularly seen in the distribution of dots across the UK (Map B). This map overcomes some of the limitations when clusters are derived from LQs (Map A). First, it is able to locate clusters at postcode level, so it can indicate in what part of a region a cluster is located, allowing us to identify clusters at the regional level right down to neighbourhood or even street levels. Second, it reveals clusters even if the relative share of industry is not large enough to appear as a cluster using LQ measures. Third, the patterns of spatial agglomeration also differ. For instance, we can observe that whereas parts of North East, West Midlands, and South West of England are not highlighted when using location quotients at TTWA level, our microclustering shows levels of agglomeration in such regions, as well as substantial levels of microclustering in Northern Ireland.

Map B also offers a more precise and detailed picture of established creative clusters. As an example, the maps in Figure 2.2 illustrates microclusters in the Greater Manchester and Greater Brighton areas, which are comprised of ten and seven local authorities respectively. Greater Manchester has a total number of 22 microclusters, while 20 microclusters are identified in Greater Brighton. These numbers of microclusters extend far beyond the standard view of so-called cultural quarters.[16] In the case of Greater Manchester, for example, the majority of creative microclusters identified are found in Manchester's Northern Quarter, an area between the district's city centre and the northern part. Interestingly we do not detect much evidence of microclustering near to Media City.

Figure 2.1. Creative clusters. Location quotients and microclusters

A: Location quotients

LQ
- 1.0 – 1.2
- 1.2 – 1.5
- 1.5 – 1.8

B: Microclusters

Number of firms
- 50
- 100
- 500
- 1,000
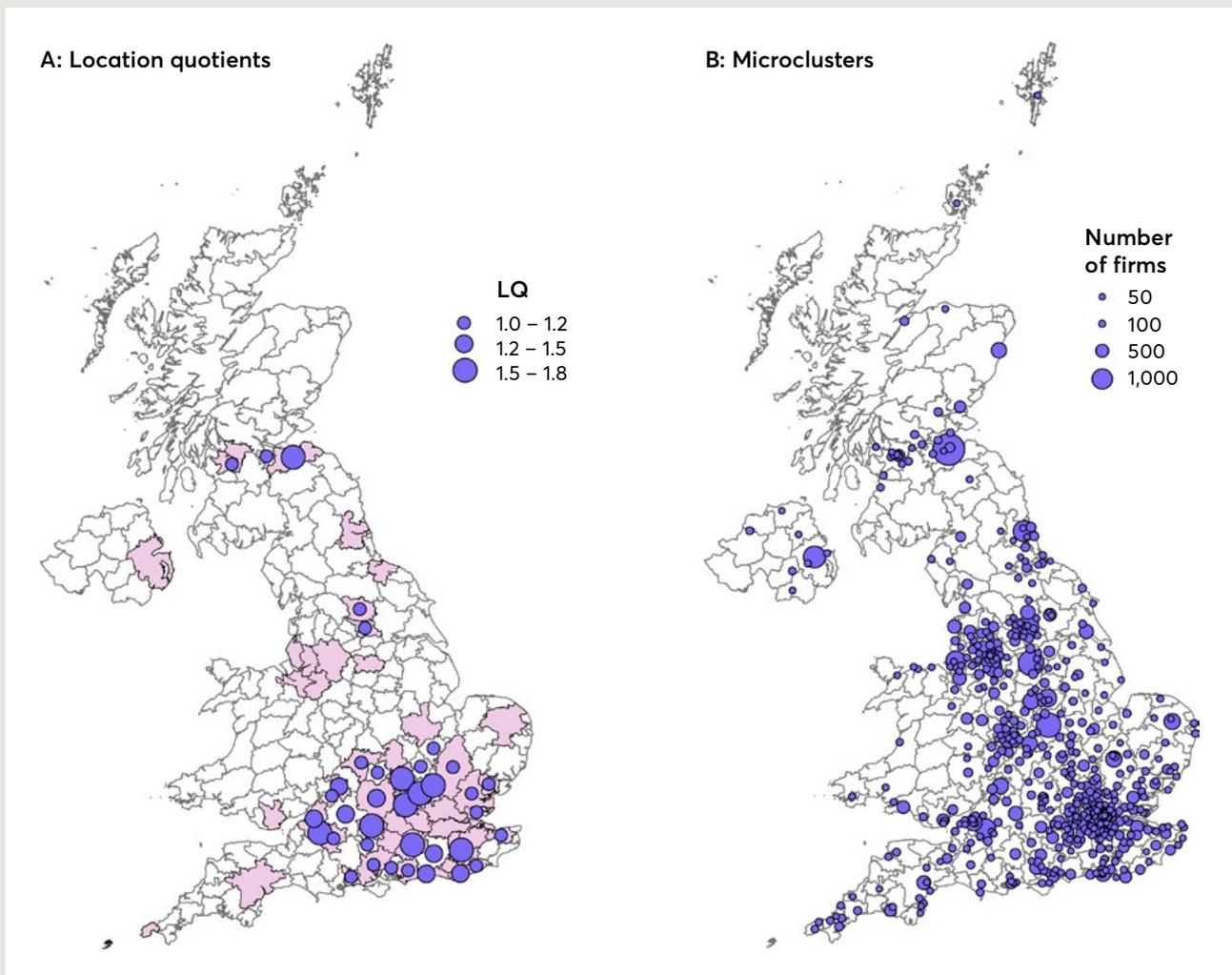
Notes: Highlighted areas in Map A represent 47 TTWAs identified as creative clusters in Mateos-Garcia and Bakhsi (2016) and Mateo-Garcia et al (2018). Location quotients based on business counts.

Figure 2.2. Microclusters identified in Greater Manchester and Greater Brighton

A: Greater Brighton
n=3,799 firms
Firms in clusters = 47%

B: Greater Manchester
n=8,396 firms
Firms in clusters = 53%
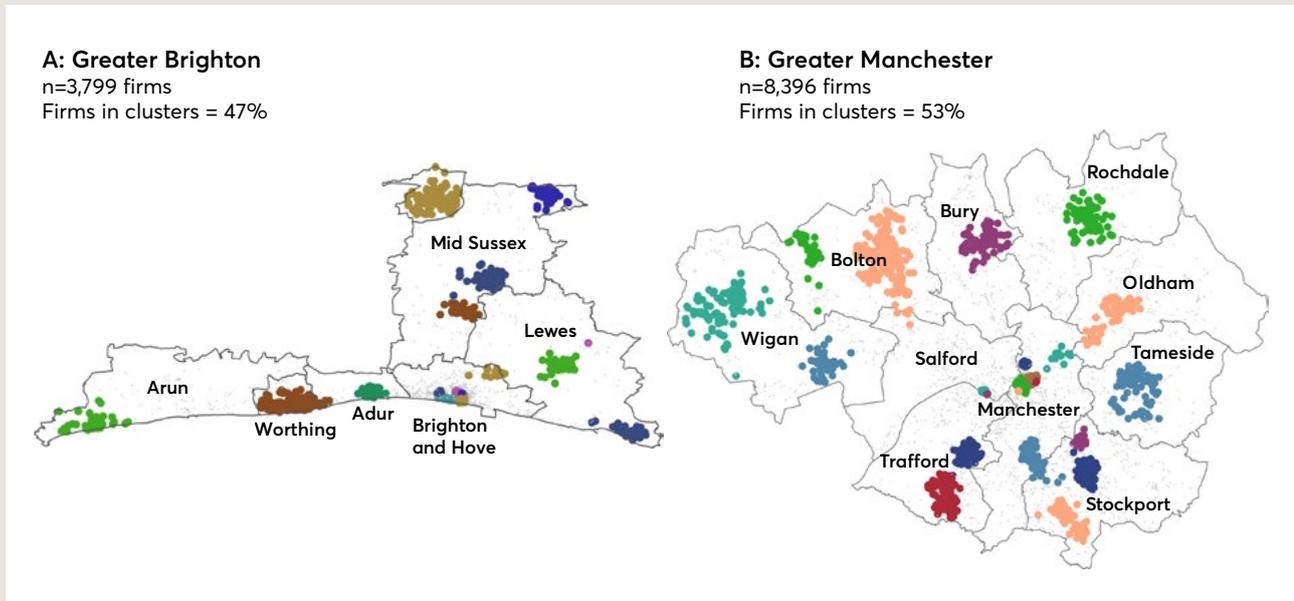
Note: Each colour represents a visually distinct cluster. Based on web scraped data.

The application of our density-based clustering gives us detailed information on hotspots for each creative industry and spatial unit. In total we identify 709 microclusters.[17] On average, each TTWA contains 3 microclusters: London being the area with the highest number of microclusters (215)[18] followed by Manchester, and Slough and Heathrow, with 23 and 19 clusters respectively. Table 2.1 below displays the top 20 TTWAs by number of microclusters. Among the top 20 TTWAs, the highest level of microclustering is found in Leicester, where 84 per cent of the firms are located within six microclusters.

Table 2.1. Top 20 TTWAs by number of microclusters

	TTWA	Microclusters	Firms in clusters	Total firms	% of firms in micro-clusters
1	London	215	25,911	56,242	43
2	Manchester	23	5,328	9,533	56
3	Slough and Heathrow	19	2,434	4,783	51
4	Birmingham	13	2,435	4,448	55
5	Cambridge	11	1,789	2,850	63
6	Guildford and Aldershot	11	1,645	3,058	54
7	Oxford	11	1,278	2,471	52
8	Bristol	10	1,504	3,749	40
9	Crawley	10	1,180	1,893	62
10	Glasgow	9	1,177	3,544	33
11	Leeds	9	1,853	2,778	67
12	Luton	9	1,672	2,279	73
13	High Wycombe and Aylesbury	7	1,140	1,676	68
14	Milton Keynes	7	808	1,531	53
15	Reading	7	1,210	2,192	55
16	Southampton	7	1,456	2,160	67
17	Brighton	6	1,130	2,419	47
18	Leicester	6	2,009	2,378	84
19	Stevenage and Welwyn Garden City	6	895	1,170	76
20	Warrington and Wigan	6	799	1,589	50
	Total top 20	402	57,653	112,743	56
	Total full sample	709	115,587	202,678	58

Looking at the extent to which each of the nine DCMS creative industries sub-sector groups[19] are clustered, we find different levels of concentration within microclusters between sub-sectors (Figure 2.3). For instance, 63 per cent of software and IT businesses are located in microclusters compared with 55 per cent in sub-sectors such as architecture and museums, galleries & libraries (Figure 2.3). In addition to our main analysis, we have mapped clusters at the sub-sector level; maps of these can be found in the appendix (note that the clusters identified at sub-sectoral level do not necessarily match those in our main analysis of all creative industries businesses).

Figure 2.3. Clustering in sub-sectors (percentage of firms in microclusters)
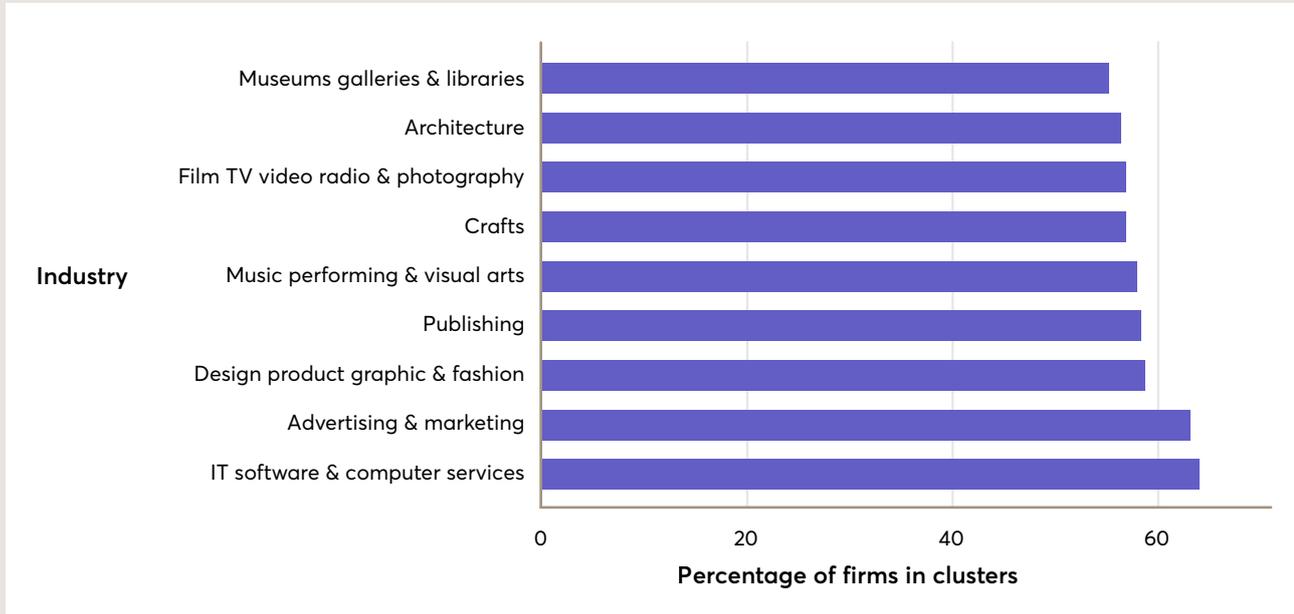
The findings in this section suggest that looking at smaller levels of agglomeration can be a potentially important way to complement established cluster maps in understanding the geography of creativity. While our maps are based on counts of businesses, this approach can be readily applied to employment too, where the data are available. We propose that microclusters are a useful unit of analysis for future policy consideration, particularly as we seek to understand, and promote, the growth and development of creative clusters. However, to better understand the relationship between established creative clusters and microclusters, we need to go beyond business counts (or employment) and use richer data, which we do in the following section.

3

Is there a creative cluster advantage?

In order for us to understand the importance of microclusters, we first revisit the role of established creative clusters, and in particular whether companies located in established clusters are different from companies outside these clusters. We then consider the intersection of established clusters and microclusters, to establish whether there are differences between companies found inside and outside microclusters, both inside and outside established creative clusters, and if they are different, in which ways.

We present evidence on the state of the UK's creative clusters, as captured just before the COVID-19 pandemic. Specifically, we define the clusters using the 47 TTWAs that were identified in Nesta's previous research[20] and match them to the location of firms in our survey. This allows us to compare companies inside established creative clusters with those outside these creative clusters, but also companies located inside and outside microclusters.

Companies in creative clusters use proximity to their advantage...

Exploring our survey responses, we confirm that companies in creative clusters benefit from proximity to other parts of the creative ecosystem. Our analysis points to four key elements:

- **Access to skills**: Companies in creative clusters are significantly more likely to rate proximity to skilled labour as important[21] (41 per cent vs 29 per cent), and are likewise more likely to view their ability to access external skills as a source of competitive advantage (51 per cent vs 43 per cent) as compared with companies outside established creative clusters. Companies in established clusters are also significantly more likely to report that their employees hold employees with creative/arts degrees (71 per cent vs 62 per cent).

- **Access to customers**: Proximity to customers is the most commonly-cited local factor identified by companies as providing a source of advantage. This is the case whether or not they are in a creative cluster, but 52 per cent of respondents in established clusters rate it as highly important, compared with 42 per cent outside clusters. While this is a statistically significant difference, it is notable that even in these clusters only half of respondents cite access to local customers as being an advantage to their business. This difference in access to local customers means that companies in creative clusters generate more sales from customers in their city than those outside (39 per cent vs 30 per cent). Yet this also speaks to the limitations of being based in clusters; despite the importance of local sources, companies on average generate between one-quarter and one-third of their revenues from elsewhere in the UK outside their region, with a further 13 per cent of turnover coming from international exports (see Figure 3.1).

Figure 3.1: Percentage of sales by established Creative Clusters
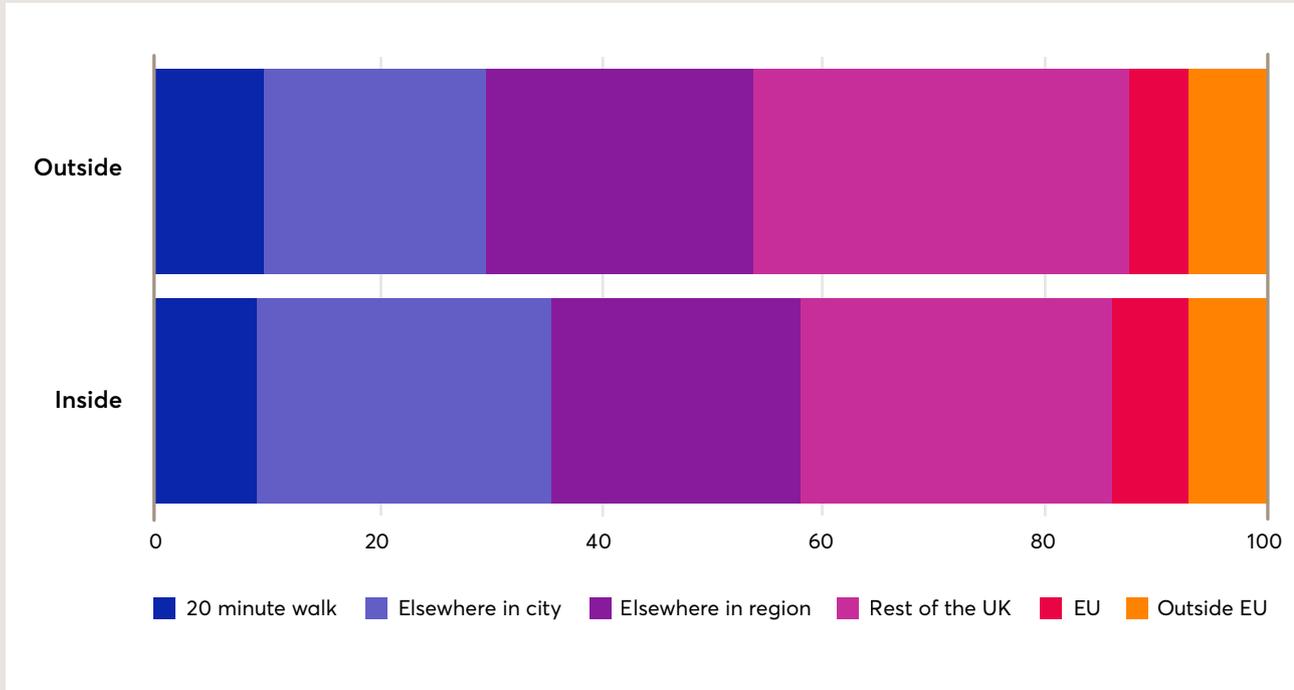
- **Access to knowledge**: Companies in clusters are significantly more likely to report that they get new ideas from within their cities/towns (37 per cent vs 30 per cent) than companies outside those clusters. They also rate proximity to parts of the creative ecosystem (for instance, suppliers, customers, and other companies) as highly important, identifying both proximity to companies in their sector (25 per cent vs 16 per cent) and to companies in other sectors (33 per cent vs 27 per cent) as a source of advantage.

- **Access to lifestyle and amenities**: Companies in creative clusters are significantly more likely to view local factors such as lifestyle, amenities and cultural communities as advantages for their business. But in both cases, less than half of companies (42 per cent for companies in clusters versus 37 per cent outside) view them as advantageous.

…but location did not help them to grow more in the previous 12 months

When we consider the performance of companies inside and outside creative clusters in the year preceding the survey, we find, perhaps surprisingly, that being in an established cluster didn't on average translate into better performance. In fact, it turns out that companies inside creative clusters if anything grew on average less in the previous year than those outside them, while companies in clusters were also more likely to have reported a decrease in turnover. Both inside and outside clusters, companies that had shown declining turnover were also more likely to point to challenges posed by the economic situation and Brexit uncertainty as significant problems for their companies.[22]

Table 3: Growth in previous 12 months of companies inside and outside creative clusters[23]

	Non-cluster	Cluster	Total
Grown by 20% or more	16.2%	15.4%	15.8%
Grown by up to 19%	32.7%	34.9%	33.7%
Stayed the same	22.6%	19.2%	20.8%
Got smaller	**26.3%**	**32.6%**	29.7%
Total	609	277	886

The reasons for this weaker growth are unclear. A priority for further research is to link the survey responses to hard (ie non-surveyed) financial performance indicators over a longer period of time drawn from company accounts or official data where this is available, as this would give a more complete picture of companies' growth dynamics.

4

Microclusters: what is the difference?

Having established that there are statistically significant differences in the way that companies inside and outside creative clusters view their ability to access resources and the way they conduct business, now we consider the extent to which microclustering provides advantages (or not) to companies inside and outside clusters.

Microclusters in creative clusters: The benefits of proximity

If firms are located in creative clusters, are there further benefits to microclustering? Our evidence suggests that there are relatively few advantages to microclustering for companies that are already within clusters; that is, the benefits of being in a cluster appear to be evident regardless of the company's relative position inside or outside a microcluster.

Of the factors supporting clusters discussed above (access to skills, access to customers, access to knowledge, and lifestyle and amenities), companies within microclusters are equally likely as those outside them to view this as an advantage. The benefits to being in a microcluster within a creative cluster appear to come from location and access to ideas rather than direct economic benefits: companies in microclusters are more likely to report getting new ideas from other firms or organisations within a 20 minute walk of their office. Likewise, companies in microclusters more frequently rate access to universities as a source of advantage.

Microclusters outside creative clusters: Ambitious and leveraging proximity

Microcluster companies want to grow

The pattern is very different for companies located outside creative clusters. There, being in a microcluster appears to be associated with substantive benefits. One of the most striking is growth, with companies in microclusters outside creative clusters being significantly less likely to have experienced a decline in revenue in the previous year, compared with companies outside microclusters but also with companies in microclusters in creative clusters. They were also more likely to have experienced higher levels of turnover growth in the previous year (pre-COVID-19) than other companies. In addition to the higher levels of performance, companies in microclusters outside of clusters were significantly more likely to aspire to high growth in the future (again, pre-COVID-19). Given that motivation for rapid growth is difficult to encourage, this suggests a strong appetite for growth coming from firms in these microclusters.

Microcluster companies take advantage of their proximity

Companies in microclusters outside of the established creative clusters are also substantially more likely to take advantage of their proximity, in ways that are quite similar to companies in creative clusters. Comparing the benefits of proximity identified in the previous section with those for companies outside microclusters, we see that companies in microclusters benefit from:

- **Access to skills**: They are more likely to report access to external skills as a major source of advantage (36 per cent vs 22 per cent, although both of these are substantially lower than the 47 per cent of firms in established creative clusters). They are significantly more likely than those outside microclusters to employ graduates with creative arts or business backgrounds (70 per cent vs 59 per cent and 22 per cent vs 17 per cent respectively).

- **Access to customers**: They are more likely to view proximity to customers as an advantage (47 per cent vs 38 per cent). They generate significantly more of their turnover from customers within a 20-minute walk of their office, i.e. within the microcluster itself, at 12 per cent vs 8 per cent (small figures, but when combined with other local sales these companies generate 34 per cent of turnover locally, compared with 27 per cent for companies outside microclusters). Companies in microclusters also rate location as an advantage in terms of access to customers and clients.

- **Access to knowledge**: They are much more likely than those outside clusters to indicate that they get new ideas from within their city. They also rate their location as an advantage in terms of access to businesses in other sectors and suppliers. This effect is particularly strong for companies that have engaged in innovative activities.

- **Lifestyle and amenities**: Similarly to companies in creative clusters, companies in microclusters outside clusters are significantly more likely to view the lifestyle and local amenities as an advantage for their business (44 per cent vs 34 per cent), but again this still only makes up less than half the sample.

Barriers to Growth

The discussion above indicates that companies in microclusters outside the established creative clusters have strong growth ambitions and are more likely to view proximity as a source of advantage. Now we consider what types of challenges these companies have: are they similar to those faced by other companies, including those in established clusters? We asked companies about various issues or barriers to growth they faced. The results we present show the relative significance of a barrier for a firm's response.[24]

Figure 4.1. Most frequently cited barriers to growth (level of responses above/below average response)
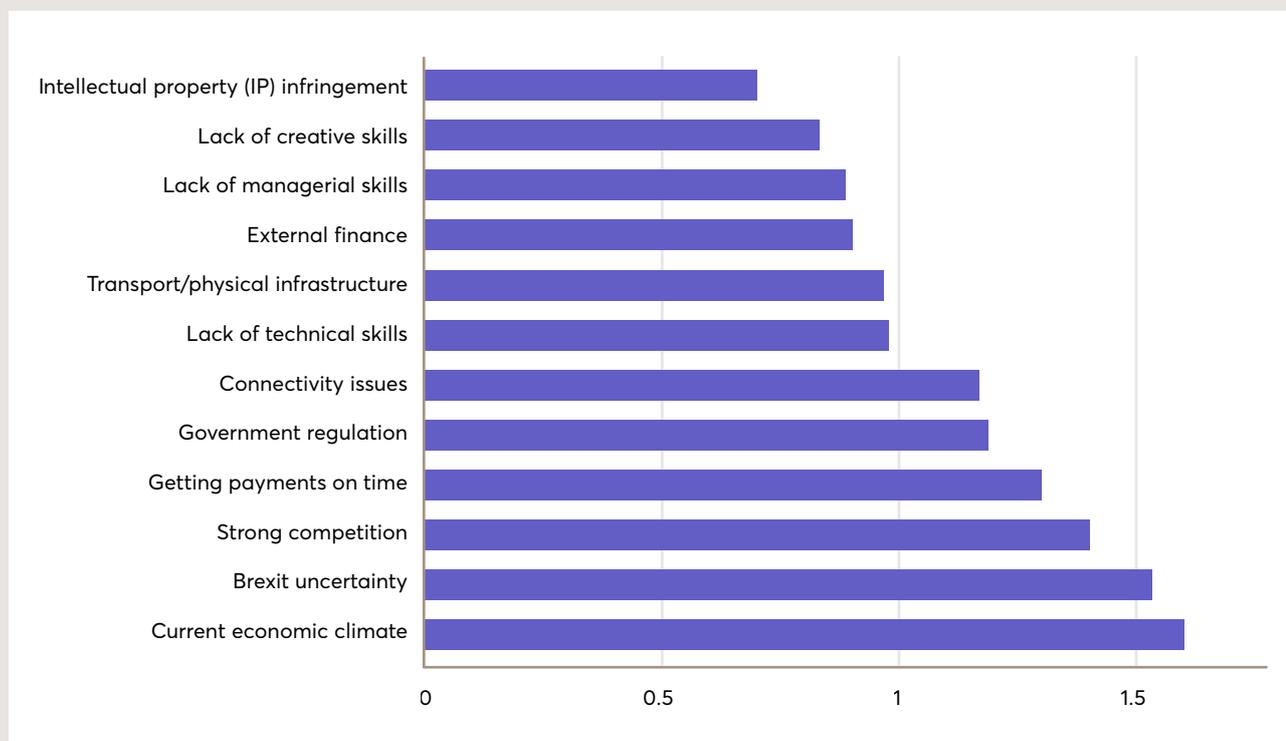
Figure 4.1 shows the most significant issues identified across all companies in our sample, regardless of location. The current economic situation (pre-COVID-19) and uncertainty around Brexit were the most frequently raised issues.

Table 4.2 summarises the differences in firms according to their location. In comparing firms in creative clusters with those outside, we see that Brexit, government regulations and access to management skills are most likely to be raised as the biggest barriers to growth. By contrast, outside these clusters technological capabilities are most likely to be raised as a major barrier.

When we consider microclusters, we find one common factor, regardless of whether these microclusters are found inside or outside creative clusters, namely that companies are significantly more likely to report access to external finance as a barrier to growth. Interestingly, when we explore these results in more detail we see that this effect is entirely driven by companies outside London and the South East. This is suggestive that there may be a perceived deficit in access to external finance among creative industries businesses in microclusters outside London and the South East.[25]

Beyond the access to finance issues, we see that there are few major differences between barriers reported by firms inside and outside microclusters in creative clusters. By contrast, we see some striking differences when we consider again the role of microclusters outside creative creative clusters. Here, companies inside microclusters are more likely than their counterparts outside microclusters to perceive access to finance and Brexit uncertainty as threats. These companies, many of which are based in rural locations, are also more likely to issues such as regulation, connectivity, and access to technology and creative skills come up as major problems.

Taken together, these results suggest that concerns about Brexit and the state of the (pre-COVID-19) economy are pervasive, but that particularly for companies in microclusters outside of established creative clusters access to finance is a major issue. For companies outside of both microclusters and clusters, the main concerns relate to capabilities, the economy and Brexit.

Table 4.2: Barriers to growth by clusters and microclusters

Inside creative clusters		Outside creative clusters	
Brexit; Management capabilities		Technological capabilities; Connectivity	
In microclusters	**Outside microclusters**	**In microclusters**	**Outside microclusters**
Access to external finance	Regulation/govt policy	Brexit	Regulation/govt policy
		Access to external finance	Technological capabilities

5

Conclusion: Why microclusters matter

This report explores the nature and impact of microclusters in creative industries across the UK. We identify 709 microclusters across the UK, which contain just over half of the UK's creative industries businesses and organisations. These are spread widely across the UK, much more so than more geographically aggregated measures of clustering typically suggest. Using this as the basis for the analysis, we then use survey data to explore the differences between companies that are located inside and outside the UK's established creative clusters, and then consider the role of microclusters.

Notwithstanding the experimental nature of the combined scraped and survey data sets we use, our findings present a potentially important and rich extension to previous accounts of the geography of the UK's creative industries. We confirm the findings of previous research that companies in the UK's established creative clusters leverage their proximity to drive business, access skills and gain knowledge. We also report evidence that companies in microclusters within these clusters enjoy further benefits associated with proximity to sources of knowledge and new ideas, but that otherwise simply being in the same city appears to give similar benefits.

But we suggest the story is quite different for microclusters outside of creative clusters. These companies are more likely to have reported growing in the previous 12 months and more likely to have indicated an ambition to grow further. Otherwise, they report to leverage their proximity very similarly to firms in creative clusters. We also find that companies in microclusters outside of London and the South East of England, both within and outside creative clusters, are more likely to perceive access to external finance as a barrier to growth. This finding tentatively suggests that there may be untapped growth opportunities within microclusters outside of the creative industries hotspots that are usually the focus of government support. As such, the analysis may provide supportive evidence for investment in Industrial Strategy programmes like the Creative Scale-Up programme to address objectives to 'level up' UK economic development. Likewise, this points to ways that the forthcoming Shared Prosperity fund could aim to support creative industries around the UK.

In any case, while the world presented in our data reflects the pre-COVID-19 period, our findings strongly confirm the importance of proximity for creative businesses. Previous PEC research[26] has shown that following the financial crisis in the early 2010s, the geography of the creative industries concentrated increasingly on London and the South East. The government's response to this crisis will be critical in ensuring that clusters and microclusters across the UK are able to recover, and history does not repeat itself. How businesses that have traditionally relied upon and benefited from proximity are adapting to a world of Zoom calls and working from home is an urgent question, and one that we will address in forthcoming PEC research.

6

Appendix: Methodology and technical details

Using scraped web data

Studying the creative industries and capturing the state and activities of creative industries businesses is not straightforward. Efforts to map the creative industries are generally reliant on official data, which despite their many advantages also have a number of limitations.

This study builds on previous mapping exercises that have drawn upon scraped and other novel data sources, such as Nesta's Creative Nation report, which used scraped web data, and Nesta's The Immersive Economy in the UK, which used scraped web data to inform survey sample frames. Using scraped web data has both advantages and drawbacks. One advantage is that it allows us to identify where businesses actually trade. Companies are required to list an address where they are officially registered, but many companies do not operate at the location where they are registered, and trading addresses may not be readily available, particularly for smaller companies. This potentially creates distortions in estimations of cluster size and economic impact.[27] Another advantage is that scraped data gives us insights as to companies' activities. Companies in the creative industries are typically identified by the SIC (Standard Industry Classification) codes, per the DCMS standard definition. The current SIC classification, which was published in 2007, does not have the flexibility to respond to emergent new trends. This means that new areas such as the immersive economy and digital agencies are not covered by SIC codes (or are only partially covered) and are therefore very difficult to count. This is a topic we will be addressing in a forthcoming piece of work. A third advantage of scraped data is the breadth of information available for each company allows scope for much more nuanced analysis of products, technologies and approaches than might otherwise be possible.

There are also some meaningful drawbacks from scraped web data. The population observed is limited entirely to companies that have websites. Companies, for instance, that have social media but not web presence wouldn't be picked up. The impact of this is likely to be uneven across creative sectors; for instance an advertising company might need to maintain a strong web presence, but a craftsperson with an online shop on a platform but no dedicated website might not be counted. Another potential drawback is the inherent marketing nature of websites, which makes self-response bias potentially an issue (for instance, a company might seek to represent itself or its activities in a different way from what they actually do). Also, as we discuss below we rely on data-driven sector classifications, which in turn rely on web content. Where websites are poorly created or inaccurate this could then result in misclassification. Another drawback, which is also somewhat advantageous, is that all websites are counted, including a range of groups, clubs, and personal interest websites. This may give a flavour of activities in a particular geographical area but the activities might not strictly be economic.

The mapping exercise

Overall, the web data consists of around 1,232,585 scraped websites of firms in the UK, collected by the data science startup Glass.ai. The activity of these firms has been inductively classified into 109 broad sectors based on the firms' self-description included in their website. These sectors, having been inductively classified, potentially differ greatly from the SIC codes assigned to businesses. The web data captures a broader range of participants in creative ecosystems, such as freelancers, charities, public sector organisations and others. For this reason, the scraped web data is intended to be a complement to existing metrics.

We took the sectors identified by Glass.ai, and manually mapped those onto corresponding DCMS sectors. This process resulted in approximately 361,459 creative industries websites. For each firm we have information about the sector, self-description, keywords, and (in some cases) location. Of these websites, we were able to geocode 202,678 companies in cases where the company listed its address on its website and a full postcode was extracted. This means that a large number of websites do not include location data, but our view is that listing an address is a good signal of association with a place, as it is a signal to customers of how to find a particular company. It is also a good indicator of a company operating as an ongoing concern, rather than as a limited company (which may be dormant or irregularly active) or a website (which may not be locally based as an operating company)

For the microclustering measure, we use the self-adjusting (HDBSCAN)-clustering method. The HDBSCAN is a hierarchical clustering method which uses a machine-learning clustering algorithm to identify a range of distances to separate clusters of varying densities from sparser noise. The algorithm computes hierarchical estimates and scores the outlierness of each data object, extracting local clusters based on a cluster tree (Campello et al 2013). This clustering method requires the user to identify the threshold of values of what constitutes a 'microcluster'. This could potentially prove to be arbitrary, so a robust justification of the threshold is important. For each firm in our web scrapped data, we calculated the number of neighbours at different radius. The average count of neighbours is presented below:

Radius (meters)	Median count
0-250	11
0-500	26
0-1,000	64
0-1,500	110

Previous exercises show that creative industries seem to only benefit from localisation economies within the first kilometre (Arzaghi and Henderson 2008; Coll-Martinez et al. 2018; Coll-Martinez, 2019). We calculate that the median number of neighbours within 1,000 meters of a company is 64 firms. We consider a conservative threshold of minimum 50 firms per cluster to fully capture clustering in a small radius (up to 250 meters the median number of neighbours is 11). Boix et al. (2015) using a similar algorithm, also consider a minimum of 50 firms per cluster. On this basis, while the choice of threshold is subjective, we feel that the 50 firms threshold is reasonable to capture effects at an immediately proximate area.

Survey

Our aim in the survey was to try to capture the activities of businesses within the creative industries, as well as those businesses engaged in creative activities (in line with the DCMS creative industries definition) but that have SIC codes outside those used by the formal DCMS definition. By doing this, we were aiming to better capture the activities of creative industries firms in the UK in aggregate. Using this broader definition, we then sought to use the survey to map similarities and differences within and between the UK creative industries according to several dimensions, including:

• Demographic characteristics (e.g. age, growth, size, location)
• Business models (e.g. activities, clients, sources of revenues, internationalisation, competitive advantage)
• Innovation (e.g. types of innovation, R&D, sources of ideas, intellectual property)
• Skills and talent (e.g. human capital, skills, combination, sources, and gaps)
• Barriers and enablers (e.g. barriers to growth, access to finance, access to public support, the role of local factors in supporting/hindering the business)

For our survey, we used as our sample frame the companies identified as being in the creative industries using the Glass.ai data. This therefore consisted of organisations with a website and with web content that was classified as being part of a creative sector. Of those organisations with a website, we required a Companies House registration number in able to ensure that telematching could be done by the survey company. Some websites list their registration number on their website, but most do not. To address this, we ran an algorithm that matched companies to registration numbers based on company name, postcode and other factors. This produced a list of approximately 96,000 firms for which we had company registration numbers.

In designing our sampling strategy, we faced a challenge. While the overall universe of firms in our survey consisted of those businesses identified as creative by the Glass data, sectors identified using Glass data do not necessarily map on to equivalent SIC codes.

Given these issues, and the fact that the experimental nature of the Glass.ai data made it difficult to easily extrapolate results about the core DCMS sectors, we decided it was not appropriate to stratify our sample for interviews based on the Glass.ai data, but instead on SIC codes, as these are more widely recognised.[28]

On this basis, we therefore selected a sample frame in which 80 per cent of respondents would belong to DCMS SIC codes, and 20 per cent would be firms identified as being creative in the Glass data, but outside of DCMS sectors. Of the 80 per cent of respondents to be based in DCMS SIC codes, we aimed to achieve a distribution to allow us to make statistically significant sectoral comparisons between DCMS sectors, whilst maintaining the distribution identified in the Glass data. One effect of this is that our sample captures the approximate proportion made up by software and IT firms in the Glass data (~10 per cent) rather than that in the official statistics (~50 per cent). The remaining 20 per cent of firms, based outside DCMS SIC codes, were not stratified further by sector as the sample of firms available to us was too small to allow us to rigorously stratify Glass sector classifications based on SIC codes. In addition to stratifying our sample by sector, we also sought to make statistically significant comparisons between regions. Doing this therefore meant oversampling most UK regions, while undersampling companies in London. We have experimented with a number of weightings to capture any possible biases due to our sampling strategy and have found results that were qualitatively similar. Our weighted statistics are generally quite similar to the raw data, but for purposes of clarity, where we present statistical analysis in this report we report based on raw data. Because of our experimental sampling strategy we did not have sufficient observations to further stratify by firm size, but our results worked out to be broadly representative of the population of creative industries firms.

The survey questionnaire was designed by the team at Sussex and underwent a series of consultations among stakeholders, including the PEC Management Board, as well as representatives from DCMS, AHRC, and multiple other trade and academic research groups. The survey was conducted as a telephone survey carried out by our survey partners OMB Research. Fieldwork took place between early January and mid-March 2020, with fieldwork closing with 976 respondents on the day that COVID-19 lockdown restrictions went into effect.

Linking survey data to clusters

For our analysis of survey data it was crucial to able to identify each respondent's location so that we could identify whether each company was in one of the 47 creative clusters or was in a microcluster. Fortunately, 85 per cent of our respondents consented for their complete postcodes to be shared with us, allowing us to accurately geocode their location. For the remaining companies, we had the anonymised postcode prefix (e.g. EC1) and local authority district, which maintained the complete anonymity of respondents while still giving us a good idea of the companies' locations. To determine whether companies were in one of the 47 creative TTWAs we mapped anonymised respondents' postcode prefix zones against TTWAs. To determine if the anonymised respondents were in microclusters, we modelled the probability that a company in a particular postcode prefix zone and LAD would be in a microcluster. Respondents modelled with a greater than 60 per cent probability of being in a microcluster were then counted as being in a microcluster for the purpose of our analysis. Our findings are robust both to changes in the threshold of probability used as well as to the exclusion of all companies for which we did not have full postcodes.

Figure A1 outlines the general analytical framework for linking web-scraped data with survey and geographical analysis.

Figure A1: Analytical framework for survey and mapping

Web address
Web site content

Web-scraped data

Geocoding clustering analysis

Match with company's registration numbers

Geographical analysis

Sample frame

Microclusters match at firm level

Stratified sampling

Firm-level survey

Business models
Innovation
Talent and Skills
Barriers and Enablers
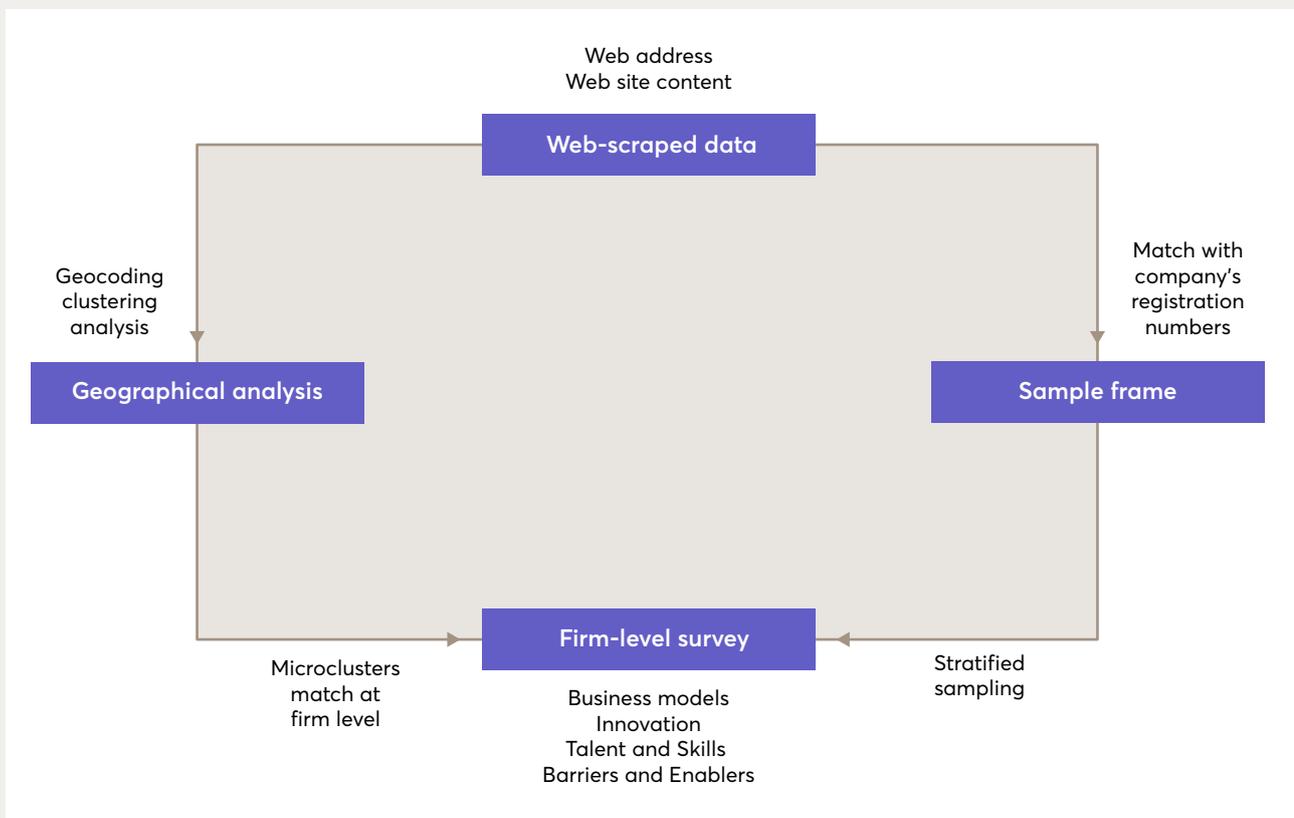
Sector-specific microclusters

We also ran our microcluster analysis on subsets of websites based on the nine DCMS creative sectors. The maps from the results are below. We use care in our analysis here as these ignore complementarities and co-location between sectors (e.g. the IT/software cluster only considers IT/software firms and no other creative businesses)

Advertising & marketing
n=87
53% firms in clusters

Architecture
n=66
68% firms in clusters
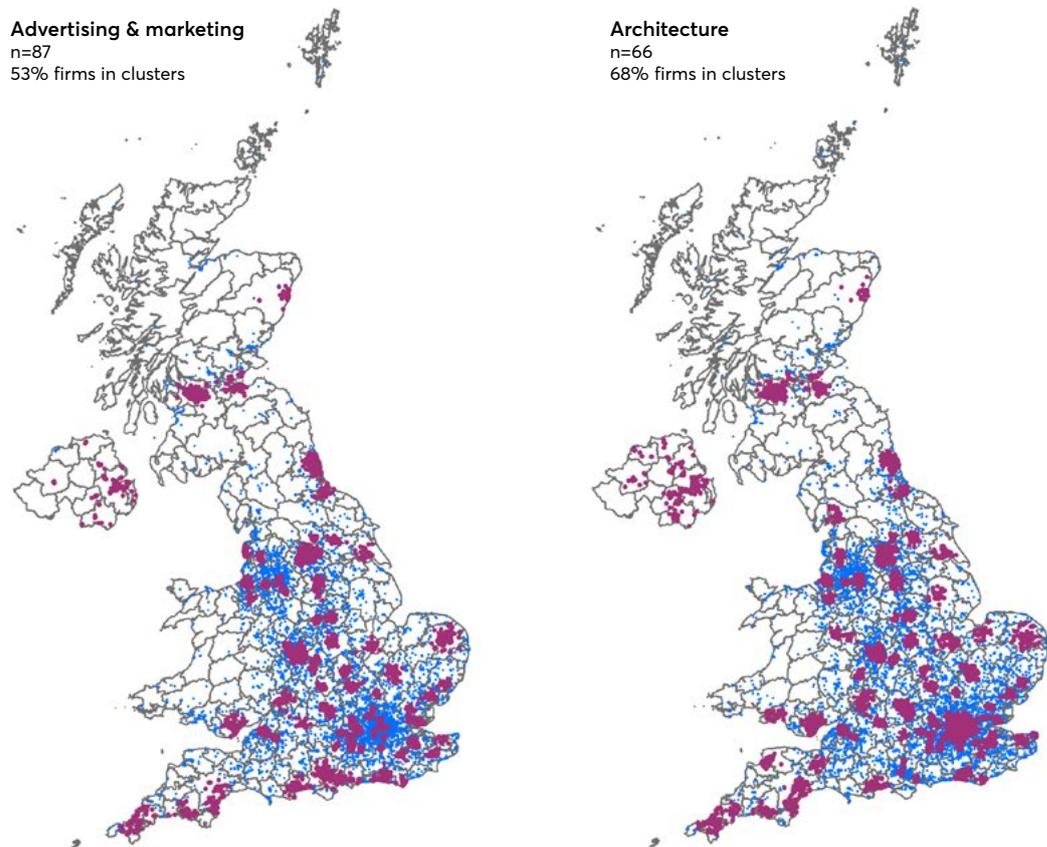
Crafts
n=43
59% firms in clusters
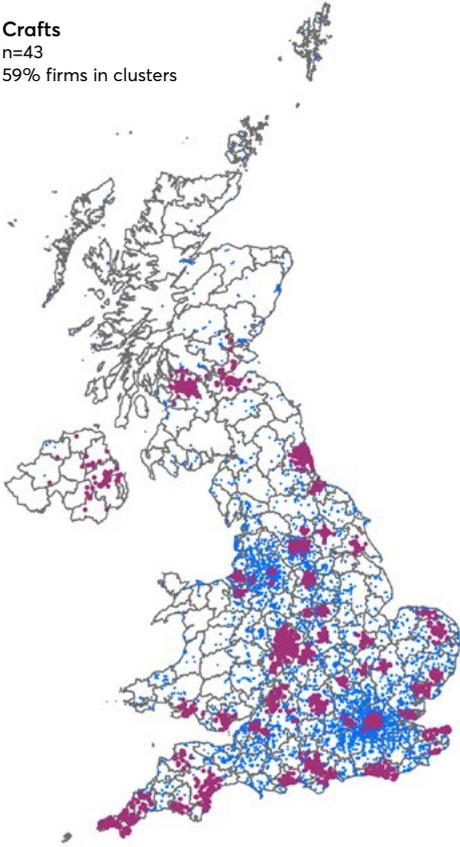
Design
n=141
54% firms in clusters
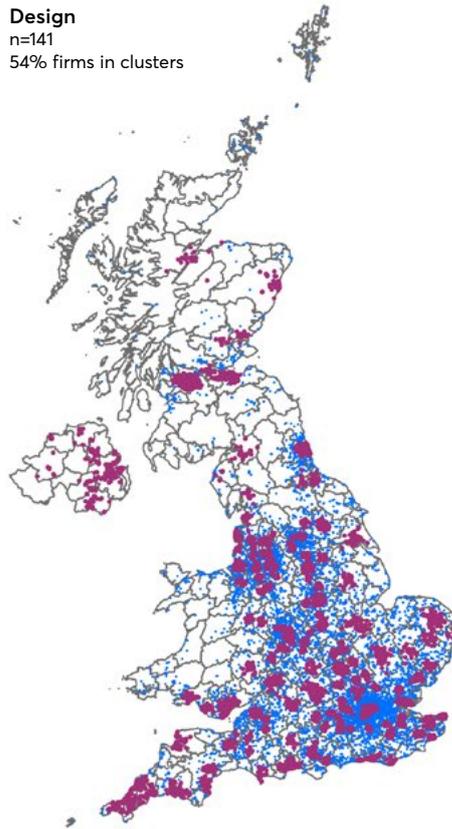
Film TV video radio & photography
n=70
48% firms in clusters
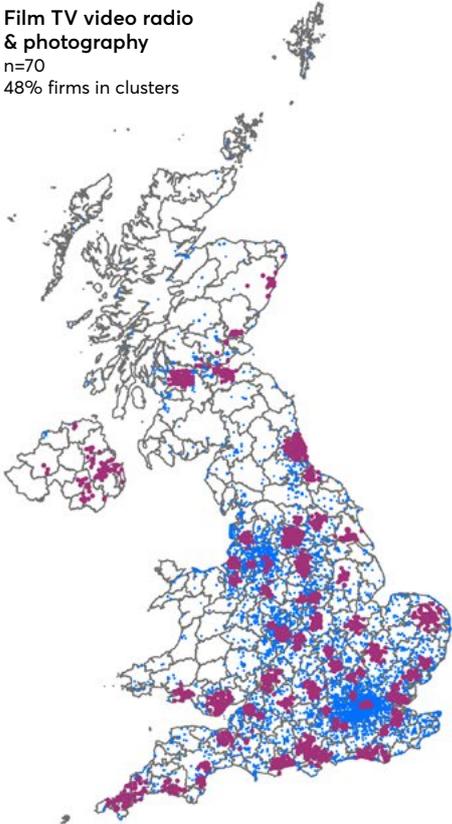
IT software & computer services
n=75
51% firms in clusters
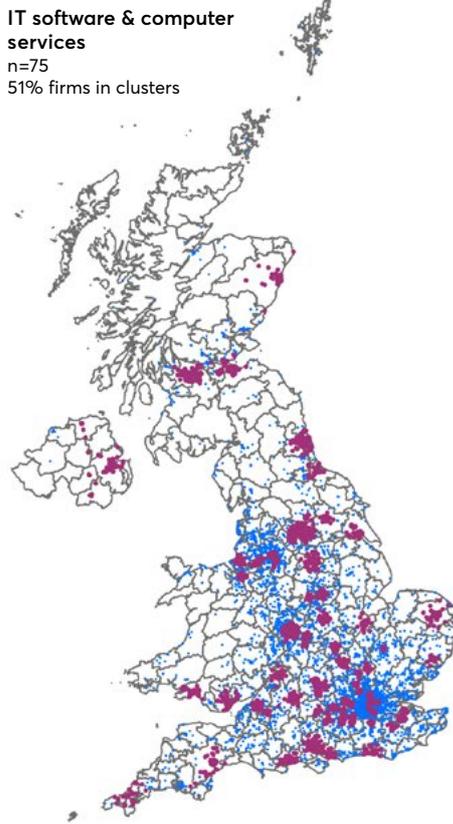
Publishing
n=75
51% firms in clusters
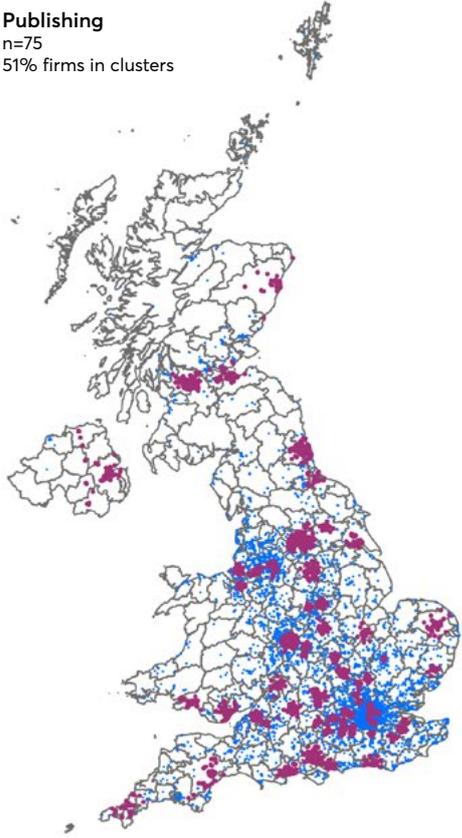
Museums galleries & libraries
n=64
46% firms in clusters
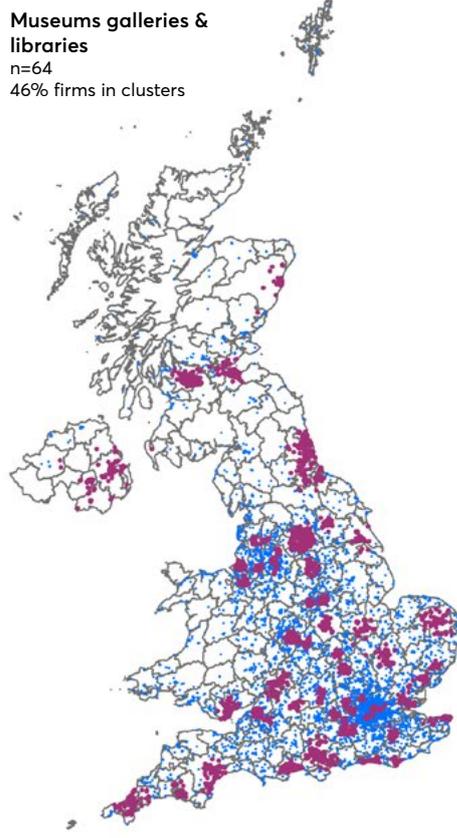
Music performing & visual arts
n=86
53% firms in clusters
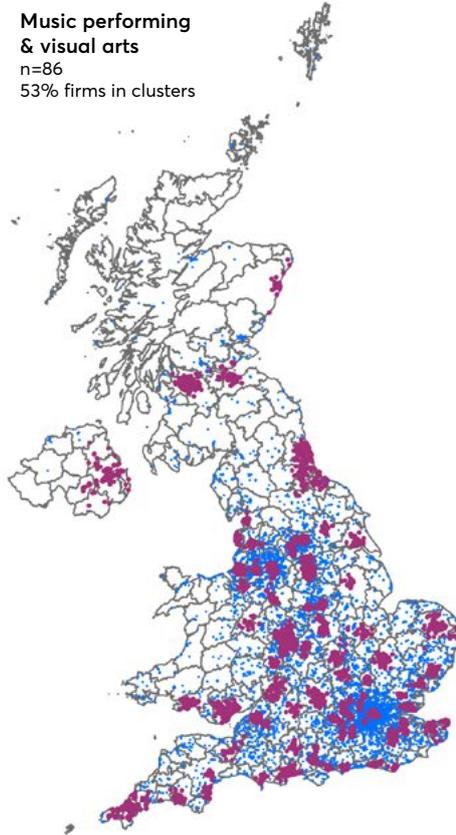
Note: Firms outside clusters indicated as blue dot

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Endnotes

1. See for instance Cooke and Lazzeretti (2008); Chapain et al 2010; Mateos-Garcia (2009); Cruz and Teixeira (2015); Mateos Garcia and Bakhshi (2016); Gong and Hassink (2017); Lorenzen 2018; Mateos Garcia et al 2018.

2. See for instance Lee (2014); Nathan et al (2016); for policy see for instance the Bazalgette review of the creative industries: https://www.gov.uk/government/publications/independent-review-of-the-creative-industries This report builds on the seminal Brighton Fuse project (Sapsed et al (2013)), which was particularly influential in documenting the economic impact of creative clusters.

3. Bloom, M. et al (2020).

4. Examples of research mapping clusters include Nesta's The Geography of Creativity in the UK (Mateos Garcia and Bakhshi (2016)) and Creative Nation (Mateos Garcia et al (2018)). Other studies using TTWAs to map clusters include Lee (2014).

5. These micro-level clusters of activity, as initially discussed in Duranton and Overman (2005), can happen at quite fine grained levels, as we will discuss. More geographically detailed analysis of creative industries have been discussed in Chapain et al (2010).

6. See Boix et al (2015), Rammer et al (2020), Hidalgo et al (2020).

7. Defined in this report by the 47 creative clusters identified in Mateos Garcia and Bakhshi (2016).

8. Please see the appendix for a detailed discussion of the advantages and drawbacks of using scraped data.

9. Glass data has been used in several previous studies of creative industries, including Creative Nation (Mateos Garcia et al (2018a) and The Immersive Economy in the UK (Mateos Garcia et al (2018b)).

10. Note that geographic concentration of creative industries is just one type of industrial agglomeration. The other mechanism suggested in the literature is regional specialisation, in which regions have a higher concentration of a particular type of economic activity, regardless of the specific geographical concentration within that region. See a discussion on both concepts in Yu (2019).

11. This approach has been widely applied in the academic literature (some applications include Boix et al 2015, Lazzeretti (Ed.). (2012), Power (2010), De propris et al (2009).

12. See Mateos Garcia and Bakhshi (2016).

13. A further typology of creative clusters was subsequently proposed in Mateos Garcia et al (2018).

14. For that aim, the self-adjusting (HDBSCAN)-clustering method was selected. The HDBSCAN is a hierarchical clustering method which uses a machine-learning clustering algorithm to identify a range of distances to separate clusters of varying densities from sparser noise (Campello, (2013)). We hope to complement this clustering approach with other clustering techniques in the future.

15. Our measure of clustering captures both patterns of location (clusters of firms in the same industry) and patterns of co-location of firms (cluster of industries that overlap). We hope to explore these two patterns in insolation in the future.

16. See for instance Roodhouse (2010).

17. Previous exercises show that creative industries seem to only benefit from localisation economies within the first kilometre (Arzaghi and Henderson (2008); Coll-Martinez et al. (2018); Coll-Martinez, (2019)). We consider a conservative threshold of minimum 50 firms per cluster to fully capture clustering in a small radius (up to 250 meters the average number of neighbours is 77). Boix et al. (2015) using a similar algorithm, also consider a minimum of 50 firms per cluster.

18. Though despite having the highest number of microclusters identified, only 43 per cent of London-based creative firms are located in a microcluster.

19. To identify the sub-sectors, we manually mapped Glass. ai's own sector classifications of its scraped web data (in which websites are assigned at least one of 109 discrete sectors) against the sub-sectors within the DCMS creative industries definition (see https://www.gov.uk/government/consultations/classifying-and-measuring-the-creative-industries-consultation-on-proposed-changes). This means that our classification of a company's sub-sector based on the content of its website may differ from its official SIC code. We are researching these differences and will publish our findings in a future report.

20. op. cit.

21. Please note that while for purposes of clarity we present percentages (e.g. X per cent vs Y per cent), in all cases our results are robust to regressions controlling for sector, firm size and age, as well as other variables where relevant. While we control for region in most cases, the high proportion of established creative clusters in London (in which every survey respondent is classed as being in a creative cluster) and the South East make some estimations difficult so in some cases we do not control for region but address regional differences in other ways, as addressed in the text.

22. This finding is broadly in line with the findings of the Creative Industries Council survey in 2018 (Creative Industries Council 2018), which found broadly similar findings, particularly for smaller firms.

23. Significance at the 0.05 per cent level is indicated in bold.

24. Respondents to our questionnaire were asked to rate factors on a scale of 1 to 5. Different respondents may answer these questions in different ways (for instance if someone were to answer '1' to all questions but '5' for just one, the relative importance of that response could be outweighed by a different respondent who answered '5' to every single question). To address this we take each respondent's answer to a question and divide it by the average of all that person's responses. Therefore a response that is substantially above the respondent's average answer will have a higher value.

25. We note that our initial analysis does not find robust statistical evidence of a difference in applications for external finance between companies inside and outside microclusters. This suggests that our finding of finance as a barrier to growth may be perceived by businesses, rather than manifested through higher rates of rejection. This is a phenomenon known as discouragement, where companies who might otherwise receive finance do not apply because they feel they will be unsuccessful. Previous research by Fraser (2011) has found this to be an issue in creative industries, and a forthcoming PEC discussion paper by Siepel and Velez Ospina, using different data from the survey used here, updates these results to show that companies in creative industries may not apply for finance because they feel they are not understood by financial institutions. Our findings in this study appear to be consistent with this hypothesis.

26. See Gardiner and Sunley (2020).

27. For example, an initial analysis of our data suggests that only 33 per cent of firms in our sample list the same address on their website as their official registered address on Companies House. Of the companies where the website address does not match the Companies House address, the median distance between the two addresses is 22km.

28. We were also aware of a risk that in a random sampling situation we might unintentionally end up with a 'creative industries' survey with more businesses formally located outside the creative industries than inside. While that on its own might be an interesting methodological exercise, it could limit the policy applicability of our overall conclusions.

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Creative Industries
Policy & Evidence Centre
Led by **nesta**

Creative Industries Policy and Evidence Centre (PEC)
58 Victoria Embankment
London EC4Y 0DS

+44 (0)20 7438 2500
enquiries@pec.ac.uk
🐦 @CreativePEC
www.pec.ac.uk