

# The Clusters and the Cluster Initiatives of the Russian Biopharmaceutical Industry

## Identification, Structure, and Geography

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1 Motivation

2 Evidence

3 Data

4 Methodology

5 Results

## What do we know about clusters?

- "Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate" (Porter, 1990)
- Clusters affect competition in three broad ways:
  - by increasing the productivity of companies based in the area;
  - by driving the direction and pace of innovation, which underpins future productivity growth;
  - by stimulating the formation of new businesses, which expands and strengthens the cluster itself
- Cluster development (Cluster Initiative) has become a focus for many government programmes (since 1990)

## What do we know about clusters?

- Geographic concentration is a key element for cluster development
- The Russian government started to develop Cluster Initiatives (CIs) in 2000
- Cluster policy is still one of the priorities of the Russian government

### Research Questions

Are the developed/created CIs in Russia economically concentrated?

AND

Are there any geographic locations in Russia where the concentration in mfg is high, without any CIs being implemented?

## Biopharmaceutical Industry in Russia

- The biopharmaceutical industry in Russia has historical patterns
- The biopharmaceutical industry is one of the most localised mfg industries in Russia (Aleksandrova, Behrens, Kuznetsova, 2019)
- The Russian government pays particular attention to the biopharmaceutical industry:
  - The 'Pharma 2020' Governmental Strategy of the Biopharmaceutical Industry was initiated in 2009
  - The 'Development of Pharmaceutical and Medical Industries for the period 2013-2020' National Target Programme was initiated in 2011
  - 'Pharma 2030' is being developed now

## Cluster Initiatives (Business Clusters)

- CIs consist of co-located and linked:
  - Industries (mfg companies),
  - Government,
  - Academia (Research Community),
  - Finance,
  - Institutions for collaborations

(Soelvell, Lindqvist, Ketels, 2003; Lindqvist, Ketels, Soelvell, 2013)
- Companies that are part of CIs are located in no more than one hour's drive from one another
- The average CI consists of around 80 companies

## Biopharmaceutical Clusters in Russia

- CIs are now supported in two ways:
  - by the Ministry of Economic Development — 27 pilot innovative territorial CIs since 2012;
  - by the Ministry of Manufacturing and Trade — 18 manufacturing clusters since 2015
- 12 CIs (out of the 27) and 10 CIs (out of the 18) have a biopharmaceutical specialisation

## Biopharmaceutical Clusters in Russia

### Results of different surveys

- CIs differ in size and by sector;
- $\approx 70$  companies per one CI;
- big mfg companies dominate in CIs;
- the share of SMEs is 19% (80% in Finland, 49% in France);
- $\approx 80\%$  of companies in CIs are located in no more than 90 minutes' drive from one another



## Biopharmaceutical Clusters in Russia

### Some concerns

- a big share of old 'Soviet' mfg companies, which are not ready for collaboration within the CI;
- a low level of SMEs in CIs;
- a low level of cooperation;
- in some cases, CIs are created to support weak industries or inefficient enterprises;
- an absence of companies with the same specialisation outside the CI in the locality (no competition outside of the CI => monopoly + lobbying)

## Data Sources for Cluster Initiatives

- the Russian Cluster Observatory of HSE (<https://map.cluster.hse.ru/>)
- the register of mfg clusters (the Russian Ministry of Manufacturing and Trade);
- the register of pilot innovative clusters (the Russian Ministry of Economic Development);
- the Russian Association of Clusters (<http://akitrf.ru/clusters/>);
- multiple documents of the Russian regional authorities

As a result: 167 CIs, 24 Biopharmaceutical CIs, the lists of all the companies in each CI

## Data Sources for Geographic Clusters (GC)

- Ruslana Database (Bureau Van Dijk Electronic Publishing <http://www.ruslana.bvdep.com>) [ $\approx$  1 million mfg companies];
- only active companies in 2018 [ $\approx$  600,000 mfg companies];
- the companies with biopharmaceutical, medical and radiation technology (using their respective OKVEDs) [ $\approx$  10,000, 1.67% of active mfg companies in 2018];

All the companies are precisely geocoded

## Identification of Geographic Clusters (GCs)

- How do we know a cluster when we see one?
- We identify GCs based on two key elements — the size and the specialisation (Delgado, Zeuli, 2016; Behrens, Boualam, Martin, 2017);
- We choose a radius ( $R = 15$  km)
- $N$  firms are in sector  $S$
- $M$  firms are in all other sectors
- For each firm  $i$  of sector  $S$ , we calculate how many firms  $n_i$  we observe in the same sector (within  $R$ ) and how many firms  $m_i$  we observe in all other mfg sectors (within  $R$ )
- We use these two parameters to identify a counterfactual distribution of the probability to see  $n_i$  firms of the sector  $S$  within  $R$
- The counterfactual distribution is formed by random permutations and bootstraps

## Identification of Geographic Clusters (GCs)

- If we observe around a firm  $i$  more than  $n_i$  firms among  $n_i + m_i$  firms within radius  $R$  ( $p$ -value  $< 0.05$ , hypergeometric distribution) → this locality has a specialisation  $S$  and the firm is a core plant;
- We also need a size criteria — a min number of firms in the same sector
- The size criteria allows us to exclude cases when (within  $R$ ) the share of firms in the sector of interest ( $S$ ) is big but the total number of firms is small

## Identification of Geographic Clusters (GCs)

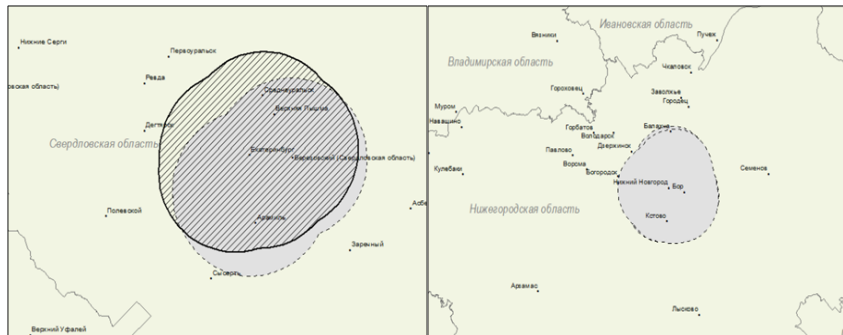
- We identify two types of GCs:
  - Primary GC —  $p$ -value  $< 0.05$ , no fewer than 50 firms within  $R = 15$  in the same sector  $S$
  - Secondary GC —  $p$ -value  $< 0.05$ , 10–49 firms within  $R = 15$  in the same sector  $S$
- For each primary and secondary GC, we plot a circle  $R = 30$  km (we increased the radius to minimise the bias for overlap)
- Overlapped circles with the same specialisation  $S$  are combined to identify the border of the cluster zone

## The Takeaway

What we have:

- Geocoded firms for each CI;
- Primary and secondary GCs (cluster zones);
- We plot CIs and GCs and look at overlaps

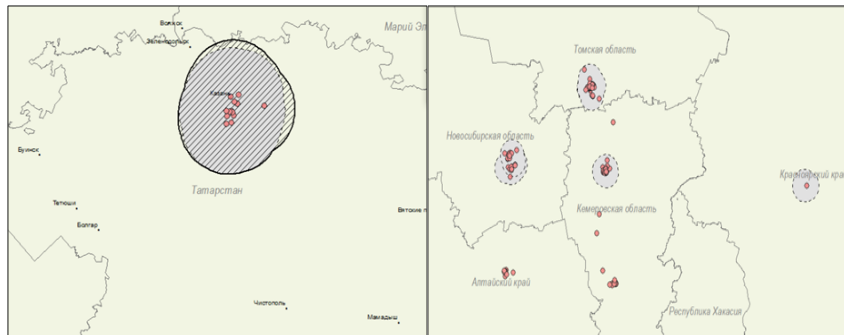
## Geographic Clusters (GCs) without Cluster Initiatives (CIs) Sverdlovsk Region and Nizhny Novgorod Region





## Overlap of GC and CI

Republic of Tatarstan and Siberian Regions (Tomsk, Kemerovo, Novosibirsk, Krasnoyarsk)



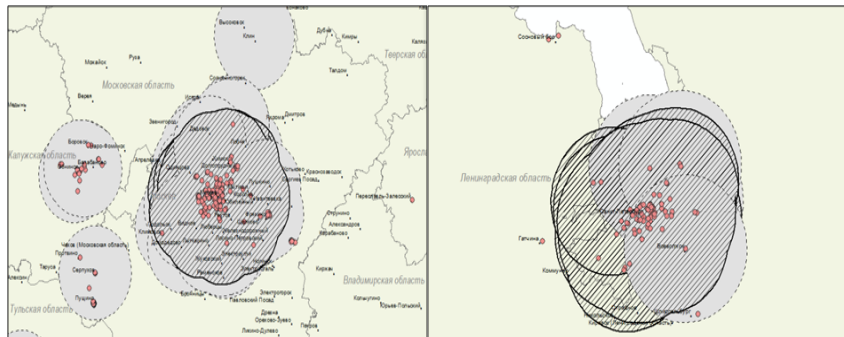
# CI without GC

## Perm Region



# Big Metropolitan Areas

## Moscow and Saint Petersburg



## Results

### CIs among GCs

- No cluster zones (GCs) for 8 out of 24 CIs
- One CI does not have any mfg companies
- We observe 3 cases when mfg companies are located in Moscow and no (or only 1-2) mfg companies in the region of locality:
  - CI of Yaroslavskaia Region — 2 out of 4 mfg companies in Moscow
  - CI of Krasnodar Region — only 1 mfg company and this company is located in Moscow (no specialisation in Krasnodar Region)
  - CI of Ivanovskaia Region — 3 out of 4 mfg companies in Moscow (no specialisation in Ivanovskaia Region)
- Protecting local companies from competition leads to excessive vertical integration and blunted pressure for innovation, retarding cluster development

## Results

### GCs — cluster zones with specialisation and without CIs

- No CIs in a region where we identified a specialisation
  - Stavropol Region
  - Novosibirsk Region
  - Tula Region
  - Voronezh Region
  - Sverdlovsk Region
- These regions probably do not completely utilise potential opportunities
- These regions probably have other priorities, or the mfg companies that form the specialisation are underproductive

# Results

## CIs — structure

- The classification of companies within CI (Soelvell, Lindqvist, Ketels, 2003; Lindqvist, Ketels, Soelvell, 2013):
  - Manufacturing companies,
  - Institutions for collaboration,
  - Academia,
  - Government,
  - Finance
- Our classification (due to our sector's being special):
  - Manufacturing (OKVED 01–02, 10–33),
  - Services (OKVED 35–63, 90, 93, 95),
  - Finance (OKVED 64),
  - Government (OKVED 68, 78, 79, 82, 84),
  - Medicine (OKVED 86, 88),
  - R&D (OKVED 70-74)

CI	N of CIs	Gov	Med	Mfg	R&D	Serv	Fin	Other	Mfg comp, N	Mfg comp, %
Medicine	10	4.0	13.7	29.6	39.6	10.4	1.5	0.0	6.6 [1–23]	62.6
Biopharmaceuticals	12	3.4	3.4	33.6	36.5	21.4	0.4	1.3	6.8 [0–18]	52.9
Nuclear and Radiation Technology	2	0.0	0.0	46.7	46.7	6.7	0.0	0.0	5.0 [4–6]	80.0
Total	24	3.5	7.1	32.6	38.0	16.8	0.8	1.2		54.3

- On average, 37 companies per one CI (min 6, max 187)
- On average, 32.6% of the mfg companies (min 6.7%, max 68.4%)
- 54.3% biopharmaceutical mfg companies among the group Mfg (min 14.3%, max 100%)
- 38% R&D companies
- 46% R&D + Medicine, but it would be nice to check whether all of them are included in the common projects
- 3 out of 24 CIs have financial organisations

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- 15 out of 24 CIs have managerial companies with extreme cases:
  - 6 managerial companies within CIs in Samara Region and in Tomsk Region
  - 4 managerial companies in Kaluga Region
  - There are some Ministries among the managerial companies
- On average, 16.8% of the service companies with extreme cases
  - 25% of the service companies in Tomsk Region and in Moscow (CI 'PhisTech XXI')
  - 40.2% in Irkutsk Region



- The mean distance between companies in CIs is 95.9 km (min 0 km, max 6151.7 km)
- The average number of workers is 508 with extreme cases:
  - 13,000 workers in Volgograd CI (Medical University)
  - 9,000 workers in Moscow (Moscow State University within CI 'Medical Technology, New Chemistry, and Biothech')
  - 6,400 workers in Moscow (Federal State Unitary Enterprise 'MicroGen' within CI 'Medical Technology, New Chemistry, and Biothech')
- 71% of the companies in CIs are SMEs (fewer than 250 workers, min 30%, max 100%)
- 17 out of the 24 CIs have nonactive companies (min 1.9%, max 20.4%)
- These companies were probably created just 'for application', or they were initially ineffective