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Article

German industry returning to cities

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AT A GLANCE

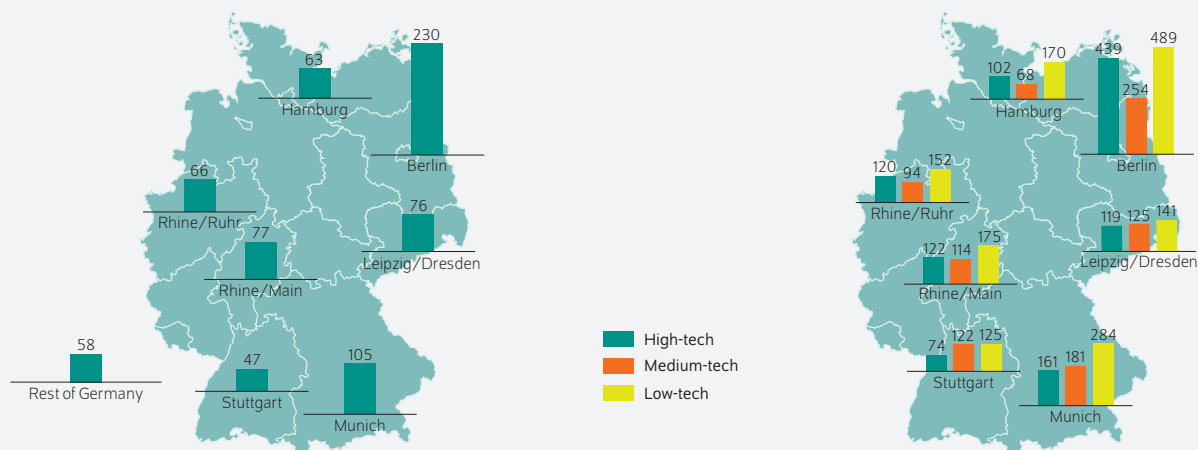
German industry returning to cities

By Martin Gornig and Axel Werwatz

- Historically, industrial activity was located in cities; after World War II, industry preferred to establish itself in less densely populated regions
- An analysis of German industrial start-up activity shows that more industrial ventures were created in big cities between 2012 and 2016 than in other regions
- Cities like Berlin, Leipzig, and Dresden, which have had little industry so far, were home to many industrial start-ups
- The example of Berlin suggests that proximity to research institutions as well as customers makes cities attractive start-up locations
- For these new urban potentials to be tapped, cities need adequate policies to solve the conflict between industrial and residential use of increasingly scarce space

The industrial start-up intensity was higher in cities than in other regions in recent years; many high-tech as well as low-tech industrial ventures have been founded in cities

Industrial start-ups per 100,000 in industry (right: in the various technology classes), 2012 to 2016; right: rest of Germany = 100



Source: Regional (state level) accounts, Regional Statistical Offices of Germany, authors' own calculations.

FROM THE AUTHORS

“For a long time we have seen mass production in industry, hence a need for wide spaces.

That led industry to turn its back on cities.

Today, we are able to produce in small series thanks to digital technologies.

It then becomes a competitive advantage to be located in cities, close to customers.”

— Martin Gornig, study author —

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ABSTRACT

Is the German manufacturing industry, which has been leaving cities for less densely populated areas since World War II, being lured back into urban centers? This report analyses industrial start-ups from 2012 to 2016 and derives their preferred locations. The analysis shows that the start-up intensity in large agglomerations is on average almost 40 percent higher than in the other regions of Germany. Agglomerations attract start-ups with the advantages they offer, namely proximity to both research facilities and customers for the new (digital) industry. Accordingly, many new companies are being founded in city centers. To tap cities' growth potential, not only must the influx of risk capital, knowledge, and skilled workers be secured, but space bottlenecks eliminated as well.

Historically, cities and industry have been inextricably linked.¹ Industrialization in the 19th century resulted in many new cities and increasingly fast growth of traditional city centers. Additionally, technology and products which further drove industrial growth were developed in cities.

Similar to many other industrialized countries, suburbanization shaped regional dynamics in Germany after World War II. Area-intensive, ground-level production organization; flexible truck-based logistics structures; and environmental requirements have partly been driving industry out of urban centers.² As a result, density, or the degree of urbanization, is negatively related to the share of industrial employment in parts of the European Union,³ as an analysis that controls for the influence of national regulations shows (Figure 1). Compared to the reference regions with low density, the industrial share is almost nine percentage points lower in very densely populated regions. Even in densely populated regions, the difference to the low-density reference region is still six percentage points. In contrast, Europe's geographic position positively affects the industrial share. The more central a region is, the higher its expected share of industrial employment.

Germany benefits from its central location in Europe as it makes the EU's large sales markets easy to access. However, even when controlling for factors such as a region's location and its degree of agglomeration, German regions benefit additionally from other favorable (national) conditions, such as Germany's research landscape or its comparatively low level of cost (relative to productivity).⁴

¹ Helmut Croon, "Zur Entwicklung deutscher Städte im 19. und 20. Jahrhundert," *Studium Generale – Zeitschrift für die Einheit der Wissenschaften im Zusammenhang ihrer Berufsbildungen und Forschungsmethoden* 9 (1963): 565-575 (in German).

² Walter Siebel, "Suburbanisierung," in *Handwörterbuch der Raumordnung*, ed. ARL – Akademie für Raumforschung und Landesplanung (Hannover: Akademie für Raumforschung und Landesplanung, 2005): 1135-1140 (in German).

³ Martin Gornig und Axel Werwatz, "Industrielle Potentiale in den Regionen der Europäischen Union," (mimeo, Technische Universität Berlin, 2018) (in German).

⁴ These conditions include, for example, the tax system, labor law, and social systems.

Germany was strongly affected by industry's exodus from the cities after the end of World War II as its economic power is more heavily based on manufacturing than that of other European countries.⁵ Especially in large urban municipalities, the industrial employment share is generally far below average.⁶ However, when looking at both the city together with its surrounding area, industry has differing levels of significance in the various large agglomerations (Figure 2).⁷ In the regions of Stuttgart and Munich, for example, significantly more individuals are employed in manufacturing relative to the number of inhabitants than the national average. In contrast, the amount of industrial activity is considerably lower in the Berlin and Hamburg regions. The Leipzig/Dresden region is on par with the Rhine/Main and Rhine/Ruhr urban regions.

Different technological specializations are decisive for these differences between regions. A breakdown by technological category as defined by the OECD⁸ shows that the Stuttgart and Munich regions are particularly strong in high-tech industries such as pharmaceuticals, automotive engineering, mechanical engineering, and electrical engineering. Medium-tech sectors such as the chemical and metal industries are strongly developed in the Rhine-Ruhr and Leipzig/Dresden regions in particular. Differences are not very pronounced in the low-tech sector: even Hamburg and Berlin have average values in the consumer goods and food industries, which are included in this category.

The following section examines the extent to which industrial start-ups differ from these existing patterns.⁹

Industrial development patterns are changing

The development conditions and growth patterns of industry are fundamentally changing. In Germany, this change is known as *Industrie 4.0* (Industry 4.0), the fourth industrial revolution. New digital relationships with customers, new data-driven management processes, new generations of robots controlled by sensors, and new additive manufacturing technologies make it possible to create and realize new industrial production processes and products.¹⁰ On the one hand, this entails enormous potentials for rationalization, which would make entire production steps and occupational

⁵ With a share of over 23 percent value added, industry in Germany is particularly important for economic performance in an international comparison.

⁶ See Figure 5 in Christian Franz, Marcel Fratzscher, and Alexander S. Kritikos, "German right-wing party AfD finds more support in rural areas with aging populations," DIW Weekly Report 7/8 (2018): 76 (available online).

⁷ Spatial planning regions used as the observation unit. Spatial planning regions are functional spatial analysis regions comparable nationwide for the purposes of spatial observation and policy advice as defined by the Federal Institute for Research on Building, Urban Affairs, and Spatial Development. The 96 spatial planning regions are between counties and districts in terms of size and generally adhere to the borders of the federal states. See the website of the Federal Institute for Research on Building, Urban Affairs, and Spatial Development.

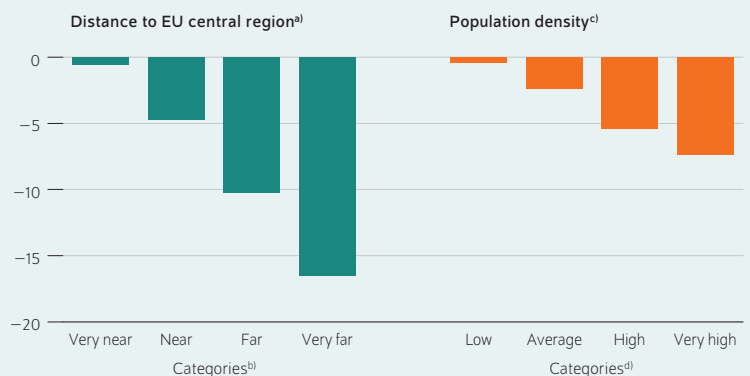
⁸ Eurostat, Glossary: High-tech classification of manufacturing industries (available online, accessed November 8, 2018; this applies to all other online sources in this report unless stated otherwise).

⁹ This study is based on work sponsored by the Hans Böckler Foundation.

¹⁰ Michael Hüther, "Digitalisierung: Systematisierung der Trends im Strukturwandel – Gestaltungsaufgabe für die Politik," *IW Policy Paper* 15 (2016) (in German; available online).

Figure 1

Impact of location and urbanization on the share of industrial employment in EU NUTS2 regions 2000 to 2015, difference in percentage points



- a) Travel time by truck to center of the EU ("blue banana"): very near (less than two hours), near (two to eight hours), far (eight to 16 hours), very far (more than 16 hours)
- b) Reference category: center of the EU
- c) Low (29 to 285 inhabitants per square kilometer), average (286 to 529 inhabitants/km²), high (530 to 1,053 inhabitants/km²), very high (more than 1,053 inhabitants/km²)
- d) Reference category: very low population density (fewer than 29 inhabitants /km²)

Note: the center of the EU is a densely populated, banana-shaped corridor spreading from northern England to the Mediterranean, encompassing the Benelux countries, parts of Germany, Switzerland, and northern Italy. It is characterized by its dynamic and highly integrated economic activity. See Roger Brunet et al, *Les villes européennes*, RECLUS-DATAR (1989).

To illustrate: the industrial employment share in a region with eight to 16 hours of travel time to the center of the EU is approximately ten percentage points lower than in the center of the EU.

Source: Eurostat; Gornig and Werwatz, *Industrielle Potentiale*.

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The closer to the center of the EU and the less populated a region is, the higher its share of industrial employment.

groups superfluous.¹¹ On the other hand, this enables completely new sales potentials, for example through small-scale and on-the-spot production.¹²

The importance of spatial price differences or transport costs are changing. Accordingly, different scenarios are conceivable as to how the spatial pattern of industrial activity may evolve.¹³ With regard to the development potentials of agglomerations, industrial processes in the high-tech sector—which can further divide urban societies—are discussed and potentials described for revitalizing previously disadvantaged urban districts.¹⁴

¹¹ Marc Ingo Wolter et al., "Industrie 4.0 und die Folgen für Arbeitsmarkt und Wirtschaft," IAB Forschungsbericht 8 (2015) (in German; available online); Dauth et al., "German Robots – The Impact of Industrial Robots on Workers," IAB Discussion Paper 30 (2017) (available online).

¹² PricewaterhouseCoopers, *Industrie 4.0: Chancen und Herausforderungen der vierten industriellen Revolution* (2014) (in German; available online); Yoram Koren, *The Global Manufacturing Revolution: Product-Process-Business Integration and Reconfigurable Systems* (Hoboken, New Jersey: Wiley, 2010).

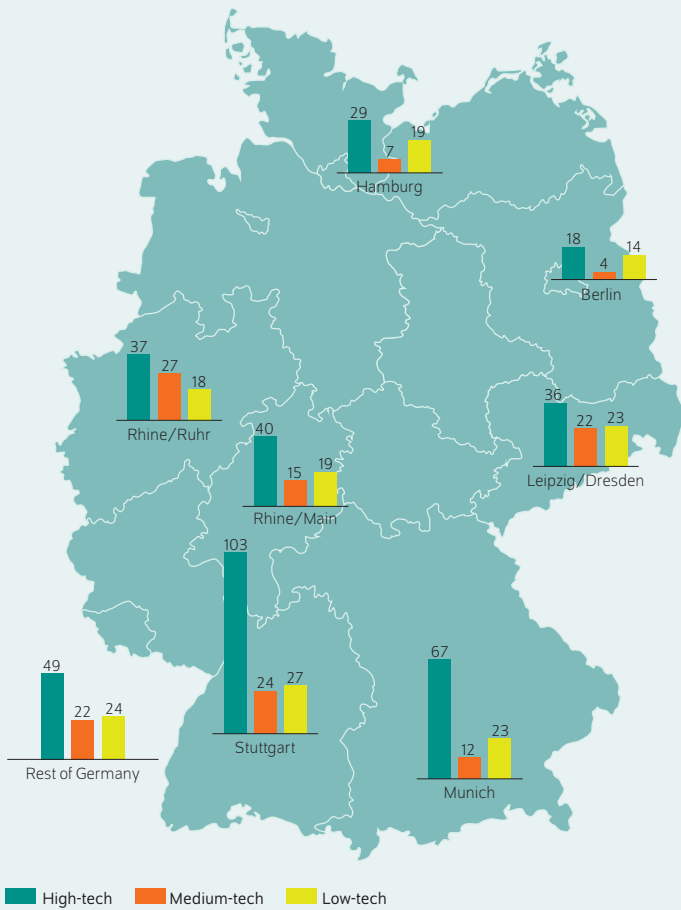
¹³ Bertelsmann Stiftung und Stiftung neue Verantwortung, *Auf dem Weg zum Arbeitsmarkt 4.0? Mögliche Auswirkungen der Digitalisierung auf Arbeitsmarkt und Beschäftigung in Deutschland bis 2030* (in German; available online).

¹⁴ Dieter Läßle, "Produktion zurück in die Stadt," *Bauwelt* 35 (2016).

Figure 2

Importance of industrial employment in the large agglomerations of Germany

Employees per 1,000 inhabitants in 2015, by technology category



Note: See Footnote 8 in the main body of the text for further information regarding the classification of industrial sectors by technology intensity.

Source: Eurostat, authors' own calculations.

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Industrial employment is above average in the southern metropolitan regions.

This analysis takes an empirical approach to the question of locational changes in industry. As a working hypothesis, it is assumed that newly established companies are most likely to provide information about new location preferences that also take digital conditions into account. This information can help identify possible future locational development patterns.¹⁵ Accordingly, we analyze where new start-ups are being founded in Germany. Start-ups recorded here are newly established, legally independent enterprises in the manufacturing sector according to business registrations.

Agglomerations have high industrial start-up intensity

In order to identify new industrial location patterns, it is more informative to work with start-up intensity rather than the absolute number of start-ups founded. We therefore looked at the number of industrial start-ups in the 2012 to 2016 period *relative* to the number of employees in the manufacturing sector at the beginning of the observation period (Figure 3).

To begin with, it should be noted that the average start-up intensity in the agglomerations mentioned is—with 80 start-ups per 100,000 employees—almost 40 percent higher than in the other regions of Germany.

At the same time, start-up intensities differ strongly between agglomerations. Those with the highest intensities are not necessarily the regions that have been previously successful. This applies particularly to Berlin, where almost four times as many companies are founded in the manufacturing sector than in the rest of Germany relative to the current level of industrial employment. The Leipzig/Dresden area, the Rhine/Main area, and the Rhine/Ruhr metropolitan area also exhibit above-average start-up intensities. Of the agglomerations in southern Germany that have thus far shown a strong growth performance, only Munich can boast a high industrial start-up intensity. In the Stuttgart region, on the other hand, the number of new industrial start-ups is below average relative to current employment. All in all, the location patterns of start-ups not only indicate that industrial growth patterns may be shifting in favor of large cities, but also that new hierarchies may emerge between agglomerations.

In order to assess whether the new growth patterns are significantly driven by the emergence of a new (digital) high-tech industry or by simpler consumer-oriented industries as well, we assigned start-ups to the technology categories of the OECD.¹⁶ Figure 4 shows the start-up intensities of the agglomerations by technology category relative to the average development in the rest of Germany.

¹⁵ The successful digitalization of existing industrial enterprises is also essential for the medium-term performance of large cities. See Ralf Lückener and Martin Gornig, "Bestandsentwicklung als Ansatz zur Industriepolitik – das Beispiel Berlin," *DIW Wochenbericht*, no. 46 (2018) (in German; available online).

¹⁶ The areas of "cutting-edge technology" and "high-quality technology" were combined into the "high-tech" category. For more information see Footnote 8.

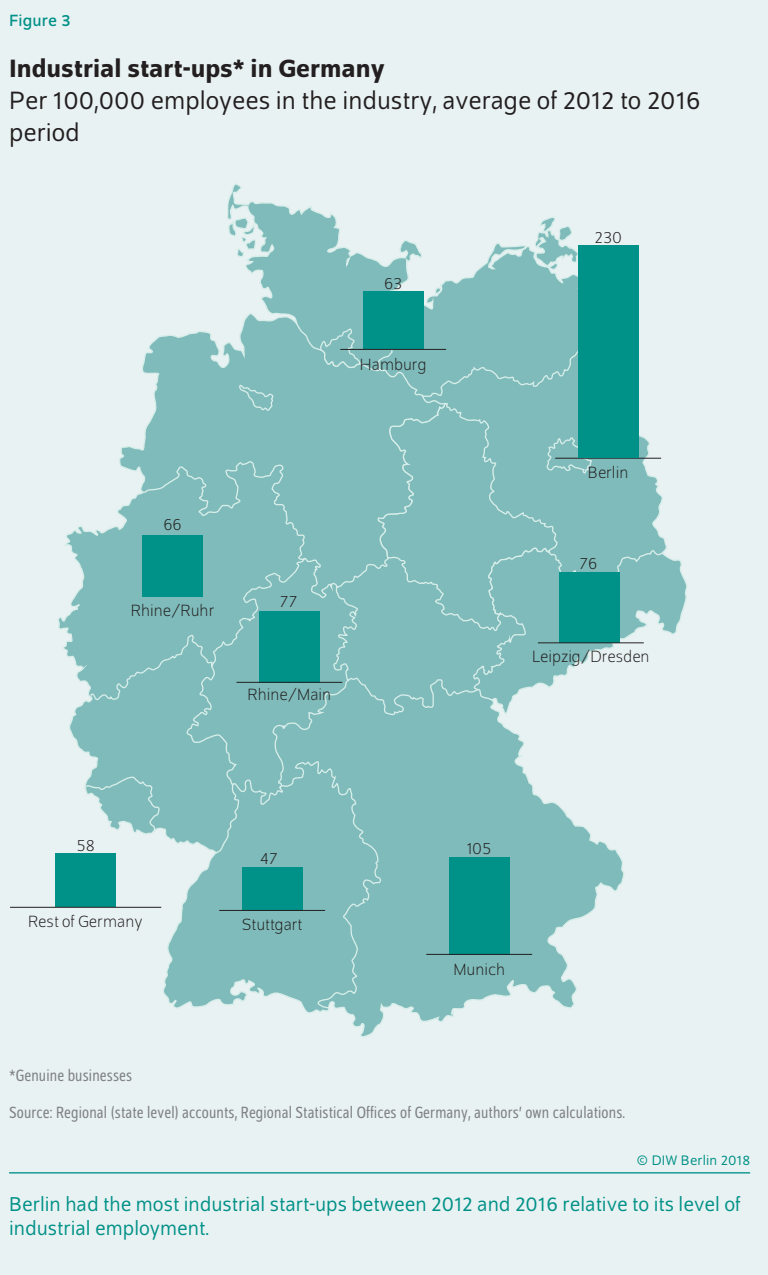
The large agglomerations appear to be particularly attractive to industrial start-up founders in the low-tech industries. In Berlin and Munich, start-up intensity in this category is five and three times higher, respectively, than the average in non-urban regions. In Hamburg and the Rhine/Main region, the start-up intensity in the low-tech industries exceeds the reference level by around 70 percent. The start-up intensity in the low-tech industries is, however, also above average in Stuttgart, Leipzig, Dresden, and the Rhine/Ruhr region. This could indicate that digitalization creates new development potential in cities, particularly in more traditional consumer goods industries. Digital manufacturing technologies, for instance, open the door to profitable, on-demand small-scale production in the vicinity of customers (customization).

At the same time, agglomerations with well-developed research infrastructure also have significantly higher start-up intensities in the high-tech industries compared to the other regions of Germany. Berlin is leading the way here: relative to employment in the manufacturing sector in 2012, more than four times as many high-tech companies were founded in Berlin than in non-agglomerations. In contrast, the start-up intensity in the medium-tech area in Berlin is relatively low. Hamburg, the Rhine/Main area, and the Rhine/Ruhr area show a similar polarization in their start-up intensity pattern. In the Stuttgart region, on the other hand, start-up intensity is below average, particularly in the high-tech industries, an area in which the region as a whole is currently successful.

Industrial start-ups looking to be near universities and customers

Start-up location decisions within cities can point to what makes large cities so attractive to industrial start-ups. We were able to analyze these location patterns of start-ups in Berlin, the largest German city, which has both the highest absolute and relative number of start-ups. To this end, we analyzed individual level data from the business register at the Research Data Center of the Statistical Office Berlin-Brandenburg.¹⁷ To ensure data protection, company locations were assigned to 60 local areas of Berlin, the “statistical planning areas” of the city.¹⁸ Start-ups founded in 2013 and 2014 were also assigned to these planning areas.

Industrial start-ups in Berlin show high spatial concentration. Of the 155 high-tech start-ups, around a third are located in six preferred locations (Figure 5). The largest number of high-tech start-ups is located in the urban, western district of Charlottenburg, where the main campus of the Technical University is located, not far from the Beuth University of Applied Sciences. Another preferred location is Adlershof in the southeast of Berlin, where a Humboldt University

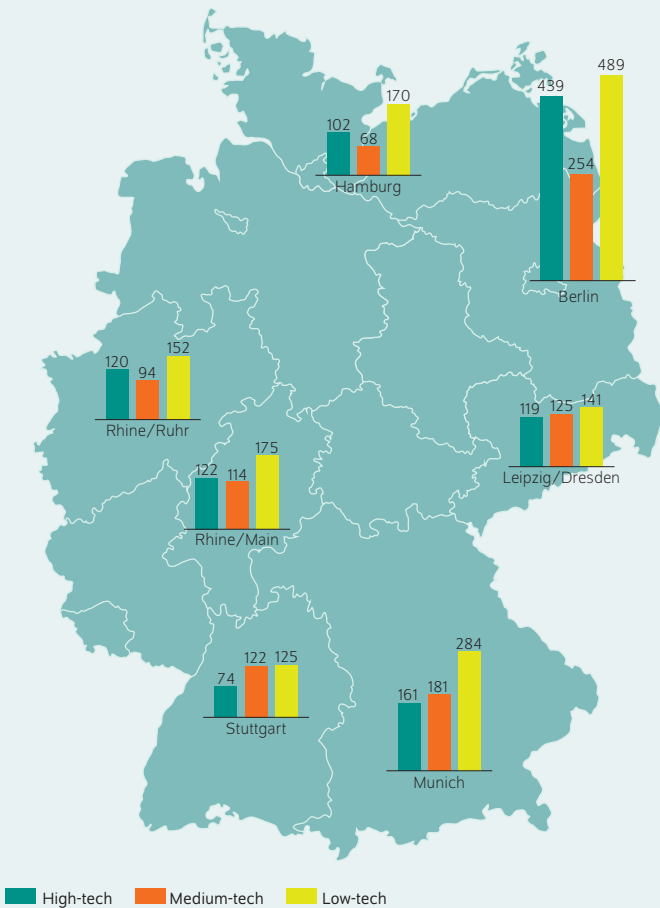


¹⁷ Jan Klare, "Industriestandort Berlin. Ergebnisse einer Auswertung des Unternehmensregisters", *Zeitschrift für amtliche Statistik Berlin-Brandenburg* 11, no. 4 (2017): 58-63 (in German).

¹⁸ The website FIS-Broker of the Senate Department for Urban Development and Housing provides information on the land use of the planning areas (in German).

Figure 4

Industrial start-ups* in Germany by technology category
Per 100,000 employees in the respective technology category, average of 2012 to 2016, throughout: rest of Germany = 100



*Genuine businesses

Source: Regional (state level) accounts, Regional Statistical Offices of Germany, authors' own calculations.

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Low-tech start-ups are the largest group among all industrial start-ups in all metropolitan regions.

campus and large technology park are located.¹⁹ The fact that these locations are rife with in-demand specialists for the start-ups plays a considerable role.

Low-tech industrial start-ups are also strongly concentrated in a few locations. In this technology area, more than a third of all start-ups are founded in the six most popular locations (Figure 6). These preferred locations are all in the highly dense city center of Berlin. One reason could be that the city center provides the proximity to customers that is a key concern in consumer-orientated production. For now, consumer goods industries are still dominated by mass production. However, through the use of additive manufacturing technologies (3D printing), small-series production is becoming increasingly inexpensive. Accordingly, individual customer demands can be dealt with directly and more easily—and it is advantageous if the customer is right around the corner.

Conclusion: politicians must set the right course for a re-urbanization of industry

The spatial location patterns of industry are changing. This applies not only to the international division of labor but to the regional patterns within Germany as well. An analysis of industrial start-up activity in Germany indicates that agglomerations can benefit from the new (digital) production opportunities. The need for spatial proximity to research institutions and consumers seems to be the main reason (digital) industrial start-ups favor agglomerations.

From a growth policy perspective, the city can thus increasingly become an incubator for the revival of industry. The expansion of high-tech industries and the development of new growth potentials in consumer goods industries will likely strengthen Germany's competitive position in the world in the long term.

From a regional policy perspective, industry's possible re-urbanization tendencies are assessed differently. On the one hand, they could widen the existing gap in economic performance between urban and rural areas. On the other, a general re-urbanization trend in industry would counteract a further polarization of growth processes to a few southern German centers in Bavaria and Baden-Württemberg.²⁰

However, newly founded companies must turn into sustainable, growing industrial enterprises to actually transform the potential of digitalization into a revival of big cities as an industrial location. Policies can support these growth processes in many ways, such as by improving access to risk capital, intensifying knowledge transfers, or increasing the availability of specialists from home and abroad.²¹

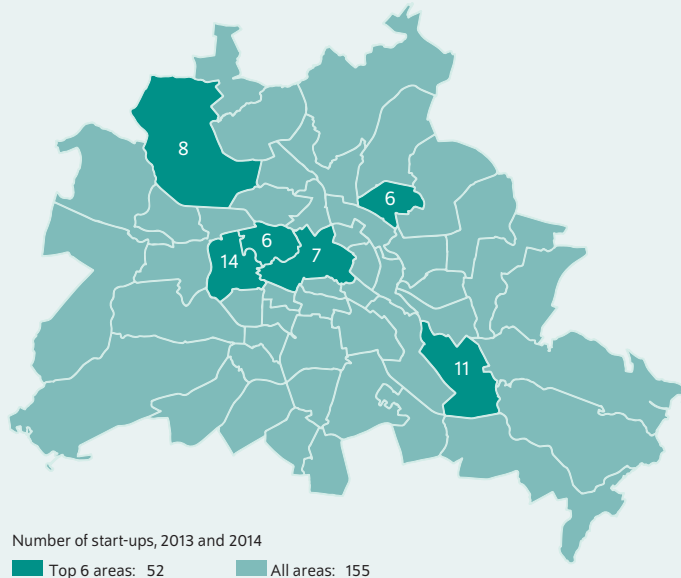
¹⁹ Lars Handrich, Ferdinand Pavel, and Sandra Proske, "Standort Berlin-Adlershof: kräftige Impulse für die Stadt," *Wochenbericht des DIW Berlin*, no. 4 (2008): 41-46 (in German; available online).

²⁰ Alexander Eickelpasch und Rainer Behrend, "Industrie in Großstädten: Klein, aber fein," *DIW Wochenbericht*, no. 32/33 (2017): 639-651 (in German; available online).

²¹ Alexander S. Kritikos, "Berlin: a Hub for Startups but Not (Yet) for Fast-Growing Companies," *DIW Economic Bulletin*, no. 29/30 (2016): 637-644 (available online); Kirsti Dautzenberg et al, "Studie über schnell wachsende Unternehmen (Gazellen)," Ramboll und Creditreform, im Auftrag des Bundesministeriums für Wirtschaft und Technologie (2012) (in German; available online).

Figure 5

Preferred locations for high-tech industrial start-ups within Berlin



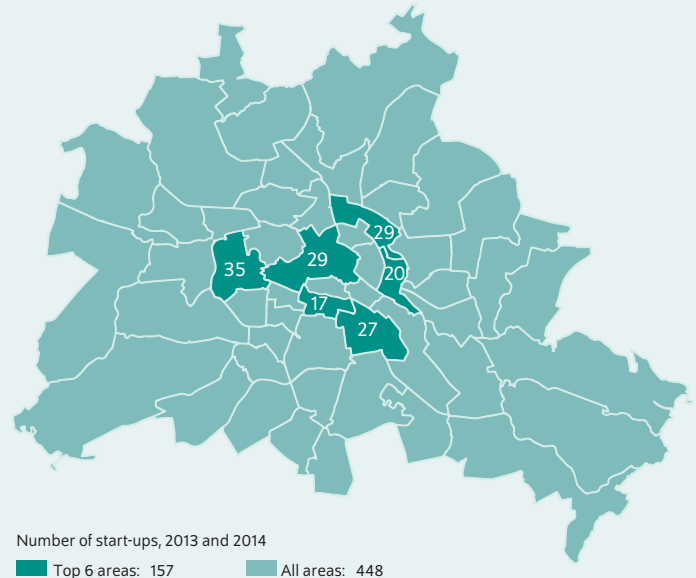
Note: Statistical planning areas are used as space units, see Footnote 18 for more details.
Source: Statistical Office of Berlin-Brandenburg, authors' own calculations.

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The science park Adlershof is among the most popular locations for high-tech industrial start-ups.

Figure 6

Preferred locations for low-tech industrial start-ups within Berlin



Note: Statistical planning areas are used as space units, see Footnote 18 for more details.
Source: Statistical Office of Berlin-Brandenburg, authors' own calculations.

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New industrial companies in the low-tech category prefer to be located in the central districts of the city.

The increasing shortage of space in agglomerations may also prove to be an important bottleneck. The limited availability of affordable living spaces in city centers is putting pressure on politicians to create additional housing, especially in large cities. At the same time, city centers offer decisive growth advantages for the new (digital) industry due to the proximity to high-quality research and solvent customers. Indeed, analyses of fast-growing industrial companies have indicated that they will retain their locations close to the city center even during expansion.²²

Thus, a central task for politicians will be to resolve conflicts of land use between residential and commercial properties.

²² Technical University of Berlin, "Aufgespürt: Raumprofile schnell wachsender Industrieunternehmen," Projektbericht am Institut für Stadt und Regionalplanung (ISR) (2017) (in German).

An essential contribution to this could be made by an active use of legal planning instruments for the mixed residential and commercial use of buildings, for example the "urban areas" introduced in zoning laws in 2017. In particular, new solutions that enable both residential and commercial use of buildings are in demand.²³ At the same time, traditional forms of fixed planning specifications, such as commercial property protection statutes, would have to be made more flexible. In many cities, there is currently also a lack of efficient area monitoring.

²³ In some North American and European metropolises, there are now examples of such "urban factories." Dieter Läßle, "Perspektiven einer produktiven Stadt," in *Urbanisierung durch Migration und Nutzungsmischung*, ed. Klaus Schäfer (Bielefeld: transcript Verlag, 2018) (in German).

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