



HSE GLOBAL CITIES INNOVATION INDEX

2023



TALENT MAGNETS: HOW TO ATTRACT
ACTORS OF INNOVATION ECONOMY
FROM AROUND THE WORLD



HSE GLOBAL CITIES INNOVATION INDEX

2023

TALENT MAGNETS: HOW TO ATTRACT
ACTORS OF INNOVATION ECONOMY
FROM AROUND THE WORLD

Moscow 2023

УДК 332.122:001.895(1-21)(083.41)
ББК 65.051(0-2)
H35

Editorial Board: Leonid Gokhberg and Evgeniy Kutsenko

Authors: Victoria Boos, Leonid Gokhberg, Ekaterina Ivanova, Evgeniy Kutsenko, Tatyana Ostashchenko, Alexander Snegirev, Ekaterina Streltsova, and Kirill Tyurchev

HSE Global Cities Innovation Index: 2023 / V. Boos, L. Gokhberg, E. Ivanova et al.; ed. by L. Gokhberg, H35 E. Kutsenko; National Research University Higher School of Economics. – Moscow : HSE, 2023. – 312 p. – 70 copies. – ISBN 978-5-7598-2770-2 (pbk).

HSE Global Cities Innovation Index (HSE GCII 2023) has been developed by the Russian Cluster Observatory of the National Research University Higher School of Economics Institute for Statistical Studies and Economics of Knowledge. It presents a measurement tool to evaluate the competitive edge of cities in terms of their attractiveness for the innovation economy leaders.

The ranking is based on a comprehensive approach to assessing innovation that covers the analysis of technological development, creative industries, and urban environment. The study is based on a specially developed system comprising 74 indicators calculated for 200 global cities with the use of recognized international data sources.

The report presents ranking scores and examines key factors of attracting the world's most successful innovation economy individuals to cities. It also discloses the ranking algorithm and provides detailed methodological comments. The publication includes 100 city profiles with full information about their rankings according to each indicator.

The publication will be of practical interest to a wide range of readers, including technology entrepreneurs and researchers, artists and representatives of creative industries, urban governance practitioners, and professionals involved in the development of specific innovation economy sectors.

УДК 332.122:001.895(1-21)(083.41)
ББК 65.051(0-2)

doi 10.17323/978-5-7598-2770-2

ISBN 978-5-7598-2770-2

© National Research University
Higher School of Economics, 2023
Reference is mandatory in case of reproduction

Acknowledgements

We express our sincere gratitude to the employees and partners of the Institute for Statistical Studies and Economics of Knowledge within the Higher School of Economics for their significant contribution to preparing HSE GCII 2023.

During all stages of preparing this report, our ISSEK colleges have demonstrated invaluable assistance – Vasily Abashkin (data collection on global cities), Sergey Artemov (communication with experts), Inga Ivanova (Chinese translation of analytical materials and government documents that shed a light on the development of Chinese megacities), Dirk Meissner, Victoria Panova, Elena Sabelnikova, and Alexander Sokolov (organization of discussions about methodology with foreign partners).

The authors appreciate the help of Russian and foreign experts: Mariam Arevadze, Arina Avdeeva, Ling Chen, Alexey Fursin, Kirill Il'nitskiy, Michael Kahn, Kristina Kostroma, Yury Kuntsev, Keun Lee, Maria Mayorova, Maria Medvedeva, Johann Mouton, Olga Nechaeva, Anna Raevskaya, Svetlana Urnysheva, and Jiahui Wang, who dedicated a lot of their time to discussing the most complicated issues of measuring innovation in global cities.

Patent and publication activity analysis has a special place in the report. The work of Maxim Kotsemir and Denis Martynov helped us gather the most complete collection of data for all 200 cities within agglomerations.

A considerable help in searching, understating, and describing in great detail the success stories of cities' innovation development was provided by Tatyana Gulyaeva, Ekaterina Nekrasova, Tatyana Raeva, Alexander Yushkin (smart visas and soft landing programs in different countries), Ilya Dunichkin (Tokyo's high tech and creative industries), and Alicia Sedano-Funciya (advertising and PR in Latin American countries).

We are grateful to the editor of this report Maria Sokolova who helped us explain all ideas and results of the study in a more understandable and convincing way.

The HSE GCII 2023 is intended for an international audience. For the English version of this report, the credit goes to Maria Rukhalenko (translation and editing) and Caitlin Montgomery (proofreading).

Exceptional graphic design has been provided by a team of designers who developed the visual concept (Galina Podzolkova, Anastasia Sevodneva, Ivan Tsygankov, and Oleg Vasiliev), created unique illustrations (Tatyana Kasimova), and prepared the layout for printing (Tatyana Koltsova and Vladimir Puchkov).

HSE GCII 2023 is based on a unique database, with numerous indicators calculated at the city level for the first time ever. We are grateful to the interns of our project: Marina Abashkina, Elina Afanasenko, Maria Ageeva, Elvina Amirova, Polina Babikova, Arina Berman, Darya Burova, Kirill Eskin, Aida Fazullina, Vasily Fedorinin, Darya Fontana, Egor Gorsky, Olga Korolenya, Darya Kuznetsova, Elizaveta Mendrelyuk,

Anna Molodtsova, Stepan Prosvirov, Marina Pozhidaeva, Arseny Rogozov, Nickolay Sevastyanov, Sofia Shklyaeva, Anna Sokoreva, Semyon Tarnavsky, Ksenia Timofeeva, Svetlana Tsyplyaeva, Artemy Voloshin, and Elizaveta Zyryanova. Without them, we would not have been able to analyze so many cities and aspects of their innovation development.

Table of Contents

Executive Summary	9
Introduction	13
Abbreviations	20
RANKING SCORES	23
1. Overall Global Cities Innovation Index	27
2. Technological Development	63
3. Creative Industries	109
4. Urban Environment	151
METHODOLOGY AND STATISTICAL AUDIT	175
CITY PROFILES	209
References	310

List of Figures and Tables

Figure 1. Ranking Structure of HSE GCII 2023	16
Figure 2. Database of HSE GCII 2023	17
Figure 3. Sampled Cities of HSE GCII 2023	19
Figure 4. Subindices' Contribution to the Overall HSE GCII 2023: Top 50 Cities	42
Figure 5. Top 30 HSE GCII Cities by Technological Development and Creative Industries Subindex Values: 2023	44
Figure 6. Subindices' Contribution to the Overall HSE GCII 2023: "Magnets for Innovation Leaders"	45
Figure 7. Subindices' Contribution to the Overall HSE GCII 2023: "High Tech Hubs"	46
Figure 8. Subindices' Contribution to the Overall HSE GCII 2023: "Poles of Parity Development of Technologies and Creativity"	48
Figure 9. Selected HSE GCII Cities' Ranks in the Overall HSE GCII and Subindices: 2023	52
Figure 10. Top 10 Cities' Ranks in the Technological Development Subindex: 2023	72
Figure 11. Selected Indicators for Tokyo and the Top 10 HSE GCII Cities by the Number of Unicorns: 2022	76
Figure 12. Top 10 HSE GCII Cities by the Number of Leading Universities: 2022	83
Figure 13. Top 20 Universities by the Number of Alumni Who Founded Unicorns	86
Figure 14. Top 10 HSE GCII Cities by the Number of International Students: 2021, thousands	88
Figure 15. Selected Indicators for the Top 15 HSE GCII Cities by the Number of Publications: 2016–2020	91
Figure 16. Top 20 HSE GCII Cities by the Number of Publications and Patent Applications	95
Figure 17. Top 20 HSE GCII Cities by the Number of Patent Applications: 2017–2019	97

Figure 18. Top 10 HSE GCII Cities by the Number of Supercomputers: 2022.....	99
Figure 19. Top 20 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises): 2023 (Normalized Estimate)	121
Figure 20. Top 20 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises) in Film and Animation and Electronic Games: 2023.....	122
Figure 21. Top 20 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises) in Fashion, Architecture, Arts, and Literature: 2023	123
Figure 22. Share of Creative Leaders (Individuals and Enterprises) in the Top Five Mega-Creative HSE GCII Cities: 2023.....	124
Figure 23. Creative Leaders (Individuals and Enterprises) Residing in Capitals as a Percentage of the Total Number of Creative Leaders: 2023	125
Figure 24. Countries of the Top 100 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises): 2023.....	129
Figure 25. Creative Specializations of the Selected HSE GCII Chinese Cities: 2023.....	130
Figure 26. Top 20 HSE GCII Cities in Advertising and PR: 2023	133
Figure 27. Top 10 HSE GCII Cities by the Number of Leading Companies by R&D Expenditure: 2021	137
Figure 28. Top 10 HSE GCII Cities by the Number of Leading Universities: 2022.....	138
Figure 29. Figure 29. Top 20 HSE GCII Cities by the Number of Animation Film Production Companies that Won International Festival Awards: 1960–2022	139
Figure 30. Top 10 HSE GCII Cities by the Number of Artists with the Best World Musical Albums: 2006–2020.....	143
Figure 31. Top 10 HSE GCII Cities by the Cost of Living: 2022 (Normalized Estimate)	163
Figure 32. Top 10 HSE GCII Cities by the Cost of Doing Business: 2022 (Normalized Estimate).....	164
Figure 33. Top 10 HSE GCII Cities in Tourist Appeal: 2022 (Normalized Estimate)	166

Figure 34. Top 10 HSE GCII Cities in Internationalization: 2022	171
Figure 35. Top 10 HSE GCII Cities by Air Traffic: 2022	172
Figure 36. Algorithm for Calculating HSE GCII 2023	176
Figure 37. City Sampling Algorithm of HSE GCII 2023.....	171

Table 1. Top 50 HSE GCII Cities with the Highest Concentration of Innovation Economy Leaders (Individuals and Enterprises): 2023.....	56
Table 2. Top 10 Cities in the Creative Industries Subindex and Startups and Venture Capital Section: 2023.....	136
Table 3. Top 10 HSE GCII Cities by Venues of Culture, Entertainment, and Sports: 2022	168
Table 4. Top 10 HSE GCII Cities by the Speed of Mobile and Broadband Internet: 2022	170
Table 5. Indicators Forming a List of Localities for HSE GCII 2023.....	177
Table 6. Agglomeration Approaches in Different Countries.....	179
Table 7. Agglomerations and Localities in the Final Sample of HSE GCII 2023	182
Table 8. Indicator System of HSE GCII 2023.....	193
Table 9. HSE GCII 2023 Indicators with Missing Scores.....	202
Table 10. Distribution of Innovation Economy Leaders by the Top 200 Cities of HSE GCII 2023.....	203
Table 11. Correlation between Sections and Subindices and the Overall HSE GCII 2023.....	206
Table 12. Correlation between Subindices and the Overall HSE GCII 2023	207

Executive Summary

1. Poles of Innovation and Creativity

The highest differentiation between cities is in the dissemination of innovation economy leaders

High tech and art have consumed the world. Today, along with prominent tech hubs and creative centers – London, New York, Tokyo, Beijing, and Paris, – alternative growth points of the innovation economy are emerging everywhere and these cities are associated with at least one organization or personality that achieved international recognition in these industries. As unbelievable as this might sound, wider opportunities for development (be it a private project or a whole economy) create a wider differentiation.

- Out of 200 cities in the overall ranking, 66% are in the top 10 countries by their number, in particular, 40 – for the United States, 22 – for Mainland China, and 16 – for the United Kingdom. In 29 out of 53 countries, where the HSE GCII 2023 cities are located, there is only one center of innovation attractiveness. The sample of the ranking is spread over five continents, with an absolute majority (91.5%) of the cities being concentrated in Eurasia (134) and North America (49). Another seven centers of innovation attractiveness are located in Australia, six – in South America, and four – in Africa.

- The average value of the Overall Global Cities Innovation Index in the top 10 HSE GCII 2023 cities is 5.8 times higher than in the bottom 10 cities. The same gap in the quality of urban environment is only 1.8 times, in the technological development this differentiation is as large as 23 times, and in the creative industries – a staggering 56 times! The top 10 HSE GCII 2023 cities have become focal points of 24% of highly cited researchers, 30% of Nobel Prize laureates and Fields Medal winners, and 60% of unicorns; they host 55% of acclaimed fashion brands, 65% of top-rated film production companies, and 70% of top artists by auction revenue. The top 10 centers of innovation attractiveness are home to around 17.6% of the population and generate 26.8% of the total GDP of all 200 cities in the final sample.

The global world has never been so diverse and the distribution of innovation economy leaders is much more uneven than the distribution of wealth.

2. Migration of Talent

Innovators are particularly mobile

The digital transformation made us rethink the spatial aspect of innovation, thus granting financial and human capital almost free movement. Remote work and relocation – the COVID-19 and post-pandemic trends – have weakened the innovators' ties to a particular city to the greatest possible extent. It is now possible to manage the best team or work at the best company from any part of the globe. Business founders and highly skilled professionals are choosing the best workplaces to build a career, and in doing so they are adding to the strengths of innovation leaders that previously succeeded due to stationary growth factors – corporations or universities. For example, the San Francisco

Metropolitan Area hosts 194 companies from the R&D Scoreboard (ranked 2nd after Tokyo) and 279 unicorns (1st).

Unicorn founders are the super mobile innovators of the modern age: over 30% of founders of venture companies worth over one billion dollars built their business outside of their home country. There are only 32 countries that turned out to be most attractive to most successful startup founders, but the geography of these countries is almost 2.5 times as large and covers 85 countries. Thus, immigrants born in India founded 85 unicorns, in Israel – 71, Mainland China – 45, United States – 39, United Kingdom – 37, and Russia – 27. The future tech entrepreneurs' relocation has been significantly influenced by leading global universities: a third of immigrants founded a unicorn in the country where they earned a degree.

3. All-Round Competition for Talent

Strengthening competition for innovation leaders between cities

The dynamic migration of talent leads to an increasing number of new cities fighting for exceptional entrepreneurs, artists, and scientists. On top of that, the list of tools that attract and retain talent is growing – from new visa programs for foreign creative and tech leaders to innovative support measures for those who have already crossed the border or, on the contrary, are at risk of a brain drain. As a result, human capital policy has been evolving as a continuous experiment: cities are

reinventing many support measures in an attempt to obtain the best of the best.

For example, a living lab format, which has been known about since early 2000s and is based on engaging users in testing the goods and services of innovative companies, was scaled up in Moscow with the involvement of 200 public and private institutions: now it has one of the largest innovation testing sites in the world. The Peacock Plan from Shenzhen, China offers prominent scientists and inventors, managers of global tech companies

and universities, artists, and creatives financial stimuli to relocate to the city from other countries. Ontario and Dubai implemented soft landing programs to simplify the relocation of foreign businesses. London, New York, San Francisco, Paris, Singapore, Toronto, and Sydney are located in countries that issue smart visas lowering some barriers for outstanding talent and promising entrepreneurs to move, live, and work there. It is namely those cities that have a total of 15% of international students, 30% of startups,

and 50% of internationally recognized artists from the top 200 cities of HSE GCII 2023.

Policymakers need to provide fine-tuned support measures on a wider scale – from digital residency that would enable foreign innovators to contribute to another city's economy without changing location or even citizenship, to the expedited granting of citizenship to talented people from all around the world through smart visas programs.

4. Choice of Talented Citizens

High tech and creative leaders become ambassadors of innovation centers

The innovators' demand for the best opportunities to do business and for artistic expression and corresponding access to cities by way of new mobility and assimilation programs lead to a rethinking of what we call a "citizen". For talented people and businesses, a city is a constellation of world-renowned people, teams, and companies with which they can connect. When innovators choose places to work and live, they choose a city whose image coincides with their worldview: tech geeks go to silicon valleys, artistic spirits gravitate to bohemian art districts, business heavyweights rush to the city centers, and the world science elite flock to campuses.

As a result, innovation economy leaders become a kind of city ambassadors: they create their own brand in creative

industries or high tech and combine it with the city brand. For example, some fashion brands are directly using the name of their city (DKNY, Temperley London), or Scoreboard 2500 corporations (Boston Scientific, Tokyo Electron, Palo Alto Networks, Shenzhen Goodix Technology), or unicorns (Alto Pharmacy, Berlin Brands Group, Delhivery, Oxford Nanopore Technologies, Cambridge Mobile Telematics).

When representatives of the innovative class use the city's image in their art or business projects, they are not only signaling how important their home city is to their identity, that they are part of the local scenery and history, they are also creating a free and rather effective advertising campaign for the cities themselves, by attracting new creators of technologies and values into "branded" centers.

5. "How many goodly cities are there here!
O brave new world, that has such places in it!"¹

Cities are grabbing leadership positions in innovation niches

The global world is developing rapidly and unevenly, and is unlikely to change in the foreseeable future. Nevertheless, its environment – the mobility of talent, flexibility of working regimes and ways of conducting business, and the diversity of commercial uses for new knowledge and art – creates a good competitive environment, where any city can get a chance at seizing innovation leadership. Some cities rise up to an Olympian status in the innovation economy, while others gain traction in specific technologies or creative industries, or set upon their own journey in selected niches. HSE GCII 2023 identified authentic cities of innovation attractiveness: venture capital stars

(Bangalore and Delhi), advertising capital (Lima), industrial design center (Shenzhen), focus point for animators and architects (São Paulo), Mecca for students (Cairo).

We also have a separate group of cities by innovation efficiency, which have the most leaders of high tech and creative industries per 10,000 residents. What is more, seven cities of the most effective top 10 are outside the HSE GCII 2023 top 100: they have small populations but are connected to globally prominent universities. And even if the specialized centers of innovation will not catch up to the leaders, their success stories may become an inspiration for other cities that are still looking for their place on the global map of the innovation economy.

¹ Paraphrasing:
O, wonder!
How many goodly creatures are there here!
How beauteous mankind is! O brave new world,
That has such people in't!
William Shakespeare, Tempest
(1610–1611)

Introduction

The extremely high concentration of talent,
new mobility of innovation leaders,
and rising competition for brainpower

Cities occupy only two percent of the world's land surface, but have accumulated over half of its population. According to different estimates, the urban population will continue to rise and by 2050 its share will reach from 68 to 80% [World Economic Forum, 2022; UNCTAD, 2022].

However, even against the background of such powerful concentrations of human potential, we note how these places are mother lodes of businesses, intellect, and art with advanced infrastructure and institutional environments, where people aspire to settle down and transfer their knowledge and capital. Global centers of innovations attract leaders of the postindustrial economy – scientists

and inventors, corporate executives and startups, designers and architects, artists and musicians, writers and filmmakers – whose inspiring success works as a magnet for new talent from all corners of the world. Some of such cities have long since earned a reputation as global hot spots for the best experts in the high tech and creative sectors – technology companies (Tokyo), venture capital business (San Francisco), advanced science (Boston), international education (London), mass research activity (Beijing), film production (Paris), and contemporary art (New York). Others have just recently started to display their attractive features due to unicorns (Bangalore), industrial designers (Shenzhen), and advertising leaders (Lima).

For this study 200 agglomerations out of 2,769 localities in 135 countries were selected to evaluate the factors of their innovation attractiveness. The yardstick of the cities' success became prominent individuals and organizations from the world of high tech and creative industries that have been included in international ratings or received other recognition by way of sectoral and professional awards.

Talented individuals have never been so free to choose their own place to live, work, or create as they are today. Among the most mobile innovators are “digital nomads” – highly qualified professionals who can work remotely and choose most attractive locations for that purpose, and tech entrepreneurs that move their startups to the best innovation ecosystems of the world. Already at universities, they benefit from student mobility programs in order to move to other leading centers of higher education, which,

in turn, become a next career step or a bridge connecting to innovation projects in other cities. For example, an Australian, Bede Moore, one of the founders of a Singapore-based unicorn “Lazada Group”, studied in Harvard (United States) and Leiden University (Netherlands), and a British citizen Terry Rudolph, co-founder of a billion-dollar startup “PsiQuantum” in the United States, is simultaneously an alumnus of the Imperial College London and University of Toronto (Canada).

The “Zoomification” that has taken over the global economy almost overnight during the COVID-19 pandemic solidified the trend of relocation by representatives of the innovative class – tech entrepreneurs, creatives, freelancers, and KIBS employees, – and this phenomenon is still ongoing after we returned to the new normal of the post-COVID world.

The strengthening of talent mobility brought about a new stage of cities’ competition for brains and money: now megacities – global centers of innovation, are competing with “zoom towns” – small localities, quite often picturesque locales with affordable costs of living and more robust environmental protection, to which many people choose to move to in order to work remotely.

For example, around 15% out of 3,300 technicians were able to leave San Francisco due to the opportunities of working from home. Another case is West Virginia, where state authorities announced in 2021 that they are going to provide non-repayable 12,000 USD to digital nomads for relocation to their state.¹

¹ Empire Resume (2022) What are Zoom Towns? Available at: <https://empireresume.com/what-are-zoom-towns/> (Accessed: 27.01.2023).

London – the top center of innovation attractiveness – struggled more than all other UK cities from the brain drain of highly skilled international professionals resulting from two crises – Brexit

and the COVID-19 pandemic. The UK rose up to this challenge and reformed the migration policy concerning talented expats, in particular by way of introducing new smart visas.

The migration of talent prompts a city to rethink its policy of attracting and retaining the most successful and promising innovators by offering them new support measures: anything from financial stimuli to simplified procedures of receiving residence and work permits or business licenses.

The HSE Global Cities Innovation Index (HSE GCII) was developed by a team from the Russian Cluster Observatory under the HSE Institute for Statistical Studies and Economics of Knowledge and is essentially an assessment tool for evaluating the current competitive edge of cities from the point of view of their attractiveness for technological and creative leaders. The Index was designed for city mayors who decide to enter the global race for

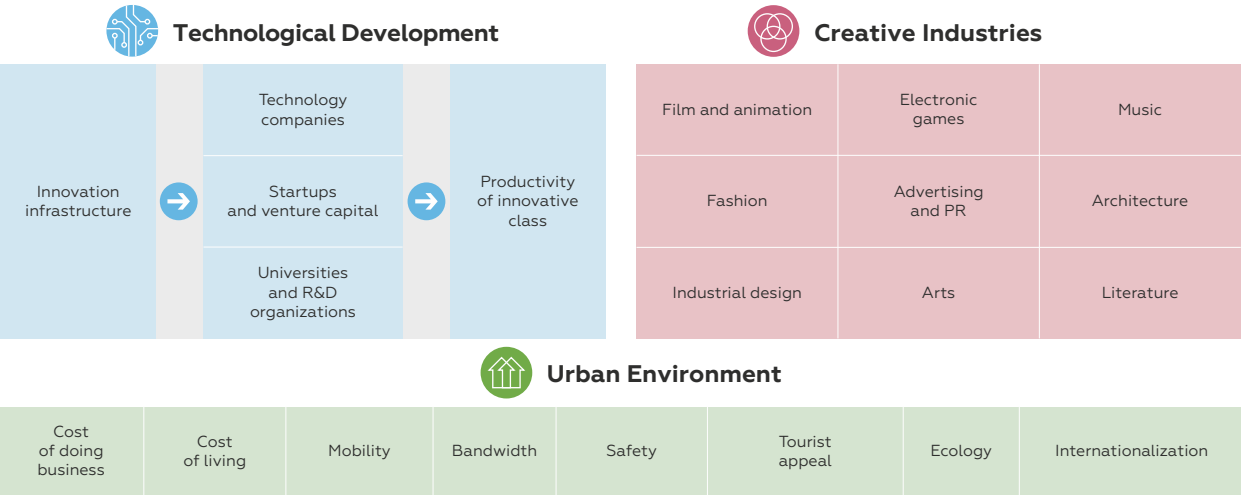
talent and want to ascertain their cities' strengths and weaknesses and receive information on the latest support measures for innovators. The target audience of the study also includes venture capital investors and entrepreneurs interested in high tech projects all around the globe. Finally, HSE GCII 2023 will be a valuable tool for talent themselves as navigators of new opportunities for professional development, business, and creative careers.

How HSE GCII 2023 works: the indicator system, data sources, and sampled cities

HSE GCII 2023 is based on an integral approach to measuring innovations in the city that encompasses the analysis of technological and creative potential, as well as infrastructure development. There is a base of 74 indicators grouped into 22 sections over three

blocks – Technological Development, Creative Industries, and Urban Environment (Figure 1). Each block has a corresponding subindex adding to the overall value of HSE GCII, which is then used to score and rank the cities.

Figure 1. Ranking Structure of HSE GCII 2023



Source: HSE University.

The Technological Development Subindex has five sections featuring corporations, startups, unicorns, leading universities, and R&D organizations. It analyzes publication and patent activities of city residents and estimates the number of clusters, technology parks, and other innovation infrastructure.

The Creative Industries Subindex consists of nine sections. They measure economic activities related to filmmaking, electronic games, music, fashion, advertising and PR, architecture, industrial design, arts, and literature.

The Urban Environment Subindex includes eight sections, describing an abundance of factors that define the attractiveness of a city to representatives of the innovative class. Among them are the cost of living and doing business, mobility, bandwidth, safety, tourist appeal, ecology, and internationalization.

When creating the indicator system for the Index we used international databases with which we could objectively compare the sampled cities without arbitrary public or

expert opinion polls, and internal data sources of city administrations hidden from the public eye of regular users that could not be used to benchmark the cities (Figure 2). The data for country or regional breakdowns were recalculated for cities.

To estimate the level of cities' technological development, the R&D Scoreboard was used as a data source on largest innovation companies. Startups and unicorns were measured according to Crunchbase, StartupBlink,

and CB Insights. Leading universities were determined based on QS, THE, and ARWU. Patent data was gathered from the PATSTAT Global database and publication data was obtained from Scopus. Finally, innovation infrastructure facilities were analyzed with the help of TCI Network, International Association of Science Parks, and TOP500.

The development of the filmmaking industry was rated using the data from IMDb, official websites of international film festivals, and the International

Figure 2. Database of HSE GCII 2023



Technological Development

R&D Scoreboard | Crunchbase | StartupBlink | CB Insights | QS | THE | ARWU | Nature | Clarivate | The Nobel Prize | IMU | Financial Times | PATSTAT Global | Scopus | TCI Network | IASP | TOP500



Creative Industries

IMDb | FIAPF | Annecy International Animation Film Festival | The Game Awards | Esports Earnings | Steam | Gamescom | Billboard | Spotify | The International Opera Awards | Fashion United | FARFETCH | NET-A-PORTER | Luisa Via Roma | Mytheresa | Effie Awards | PProvoke Media | Cannes Lions International Festival of Creativity | D&AD | The Pritzker Architecture Prize | World Architecture Festival Awards | A' Design Award | iF Design Award | Red Dot Design Award | Artprice | ArtReview | QS | THE | Wikipedia



Urban Environment

Nomad List | PwC | Numbeo | OpenFlights | Speedtest | STC Database | Brand Finance | Tripadvisor | World Stadiums | International Baccalaureate Organization | ICCA

Source: HSE University.

Federation of Film Producers Associations (FIAPF). The developers of popular video games were identified from the lists of Steam players, The Game Awards, Esports Earnings, and Gamescom. Leaders of the musical world were taken from Billboard, Spotify, and The International Opera Awards. The major fashion industry players were assessed according to information from Fashion United, FARFETCH, NET-A-PORTER, Luisa Via Roma, and Mytheresa. Leading advertising companies were taken from the websites of Effie Awards, PProvoke Media, Cannes Lions International Festival of Creativity, and D&AD. To find leaders in architecture and industrial design, we used information about awardees of The Pritzker Architecture Prize, World Architecture Festival Awards, A' Design Award, iF Design Award, and Red Dot Design Award. The Arts section indicators were calculated according to data from the Japan Art Association, ArtReview, Artprice, QS, and THE.

Finally, the quality of infrastructure and the urban environment was estimated with the help of international databases – Nomad List, PwC, and Numbeo (most of the cost of living and cost of doing business indicators), OpenFlights (number of airline routes), Speedtest (bandwidth), STC Database (safety level), Tripadvisor and World Stadiums (number of venues of cultural entertainment and sports), Brand Finance (number of international hotels),

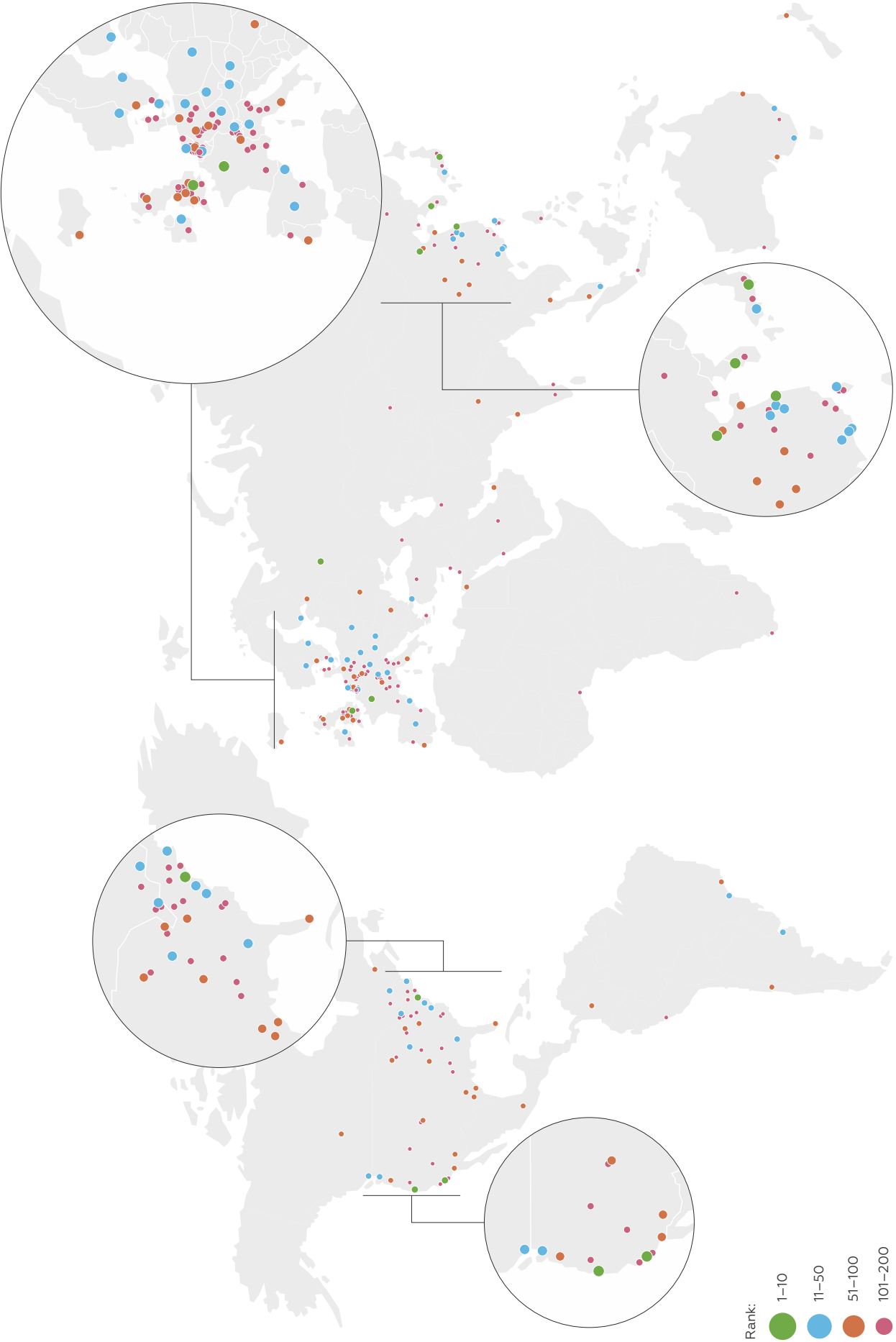
the International Baccalaureate Organization, and International Congress and Convention Association (internationalization indicators). The study sample includes 200 cities estimated to be most attractive for innovators (Figure 3).

There are three sections in the report. The first section provides an analysis of innovation attractiveness of global cities. It contains the results of the final scoring and key factors behind the attractive force of cities for innovators (levels of technological development, creative industries, and urban environment). For each of the blocks, subindex values were calculated.

The second section describes the algorithm for building the ranking, including some comments on the methodology of finding the calculated indicators and the results of a statistical audit.

The third section provides profiles of the top 100 cities in HSE GCII 2023 by their innovation attractiveness, which helps to tell the story of each city's development and rank it according to all indicators and benchmark against the leader. The authors hope that this work will serve as an analytical support of city governance and management in specific sectors of the innovation economy, including in knowledge-intensive business services and creative industries.

Figure 3. Sampled Cities of HSE GCII 2023



Abbreviations

ARWU	Academic Ranking of World Universities
BIM	Building Information Model
BYD	Build Your Dreams
D&AD	Design and Art Direction
D.C.	District of Columbia
DJI	Dajiang Innovation Technology
ENoLL	European Network of Living Labs
EPO	European Patent Office
FDI	Foreign Direct Investment
FIAPF	Fédération Internationale des Associations de Producteurs de Films – International Federation of Film Producers Associations
FIFA	Fédération Internationale de Football Association – International Association Football Federation
FTV	French Tech Visa
FUA	Functional Urban Area
GCII	Global Cities Innovation Index
HSE	Higher School of Economics
IASP	International Association of Science Parks
ICCA	International Congress and Convention Association
IIT	Indian Institutes of Technology
IMDb	Internet Movie Database
IMU	International Mathematical Union
IPO	Initial Public Offering
ISSEK	Institute for Statistical Studies and Economics of Knowledge

JPO	Japan Patent Office
JSC	Joint-Stock Company
KeSPA	Korean e-Sports Players Association
KIBS	Knowledge-Intensive Business Services
K-pop	Korean pop
MCST	Ministry of Culture, Sports and Tourism
MEPhI	Moscow Engineering Physics Institute, today – National Research Nuclear University MEPhI
MIT	Massachusetts Institute of Technology
NFT	Non-Fungible Token
OECD	Organisation for Economic Co-operation and Development
OGN	OnGameNet
PATSTAT	EPO Worldwide Patent Statistical Database
PCT	Patent Cooperation Treaty
PwC	PricewaterhouseCoopers
QS	Quacquarelli Symonds – QS World University Rankings
RPG	Role-Playing Game
TCI	The Competitiveness Institute – A global network of experts in clusters, innovation, and competitiveness
THE	Times Higher Education World University Rankings
TRL	Technology Readiness Level
UNCTAD	United Nations Conference on Trade and Development
USPTO	United States Patent and Trademark Office
VC	Venture capital
VDNKh	Vystavka Dostizheniy Narodnogo Khozyaystva – Exhibition of Achievements of National Economy
VTB	VneshTorgBank (International Trade Bank), VTB Bank

RANKING SCORES





1

Overall Global Cities Innovation Index

Cities' Ranking by the Overall HSE GCII: 2023



(continued)

	HSE GCII rank	Subindices' ranks		
		Technological Development	Creative Industries	Urban Environment
Philadelphia	41	27	63	119
Buenos Aires	42	50	54	32
Warsaw	43	94	28	34
Atlanta	44	68	34	47
Brussels	45	40	41	100
Helsinki	46	72	46	22
Budapest	47	63	57	19
Oslo	48	82	38	28
Vancouver	49	80	43	36
Prague	50	109	44	13
Chengdu	51	51	145	21
Miami	52	79	39	60
Houston	53	45	101	55
Dallas	54	54	62	62
San Diego	55	42	50	121
Tianjin	56	43	172	38
Essen-Dortmund	57	47	97	71
Dubai	58	93	76	12
Wuhan	59	31	162	103
Lisbon	60	73	142	11
Frankfurt am Main	61	105	53	25
Mumbai	62	49	45	150
Gothenburg	63	57	60	99
Quebec	64	98	109	16
Rome	65	59	52	122
Edinburgh	66	75	80	66
Hamburg	67	135	22	130
Geneva	68	81	58	79
Qingdao	69	69	139–140	48
Auckland	70	152	47	42
Austin	71	58	87	105
Mexico City	72	67	37	163
Brisbane	73	86	129	33
Bogotá	74	34	95	166
Bangkok	75	106	83	43
Cambridge	76	53	104	124
Delhi	77	46	88	156
Rio de Janeiro	78	100	48	106
Columbus	79	146	69	44
Phoenix	80	76	78	112

1–10
 11–50
 51–100
 101–150
 151–200

(continued)



(continued)

	HSE GCII rank	Subindices' ranks		
		Technological Development	Creative Industries	Urban Environment
Düsseldorf	121	149	68	123
Stuttgart	122	120	49	164
Lyon	123	70	100	172
Cologne	124	142	65	132
Lima	125	112	55	160
Basel	126	115	72	148
Oxford	127	103	93	140
Salt Lake City	128	163	141	65
Glasgow	129	148	156	76
Las Vegas	130	196	75	84
Nashville	131	181	84	92
Johannesburg	132	143	64	142
Boulder	133	141	175–176	81
Bonn	134	180	155	61
Hamilton	135	95	173–174	117
Marseille	136	48	160	188
Hsinchu	137	65	177–194	170
Heidelberg	138	119	177–194	108
Bangalore	139	85	119	158
Leeds	140	156	124	101
Toulouse	141	102	170	127
Aberdeen	142	171	163–164	78
Malmö	143	154	165	93
Nuremberg	144	175	61	143
Tel Aviv	145	62	73	194
Aarhus	146	168	81	139
Jeddah	147	187	147	95
Canberra	148	164	173–174	98
Xiamen	149	96	157–158	153
Hanover	150	182	125	109
Aalborg	151	194	130	96
Brighton	152	190	167–168	89
Exeter	153	173	177–194	97
Kitchener	154	166	177–194	110
Leiden	155	179	157–158	111
Sacramento	156	177	177–194	107
Leuven	157	153	177–194	126
Leipzig	158	189	136	116
Cuyahoga	159	136	177–194	141
Cape Town	160	121	91	177



1–10



11–50



51–100



101–150



151–200

(continued)

	HSE GCII rank	Subindices' ranks		
		Technological Development	Creative Industries	Urban Environment
Braunschweig-Salzgitter-Wolfsburg	161	162	138	134
Washtenaw	162	124	177–194	149
Santa Barbara	163	169	99	152
Hefei	164	77	195–200	184
Utrecht	165	129	126	165
Bern	166	172	111	151
Santa Cruz	167	195	163–164	113
Chennai	168	134	166	159
The Hague	169	178	148	138
Taichung-Changhua	170	131	116	174
Rotterdam	171	145	79	185
Jakarta	172	150	135	162
Gent	173	158	96	176
Raleigh	174	160	98	175
Bologna	175	89	159	187
Almaty	176	167	152	157
Jinan	177	107	195–200	178
Cork	178	133	177–194	171
Lausanne	179	127	120	183
Dalian	180	130	177–194	173
Groningen	181	183	177–194	147
Beirut	182	170	85	179
Tbilisi	183	199	154	137
Harbin	184	116	177–194	182
Memphis	185	193	177–194	144
Turin	186	123	86	196
Manila	187	99	115	195
Florence	188	192	90	186
Tsukuba	189	157	177–194	181
Grenoble	190	161	175–176	180
Rochester	191	197	195–200	169
Antwerp	192	185	112	190
Fuzhou	193	140	195–200	192
Lagos	194	184	106	193
Zhenjiang	195	118	195–200	197
Padua	196	191	171	189
Venice	197	200	150	191
Daejeon	198	138	139–140	199
Benton City	199	198	195–200	198
Hampden	200	186	128	200

1–10

11–50

51–100

101–150

151–200

In 2023, London and New York are still the main centers of attractiveness for leaders of the postindustrial economy. They remain the first choice of the most successful innovators and creators of modern narratives from around the globe who stream to these cities, excited by the vigorous business environment, vibrant creative industries, and edgy high technology. Access to global corporations and capital and centers of knowledge and art still remain the features of the most popular cities for innovation. Furthermore, one could find talent even outside these focal points of the business elite, artists, and intellectuals. Startup founders and inventors, advertising and industrial design trendsetters sometimes find themselves in unexpected places. The varied geography of innovation may surprise you.

London: the Unsmogged Leadership

Albion's capital topped the HSE Global Cities Innovation Index in 2023

Triumphant creative industries and high technologies are the main factors that turned London into a powerful magnet attracting prominent carriers of creative, scientific, and business potential from all around the globe. This city is in the top three according to 22 of 44 indicators of corresponding sub-rankings. Its business environment and cultural diversity inspires the current and future leaders of

the innovation economy – be it Nobel Prize laureates or students who work their way into the main innovation hub of the planet – despite the high cost of living and doing business. London is ranked 1st among HSE GCII 2023 cities by the scale of creative industries, 2nd – by the quality of urban environment, and 5th – by the level of technological development.

Talent as New Citizenship

The UK opens doors to the best

“Why, Sir, you find no man, at all intellectual, who is willing to leave London. No, Sir, when a man is tired of London, he is tired of life; for there is in London all that life can afford.”¹ This is how the British capital was described in the 18th century by poet and critic Samuel Johnson. Since then, London has remained a city that one is not only reluctant to leave – it is a place to which students and professors, startup founders and investors, designers, architects, musicians, and writers yearn to go. Their talent has transformed London into the main focal point of creative industries, a global center of high tech, education, and science, and ultimately – into the most powerful magnet for new leaders of the innovation economy.

However, the world is changing swiftly. Digital transformation has made capital – financial and human – extremely mobile, which has led to a re-evaluation of the geographical aspect of innovations: now business founders and their employees can relocate anywhere. The COVID-19 pandemic strengthened this trend, when talent refuses to be tied down to a specific place by choosing to work remotely from any point in the world: it is choosing the best team or the best company and does not have

to live in megacities [Minasyan, 2020]. As a result, “polestars like Silicon Valley, London, and Beijing must compete with hundreds of expanding constellations, each with its own legal, economic, and lifestyle advantages.” [Startup Genome, 2022, p. 20]. How then will the global hubs of innovations overcome the challenges of this new reality?

The entire UK has fought for London in the global battle for talent, when they launched a new UK Innovation Strategy in 2021. Its goal is to turn the country into an international center of knowledge, creativity, and entrepreneurship [Department for Business, Energy and Industrial Strategy, 2021]. The white paper places a great emphasis on reforming the UK’s policy with respect to talented immigrants, irrespective of their country of origin. Great Britain opens its borders to the best innovators from the around the world and introduces new types of visas for high potential individuals², fast-growing companies¹ capable of attracting exceptional talent into the country, and global business mobility.²

The High Potential Individual visa allows recent graduates from the top 50 universities in the world according to QS, THE, and ARWU rankings

¹ London Quotes. The Samuel Johnson Sound Bite Page. Available at: <https://www.samueljohnson.com/london.html#238> (Accessed: 18.12.2022).

² High Potential Individual Visa. Available at: <https://www.gherson.com/personal-immigration/high-potential-individual-visa/?lang=ru> (Accessed: 18.12.2022).

to work in the UK without receiving a job offer. Other qualifications include job search, freelance work, and launching a new business. By the end of the visa's validity period, graduates with high career potential can apply to prolong their stay in other categories.

The Scale-Up visa provides a simplified onboarding procedure for British companies to employ highly skilled professionals from abroad. Companies that demonstrated an average income and employment growth rate of 20% for three years and employed at least 10 people in the beginning of this three-year period can attract talented individuals, who will receive a two-year residence permit without having to prove additional sponsorship or seek a permit after the first six months of staying in the country.

The UK Global Business Mobility program is an immigration route specifically established to help start new businesses in the UK. It includes five categories of visas for foreign professionals that enterprises can bring into the country when opening a branch in the UK or for the

temporary transfer of employees to an active British firm, for example, for the purpose of opening an office, establishing a business trip destination, rotating employees, interning, or fulfilling an order.

Before the UK came to realize that it would not be able to push forward its advanced economy without attaining a global pool of talent, two crises occurred and dealt considerable damage to the economy of the whole country, especially London's economy. The first one was Brexit, after which regional authorities even started to discuss the possibility of introducing independent regional visas to replenish the London's labor force with EU member states' professionals that used to occupy 12% of the job market.³ The second crisis was coronavirus, which dealt London more damage than any other UK city because of the brain drain of high tech foreign employees from the KIBS sector.⁴ This is how the UK Innovation Strategy demonstrated a coordinated approach by combining the efforts of the centralized government and London's authorities to find the best actors in the global innovation economy.

¹ New Scale-up Visa for fast-growing business capable of attracting exceptionally talented individuals into the UK started working August 22. Available at: https://www.lawfirmuk.net/post_e/novaya-scale-viza-dlya-bystrorastushchih-kompanij-sposobnyh-privlech-isklyuchitelnye-talanty-v-velikobritaniyu-nachala-dejstvovat-s-22-avgusta (Accessed: 18.12.2022).

² New UK immigration routes in 2022: global business mobility, High Potential Individual and Scale-Up visas. Available at: <https://www.penningtonslaw.com/news-publications/latest-news/2022/new-uk-immigration-routes-in-2022-global-business-mobility-high-potential-individual-and-scale-up-visas> (Accessed: 18.12.2022).

³ City of London publishes report for a post-Brexit 'regional visa' system. Available at: <https://news.cityoflondon.gov.uk/city-of-london-proposes-a-post-brexit-regional-visa-system/> (Accessed: 18.12.2022).

⁴ London is still most attractive destination for skilled migrants, despite being hit hardest by the pandemic-driven decline in overseas workers. Available at: <https://migrationobservatory.ox.ac.uk/press/london-still-most-attractive-destination-for-skilled-migrants-despite-being-hit-hardest-by-pandemic-driven-fall-in-overseas-workers/> (Accessed: 18.12.2022).

From “Smart Visas” to “Soft Landings”

Talent attraction guidelines

World innovation centers are actively competing for talent – individuals or teams implementing groundbreaking projects in high tech or creative industries. When 30% to 50% of London, New York, Singapore, or Los Angeles residents were born in other countries and around 40% of companies from Fortune 500 were founded by immigrants [Kutsenko et al., 2022], one of the main ways of getting the best of the best is smart visa programs. Within such programs, visas work as an effective tool for attracting talent by lowering thresholds for unique professionals so they could arrive, stay, and work in the country, as well as relocate innovation projects.

Smart visas could be divided into four categories depending on the specifics of the applicant:

- talent visas, awarded to people with special achievements in science, arts, or sports;
- investor visas, awarded to high-income individuals ready to “pay” for the residence permit or citizenship by investing in promising sectors of the economy;
- digital nomad visas, awarded to attract professionals working remotely;
- startup visas, awarded to creators of promising business projects.

For the contemporary talent visa, O visas that appeared in the US in the early 1990s¹ were used as a prototype. Visas for Individuals with Extraordinary Ability or Achievement are given to talented people in science, education, or sports (O-1A), arts (O-1B), as well as their accompanying persons (O-2) or family members (O-3). The most important factor in issuing O visas is the proven superiority of an applicant over others in the given discipline, which helps one invite the cream of the crop to the country.

Later, similar programs appeared in other countries, for example, a Global Talent Visa in the UK. This visa opens new opportunities for receiving a UK residence permit and is issued for five years to talented people in the creative economy, digital technologies, and research and development.² Interestingly, both newly developed talent could apply for a “promise” visa and accomplished professionals – for a “talent” visa. In Singapore, representatives of creative industries can obtain resident status under the The Foreign Artistic Talent Scheme in joint management

¹ O-1 Visa: Individuals with Extraordinary Ability or Achievement. Available at: <https://www.uscis.gov/working-in-the-united-states/temporary-workers/o-1-visa-individuals-with-extraordinary-ability-or-achievement> (Accessed: 18.12.2022).

² Apply for the Global Talent visa. Available at: <https://www.gov.uk/global-talent> (Accessed: 18.12.2022).

of the Immigration and Checkpoints Authority with the National Arts Council. In order to do that, candidates from performing and visual arts, literature, design and media must comply with several requirements, including making a considerable contribution to the culture of Singapore and planning to further develop their artistic field in the country.¹

Unlike talent visas, investor visas are aimed at attracting well-to-do entrepreneurs to saturate the country's economy with sufficient financial assets. Dubai, for example, has been implementing a Golden Visa program² since 2019 that includes a flexible four-visa system for real estate investors depending on how much capital they invest. For example, if the sum of the investment is over 200,000 USD, you can receive a visa for three years; a five-year visa is issued if applicant invests over 550,000 USD; a ten-year visa will be available to those who have been a real estate owner for three years; and finally, there is a retiree visa issued for up to five years if the individual has had a monthly income of 5,500 USD or has savings equal to 270,000 USD and more or had invested at least 550,000 USD in the city's real estate.

Conversely, digital nomad visas create an opportunity for talented freelancers and professionals working remotely to move to the visa-issuing country while keeping the official employment in companies abroad. The en masse attraction of digital nomads enhances the purchasing power of the receiving country's services sphere, and therefore, the main condition for receiving this type of visa is the applicant's verified monthly income. The digital nomad visa program covers a lot of countries such as Georgia (Remotely from Georgia),³ the Czech Republic (Zivno),⁴ Spain (Non-Lucrative Visa)⁵, and the Bahamas (Bahamas Extended Access Travel Stay)⁶. In Estonia, this service supplements e-residency awarded to foreign citizens with a foreign passport giving them access to electronic services in the country. As a result, an e-resident may conduct business online (perform transactions in online banking, file e-documents, like tax declarations, and sign contracts with a digital signature), whilst living in another country⁷.

Finally, the fourth type of smart visas are startup visas allowing the founders of innovative business projects and their team members to legally reside and work

¹ Foreign Artistic Talent Scheme (ForArts). Available at: [https://www.nac.gov.sg/support/capability-development/leadership-career-and-artistic-development/foreign-artistic-talent-scheme-\(forarts\)](https://www.nac.gov.sg/support/capability-development/leadership-career-and-artistic-development/foreign-artistic-talent-scheme-(forarts)) (Accessed: 18.12.2022).

² UAE Golden Visa. Available at: <https://goldenvisa.ae/> (Accessed: 18.12.2022).

³ Remotely from Georgia. Available at: https://georgia.travel/en_US/article/remotely-from-georgia (Accessed: 18.12.2022).

⁴ Zivno Visa. Czech Republic. Available at: <https://movetoprague.com/zivno-visa-czech-republic/> (Accessed: 18.12.2022).

⁵ Non-Lucrative Visa. Spain. Requirements. Available at: <https://myspainvisa.com/non-lucrative-visa-spain/> (Accessed: 18.12.2022).

⁶ The Bahamas Extended Access Travel Stay. Available at: <https://www.bahamasbeats.com/> (Accessed: 18.12.2022).

⁷ e-Residency vs digital nomad visa. Available at: <https://www.e-resident.gov.ee/nomadvisa/> (Accessed: 18.12.2022); e-Residency. Available at: <https://www.eesti.ee/ru/predprinimatel/erezidentstvo> (Accessed: 18.12.2022).

in the receiving country. For example, France, as part of President Macron's policy to make the country into a "nation of unicorns", launched in March 2019 a special French Tech Visa (FTV), with a simplified residency application process for startup employees, founders, and investors from non-EU member states. The validity term of this visa is four years, it extends to spouses and minor children – the applicant's dependents and does not require a higher education diploma.¹ Since 2020, Singapore has been applying a Tech@SG program, which is essentially a shortcut mechanism for attracting international talent for seed-stage tech companies that are looking to create a team very fast. This program is run by the Economic Development Bureau, which does not issue work permits per se, rather it provides endorsements to the Ministry of Manpower, thus reducing new employees' risk of refusals.

A Singaporean company can receive up to 10 endorsements for highly skilled foreign professionals within two years to boost their core teams. Tech@SG was made for applicants with a fixed monthly salary of at least 3,900 Singapore dollars (ca. 2,833 USD) performing main business functions on, for example, a manager's or chief technology officer's team [Paavola, 2020].

In addition to visa policy measures that could only be managed at a national level, some cities implemented soft landing programs for startups abroad. It is a set

of services that simplify the relocation of your business and, as a rule, work for accomplished companies that would like to scale up into foreign countries.

One of the first soft landing programs was launched in Toronto: The Land & Expand Program has been implemented in Ontario since 1990 with support from the Toronto Business Development Centre. Foreign startups and scaleups which provided proof of meeting Start-Up Visa requirements and successfully passed the due diligence interview will have an eight-month permit to use office spaces and specialized educational programs; receive assistance in registering a legal entity; and enter into local networks of startups, mentors, investors, and talented professionals. During implementation of the program over 9,000 businesses appeared in 20 sectors, their founders came to Toronto from 70 countries.

Moscow's first soft landing program for foreign startups called Softlanding in Skolkovo appeared in 2019. It is conducted three times per year in six areas: energy efficiency, information, nuclear and biomedical technology, space technology and telecommunications, and agriculture. Each company within these areas can send up to three representatives to participate in the program. Softlanding in Skolkovo will grant them free co-working spaces for one month, help them meet with investors and development institutes, visit educational events, and work with an assigned project manager. On top of that, they will

¹ Talent Attraction and Work-Related Residence Permit Process Models in Comparison Countries (2020). Available at: https://julkaisut.valtioneuvosto.fi/bitstream/10024/162601/1/TEAS_2020_54.pdf. (Accessed: 18.12.2022).

have access to Immigration Support Center services and some paid services if the company requires them. In 2019–2020, due to Softlanding in Skolkovo, over 50 foreign startups “landed” in Moscow.

Scale2Dubai was announced to be launched in 2021 – a program to attract foreign startups to Dubai. This soft landing program is implemented by the city authorities in partnership with Fortune 500 programs, accelerators, incubators, and research institutes, which are going to be located in innovation hub – District 2020. To participate in Scale3Dubai,

startups are supposed to be at a seed stage or Round A and meet priority sector-specific and technological areas of District 2020, like smart cities, digital healthcare, artificial intelligence, 5G, big data, Internet of Things, robotics, and blockchain. Program participants receive visas, free office space, and accommodation for two years; access to hub events, venture capital investors, and global network of partners; as well as the opportunity to use accelerators and incubators services for special tariffs and support in registering their business in Dubai.



Leaders Are Good at Everything

The best global innovation attractiveness centers combine high tech and personal artistry

The geography of leading cities practically covers the entire Northern Hemisphere, with all the diversity of business cultures, art traditions, and management practices of Western and Eastern centers of innovation. It is London, New York, Tokyo, Beijing, Paris, San Francisco, Los Angeles, Shanghai, Seoul, and Moscow. Their top positions are secured first and foremost by receiving high ranks in the technological development and creative industries blocks of indicators (for example, New York – ranked 4th and 2nd respectively, Tokyo – 3rd and 5th, Beijing – 1st and 10th, Paris – 9th and 4th) (Figure 4).

As the study has shown, cities and agglomerations included in the top 10 cities are some of the most densely populated areas on the planet (with average population density of almost 20 million people). Seven cities in the top 10 are located in high income countries (France, Japan, Republic of Korea, United Kingdom, and the United States), another three – with income higher than average (China and Russia). Countries with HSE GCII 2023 top cities also ended up having the most cities in the full sample of the rating: United States – 40 cities, Mainland China – 22, United Kingdom – 16.

Countries with HSE GCII 2023 top cities

United States

40

sampled cities

United Kingdom

16

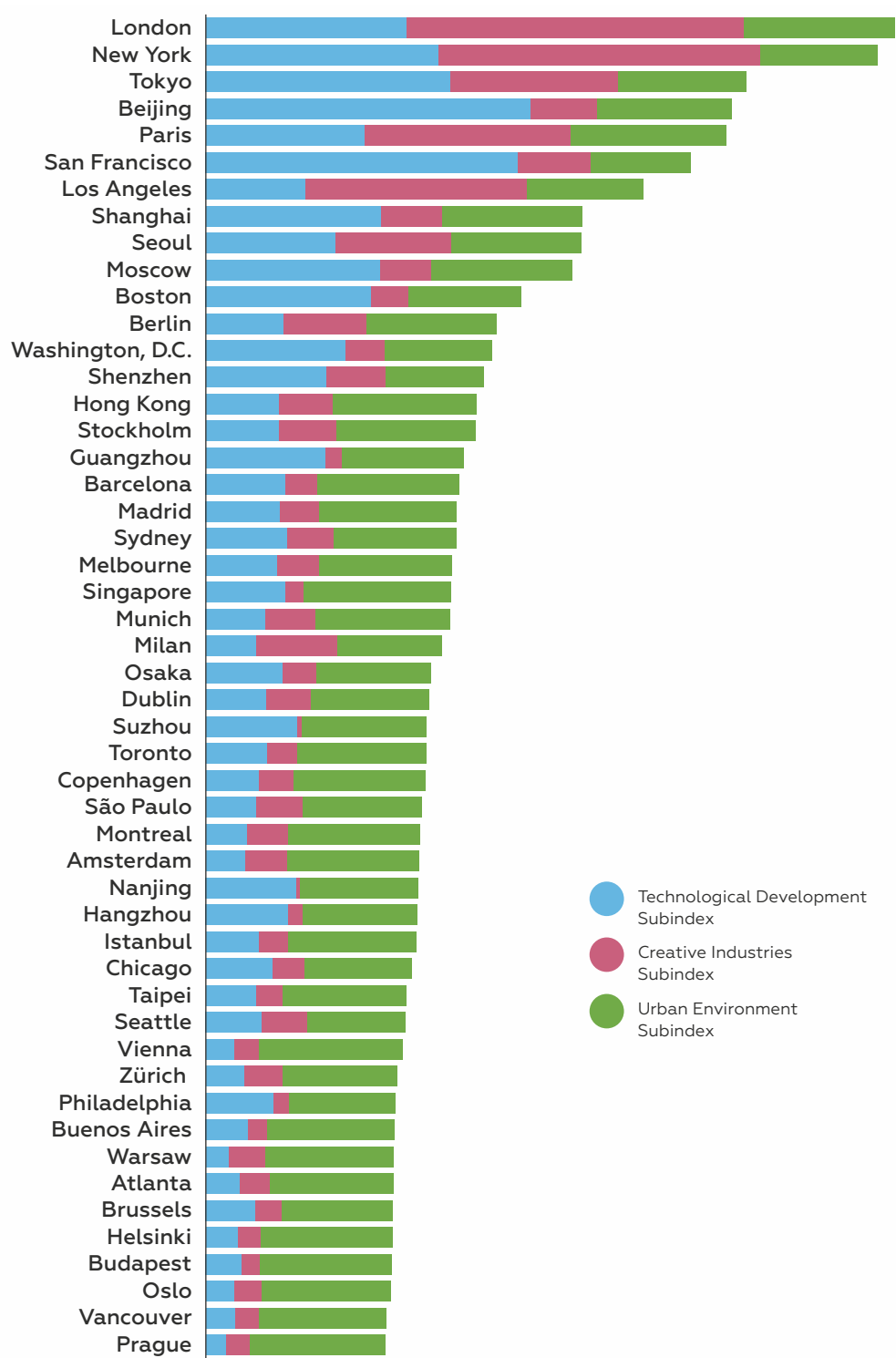
sampled cities

Mainland China

22

sampled cities

Figure 4. Subindices' Contribution to the Overall HSE GCII 2023: Top 50 Cities



Source: HSE University.

Leaders are All Alike, Every Successful City is Successful in Its Own Way

Where does the difference lie between strong innovator cities and leading innovator cities?

The research conducted for HSE GCII 2023 revealed prominent centers of high technologies, creative industries, and advanced urban environments all around the world. This means that even in the second hundred cities there is at least one leader of the innovation economy, an enterprise or an individual, included in international lists and databases, – by which aspects of the city’s innovative attractiveness could be evaluated.

The analysis of the obtained results allowed to divide the sampled cities

into four groups (Figure 5). After studying those groups, it was possible to identify success factors of HSE GCII leaders and determine room for growth for those that scored lower.

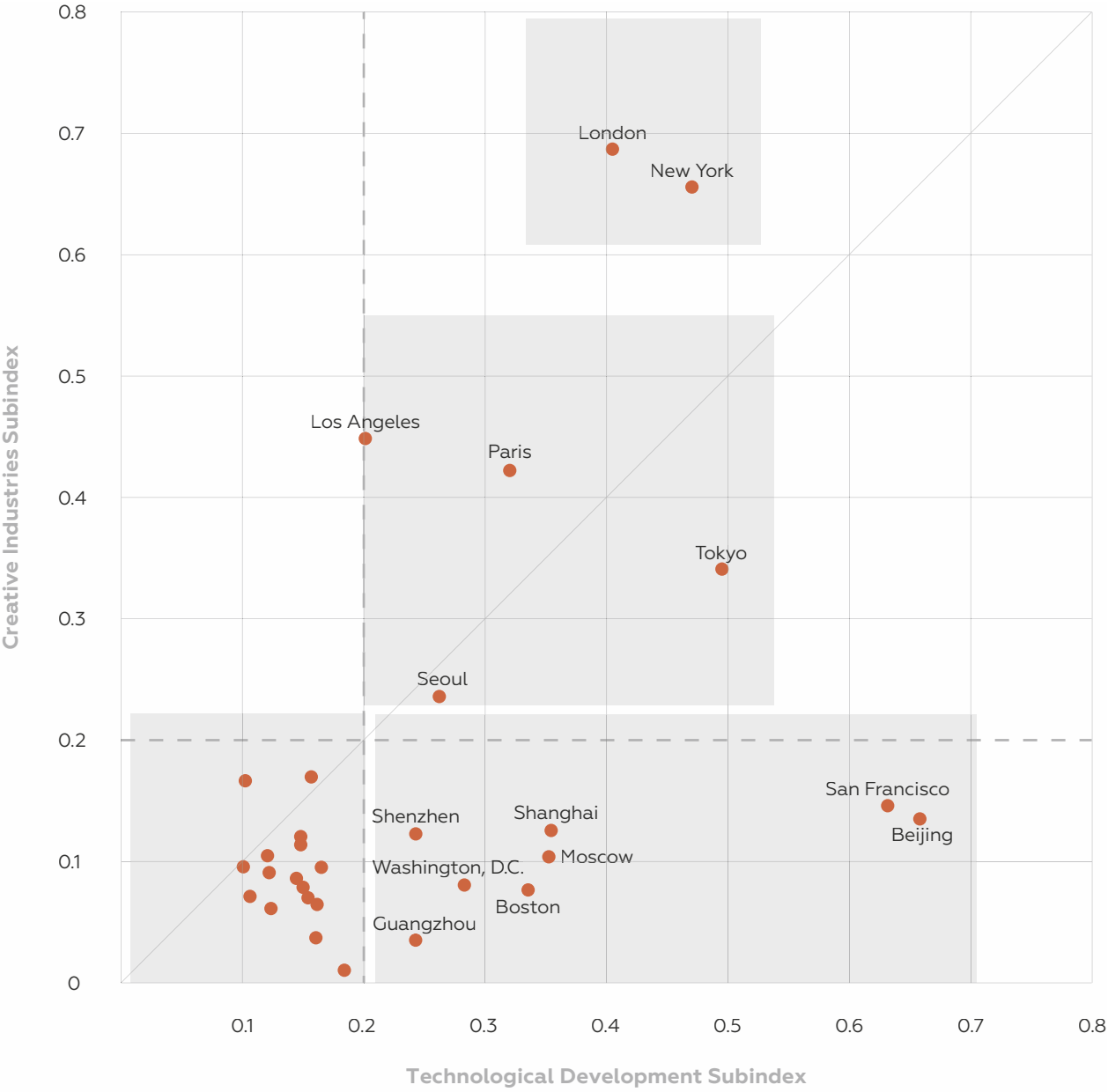
Three “patterns of attractiveness” – a number of characteristics that move the cities up in the ranking – could be distinguished only among top 10 cities, Boston (ranked 11th in HSE GCII 2023), Washington, D.C. (13th), Shenzhen (14th), and Guangzhou (17th).

“Magnets for Innovation Leaders”

The chief “workshops of modern progress”. London and New York not only occupy paramount positions in creative industries (ranked 1st and 2nd, respectively) and in technological development (5th and 4th), they also thrive in both economic areas, whereas less attractive global centers of innovation usually specialize in only one (Figure 6).

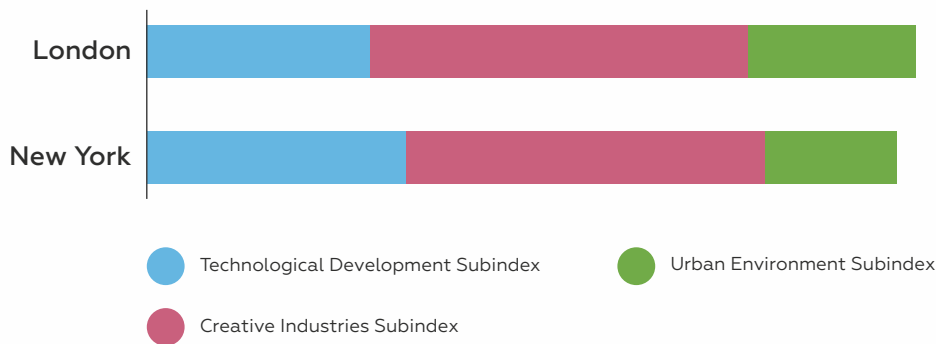


Figure 5. Top 30 HSE GCII Cities by Technological Development and Creative Industries Subindex Values: 2023*



* In the lower left square – HSE GCII 2023 cities ranked 12th, 15th, 16th, and 18th–30th.
Source: HSE University.

Figure 6. Subindices' Contribution to the Overall HSE GCII 2023: "Magnets for Innovation Leaders"



Source: HSE University.

Their success in education, fashion, advertising, literature, and arts is unachievable for the majority of other cities. London and New York swept top three places in 11 out of 20 indicators in technological development, and in 18 out of 24 indicators – in creative industries. These cities get chosen by leaders of the innovation economy. For example, London has the largest number of international students (133,000); it is home to the largest number of global art universities (24), among them is the Royal College of Art, that has been ranked 1st in the QS "Design" category since 2019. The British capital is a global capital of civil engineering with a high concentration (23) of both architecture firms (for example, Zaha Hadid Architects named after the most famous female architect who designed over 950 projects in 44 countries, including the Al Janoub Stadium in Qatar for FIFA 2022) and individual architects, like Norman Foster, a high tech visionary.

London is also leading by the number of best opera performers: there are 22 singers and ensembles, and one of them is Opera Rare – a unique record label that brings back the forgotten compositions of the past.

New York has over 3,000 venture capital funds and innovation infrastructure organizations, 11 largest fashion companies, and 289 fashion brands, including the now legendary Ralph Lauren, Calvin Klein, and Tiffany@Co. In this city, there is already the highest concentration of advertising leaders: 47 PR companies from PProvoke Media (for example, global holding company "Omnicom"); 19 advertising agencies classified by D&AD as among the best in the field (among them is Ogilvy, created by the founding fathers of advertising, Edmund Mather and Francis Ogilvy); 17 ad producers that won awards at Cannes Lions International Festival of Creativity. The Big Apple has ties with 52 painters – leaders of auction sales

(for example, Jeff Coons, pioneer of kitsch and neo-pop), 35 internationally recognized artists, 30 authors of best-selling books (among them Dale Carnegie, bestselling author

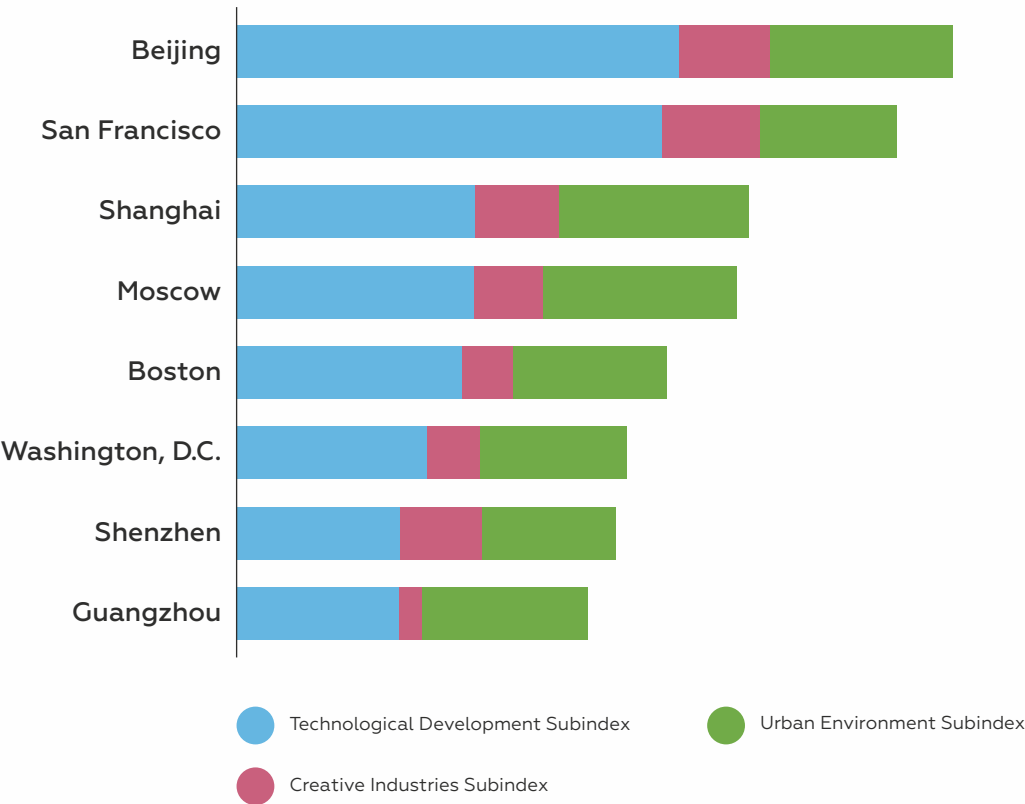
of books on self-improvement), 27 of the most influential people in contemporary art (like Brian Donnelly, designer of a popular toy “KAWS”).

“High Tech Hubs”

Cities of the second type, among which there are capitals, megacities, or large research centers, have a particularly advanced high tech sector. They all are in the top 10 by the Technological Development Subindex sections because of the unique value offers for innovators (Figure 7).

- Beijing 4
- San Francisco 6
- Shanghai 8
- Moscow 10
- Boston 11
- Washington, D.C. 13
- Shenzhen 14
- Guangzhou 17

Figure 7. Subindices’ Contribution to the Overall HSE GCII 2023: “High Tech Hubs”



Source: HSE University.

For example, San Francisco is the main magnet for startups and unicorns (including Stripe, which can nearly be considered a hectocorn¹ with its current valuation of 95 billion USD), – there are 9,096 startups and 279 unicorns in the city.

Moscow boasts some of the most advanced innovation support infrastructure that includes over 100 co-working spaces, seven IASP technology parks, and three TCI clusters, among which are the Moscow Innovation Cluster and International Medical Cluster.

Boston attracted the elite of global science: 479 highly cited researchers, 40 Nobel Prize laureates and Fields Medal winners. Among them is the founder of click chemistry Karl Barry Sharpless from Massachusetts Institute of Technology (MIT) – a double Noble Prize laureate in Chemistry (in 2001 and 2022), and Ben Bernanke, former chairman of the US Federal Reserve System, Harvard and MIT alumnus awarded a Nobel Prize in Economic Sciences in 2022.

Washington, D.C. has the greatest number of leading research institutes – 16, which is three times higher than London.

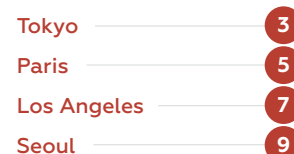
Shenzhen and Guangzhou are in the top 3 by patent activity (on average, both cities filed in total over 400,000 patent applications each in 2017–2019).

Beijing holds 1st to 5th places for all sections of the Technological Development block, and especially outmatching their competitors in the number of patent applications – 343,000 (the gap between Beijing and London is 26.5 times, between Beijing and New York – over 6 times), supercomputers – 38 (in the runner-up San Francisco there are only 15), publications – over 700,000 (which is 2.77 times more than London and 2.89 times more than New York).

Despite an apparent inclination toward high tech, these cities have creative specializations. For example, Beijing is ranked 2nd in the world by the number of leading artists in terms of auction sales (among them is Cui Ruzhuo, who works in the traditional ink wash painting style), Moscow is included in the global top three by the number of most effective advertising agencies, and San Francisco is among global top five by the number of developers of most popular electronic games.

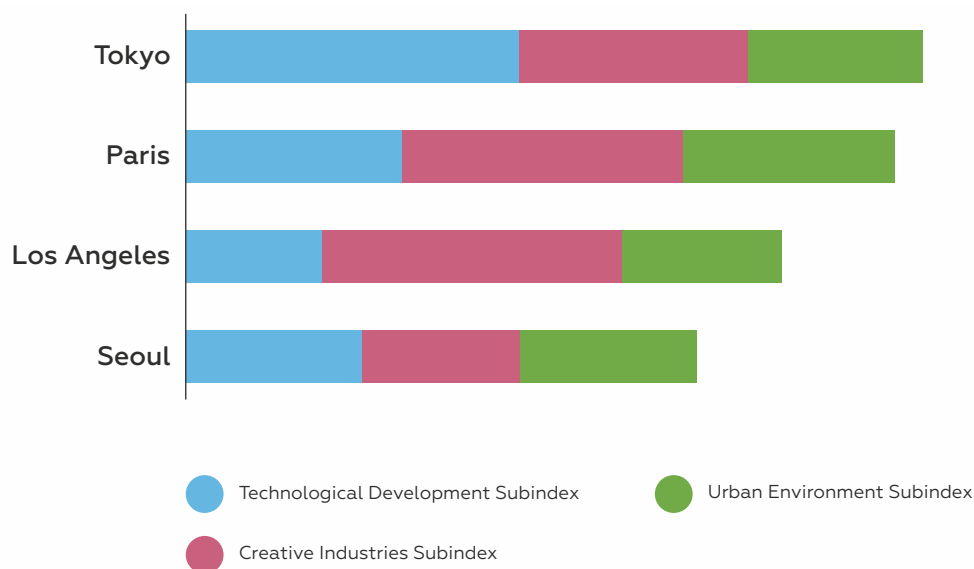
“Poles of Parity Development of Technologies and Creativity”

Cities of the third type are diverse not only when it comes to geography (Southeast Asia, Europe, and US West Coast) or size (from 12 million in Paris to 36 million in Tokyo), but also in terms of the factors of innovation attractiveness. They hold top 10 positions in many sections of technological development and creative industries and demonstrate more or less even development in both of these fields (Figure 8).



¹ Hectocorns are unicorn companies with a value of over 100 billion USD [HSE University, 2022].

Figure 8. Subindices' Contribution to the Overall HSE GCII 2023: "Poles of Parity Development of Technologies and Creativity"



Source: HSE University.

For example, Paris is a global capital of independent film and animation industry and most film companies that have produced feature films or animated films won awards at international festivals (58 and 30, respectively, in comparison to Los Angeles with 19 and 6, respectively). Among them are winners of most recent years: "Titane" that won the Golden Palm at the 2021 Cannes Film Festival, "Happening" that won the Golden Lion at the 2021 Venice International Film Festival, and "Calamity, a Childhood of Martha Jane Cannary" that won the highest prize at the 2020 Annecy International Animation Film Festival. Paris is home to 243 headquarters of leading fashion brands, including Louis Vuitton, Hermes, Chanel, Balenciaga, Chloe, and Christian Louboutin (ranked 3rd after London and New York), 24 internationally recognized artists (ranked 2nd after New York) and nine of the best opera performers (ranked 3rd

after London and New York). On top of that, this is a city of groundbreaking science, both academic and corporate (ranked 6th by R&D expenditure of the largest innovation companies, number of leading R&D organizations, Nobel Prize laureates and Fields Medal winners) and education (ranked 2nd by the number of business schools, 4th – by the number of international students, and 9th – by the number of leading universities).

Seoul topped the ranking for the number of singers who recorded the highest-grossing albums: 14 out of 59 musicians – participants of the Billboard World Album Charts, for example, G-Dragon or Agust D (in New York and London there are three times fewer singers). The city is also in the top three by leaders of industrial design and in the top five by centers of game industries. At the same time, the South Korean capital

is among the top 10 of the most advanced cities by technological entrepreneurship (ranked 7th by R&D expenditure of largest innovation companies), education, and science (ranked 2nd and 6th by the number of leading universities and R&D organizations, 7th – by the number of international students).

Los Angeles is one of the global centers of venture capital investment: together with London, they share 5th place by the number of unicorns – 41. At the same time, this is a global gaming capital, where 17 winners of The Game Awards are located and where the finals of the 44 largest e-sports tournaments (2005–2021) were held, for example, a global League of Legends tournament in 2016 with a prize fund of 5 million USD. And, of course, Los Angeles is the most important city for show business: it has 272 top-rated film production companies (by audience votes), including the legendary Columbia Pictures, 20th Century Fox Film Corporation, Paramount Pictures, Walt Disney Pictures, and Warner Bros. (Paris, ranked 2nd by this indicator, has 73 of such companies). Here live 30 of the most-streamed artists (three times higher

than in London, which holds 2nd place) – from Red Hot Chili Peppers who earned their place in the hall of fame in the 1980s to Billie Eilish who became a Grammy triumph in 2020.

However, Tokyo is the one city that has the most achievements in creative industries and high tech – in 11 out of 14 sections of the corresponding blocks Tokyo is included in the top 10. The Japanese capital has 45 leading world universities (ranked 1st), twice as many as London (22) or New York (20). By the number of the largest innovation companies, Tokyo is also number one: there are around 200 headquarters of companies included on the R&D Scoreboard here, including Honda Motor, Sony, Hitachi, Canon, Mitsubishi, Fujifilm, and Toshiba, which is 2.7 and 2.9 times higher than New York (75) and London (69), respectively. Tokyo is the birthplace of prominent architects and writers: seven Pritzker Prize winners (ranked 1st, Shigeru Ban is one of them, he became known for his prefabricated houses for disaster victims), and 19 authors of best-selling books (2nd). Developers in the gaming industry also brought the city its popularity – Square Enix, Konami, and Capcom (5th).

“Specialized Innovation Centers”

This fourth group is the largest and comprised of cities from ranks 12th to 200th in the HSE GCII 2023.¹ The competitive edge of leaders with super dense concentrations of talent likely poses a challenge for them to make it into the top ranks of ratings, however they do have their success stories.

For example, Shenzhen is number one by industrial design (28 designers and design firms – leaders of the A’ Design Award, iF Design Award, and Red Dot Design Award), Lima is first by the number of most

effective advertising agencies (16 Global Effie Awards participants). Bangalore, Delhi, and Mumbai are the new venture capital stars with 33, 22, and 14 registered unicorns, respectively. Barcelona, Stockholm, Marseille, Bogotá, Berlin, Dublin, and Sydney – are cities with advanced innovation infrastructure. Milan, Columbus, Hong Kong, Shanghai, and Florence compete with recognized leaders of fashion industry, and Brussels, Mumbai, Amsterdam, and Madrid created “dream factories” that made it into the top 10 of the world.

In this global environment, various cities have their chance at leadership. Some will rise to the peaks of the innovation economy, others will be fixed on the technological or creative pedestals, while yet others will find their own niches.

¹ Save for Boston, Washington, D.C., Shenzhen, and Guangzhou which ranked 11th, 13th, 14th, and 17th in the overall ranking, respectively, included in the sample of cities in High Tech Hubs group.

Multifactor Leadership and the Hygienic Role of Infrastructure

Is there a connection between the even development of all components of innovation attractiveness and success in rankings?

Cities' placements in the overall HSE GCII 2023 were benchmarked with their positions in the sub-rankings – Technological Development, Creative Industries, and Urban Environment. In the majority of cases, high values in one subindex go hand in hand with low values in other subindices or there are other deviances from the overall HSE GCII by one or several subindices. The overall index both balances and hides various components of innovation attractiveness.

Even¹ development is endemic only for 15 cities in the ranking, half of them are from the Greater Europe and only four – from the United States and Mainland China, leading countries by the number of HSE GCII cities. They are London (ranked 1st), Paris (5th), Shanghai (8th), Moscow (10th), Hong Kong (15th), Stockholm (16th), Madrid (19th), Melbourne (21st), Munich (23rd), Toronto (28th), Copenhagen (29th), Istanbul (35th), Taipei (37th), Dallas

(54th), and Benton City (199th). And even though the last example does not help clearly identify the link between the even development of all components of innovation attractiveness and the success in the rankings, it would be incorrect to state otherwise: more often than not, leaders of the postindustrial economy are attracted to cities that combine high tech, creativity, and comfortable conditions.

At the same time, it is the Urban Environment Subindex that is characterized by the most diversity in terms of the Overall HSE GCII. Some cities which scored top positions in the overall ranking have equally high scores in Technological Development and Creative Industries, and low scores in the Urban Environment. Among them are Boston, Los Angeles, New York, San Francisco, Shenzhen, and Washington, D.C. (Figure 9).

¹ The level of innovation attractiveness was considered even if the deviation of the ranks for all HSE GCII subindex values was less than ten positions in either direction. Otherwise, it was considered that the thematic block, as reflected by the corresponding subindex, is a strength or weakness in the innovation attractiveness of the city.

Figure 9. Selected HSE GCII Cities’ Ranks
in the Overall HSE GCII and Subindices: 2023

City	HSE GCII rank	Subindices’ ranks		
		Technological Development	Creative Industries	Urban Environment
New York	2	4	2	72
San Francisco	6	2	9	146
Los Angeles	7	14	3	77
Boston	11	8	29	94
Washington, D.C.	13	10	25	114
Shenzhen	14	12	12	155



Source: HSE University.

All these cities, save for Shenzhen, are among most expensive cities in the world (average apartment rental cost is 2,687 USD, cost of a meat at a restaurant – 16 USD), they struggle with traffic jams (commute time is on average 45 minutes), and New York, San Francisco, and Shenzhen

also have relatively unfavorable ecology (ranked 130th, 109th, and 142nd by the environmental pollution level, respectively).

However, all these weaknesses of the urban environment do not stand in those cities’ way of becoming attractive for innovators.

Global cities attract leaders of the innovation economy, first and foremost, with opportunities of building relationships with other leaders. Comfort and thought-through infrastructure have more of a hygienic significance, rather than a deciding role: their absence can push people away, but their presence cannot attract anybody.

The Peacock Spreads Its Feathers

How Shenzhen attracts talent

Shenzhen could be rightly called one of the “stars” of HSE GCII 2023. It occupies first place by the number of leading industrial design companies (28) – design firms and designers that achieved professional ratings¹, and by that indicator, it has twice as many as its nearest competitor – Tokyo (13). Shenzhen came second in patentability: it has 9.09% of patent applications filed by HSE GCII cities in 2017–2019 (for comparison, Beijing’s share is 6.9%). The city is also in the top 10 by the number of technology companies and unicorns, of which it has 54 (ranked 8th) and 27 (ranked 9th), respectively. Among them is a telecommunication giant “Huawei” (ranked 2nd in the R&D Scoreboard 2500 by R&D expenditure that totaled 22.4 billion USD in 2021, and its percentage in the revenue grew from 13.9% in 2018 to 22.4% in 2021), manufacturer of electric cars “BYD”, manufacturer of drones “DJI” (8th unicorn in China by value) and IT holding company “Tencent”, which has been recognized as the most appeal-

ing employer for Chinese returnees outrunning Alibaba Group from Hangzhou, ByteDance from Shanghai, and Baidu from Beijing [Wang, 2022].

During its short history as a city (until 1979, it was a fishing village), Shenzhen rose up to global recognition in different categories. It is known as a “global factory”², “Silicon Valley of China”³, UNESCO’s creative city of design (official status since 2008)⁴, and a Chinese city of talented migrants [Wang, 2022]. The name Shenzhen is associated with the transition in national production philosophy from *shangzhai*⁵ to original design combining high technologies and the creative sector. It is this synergy of high tech and individual artistry that attracts representatives of the innovative class to this city from other areas in China and abroad. For example, the co-founder of DJI and a student from Hong Kong, Frank Wang, or chief designer for BYD, Wolfgang Egger, an expat from Germany, that used to work for Audi Group.⁶

¹ A’ Design Award, iF Design Award, and Red Dot Design Award.

² 5 Things to Know About Doing Business in Shenzhen. Available at: <https://www.inc.com/will-yakowicz/shenzhen-city-of-electronics.html> (Accessed: 20.12.2022).

³ Shenzhen vs Silicon Valley? From Female Empowerment to ‘Peacock Talents’. Available at: <https://daoinsights.com/opinions/shenzhen-vs-silicon-valley-from-female-empowerment-to-peacock-talents/> (Accessed: 20.12.2022).

⁴ Shenzhen. Available at: https://ru.wikipedia.org/wiki/%D0%A8%D1%8D%D0%BD%D1%8C%D1%87%D0%B6%D1%8D%D0%BD%D1%8C#cite_note-6 (Accessed: 20.12.2022).

⁵ Shangzhai (chi. “fortress in the mountain”) – is a Chinese word used in modern-day speech about replicas of an original product. In this sense it was first used to describe mobile phones, Nokir and Samsung, manufactured at Shenzhen’s many co-op factories, and after that – for many Chinese products. Source: Shanzhai. Available at: <https://culture.org/logger/shanzhai/> (Accessed: 10.01.2023).

⁶ BYD’s new design hub has been completed. Available at: http://www.eyeshenzhen.com/content/2019-06/27/content_22210167.htm (Accessed: 20.12.2022).

Shenzhen was recognized as the best city in China to build a career and earn a living, thus outperforming traditionally famous Chinese megacities, like Guangzhou (ranked 2nd), Beijing, and Shanghai (ranked 4th) [Wang, 2022]. It is also included in the top 10 by most attractive cities in China for expats because of many career opportunities, cultural diversity, hospitality and tolerance¹, reflected in the city's moto: "You become Shangzhanian as soon as you arrive in Shenzhen" [Wang, 2022].

Shenzhen's "talent magnetism" is largely the result of a smart policy to attract leaders of the innovation economy. In 2010, the Municipal Government launched the Peacock Plan that offers scientists and innovators, managers of global tech companies and universities, recognized global artists and creatives financial stimuli to relocate to Shenzhen.

Applicants could be divided into three talent categories – A, B, and C. The first category includes "superstars" with international recognition in the corresponding areas, for example, Nobel Prize laureates, top managers at Fortune Global 500 companies, or Olympic gold medalists. Their main contribution to the development of Shenzhen is reputational gain. It is all about serving as the city's ambassadors to the global economic community. In the second category are chief editors of most recognized

scientific journals, professors of leading universities, authors of articles published in highly cited journals, like *Nature* or *Science*, heads of representative offices of Fortune Global 500 companies, or soloists of globally renowned orchestras. The third "talented" group has, in particular, winners of the Red Dot Award for designers and returnees with a PhD from a leading prestigious university.

The Peacock Plan stipulates individual grants from 1.6 to 3 million yuan (approximately from 224,000 to 420,000 USD) will be paid out, as well as medical insurance, children's education, and research support.² Talented individuals that came to Shenzhen under the Peacock Plan will be able to stay in the county on simplified visa rules. For example, they do not need to obtain a work permit if they are going to stay in the country for fewer than 90 days. Further, professionals provided with an invitation from the city's Center for International Exchange of Personnel could apply for an F multi-visa.³

Already after the first three years of implementing the Peacock Plan, Shenzhen attracted 2,954 highly skilled professionals from abroad (mainly, returnees with a PhD, working in computer science, biotechnology, and electronics) who received 0.92 billion yuan (around 129 million USD) from the government [OECD, 2018].

¹ World Population Review. Available at: <https://worldpopulationreview.com/world-cities/shenzhen-population> (Accessed: 20.12.2022).

² Peacock Plan. Available at: <http://science-en.sustech.edu.cn/uploads/file/20200312/1583998321555181.pdf> (Accessed: 20.12.2022).

³ Shenzhen's Policies on Recruiting Talents. Permanent residency and exit and entry for talents. Available at: http://www.eyeshenzhen.com/content/2022-05/13/content_16256876.htm (Accessed: 20.12.2022).

Creative Watershed

The polarization of global cities due to their level of creative industries is one of the main trends of cities' innovation attractiveness in the 21st century.

Which parameters of innovation attractiveness create a divide between cities, and which ones bring them closer together? To measure how far these cities deviate from one another, the values of the overall HSE GCII 2023 were benchmarked in three subindices – for cities leading in these rankings, and the cities that come last in the corresponding top 100.¹

Global centers of the first hundred had little deviation in the overall index (five times), which is explained by the adjustment of the overall HSE GCII value thanks scoring high in one factor of innovation attractiveness and lagging

behind in others. The gap between cities in Technological Development ended up being more significant (15 times). Almost 35% of highly cited researchers, 40% of companies with highest R&D expenditure, and 60% of unicorns are spread between ten key HSE GCII cities. However, the biggest gap was in Creative Industries – 37 times! As always, the first ten cities are a home to over 55% of recognized fashion brands, 65% top-rated film production companies, or 70% of top painters by auction sales [Kutsenko et al., 2022].

The smallest gap among the cities is in Urban Environment – 1.4 times.

A practically even level of urban infrastructure development proves that this is an important factor that attracts a lot of innovators. Most studied cities offer their residents Internet services, mobility, and entertainment options that correspond to modern standards.

¹ Comparison for the whole sample was not conducted in order to exclude the bias on account of cities with values approaching zero that occupy last places in the ranking.

When Size Does Not Matter

Which cities are the most effective “workshops of progress”?

HSE GCII is based on the identification of “superstars” of the innovation economy – the best representatives of the high tech world and creative industries that received recognition by way of professional awards or top positions in specialized ratings. Numerically speaking, most of such organizations and individuals tend to gather in the main centers of innovation attractiveness – New York (1,173) and London (1,051). However, if one

compares the number of leaders of the innovation economy to the number of people residing in their localities, one will discover a new group of cities proving to be more effective in accumulating, attracting, and retaining those who create and use intellectual property or make goods and perform services based on their creative potential. Here, there are more leaders of the innovation economy per 10,000 residents than in other cities (Table 1).

Table 1. Top 50 HSE GCII Cities with the Highest Concentration of Innovation Economy Leaders (Individuals and Enterprises): 2023

No.	City	Country	HSE GCII rank	Population (persons)	Number of innovation economy leaders
1	Ithaca	United States	118	30,014	46
2	Durham	United States	108	322,584	100
3	Rochester	United States	191	110,742	32
4	Heidelberg	Germany	138	146,751	42
5	Cambridge	United Kingdom	76	374,167	100
6	Leuven	Belgium	157	102,126	22
7	Champaign	United States	119	81,055	16
8	Boston	United States	11	4,431,716	710
9	Boulder	United States	133	326,209	49
10	Munich	Germany	23	1,561,094	227
11	San Francisco	United States	6	6,698,768	972
12	Oxford	United Kingdom	127	549,909	79
13	Reykjavik	Iceland	95	134,010	19
14	Ghent	Belgium	173	377,978	50
15	Geneva	Switzerland	68	602,407	77

(continued)

No.	City	Country	HSE GCII rank	Population (persons)	Number of innovation economy leaders
16	Lausanne	Switzerland	179	428,716	45
17	Tsukuba	Japan	189	220,566	23
18	Cork	Ireland	178	208,669	21
19	Santa Cruz	United States	167	272,169	27
20	Washtenaw	United States	162	368,421	34
21	London	United Kingdom	1	12,389,370	1051
22	Bonn	Germany	134	330,579	28
23	Canberra	Australia	148	426,014	36
24	Zürich	Switzerland	40	1,400,427	118
25	Copenhagen	Denmark	29	1,944,361	157
26	Marseille	France	136	1,277,358	103
27	Leiden	Netherlands	155	352,186	28
28	Nijmegen	Netherlands	106	329,320	26
29	Antwerp	Belgium	192	529,247	41
30	Hsinchu	China	137	499,348	38
31	Stockholm	Sweden	16	2,371,065	179
32	Santa Barbara	United States	163	445,122	32
33	Basel	Switzerland	126	552,847	39
34	Benton City	United States	199	303,501	20
35	Utrecht	Netherlands	165	898,898	59
36	Aarhus	Denmark	146	526,218	34
37	Milan	Italy	24	4,971,910	321
38	Exeter	United Kingdom	153	494,396	31
39	Edinburgh	United Kingdom	66	905,946	56
40	Florence	Italy	188	789,720	48
41	Paris	France	5	12,877,795	782
42	Bern	Switzerland	166	422,091	25
43	New York	United States	2	19,875,139	1173
44	Amsterdam	Netherlands	32	2,863,872	165
45	San Diego	United States	55	3,331,789	173
46	Leipzig	Germany	158	593,145	30
47	Aalborg	Denmark	151	322,077	16
48	Los Angeles	United States	7	17,819,845	883
49	Brussels	Belgium	45	1,831,742	90
50	Washington, D.C.	United States	13	9,145,013	439

Source: HSE University.

Among the leaders of innovation attractiveness, the most effective are San Francisco, occupying the corresponding 11th place, London – 21st, Paris – 41st, New York – 43rd, and Los Angeles – 48th. On top of that, seven out of the top 10 cities by “talent effectiveness” are in the second hundred of HSE GCII 2023, occupying the ranks from 108th to 191st. They have a particularly low population – on average 750,000 persons, and save for two million-plus cities – Boston and Munich – less than 200,000. However, the key characteristic of the first ten cities with the highest concentration of innovation leaders are strong universities. Among them are Harvard, MIT, and Cambridge (included in top five of QS, THE, and ARWU), Heidelberg University (oldest in modern Germany), The Technical University of Munich (the only technical university in Bavaria), Cornell University in Ithaca (Ivy League), Duke University in Durham and Mayo Clinic College of Medicine & Science in Rochester (leading centers of medical research in the US), Catholic University of Leuven (long-term leader of the most innovative European universities according to Reuters¹), University of Illinois Urbana-Champaign (largest campus of all universities of Illinois), University of Colorado Boulder (alma mater of Tom Maniatis, the first biologist in the world who sequestered and cloned a human gene and became one of the most cited scientists of Greek origin in the world, and where a Soviet and American theoretical physicist, astrophysicist, and writer of popular science books George Gamow gave his lectures).

It would be unjust, however, to call the main centers of innovation effectiveness university towns or science cities. It is more likely that universities worked as sort of a nucleus, building around itself a strong venture capital ecosystem with a wholesome entrepreneurial and creative environment. This is how two large cities from the top 10 by innovation effectiveness – Boston and Munich – gave the world 710 and 227 leaders of the innovation economy, respectively. Boston has the most highly cited researchers, Nobel Prize laureates and Fields Medal winners. The city is even one of global centers of technological business: it hosts the headquarters of 94 companies included in the R&D Scoreboard (ranked 4th by the value of corresponding indicator), 2,591 startups (7th) and 29 unicorns (8th). Munich is one of the HSE GCII cities where high tech and creativity go hand in hand. It is in the top three global opera capitals represented by nine winners of The International Opera award, is ranked 4th by the number of leaders of industrial design (11). Munich is 8th both by the number of highly cited researchers (114 persons) and by the number of supercomputers (5). The Bavarian capital has registered 500 startups and seven unicorns.

All in all, every city in the top 50 by innovation effectiveness has startups and highly cited researchers, in 30 cities there is at least at least one live Nobel Prize laureate and Fields Medal winner, in 37 – one headquarters of at least one large tech company, and in 23 – one registered unicorn, which is a “rare creature” anyway.

¹ Europe's Most Innovative Universities 2019. Available at: <https://www.reuters.com/graphics/EUROPEUNIVERSITY-INNOVATION/010091N02HR/index.html> (Accessed: 11.01.2023).





2

Technological Development

Cities’ Ranking by the Technological Development Subindex: 2023



(continued)

	Techno- logical Development Subindex rank	Technology companies	Startups and venture capital	Sections' ranks Universities and R&D organiza- tions	Productivity of innova- tive class	Innovation infrastruc- ture
Xi'an	41	83	183	34	17	162–200
San Diego	42	13	31	39	52	117–119
Tianjin	43	86	147	80	10	134–140
Cairo	44	147–200	68	17	81	83–89
Houston	45	51	39	37	30	78
Delhi	46	101	8	101	47	43
Essen-Dortmund	47	59	134	65	91	14
Marseille	48	147–200	158	96	151	6
Mumbai	49	44	12	42	82	95–98
Buenos Aires	50	124	85	28	155	46
Chengdu	51	66	93	76	16	134–140
Montreal	52	82	49	35	55	62
Cambridge	53	56	98	31	53	79
Dallas	54	37	25	51	54	76–77
Amsterdam	55	34	24	67	62	68
Zürich	56	39	45	41	63	76–77
Gothenburg	57	50	132	149	133	11
Austin	58	24	22	93	78	75
Rome	59	68	130	45	26	126
Chongqing	60	89	137	107	18	101–108
Ankara	61	116	153	68	85	20
Tel Aviv	62	35	17	64	86	114–116
Budapest	63	129	109	95	131	17
Tehran	64	147–200	144	61	33	52
Hsinchu	65	21	167	160	97	22
Nagoya	66	16	164	103	34	91
Mexico City	67	147–200	53	32	103	92–94
Atlanta	68	64	34	55	51	117–119
Qingdao	69	77	141	91	20	162–200
Lyon	70	88	117	72	110	33–34
València	71	147–200	113	143	130	15
Helsinki	72	36	48	73	88	64
Lisbon	73	131	103	56	105	44
Changsha	74	70	157	63	31	83–89
Edinburgh	75	147–200	101	81	104	32
Phoenix	76	38	46	70	83	74
Hefei	77	55	148	86	25	162–200
Eindhoven	78	46	121	190	128	18
Miami	79	81	18	88	76	95–98
Vancouver	80	93	38	54	75	111–113



1–10



11–50



51–100



101–150



151–200

(continued)



(continued)

	Techno- logical Development Subindex rank	Technology companies	Startups and venture capital	Sections' ranks Universities and R&D organiza- tions	Productivity of innova- tive class	Innovation infrastruc- ture
Cape Town	121	147–200	87	74	174	114–116
Minneapolis	122	47	60	123	84	127–130
Turin	123	120	151	115	117	72
Washtenaw	124	132	127	110	67	101–108
New Haven	125	43	76	121	87	146–161
Reykjavik	126	137	120	198	198	30
Lausanne	127	91	118	85	119	146–161
Porto	128	142	145	188	132	48
Utrecht	129	118	105	119	106	83–89
Dalian	130	140	196	146	37	162–200
Taichung-Changhua	131	75	186	113	112	101–108
St. Louis	132	95	84	99	100	146–161
Cork	133	121	161	193	193	38
Chennai	134	119	63	129	58	146–161
Hamburg	135	52	59	164	98	111–113
Cuyahoga	136	49	99	117	99	146–161
Athens	137	147–200	126	124	118	83–89
Daejeon	138	103	192	156	69	83–89
Liverpool	139	147–200	154	89	115	146–161
Fuzhou	140	67	174	131	64	162–200
Boulder	141	127	69	108	134	134–140
Cologne	142	40	115	128	149	146–161
Johannesburg	143	147–200	83	100	170	124–125
Birmingham	144	100	116	102	108	162–200
Rotterdam	145	115	80	147	156	83–89
Columbus	146	84	77	134	92	131–133
Adelaide	147	147–200	139	106	138	120–122
Glasgow	148	145	124	98	129	162–200
Düsseldorf	149	79	125	140	180	90
Jakarta	150	147–200	41	125	167	146–161
Kyiv	151	147–200	92	191	160	56
Auckland	152	117	88	118	148	131–133
Leuven	153	126	165	112	93	162–200
Malmö	154	108	123	180	194	63
Ottawa	155	110	100	130	101	146–161
Leeds	156	141	133	105	147	162–200
Tsukuba	157	147–200	194	122	107	134–140
Gent	158	125	149	109	146	162–200
Bristol	159	147–200	90	127	145	141–145
Raleigh	160	134	61	139	152	146–161



1–10



11–50



51–100



101–150



151–200

(continued)

	Techno- logical Development Subindex rank	Technology companies	Startups and venture capital	Sections' ranks Universities and R&D organiza- tions	Productivity of innova- tive class	Innovation infrastruc- ture
Grenoble	161	147–200	176	114	123	162–200
Braunschweig-Salzgitter-Wolfsburg	162	26	199	195	179	162–200
Salt Lake City	163	73	70	181	142	127–130
Canberra	164	147–200	168	126	165	127–130
Bucharest	165	147–200	112	187	150	80–81
Kitchener	166	96	107	136	154	162–200
Almaty	167	147–200	187	141	195	101–108
Aarhus	168	112	143	179	166	99–100
Santa Barbara	169	98	108	144	178	146–161
Beirut	170	147–200	136	111	189	162–200
Aberdeen	171	123	155	185	188	82
Bern	172	90	173	189	162	99–100
Exeter	173	147–200	188	169	177	110
Champaign	174	147–200	184	145	143	162–200
Nuremberg	175	65	189	177	135	162–200
Ithaca	176	147–200	178	137	164	162–200
Sacramento	177	122	179	165	109	162–200
The Hague	178	130	114	168	137	146–161
Leiden	179	87	166	167	153	162–200
Bonn	180	109	177	163	159	146–161
Nashville	181	99	73	184	141	162–200
Hanover	182	63	150	176	172	162–200
Groningen	183	147–200	138	158	158	146–161
Lagos	184	147–200	56	166	199	141–145
Antwerp	185	136	128	151	182	162–200
Hampden	186	147–200	197	133	183	162–200
Jeddah	187	147–200	159	154	163	162–200
Leicester	188	147–200	172	152	173	162–200
Leipzig	189	147–200	146	186	169	114–116
Brighton	190	147–200	169	148	191	162–200
Padua	191	147–200	198	175	144	162–200
Florence	192	147–200	190	182	125	162–200
Memphis	193	147–200	140	174	181	162–200
Aalborg	194	147–200	191	197	185	101–108
Santa Cruz	195	128	163	183	192	141–145
Las Vegas	196	114	65	199	186	146–161
Rochester	197	147–200	181	196	126	162–200
Benton City	198	147–200	200	192	196	134–140
Tbilisi	199	147–200	175	194	200	131–133
Venice	200	147–200	195	200	197	162–200

1–10

11–50

51–100

101–150

151–200

The technology landscape of modern cities is shaped by global corporations, fast-growing startups, and groundbreaking unicorns – high tech trendsetters delivering cutting-edge projects. At the nucleus of this ecosystem are leading universities and research institutes that attract talent from all around the world and train innovators. Leadership positions in high tech is something most leading cities in terms of innovation attractiveness have in common, and Beijing's strong positions on all those accounts put it at the pinnacle of the technological development ranking. Nevertheless, as evident from other cities' success stories, even niche specializations could bring about significant achievements.

The technological development of a city reflects its overall potential in science, education, and innovation entrepreneurship. To measure that, we calculated the corresponding subindex which includes 20 indicators grouped into five sections:

- Technology Companies (2 indicators)
- Startups and Venture Capital (5)
- Universities and R&D Organizations (7)
- Productivity of Innovative Class (2)
- Innovation Infrastructure (4).

The city's technological profile is made of large companies with some of the highest expenditures on research and development (R&D); promising startups and unicorns, whose development is actively supported by venture

capital investors and innovation funds; world famous universities, research institutes, business schools, and exceptional researchers; publications and patents that demonstrate innovators' productivity and define future technology trends; and advanced infrastructure that links the participants in the innovation process and lays the groundwork for complex knowledge-intensive solutions.

The Technological Development Subindex rank reflects the level of the city's technological prowess in comparison to other centers of high tech and its position in the corresponding section allows one to see which factors or participants of innovation ecosystem influenced its development.

Global Tech Parity

The top 20 global cities by technological development are evenly represented in the East and West

Today, Asian cities are frequent centers of the global technological stage. Beijing, Tokyo, Shanghai, Seoul, and Shenzhen rank 1st, 3rd, 6th, 11th, and 12th in the Technological Development Subindex, respectively, competing with solid performers from Greater Europe and the New World – San Francisco, New York, London, Moscow, and Paris (ranked 2nd, 4th, 5th, 7th, and 9th, respectively). These cities have different historical and cultural backgrounds, traditions, and development trajectories, all vying for the title of the main world high tech hub. Asian cities' strong suit is global high tech corporations; and Western

cities, in turn, absolutely outdid themselves in venture capital businesses.

The top 10 frontrunners in tech are spread across the Northern Hemisphere (Northern America, Eurasia); and the high tech cities after them are speckled across Southern countries and continents in Australia (Sydney – ranked 18th, Melbourne – 26th), New Zealand (Auckland – 152nd), Indonesia (Djakarta – 150th), Latin America (Bogotá – 34th, São Paulo – 38th, Buenos Aires – 50th), and Africa (Cape Town – 121st, Johannesburg – 143rd).

Powerful VC Ecosystems, Multitudinous Patents, Dominance of Science, and Niche Leadership

What are the strengths that secured the global high tech centers' success in the ranking?

The cities at the head of the high tech game demonstrate the same outstanding results in several technological and KIBS activities (Figure 10).

Most of all, leading universities and R&D organizations are brought together by top cities – nine of them have made it into the top 10 for this section (New York is ranked 1st, London – 2nd, Washington, D.C. – 3rd, Paris – 4th, Beijing – 5th, Boston – 6th, Tokyo – 7th, San Francisco – 9th, Shanghai – 10th, respectively). Most R&D organizations are concentrated in Washington, D.C., Beijing, and New York, and the top three by globally recognized universities include Tokyo (45), Seoul (26), and Moscow (25).

Most leaders of the overall Technological Development Subindex are also in the top 10 by the Technology Companies section (San Francisco is ranked 1st, Tokyo – 2nd, Beijing – 3rd, New York – 4th, Boston – 5th, Paris – 7th, London – 8th, Shanghai – 10th, respectively). These cities not only host the largest number of corporations from the R&D Scoreboard (43%), but also use almost half of the total R&D expenditure of the largest companies (48%) among all 200 HSE GCII cities. Almost 17% of the total R&D expenditure of largest innovation companies is spent in San Francisco, a city where the representative offices of 194 tech companies are located, including Salesforce, Airbnb, Uber, etc.

Top 10 cities by the Technological Development Subindex have

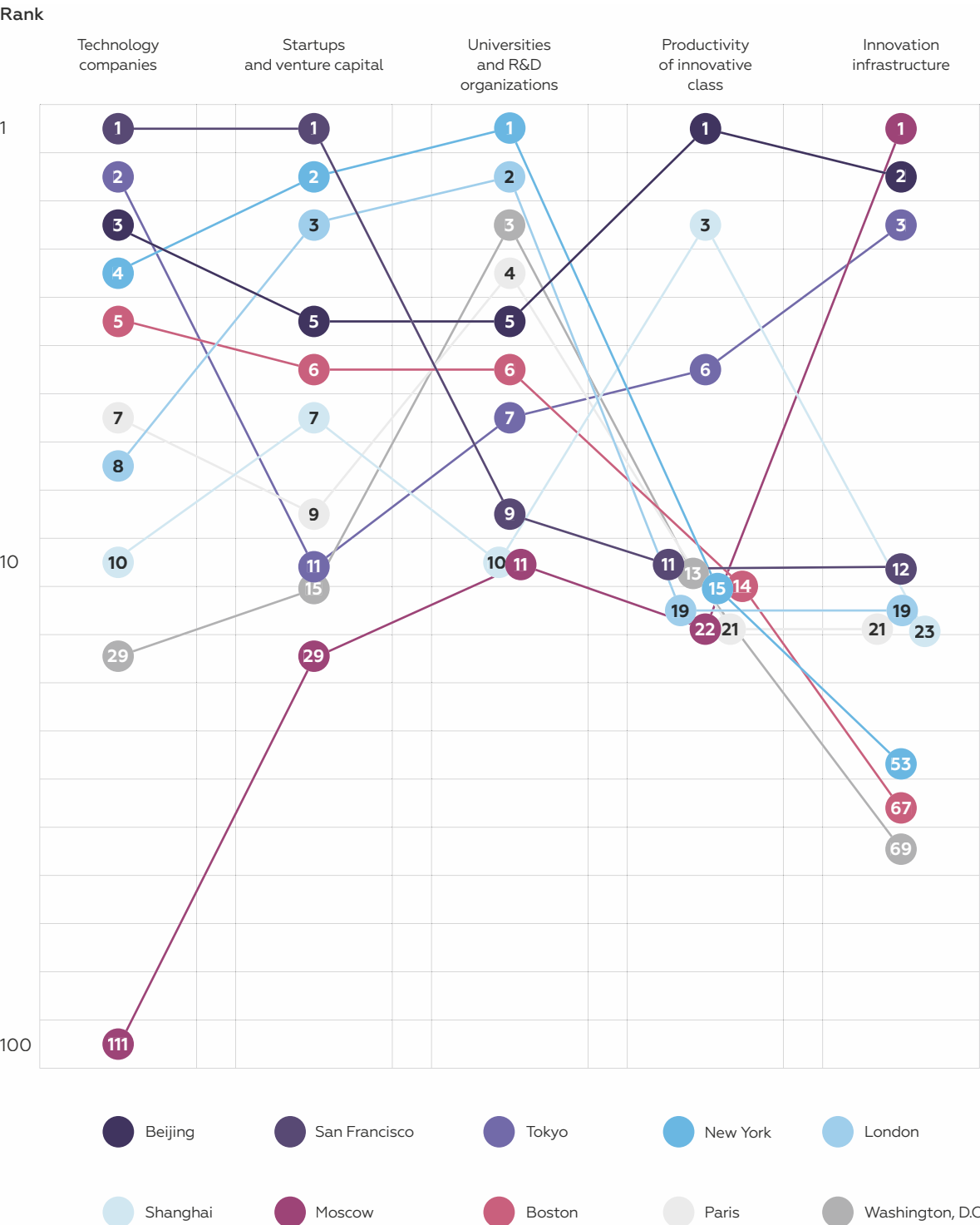
43%

of corporations from the R&D Scoreboard

48%

of R&D expenditure of largest innovation companies

Figure 10. Top 10 Cities' Ranks in the Technological Development Subindex: 2023



Source: HSE University.

Venture capital is another factor that is common for all tech leaders: seven of them are distributed within top 10 of this section (San Francisco is ranked 1st, New York – 2nd, London – 3rd, Beijing – 5th, Boston – 6th, Shanghai – 7th, Paris – 9th, respectively). San Francisco occupies the first rank for as many as four indicators in this section – here, you will find the largest number of startups (9,096), unicorns (279), venture capital investments (297.4 billion USD), and business angels (4,584). An evenly high level of venture capital development is demonstrated as well in New York (top three by all section indicators), London, and Boston (top 10 by all section indicators).

High science and patent activity is typical for three cities out of the first

“tech ten” (Beijing – 1st, Shanghai – 3rd, and Tokyo – 6th, respectively); the positions of the rest vary between the first 22 ranks (San Francisco – 11th, Washington, D.C. – 13th, Boston – 14th, New York – 15th, London – 19th, Paris – 21st, Moscow – 22nd, respectively). The least cohesive factor for tech leaders is innovation infrastructure: cities’ ranks for this section deviate from the overall Subindex rank on average by 23 positions, and its leaders are Moscow, Beijing, and Tokyo.

Global high tech centers are multi-faceted when it comes to their strengths, but some of those facets are unique in scale. The analysis of Technological Development indicators for HSE GCII 2023 cities identified four groups of tech leaders, along with key factors of their success.

“Venture capital hubs”

A unique startup culture mixed with highly active private VC investors and innovation support funds is the perfect breeding ground for new tech companies and their most prominent representatives – unicorns. This combination is precisely what solidified New World cities’ dominance in the ranking.



“Centers of en masse R&D”

A dynamic innovative class is a distinguishing trait and a strong competitive advantage of Asian cities. By the measure of patent registrations and publication of scientific works, they are way over the head of other global centers of science and research. The total number of patent applications of this group of cities is almost 45% of the overall number for all cities, and Beijing’s publication activity is almost 2.5 times higher than its nearest Western competitor – Washington, D.C.



"Leaders of elite science"

The success of this group is built around a strong nucleus of science and education – a forge of exceptional talent. These cities turned out to be attractive for 17% of international students from two hundred cities in the ranking. They became unprecedented leaders by the number of world-famous universities, R&D organizations, business schools, and prominent researchers.

London	5
Moscow	7
Boston	8
Paris	9
Washington, D.C.	10
Seoul	11
Los Angeles	14
Nanjing	16
Singapore	20

"Specialized centers of high tech"

Some cities gained success in selected tech niches. For example, Sydney's strong points are colleges and universities attractive for international students (ranked 3rd by the corresponding indicator's value) and exceptional scholars – highly cited researchers (10th). Barcelona is in the top 10 by two indicators – the number of technology parks and co-working spaces. Cairo is the global leader by the number of students (976,000). And Delhi agglomeration has developed a strong venture capital ecosystem (ranked 5th by the number of startups and business angels, 12th – by unicorns) and flexible co-working spaces (6th).

Hangzhou	17
Sydney	18
Barcelona	19
Berlin	21
Osaka	22
Madrid	23
...	
Cairo	44
Delhi	46
...	

Unicorns are the Creations of Mature Venture Capital Investment Markets

Billion-dollar startups are gradually extending their geographical spread, but are still considered rare creatures, often concentrated in the smallest number of most attractive cities

Unicorns became a phenomenon of global innovation ecosystems. Their high market value is based on the potential growth of the business, the uniqueness of sold goods or services, and the fast coverage of users. Such radical innovators are capable of competing not only with mature corporations, but also with entire industries or even economies. For example, the total value of unicorns in the US is over 2 trillion USD, which is higher than the value of all companies traded on major stock exchanges in Argentina, Columbia,

Peru, Portugal, Ireland, and Russia [Anderson, 2022].

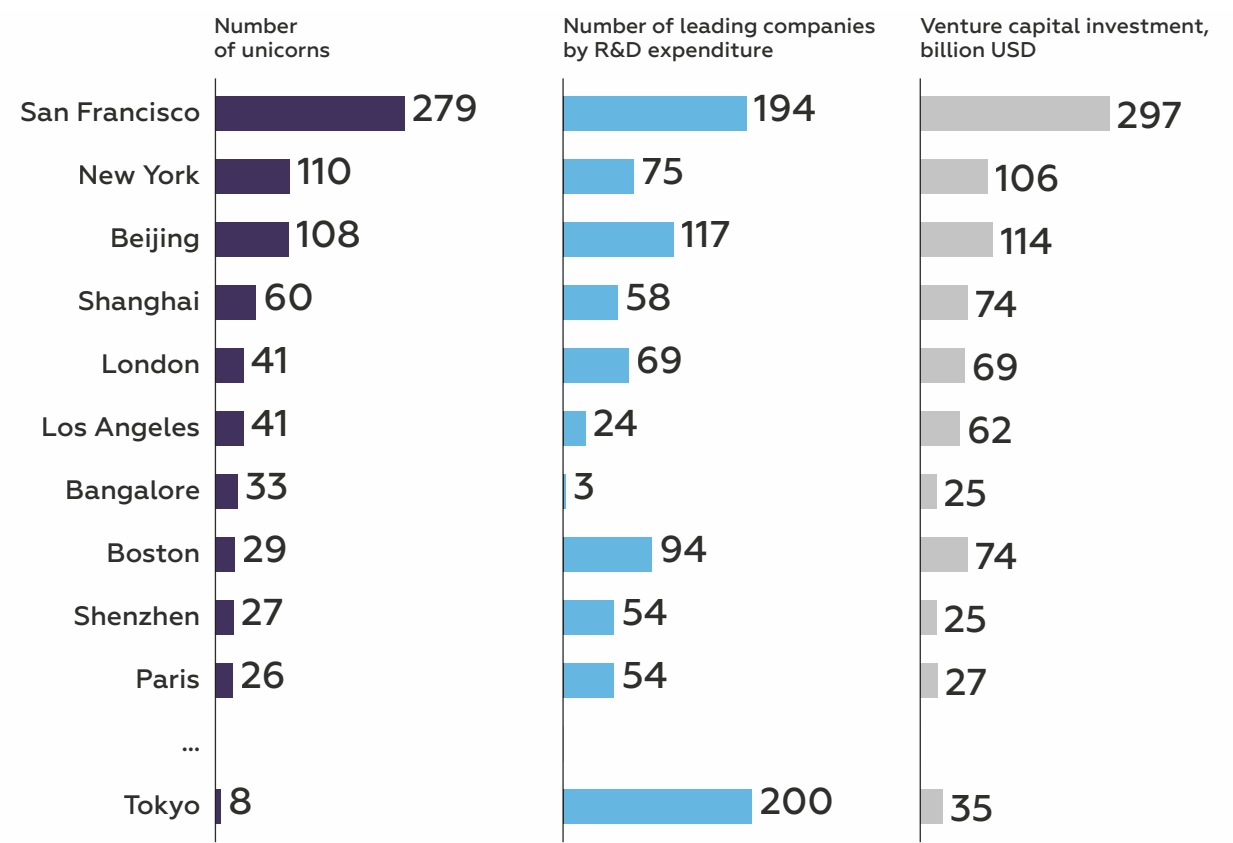
Unicorns are located in 106 of the 200 cities of the ranking, whilst 62% of the total number of billion-dollar startups are found in the top 10 cities. At the same time, new cities are constantly added to the list of those hosting unicorns. They are located outside of the top 10 (Shenzhen is ranked 14th) or even top 100 cities (Bangalore – 139th) of the overall HSE GCII 2023, but have developed a mature venture capital investment market.

There are three poles in the world where unicorns are concentrated – US cities that host 48% of unicorns, cities in Mainland China – 22%, and Indian cities – 6%.

What is interesting to point out, is that the leaders of the Technological Development Subindex – Tokyo, San Francisco, and Beijing – have the largest number of corporations, but not all of them could achieve the same impressive

results in raising unicorns. Tokyo, for example, has the largest number of companies from the R&D Scoreboard (ranked 1st), however the city's accomplishments in creating unicorns are notably humbler (30th) (Figure 11).

Figure 11. Selected Indicators for Tokyo and the Top 10 HSE GCII Cities by the Number of Unicorns: 2022*



* Note: the number of leading companies by R&D expenditure is given according to 2021 data, venture capital investment – according to 2018–2022 data.

Source: HSE University, based on Crunchbase, CB Insights, and R&D Scoreboard 2021.

The founders of unicorns are quite selective as to where they conduct their business and prioritize locations with a lot of resources – human, finance, or infrastructure. For example, the top 10 cities by unicorns attract 55% of venture capital investment among global innovation centers. Distinctive traits of the localities

found attractive by unicorns are mature venture capital investment markets, strong universities, leading R&D organizations, and business schools recognized by members of global science community – Nobel Prize laureates, Fields Medal winners, and highly cited researchers [Kutsenko et al., 2022].

Seize the Day!

India turned innovations into a public good and became one of the global leaders of venture capital

A statue of a unicorn on the central square, the battle between megacities for the venture capital throne, the startup as a political platform and a national idea with a special day on the calendar – all of this is Incredible India, where the economy became the second largest in the world by the number of startups and third – by the number of unicorns during the years of the pandemic. Here one can find a minivan trotting provincial towns searching for innovations, young men and women who just recently graduated and made billions in venture capital, as well as leaders of the Forbes lists. Modern Indian entrepreneurs are driven by the growing needs of a large audience of new Internet users in an ultimately diverse set of services: processing cryptocurrency, studying English, or purchasing pre-owned cars.

On the way to Amrit Kaal: the Indian government bets on startups to bring future prosperity

In 2047, India will celebrate its 100th Anniversary of Independence. There are many ambitious goals that are linked to this event, in particular, its complete transfer from an emerging to developed economy based on innovation and entrepreneurship. Prime Minister Modi called startups “the backbone of new India” [Startup Genome, 2022, p. 20] and linked to them the country’s movement towards Amrit Kaal – according to Vedic astrology, this is a perfect moment to start new work, when with certain efforts one can achieve a lot of success.¹

Presently, the Indian government has already invested resources in developing a digital economy and creating an ecosystem of innovations by laying the groundwork for the speedy growth of the number of startups and their value. A milestone in the Indian digital revolution was the launch of India Stack in 2009, a national technology platform that paved the way to a paperless and cashless economy with a billion users and secured a breakthrough in fintech and e-commerce – sectors where 60% of Indian unicorns had appeared by 2022.

¹ Governance focus has shifted outside Delhi, adopting a holistic approach: PM Modi to new IAS officers. Available at: <https://economictimes.indiatimes.com/news/india/governance-focus-has-shifted-outside-delhi-adopt-holistic-approach-pm-modi-to-new-ias-officers/articleshow/94695608.cms> (Accessed: 22.12.2022).

The next step was launching Startup India in 2016 – a flagship interagency initiative aimed at all-round support of businesses in the country. The day this initiative was launched – January 16th – became National Startup Day. Startup India makes innovative businesses affordable to everyone, irrespective of startup capital, area of economic activity, or physical location. The initiative is curated by the Ministry of Commerce and Industry of India, where support measures – 124 “government schemes” – are provided to branches of various authorities and institutions across the country.¹

Startup India works based on demand. The government extended the term “startup” by setting minimum criteria for receiving the status by company: under 10 years old, turnover for any financial year after registration under 100 crores (approximately 12 million USD), and the performance of activities in innovations or the creation of a scalable business model with high employment or profit-making potential [Government of India, 2021]. Startups that correspond to these criteria have several advantages, in particular – expedited patent application processing and up to 80% discounts on registration fees, as well as up to 50% discounts on trademark registration; tax deductions on capital gains and incomes for three years;

preferential treatment in public procurement without bid security and background requirements; the opportunity for self-certification in compliance with labor and environmental norms within a fixed period. Financing under Startup India is performed out of the Fund of Funds with a total of 10,000 crores (1.2 billion USD) via a system of alternative investment funds registered with the Securities and Exchange Board of India.

One of the goals of Startup India is to find promising startups outside megacities and increase the awareness of tier 2 and tier 3² Indian cities’ populations about a growing national venture capital ecosystem and all the stimuli that entails. For that, in 2017, Startup Yatra was launched – an initiative that involves nationwide competitions of innovative ideas and workshops in which winners receive grants, incubation offers, and mentorship. By 2020, the Startup India Yatra Van, a minivan with event managers, visited 236 regions of the country, where 78,000 amateur entrepreneurs presented their ideas, and 1,434 of the best ideas were selected for further development [Government of India, 2021]. By authorities’ estimates, 49% of all Indian startups that received this status within Startup India emerged outside megacities.³ Thus, tier 2 cities

¹ Startup India. Schemes. Available at: <https://www.startupindia.gov.in/content/sih/en/government-schemes.html> (Accessed: 22.12.2022).

² This classification is based on the size of the population: tier 1 cities are cities that have a population of over 100,000 residents, tier 2 cities – from 50,000 to 99,999 residents, tier 3 cities – from 20,000 to 49,999 residents. Source: India’s Tier 2 and Tier 3 Cities: Are They Right for Your Business? Available at: <https://www.india-briefing.com/news/india-tier-2-tier-3-cities-15932.html/#:~:text=What%20are%20tier%20%20and,classified%20as%20tier%20%20cities>. (Accessed: 22.12.2022).

³ A total of 49% Indian startups are now from tier 2 and 3 cities: Jitendra Singh. Available at: <https://www.thestatesman.com/business/49-indian-startups-now-tier-2-3-cities-jitendra-singh-1503099680.html> (Accessed: 22.12.2022).

like Gurugram, Noida, and Faridabad that are part of the National Capital Territory of Delhi have 19 out of 22 registered unicorns.

The results of national policy-making with respect to venture capital are impressive: at the start of 2022, India was ranked 2nd in the world by the number of startups and business

angels, 3rd – by the number of unicorns, and 4th – by venture capital investment. And even though the central government involves states in finding promising innovators and growing startups, the high results of the country in global venture capital has been secured by three major centers – Bangalore, Delhi, and Mumbai, each in their own niche.

Cities full of risks: drivers of VC entrepreneurship in India

Bangalore, Delhi, and Mumbai host 40% of all startups and 64% of all unicorns in the country. On top of that, every city contributes to the global success of India in their own way: Delhi is ranked 5th by the number of startups, Bangalore – 7th by the number of unicorns, and Mumbai – 5th by the number of business angels and 8th – by the level of venture capital investment. Even though such polycentrism could be useful on a national scale, for the cities themselves it sets the stage for a vicious competition for the venture capital throne in the country.

Thus, after winning the 2015 elections, Delhi Chief Minister Kejriwal and his party Aam Aadmi Party (Common Man's Party) announced the start of a campaign to transform Delhi into a global innovation hub. The first step was to create a network of 11 incubators in 2016 under the public universities of Delhi.¹ After that, the managers of these incubators, together with local startup founders and sector

organizations, were invited to the Commission on Dialog and Development, and instructed by the Delhi Government to develop a venture capital business policy. The Delhi Startup Policy was announced in May 2022 and stipulates the following financial incentives: compensation of rental payments – 50% or up to 5 million rupees (60,000 USD) per year; grants to reimburse expenses related to filing patent applications up to 1 lakh (1,200 USD) per year for the national patent, and up to 3 lakhs (3,600 USD) per year for a foreign patent; a monthly bonus to cover operational expenses or employee costs – up to 30,000 rupees (360 USD) per month during one year. Among financial measures – the mass introduction of business administration programs in vocational schools, the provision of leaves of absence up to two years to students of Delhi public universities that founded startups while still a student, as well as scholarships to pay tuition for students who won innovation competitions.²

¹ Delhi Startup Policy. Available at: <https://ddc.delhi.gov.in/our-work/7/delhi-startup-policy> (Accessed: 22.12.2022).

² Startup Policy of Delhi Govt. Available at: <https://www.studyiq.com/articles/startup-policy-delhi-govt-free-pdf/> (Accessed: 22.12.2022).

Focus on academia is one of the special traits of the Delhi policy with respect to startups. The Indian capital has a high level of population literacy – 86.2%¹, and by the number of leading universities, Delhi is ranked 20th in the world. Eight universities of the city are participants in QS, THE, or ARWU international ratings, including the Indian Institute of Technology, Delhi (IITD). IITD is ranked 185th in QS 2022 and is included in a network of Indian Institutes of Technology (IIT) – public universities owned by the central government and declared technology institutes of national importance.² A total of 86% of founders of Indian unicorns are alumni of various IITs across the country³, most of them – 30 individuals – graduated from the Indian Institute of Technology, Delhi.⁴

Considering that the Delhi Startup Policy has not been active for that long, it is premature to make any conclusions about whether it has made this administrative capital into a startup capital. Up until now, it has been an unofficial title, same as how Indian Silicon Valley is used with respect to Bangalore.⁵ Bangalore received such high recognition due

to an innovation ecosystem that is considered the most advanced in the country [Patil, Wadajkar, 2021]. Karnataka became one of the first states with its own startup policy (2015). According to the central government's estimates, Bangalore received high scores in institutional support, access to capital, development of business potential, and innovation infrastructure within the regional startup ranking⁶ in 2021. As such, several venture capital support funds for a total of 300 crores (36 million USD) were founded in Bangalore. On top of that, Karnataka state also attracted 45% of the total volume of foreign direct investment (FDI) in India in the first six months of the 2021–2022 financial year, most of them – for Bangalore. For comparison: Delhi accumulated a total of 13% of all FDI in India from October 2019 to December 2021.⁷ Innovation infrastructure includes 40 public and private incubators and the best co-working network in the country.⁸ Apart from that, a support program was adopted in 2021 to fund the creation of testing and prototyping infrastructure in the interests of startups. Institutional support is all about creating

¹ Delhi. Department of Industries. Available at: <https://www.startupindia.gov.in/srf/state1.html?state=Delhi> (Accessed: 22.12.2022).

² Indian Institutes of Technology. Available at: https://en.wikipedia.org/wiki/Indian_Institutes_of_Technology (Accessed: 22.12.2022).

³ Indian start-ups' Unicorn strides. Available at: <https://www.thehindubusinessline.com/opinion/indian-start-ups-unicorn-strides/article34782934.ece> (Accessed: 22.12.2022).

⁴ Where do founders of 100 Indian unicorns come from? IIT Delhi tops list, IIMs nurtured many too. Available at: <https://theprint.in/india/education/where-do-founders-of-100-indian-unicorns-come-from-iit-delhi-tops-list-iims-nurtured-many-too/998090/> (Accessed: 22.12.2022).

⁵ 7 reasons why Bangalore is called the startup capital of India. Available at: <https://www.novelloffice.in/blog/7-reasons-why-bangalore-is-called-the-startup-capital-of-india/#1573026091826-191e25c5-ef26> (Accessed: 22.12.2022).

⁶ Karnataka. Department of Information Technology, Biotechnology and Science & Technology. Available at: <https://www.startupindia.gov.in/srf/state1.html?state=Karnataka> (Accessed: 22.12.2022).

⁷ Will Kejriwal's Gambit Pull Startups Out of Bangalore? Available at: <https://www.outlookindia.com/business/startups-in-india-will-arvind-kejriwal-s-gambit-pull-startups-out-of-bangalore--news-195853> (Accessed: 22.12.2022).

⁸ Co-working Space in Bangalore. Available at: <https://novelloffice.in/bangalore/coworking-space/> (Accessed: 22.12.2022).

“regulatory sandboxes” that help startups receive temporary exceptions from the laws of states and municipalities that could prevent the testing of products.

Another goal of the policy is to develop business potential. To a large extent, Bangalore’s success in creating startups can be attributed to a high concentration of IT specialists in the city: 25% of the digital talent of India is located in Bangalore.¹ The third Indian decacorn by value – Byju’s and unicorns – Ola, Swiggy, Quikr – are examples of high-value startups that gained traction because of Bangalore’s developed IT environment. To make such success stories more frequent, policymakers decided to supplement hard professional skills with soft business competencies with the help of 15 accelerated programs. For example, the New Age Incubator Network, a program that commercializes ideas for students, researchers, and alumni is aimed at solving local problems. WE EDGE is a 12-week accelerated program for businesswomen. Women have a good role model in India: one of Bangalore’s unicorns – Biocon Biologics – was founded by Kiran Mazumdar-Shaw, who is today ranked 3rd among the wealthiest women in India.²

Urban infrastructure is another important factor that creates a favorable environment for startups in Bangalore: the government invests

7,800 crores (940 million USD) for the development of Bangalore city. Bangalore’s landscape is also going to become more attractive: in 2022, it was declared that a statue of a unicorn is going to be erected on the city square in front of the Legislative House, Vidhana Soudha³, to record the leadership of the city by the number of unicorns.

Another center on the innovation map of India is Mumbai. Its distinguishable trait is a high concentration of capital in the venture capital system. Within the 2018 startup policy, Mumbai founded its own Fund of Funds in the amount of 500 crores (60 million USD) for five years. It is remarkable that Mumbai has two of the most expensive decacorns in India and the world. Reliance Retail (with a capitalization of 63 billion USD) and Reliance Jio (58 billion USD) are ranked 6th and 7th in the global pool of unicorns, respectively, and their total value is 54% of the value of all unicorn startups in the country (223.5 billion USD). The founder of both decacorns is Mukesh Ambani, Board of Directors Chairman, CEO, and majority shareholder of Reliance Industries – the largest company in private sector of India, as well as a silver medalist on the Forbes India list.⁴

All three cities are marked by an ecosystem approach with respect to startups, which bears its fruit

¹ Bengaluru has quarter of India’s digital talent. Available at: <https://timesofindia.indiatimes.com/city/bengaluru/bengaluru-has-quarter-of-indias-digital-talent/articleshow/89627120.cms> (Accessed: 22.12.2022).

² Meet the top 10 wealthiest women in India. Available at: <https://www.businessinsider.in/business/news/top-10-wealthiest-indian-women/slidelist/93164704.cms> (Accessed: 23.12.2022).

³ A Unicorn Logo to Be Installed in Bengaluru, Here’s Why. Available at: <https://metrosaga.com/a-unicorn-logo-to-be-installed-in-bengaluru-heres-why/> (Accessed: 23.12.2022).

⁴ India’s 100 Richest. Available at: <https://www.forbes.com/lists/india-billionaires/?sh=4ad0e1d1109b> (Accessed: 23.12.2022).

in a sort of virtuous cycle. For example, Bangalore has Flipkart – one of the first Indian decacorns, which has already had its IPO and is investing in other unicorns in the country: PhonePe and Pine Labs. In a similar way, Zomato, a former unicorn from Delhi, funded modern-day Blinkit and Cure.fit. Finally, currently active unicorns Lead School (Mumbai), Rivigo, and Cars24 (Gurgaon, National Capital Territory of Delhi) declared that they are going

to create a joint Bharat Founders Fund to support seed-stage companies.

This experience of becoming the third venture capital of the world is as diverse as India itself. However, the main achievement could be the creation of special sentiments in the country that galvanized the whole nation when everyone started to believe that becoming a venture capital entrepreneur is possible.

Today, out of 41,000 startups to which the Indian government has given this status since 2016 within the framework of Startup India, 15,800 are indexed in Crunchbase and CB Insights. There are 74¹ unicorns registered in India, and among billion-dollar startups in the world – 158 were founded by participants of Indian origin.

¹ As of July 2022.

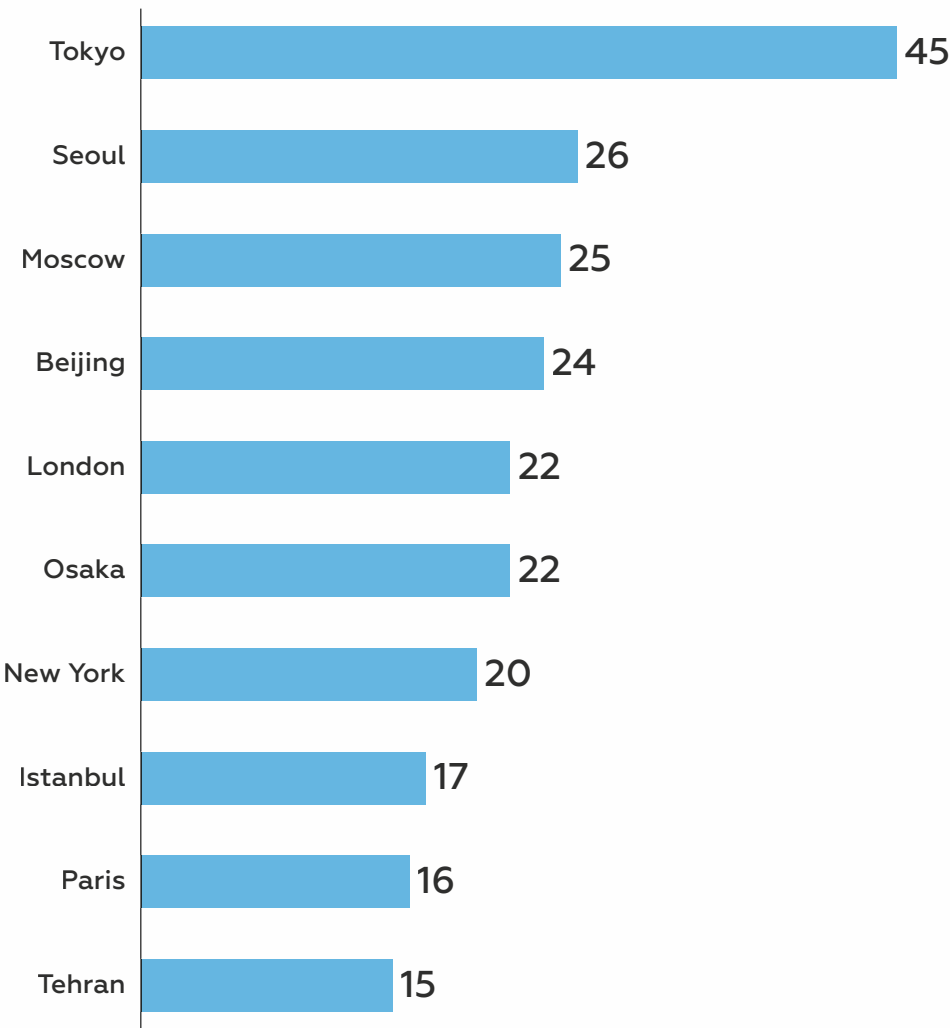
Where It All Begins

World-famous universities are a must-have for a city's innovation attractiveness

In 199 out of 200 cities in the ranking, there is at least one internationally recognized university. Although most leading universities are concentrated

in global technopolises – Tokyo, Seoul, and Moscow (Figure 12), small cities with a population of under 500,000 also have something to be proud of.

Figure 12. Top 10 HSE GCII Cities by the Number of Leading Universities: 2022



Source: HSE University, based on QS, THE, and ARWU.

For example, the Dutch city Leiden is famous for Leiden University, which is an important international research center in Europe and is associated with names of 16 Nobel Prize laureates¹, among whom are theoretical physicists Albert Einstein and Hendrik Antoon Lorentz, physiologist Willem Einthoven, and a Leiden alumnus, immunologist Nils Kaj Jerne.² The Japanese city Tsukuba has one of the best multi-profile higher education institutions – The University of Tsukuba that boasts

three Nobel Prize laureates (in Physics – Leo Esaki and Sin-Itiro Tomonaga, in Chemistry – Hideki Shirakawa)³, two of whom occupied management positions at different periods. In Venice, there is a public higher education institute, Ca'Foscari University, which was ranked 7th in Europe by the number of awarded fellowships within the prestigious Marie Skłodowska-Curie Fellowship Programme.⁴ For the majority of small cities, world-famous universities lie at the base of innovation attractiveness.

¹ QS World University Rankings. Available at: <https://www.topuniversities.com/universities/leiden-university#p2-rankings> (Accessed: 15.11.2022).

² Official website of Leiden University. Available at: <https://www.universiteitleiden.nl/en/academic-staff/nobel-prize-laureates> (Accessed: 15.11.2022).

³ Official Website of The University of Tsukuba. Available at: <https://www.tsukuba.ac.jp/en/about/history/nobel/index.html> (Accessed: 15.11.2022).

⁴ QS World University Rankings. Available at: <https://www.topuniversities.com/universities/ca-foscari-university-venice#p2-university-information> (Accessed: 15.11.2022).

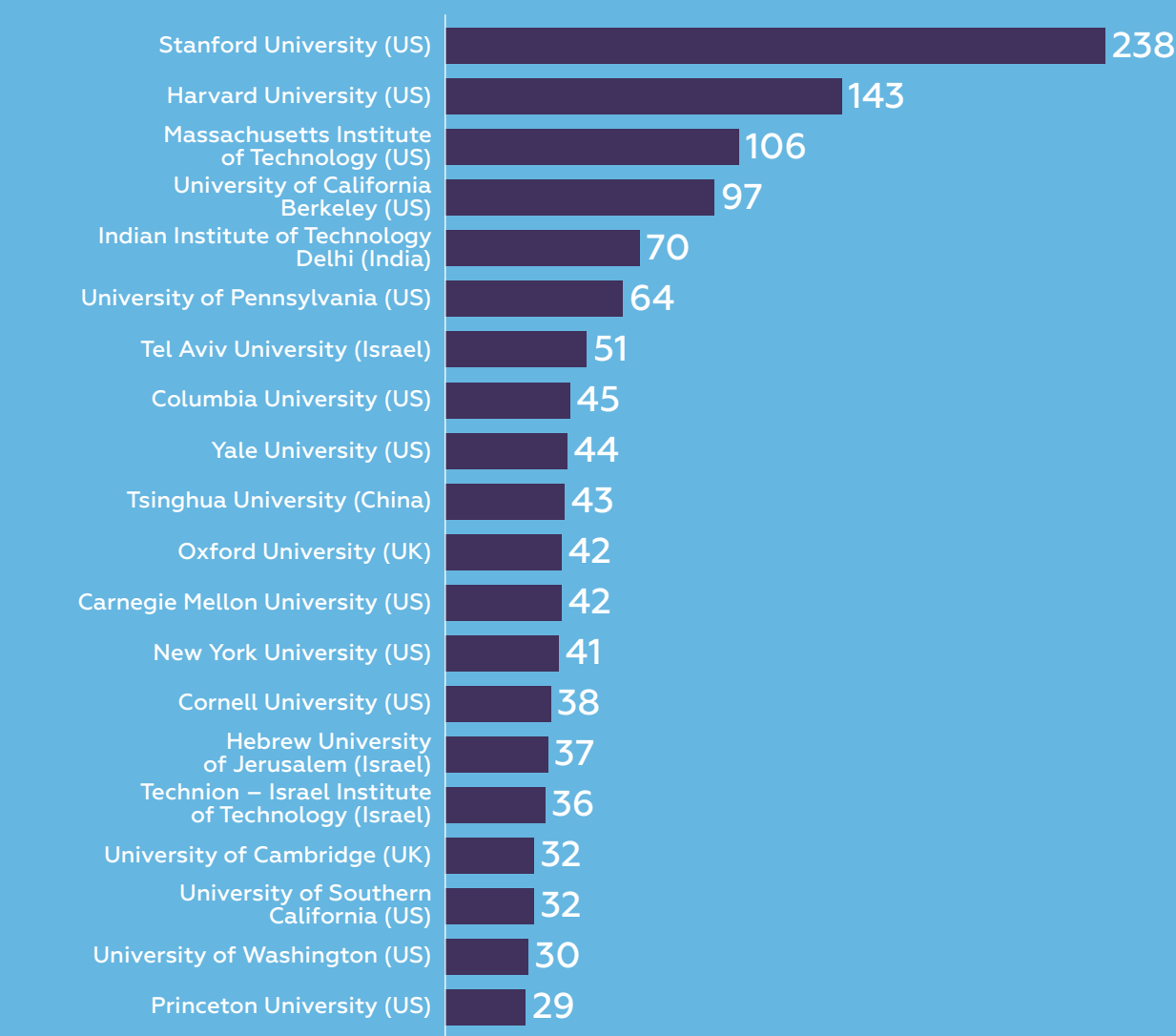


Alma Mater for Unicorns

What is the role of universities in raising startups with a value of over a billion USD?

The founders of unicorns all have basic academic education in common. The majority of them are alumni of leading global universities (Figure 13).

Figure 13. Top 20 Universities by the Number of Alumni Who Founded Unicorns



Source: HSE University.

For example, Stanford, Harvard, and MIT alone have over 15% of founders of high-value startups that walked out their doors, and the top 20 most prestigious universities in the world have almost 40% of such alumni¹ [Kutsenko et al., 2022]. Former alumni of the three leading US universities located in the San Francisco Metropolitan Area and Greater Boston not only have become successful tech entrepreneurs, they have also founded unicorns with the highest

value – their average value exceeds the average value of all other unicorns by 20%. Examples of such companies created by Stanford alumni are SpaceX – the space giant, Chime – a fintech startup; Harvard alumni founded Stripe and Rapyd – fintech startups, Trendyol Group – an e-commerce platform; among alumni of Massachusetts Institute of Technology are Cruise – a manufacturer of driverless cars, Thrasio – a retail brands aggregator, and several others.

40% of unicorn founders graduated from the top 20 most prestigious universities in the world.

The important role universities play in educating the founders of unicorns is obvious not only on the global scale, but on the level of countries themselves, where founders of billion USD ventures are studying at the best national universities (for example, Indian Institute of Technology Delhi, Tel Aviv University, Tsinghua University, Oxford University, National University of Singapore, or Seoul National University).

Apart from preparing their own future founders of unicorns, many universities become hot spots for successful startup founders from abroad – a third of immigrants created a unicorn in the country

where they received their education; of whom around 87% of founders graduated from US universities.

Some universities' policy-making involves the active attraction of talent from around the world, offering special education programs, fellowships, and visa programs for promising international students, many of whom remain in the country to conduct business after receiving their diploma. For example, University of Waterloo alumni who founded unicorns after the graduation are 60% foreigners who came from Canada, India, Russia, Romania, Lithuania, Iran, Kenya, Nigeria, and Brazil.

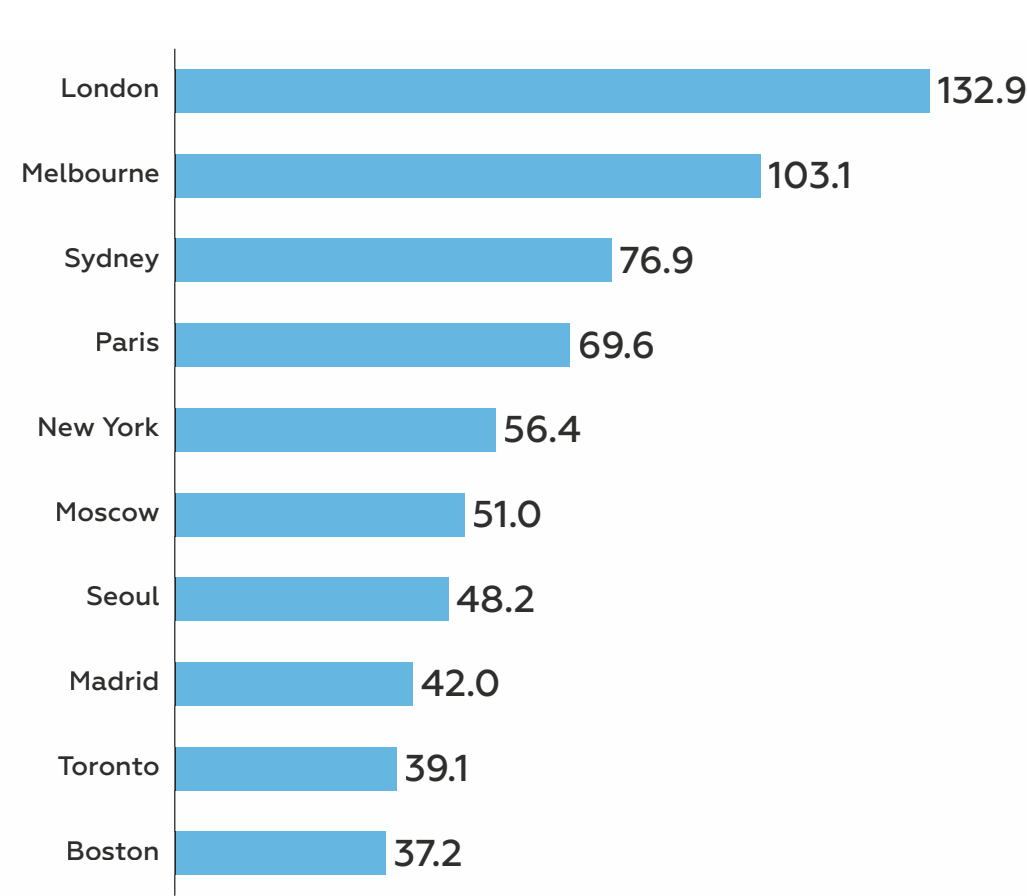
¹ Data on 2,699 founders of unicorns that HSE University could find in open sources.

Academic Mobility in the Interests of a City's Innovation Ecosystem

Why does Sydney attract students from Delhi, while Melbourne's export of educational services to Beijing remained high for the last 20 years?

The most popular universities among international students are those in Anglo-Saxon cities: they comprise approximately a third part of ranking's sample and they also attract almost half of their students from abroad (Figure 14).

Figure 14. Top 10 HSE GCII Cities by the Number of International Students: 2021, thousands



Source: HSE University, based on QS, THE, and ARWU.

The top three global cities by the number of international students along with London (ranked 1st) includes two Australian cities – Melbourne (2nd) and Sydney (3rd). How did they earn silver and bronze in attracting international students? They do not have world famous universities; their location could hardly be called a “crossroads of the nations”. Why is Sydney so attractive to students from Delhi and why has exporting educational services from these two cities into Beijing remained high for the last 20 years, reaching a more than twofold increase¹?

To answer these questions, we want to take a look at the reasons why future innovators are choosing to immigrate. Goal number one is to find cheaper education in order to relocate from a country with a higher cost of living to a country where this indicator is lower. It could explain the movement of students within Europe, as well as from more expensive US universities into less expensive European universities. However, even if tuition prices in Melbourne and Sydney are considerably lower than at US and UK leading universities, they are still significantly higher than

same indicators of Beijing, Delhi and other cities in China and India. The second goal is to find high quality, but in many cases very specific educational services. Nevertheless, it still does not explain the success of Australian cities on the international market of educational services. The universities of Melbourne and Sydney are examples of new basic and applied education with a focus on PhD programs and research activity. However, it is a standard set that does not include any exclusive areas.

The majority of universities in these cities appeared only in the twentieth century and have passed through several stages of international positioning of their educational products: from giving away scholarships to ramp up student flow from the Asian-Pacific Region to reforming the cities’ economy to gain profits from education exports. Today, Melbourne and Sydney use new tools to strengthen their positions on the global educational arena – additional regulatory stimuli intertwining higher education and labor market to give a leg-up to foreign talent moving back and forth within their

International students were attracted by introduction of education visas (Graduate Work Visa and Post-Study Work Visa) that give graduates the right to live and work in Australia.

¹ UNESCO Institute for Statistics. Available at: <https://uis.unesco.org/en/uis-student-flow> (Accessed: 15.11.2022).

professional trajectories. For example, international students, whose skills and qualifications correspond to the Skilled Occupation List¹, can claim a Graduate Work Visa after they have finished their educational programs, which gives them the right to stay in the country for 18 months.² In doing so, young professionals get an opportunity to implement their ambitious projects in Australia, which makes it one of the major countries where students would choose to move.

Another student visa is a Post-Study Work Visa that enables international graduates of Melbourne and Sydney universities to work for two to three years (Bachelor's and Master's graduates) and up to four years

(for PhD graduates).³ A four-year residence permit to stay in Australia is provided if a graduate's specialization is on the list of in-demand occupations, which gives grounds for receiving the right of permanent residency in the country.

As a consequence, more and more talented young individuals and promising professionals are discovering their creative potential in the innovation ecosystems of Melbourne, Sydney, and other Australian cities. For example, Airwallex, a company that can process payments wired from almost any place on Earth within its own payment system, was created by Chinese students in Melbourne.

¹ Approved by the National Skills Commission.

² Graduate Work stream. Available at: <https://immi.homeaffairs.gov.au/visas/getting-a-visa/visa-listing/temporary-graduate-485/graduate-work> (Accessed: 06.12.2022).

³ Post-Study Work stream. Available at: <https://immi.homeaffairs.gov.au/visas/getting-a-visa/visa-listing/temporary-graduate-485/post-study-work> (Accessed: 06.12.2022).

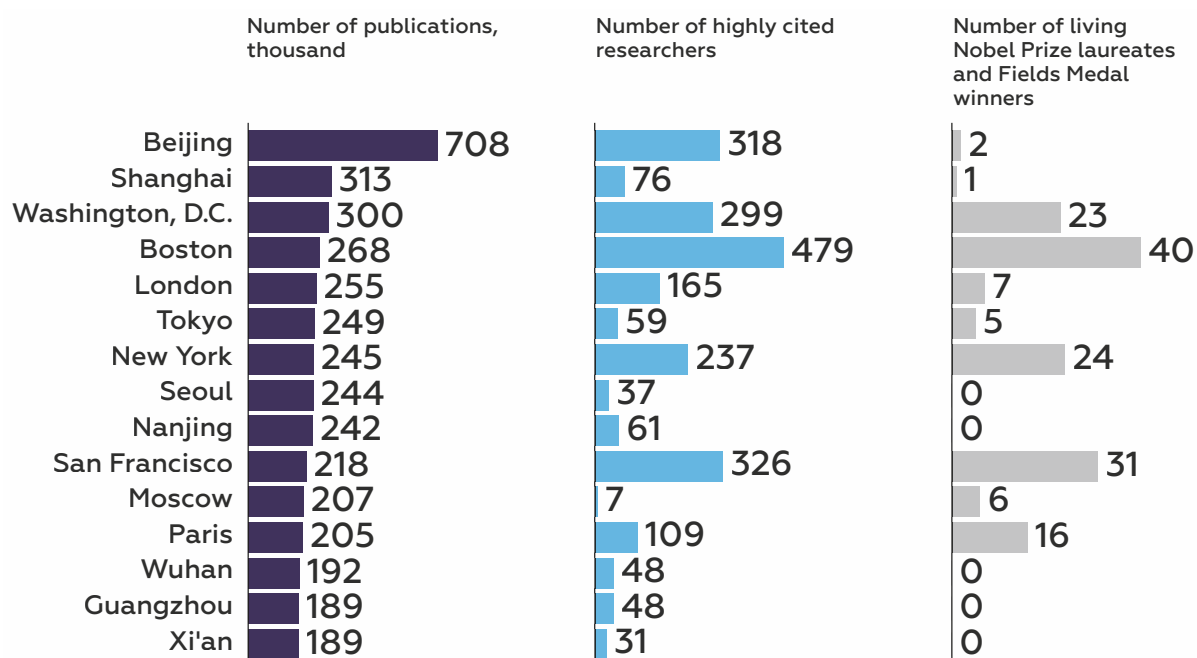
Mass Science vs Elite Science

What is the distinction between the publication activity of Chinese and US cities?

A distinguishing trait of most Asian cities is large-scale research activity that could be explained not only by the large populations, but also by the significant level of people's engagement in science. Chinese cities in the top 15 positions of the ranking by the publication activity have 14% of the total number of publications, but only 9% of highly cited researchers and 1% of Nobel Prize laureates and Fields Medal winners (Figure 15). Meanwhile, the US cities in the top 15 have proven to be less productive –

they had a twice lower number of scientific publications in comparison with their Chinese competitors, however they were considered more attractive for internationally recognized scientists – they were chosen by almost 22% of highly cited researchers and over 35% of Nobel Prize laureates and Fields Medal winners. Laureates of prestigious awards are some of the most sophisticated representatives of the innovative class – they were drawn into only 78 cities of the ranking.

Figure 15. Selected Indicators for the Top 15 HSE GCII Cities by the Number of Publications: 2016–2020*



* Note: number of highly cited researchers, living Nobel Prize laureates, and Fields Medal winners are given according to 2021 data.

Source: HSE University, based on Scopus, Clarivate (Web of Science), and official websites of the Nobel Prize and International Mathematical Union.



No Scientist is an Island, Entire of Itself

Some corporations make a considerable contribution to the publication activity of their home cities

Publications in scientific journals are usually associated with universities and R&D organizations doing basic research, while from the business side of the innovation process it is more likely to be expected that applied results and new technical solutions are capable of entirely changing production processes and securing the technological modernization of the economy. Nevertheless, some corporations have succeeded in both areas and today make a significant contribution not only to patents, but also to the publication activity of their home cities. For example, Microsoft employees (United States) have prepared over 19,000 publications over the last decade (2012–2021), which have been published in scientific journals indexed in Scopus. A considerable part of them (around 80%), as expected, was done within the field of computer sciences, however the company's publication portfolio has other specializations as well: mathematics, physics and astronomy, medicine, materials science, and even social sciences. In the same manner, Siemens AG (Germany) published over 12,000 new publications in Scopus over the last 10 years. Half of them – in mechanical engineering, even though the share of works on computer and medical sciences is also quite high – over 25% in both areas.¹ Today, Asian cities also

have corporations that can give Western players a run for their money not only in business, but also in science. For example, Huawei (China) published 7,300 research studies in journals indexed in Scopus for the surveyed period, albeit not that long ago, in the early 2000s, it could only boast several articles per year. Its scientific specializations are computer sciences and mechanical engineering.

These and other corporations are dispelling myths that corporate science is only interested in the achievements of applied science. They were successful not only because of serious investment in in-house R&D, but also as a result of collaborating with universities and R&D organizations in other sectors. For example, a large number of Microsoft publications in Scopus were prepared together with universities of Washington, D.C., as well as Stanford and Massachusetts Institute of Technology. Scientists from Siemens AG are actively working on joint publications together with colleagues from the University of Erlangen–Nuremberg and the Technical University of Munich; and developers from Huawei collaborate with researchers from the University of Tsinghua, the Chinese Academy of Sciences, and Peking University.

¹ The total exceeds 100%, as one publication could correspond to several scientific fields.

How to Have Your Cake and Eat It Too

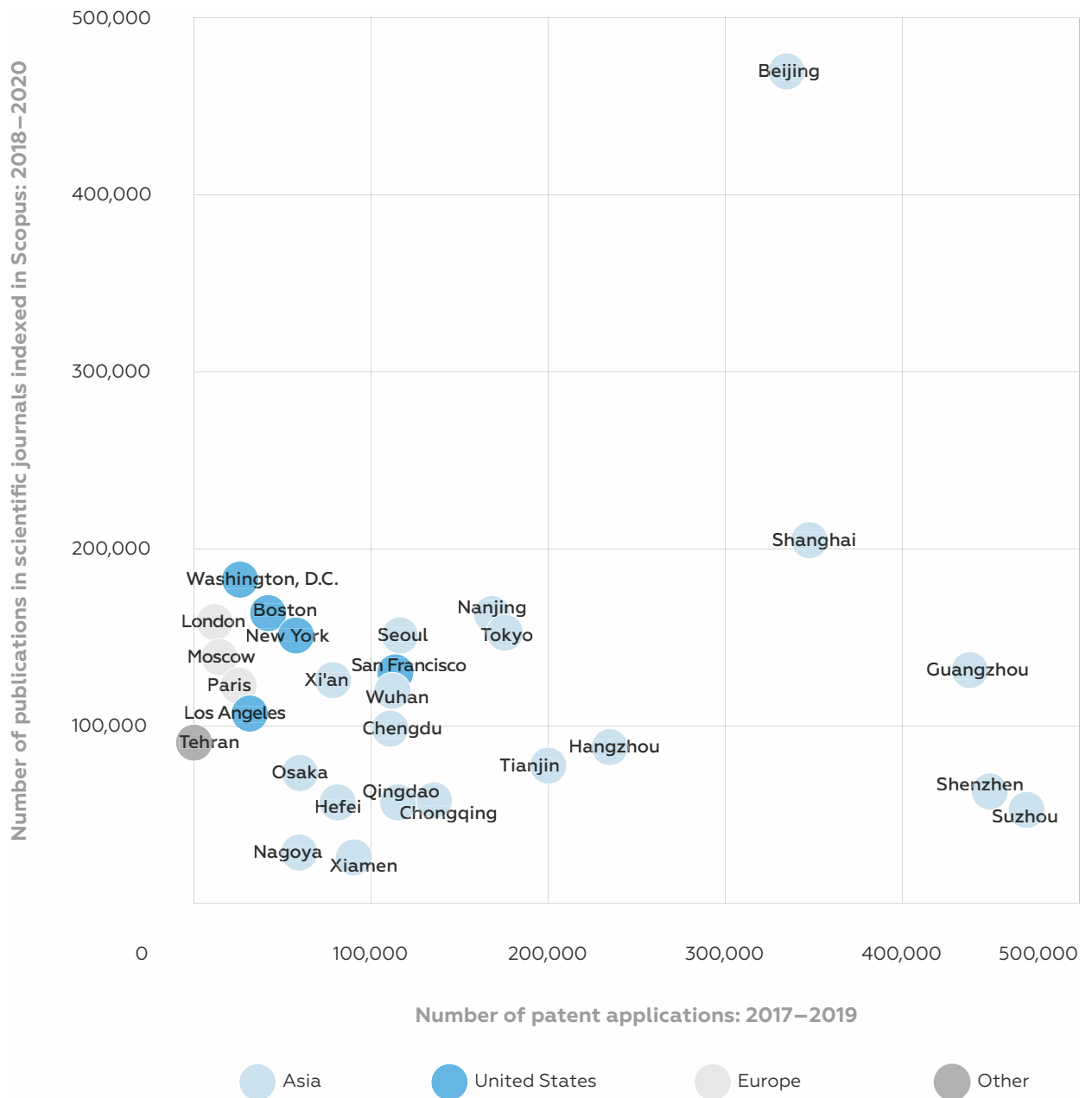
The most productive cities proved their worth in publication and patent activity

The group of top cities by R&D results is a tight bunch: the top 20 by the number of publications in Scopus (2018–2020) and top 20 by the number of patent applications (2017–2019) include 28 cities (Figure 16). A substantial share of them falls into both rankings: Beijing, for example, is ranked 1st by the publication activity and 5th – by patent activity; Shanghai – 2nd and 4th; Tokyo – 7th and 8th, respectively.

Even though most leaders demonstrate comparable levels of publication and patent activity, some of them have undeniable preferences. Thus, China's Xiamen is ranked 16th by the number of patent applications (2017–2019), and only 99th by the number of publications. Such a preponderance toward patents is typical for many Chinese cities. However, agglomerations that are higher in the ranking with respect

to patents and not publications include three US cities – Detroit (ranked 35th by patent applications vs 145th by publications), Phoenix (49th vs 121th), and Miami (50th vs 107th). All are large industrial centers where the headquarters of mechanical engineering corporations are located, as well as important industrial enterprises. These players make a sizable contribution to the development of new technologies, and that, given the limited number of competitive research institutes and universities, leads to a tangible offset in the cities' specializations. However, the conducted analysis did not find a significant correlation between indicators of patent activity and the number of largest companies, leading universities, and R&D organizations in the cities.

Figure 16. Top 20 HSE GCII Cities by the Number of Publications and Patent Applications



Source: HSE University, based on Scopus and PATSTAT Global.

Patents for the Planet

How have Chinese cities managed to secure almost half of the world's total patents?

The top 20 global cities by the number of patent applications are almost entirely from Asia (Figure 17). Sixteen Chinese agglomerations, Seoul, Osaka, and Nagoya have made it into the leading ranks. The West is represented in this group only by San Francisco, but only on account of San Jose, the unofficial capital of Silicon Valley, which is also included in the San Francisco Metropolitan Area.

For every 10 Chinese cities that top this rating, there is an almost one third share of the world total of patent applications in 2017–2019. This is reflected in the overall level of patent activity of the country: in 2020, applicants from the Celestial Empire filed a total of over 1.4 million patent applications in the country and abroad.

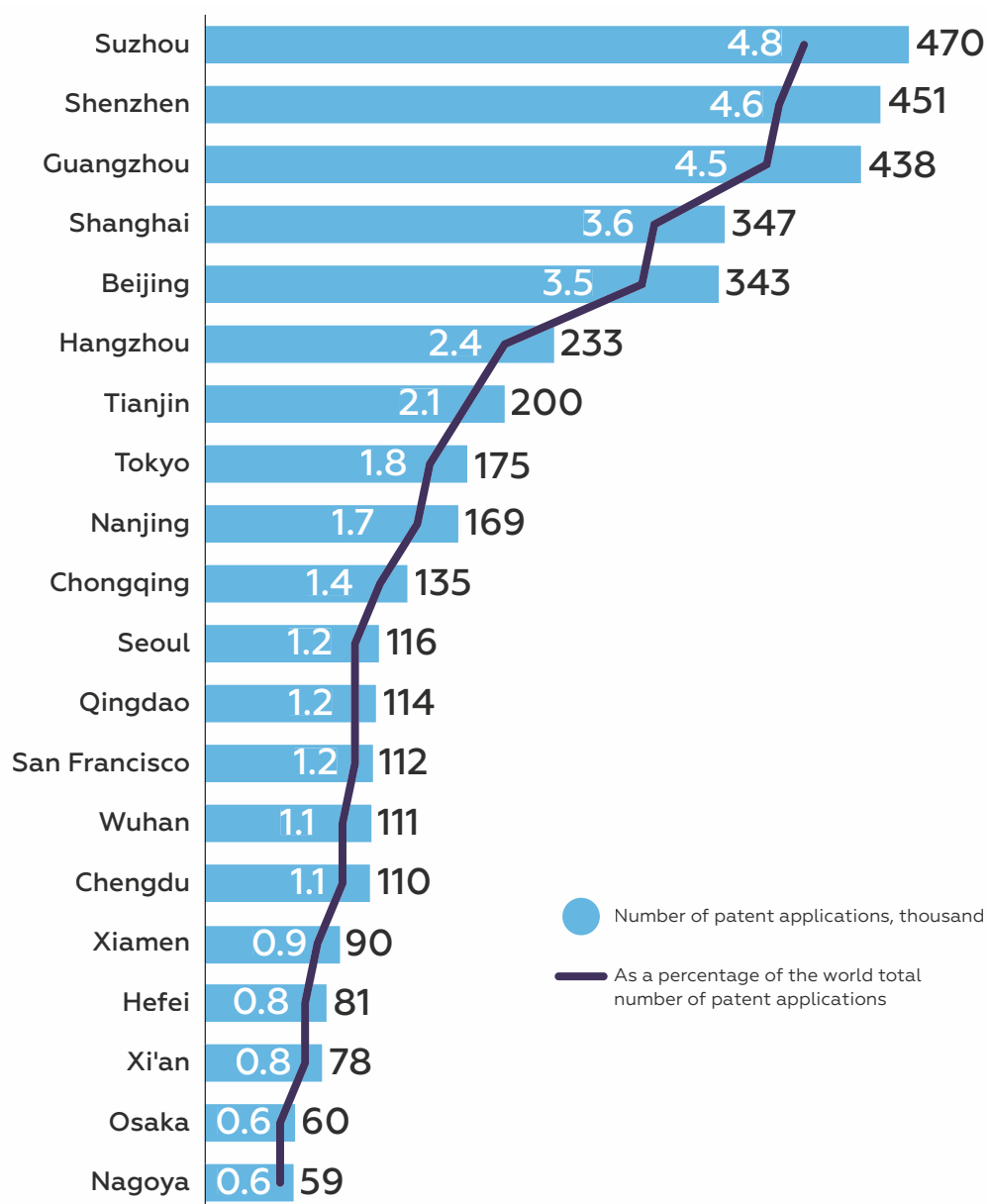
In 2020, Mainland China's contribution to the world flow of patents reached 44.4%, which is three times as high as the same indicator 10 years ago – 15.4%.

The reasons for such a surge of interest in patenting lies in the features of the R&D performance evaluation system that has been used in China for the past ten years. Within this system, many city administrations of the country introduced different patent activity support measures to reach targets. These measures included reimbursement of expenses related to patenting technical solutions abroad or filing PCT applications; and the issuing of additional funds for organizations that produced such results. For example, organiza-

tions in the Qinghai province that filed over 20 applications within a year could receive a remuneration of up to 100,000 yuan (approximately 14,000 USD). Patent activity was considered an important condition before moving scientific workers and university teachers up the career ladder, awarding enterprises with a "high tech" status, or receiving benefits related to that. However, it is planned to reduce all types of financial support for patent activity during the latest five-year period (2021–2025).¹

¹ China National Intellectual Property Administration. Available at: www.cnipa.gov.cn (Accessed: 25.11.2022).

Figure 17. Top 20 HSE GCII Cities by the Number of Patent Applications: 2017–2019



Source: HSE University, based on PATSTAT Global.

Innovation Infrastructure – Reinforcing the Strongest

To develop infrastructure, city authorities use experimental formats of innovation support

The path of actively developing innovation infrastructure and increasing the efficiency of cooperation between city authorities, science, and high tech business was chosen by European cities – Moscow (ranked 1st by the Innovation Infrastructure section value), Barcelona (4th), and Stockholm (5th). Moscow topped the innovation infrastructure ranking due to its absolute leadership in terms of the number of clusters and co-working spaces; by the number of technology parks the Russian capital is ranked 2nd, surpassed only by Beijing, and by the number of supercomputers – it is last among the top 10.

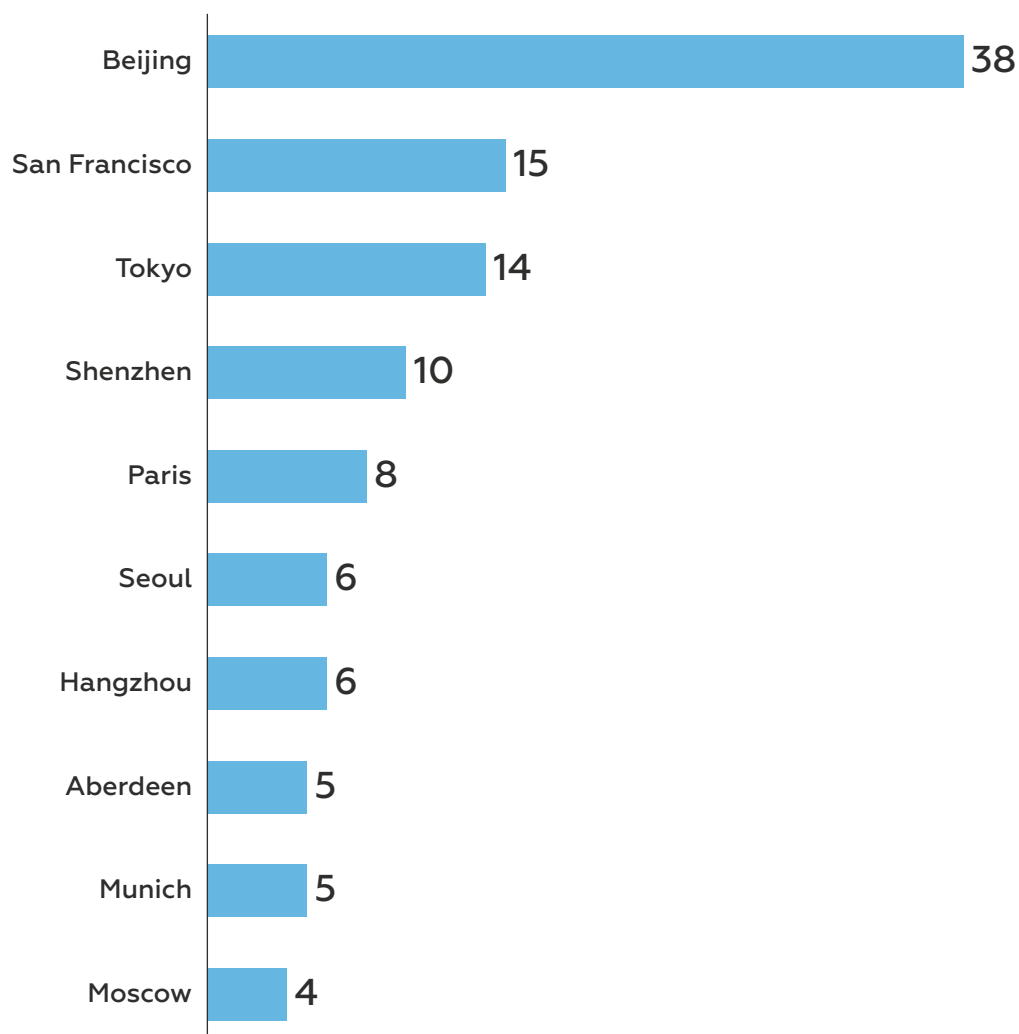
Innovation infrastructure is the least integrating among tech leaders. The top 10 of the Technological Development Subindex, along with cities at the top of the innovation infrastructure ranking (Moscow, Beijing, and Tokyo), includes cities

that did not even make it into the top 50 for infrastructure (New York, Boston, and Washington, D.C.) – in the first case, infrastructure strengthened cities' ranks, in the second – it did not become a deciding factor in their success.

An important asset of leaders of innovation attractiveness are supercomputers. Only 63 cities out of 200 have such powerful machines, while 48% of supercomputers are concentrated in the top 10 tech cities (Figure 18).

In order to develop infrastructure, city authorities use experimental formats for supporting innovation by involving the authorities, science, business, and even ordinary citizens – consumers of innovations. What possibilities do such forms of communication open for participants in the innovation process?

Figure 18. Top 10 HSE GCII Cities by the Number of Supercomputers: 2022



Source: HSE University, based on TOP500.

Livening Up Innovations

How Moscow's innovators benefit from one of the largest living labs in the world

Traditionally, the key participants of the innovative process were representatives of businesses, universities, R&D organizations, and authorities: this cooperation was even conceptualized as the Triple Helix [Etzkowitz and Leydesdorff, 1995]. However, in mid-2000s this model underwent some adjustments, when the idea of creating innovations collaboratively became widely implemented. This idea of changing ordinary users into co-authors of novel solutions laid the groundwork for living labs. Professor William J. Mitchell of the Massachusetts Institute of Technology became one of the founders of this concept who pointed out the need to test complex technological solutions in many settings of real life for ordinary people [Eriksson et al., 2005]. Living labs entered the European agenda after the Helsinki Manifesto was published in 2006.¹ Such experimental platforms, according to the European scale of Technology Readiness Level (TRL)², include stages of user testing innovations in labs (TRL5) and in real life conditions (TRL6).

Today, many living laboratories have become popular elements of a city's innovation infrastructure. They are

used as a base to test technological developments that could be potentially beneficial to the city, society, or businesses. Engaging end users in testing innovative solutions helps modify those solutions and replicate best practices. The geography of living labs covers EU member countries, Russia, the United States, Canada, Brazil, Columbia, Egypt, South Africa, Australia, and several other countries. Under the auspices of European Network of Living Labs (ENoLL) over 480 pilot infrastructure facilities have been created around the world.³

In 2019, Moscow launched the Innovation Pilot Testing Program that became one of the largest living labs in the world. Its goal is to help high tech companies and startups in the capital and other Russian regions test their products in real life. Testing sites are public facilities and commercial organizations whose number has exceeded 200 units over the last three years (22 federal, 104 city, and 89 commercial platforms). It is possible to test technologies in 18 sector-specific areas, including at the largest banks and IT companies (VTB Bank, Otkritie FC Bank, Cloud), in retail (Lenta,

¹ Helsinki Manifesto. Available at: <https://ru.scribd.com/document/290101063/Helsinki-Manifesto-201106> (Accessed: 18.11.2022).

² Horizon 2020 – Work Programme 2016–2017. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2016_2017/annexes/h2020-wp1617-annex-g-trl_en.pdf (Accessed: 18.11.2022).

³ European Network of Living Labs. Available at: <https://enoll.org/about-us/> (Accessed: 18.11.2022).

The Innovation Pilot Testing Program in Moscow (2019–2021)

215

testing sites

80%

successful pilot innovations

238

pilot tests

8.4 million USD

total sum of contracts

X5 Group, Angara), at educational institutions (National Research Nuclear University MEPhI, Moscow University of Finance and Law, People's Friendship University of Russia), healthcare (Pirogov Russian National Research and Medical University, City Clinical Hospital no. 67), culture and entertainment (Tumo Center for Creative Technologies in Moscow, VDNKh, Memorial Museum of Cosmonautics), construction (A101 Development Company), manufacturing (Moskalbelmet group of companies, Technopolis Moscow, Technopark Mosgormash), and safety and public utilities (Mossvet State Unitary Enterprise, United Energy Company JSC).

A middleman between tech companies and startups, on the one hand, and pilot testing sites, on the other, is the Moscow Agency of Innovations, which evaluates and selects projects. During the four years that the program has been implemented (2019–

2022), 1,022 applications have been filed, 238 pilot tests have been completed (on federal and commercial sites – 97, on city sites – 141), and around 80 projects are currently being implemented.

Program participants attracted a total of over 800 million rubles (11.2 million USD) in investments. Since 2022, grants of up to 2 million rubles (28,000 USD¹) could be claimed by residents of the Moscow Innovation Cluster to test pilot projects.²

What startup projects received the recognition of experts and users within the largest living lab in Russia?

Medicine is one of the most complex and conservative spheres in which to implement innovative ideas given the limited and sometimes even closed-off access to medical institutions for businesses. This challenging sector has been chosen by Habilect, a company that develops rehabili-

¹ Bank of Russia exchange rate as at 29.12.2022: 71.3261 rubles to 1 USD.

² Pilot testing of innovation solutions. Available at: <https://i.moscow/platforms/lending/> (Accessed: 16.11.2022).

Over 80% of the total number of pilot innovations turned out to be successful, every fourth developer signed an implementation contract per the results of pilot testing at a total sum of more than 600 million rubles (8.4 million USD).

tation systems with a 3D sensor for patients who have suffered a stroke. When a rehab center in Zelenograd¹ entered the pilot platform, Habilect could improve their invention using the recommendations from practicing physicians and scale up their business afterwards. Now, the innovative Habilect rehab system is used at over 70 healthcare institutions all over the country.

Another example is testing the equipment of Rehab Medical² on the platform of the Moscow Department of Labour and Social Protection. After testing, the Department bought a telescopic lift – gait trainer TRAM for the support of the independent mobility of patients of all ages with different motor impairments.

Next success story in testing rehab equipment is an innovation developed by Exoplast – a robotized assistive Exohand-2 that helps with the rehabilitation of motor functions on the basis of a brain–computer

interface.³ Exohand-2 was tested at the Moscow Center of Speech Pathology and Neurorehabilitation in August–October 2019 and it was bought by the Moscow Healthcare Department.

During the COVID-19 pandemic, Moscow Hospital no. 67 tested Easy ECG, a system that helps transfer ECG results from the cardiograph to the computer.⁴ This technology helped substantially decrease the hospital's workload and increase the speed of processing and issuing test results to patients. Right now, this system is highly desirable among other Moscow clinics; and Hospital no. 67 now has a center for processing cardiograms of third-party institutions.

Moscow Oncological Hospital is successfully testing another AI technology called Medical Neuronets. It was developed to diagnose malignant changes in body tissues to prevent cancer. Another popular product is a system of automated injections

¹ Test site for innovations: Moscow tests new technologies. Available at: <https://www.forbes.ru/spetsproekt/476069-poligon-dla-innovacij-kak-moskva-testiruet-novye-tehnologii> (Accessed: 12.12.2022).

² Seldon.News. Available at: <https://news.myseldon.com/ru/news/index/230656347> (Accessed: 12.12.2022).

³ CNews. Available at: https://www.cnews.ru/news/line/2021-02-17_bolee_100_ploshchadok_dlya_ispytaniya (Accessed: 12.12.2022).

⁴ Hightech+. Available at: <https://hightech.plus/2022/08/26/startup-vzletaem-kak-rabotaet-programma-pilotnogo-testirovaniya-v-moskve> (Accessed: 12.12.2022).

“Komarik” that helped inject medications at home less painfully. The testing was performed at the Kom-munarka Medical Center.¹

Is it possible to become an innovator when you are still behind a school desk? There is one positive answer that could be found at Moscow School no. 2065. A 10th grade pupil developed a prototype of a sign language interpreter glove that is supposed, as intended by the inventor, to scan finger movements and translate the sign language into Russian, and then vocalize the message through an internal speaker. Experts of the Moscow Agency of Innovations highly praised this idea and offered to test this prototype. After registering the student’s start-up, this device will be tested at Moscow rehab centers.

There is a number of other projects in education that are scheduled to be tested. For example, the Skillbox online school tested educational products among students of Moscow Krasin Technical School. Educational platform Businessfox for children with limited capacities has been tested in a number of children’s rehabilitation and education centers and teaches the basics of financial literacy and entrepreneurship with elements of gamification.

One of the innovative solutions tested at the State University of Management during the COVID-19 pandemic was Examus, a system that detects students cheating during

remote examinations.² The technology analyzes the student’s eye line, the programs he or she opens or unusual sounds; it prevents students from using cheat sheets and search engines. This innovative solution is used at over 100 Russian universities, as well as in corporate education and training.

The framework of the Moscow pilot testing project also includes sports. Thus, Impulse Sport has proven its effectiveness as an innovative solution. It is a percussing massage gun for the recuperation of muscles after exercises. This innovation was tested by Russian Rowing Federation and the Russian Luge Federation, as well as at the Center Sports School with the use of grant funds. In 2022, pilot testing was finished for Helmetex–Odor Neutralizer on the platforms of Udarnik Boxing Club, Chempionka Football Club, and MIKS Karting go-cart center.

In safety and security, Ecolight, an arc-fault circuit interrupter that prevents house fires, has been successfully tested.³ It helps identify faults in power grids or electrical installations and break the circuit to protect the grid. This product has been bought by the pilot platform.

Cleaning services are also among the products being tested. Bruno’s Cloud for monitoring the cleaning of premises, with which one can say goodbye to paper-based cleaning schedules and use a phone app, has been successfully tested by the A101

¹ Inc.Russia. Available at: <https://incrussia.ru/specials/aim-moscow/> (Accessed: 12.12.2022).

² A system for monitoring online exams was tested at the pilot testing site. Available at: <https://www.mos.ru/news/item/79248073/> (Accessed: 12.12.2022).

³ Expert. Available at: <https://expert.ru/2022/05/23/v-moskve-razrabotali-sistemu-protiv-pozharov-na-elektrosetyakh/> (Accessed: 12.12.2022).

Development Company and Golovino Technopark, after which this technology has been implemented on all sites of these platforms. There were 50 sites in total in Moscow and other Russian regions, as well as in Kazakhstan, that used this solution.¹

These and other startups have received the opportunity to verify the feasibility of their products, fine-tune the technology based on feedback from experts and potential clients, and scale the best innovative solutions. Other stakeholders also receive advantages from living labs. City authorities benefitted from the qualitative restructuring of the urban environment and compensation of social and economic challenges with the use of modern technologies. Universities now have the opportunity to implement innovative projects jointly with businesses, and users can influence the features of innovative products and services and improve user experience.

At the same time, Moscow does not limit its pilot testing only to Russia. Since 2021, this program has been implemented on the international level. The first memorandums of understanding were signed with the Almaty Digitalization Administration (Kazakhstan) and INNOBIZ Agency (Republic of Korea). Initially, cooperation with foreign partners was defined as a “two-way street” partnership, which means the exchange of innovative solutions, pitch sessions to select the best of the best, and the subsequent testing and potential procurement. The testing of the first medical solution selected by Kazakhstan

is NeuroChat and it has been successfully completed at one of the clinics of Almaty in 2022. In March 2023, a Moscow university plans to commission the testing of a South Korean system called HVAC, an automated air control and monitoring system for various areas based on AI solutions.

Thanks to the partnership between the Moscow Agency of Innovations and the Federal Agency for CIS Affairs, a new format for promoting the Innovation Pilot Testing Program has been created in Russia and abroad. As such, Moscow started to conduct Days of Moscow Innovation at Russian Science and Culture centers in other countries together with partner organizations in the hosting country, including ministries, agencies, and departments of innovation and digitalization at the national, regional, and city levels. These events are intended for the exchange of pilot testing results, the promotion on foreign markets of Russian innovations tested in Moscow, and the outsourcing of current foreign technological developments on the Moscow’s market. The first Day of Moscow Innovations was conducted in October 2022 in Baku (Azerbaijan) as a teleconference and included presentations of innovation solutions in education from five Moscow companies. Two solutions, chosen by local firms, were further discussed for the launch of testing and procurement in Azerbaijan. Such ways of cooperating help tech entrepreneurs to test innovation solutions in conditions set by local innovation ecosystems and scale successful projects on foreign markets.

¹ CNews. Available at: https://www.cnews.ru/news/line/2021-02-17_bolee_100_ploshchadok_dlya_ispytaniya (Accessed: 12.12.2022).

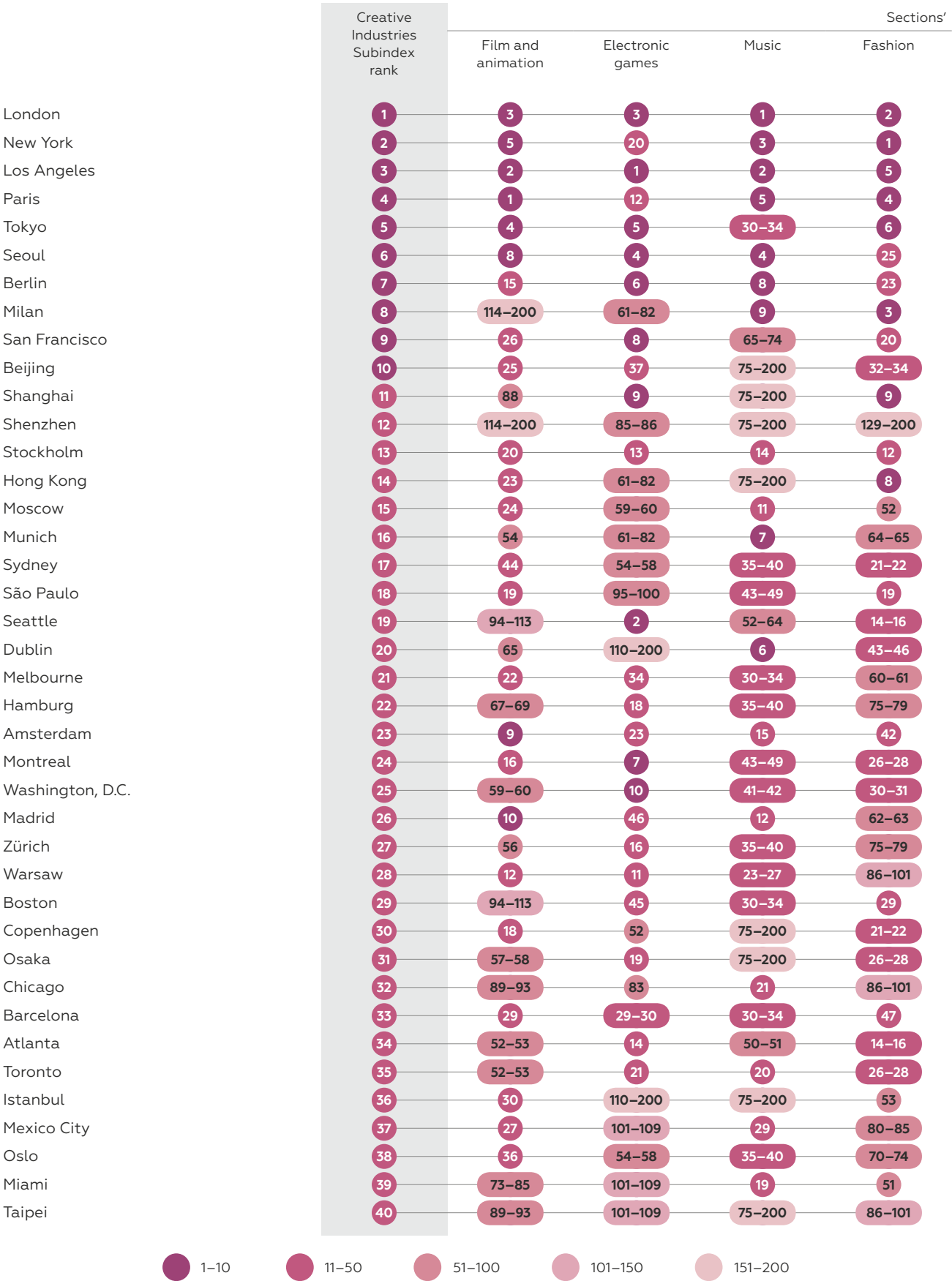




3

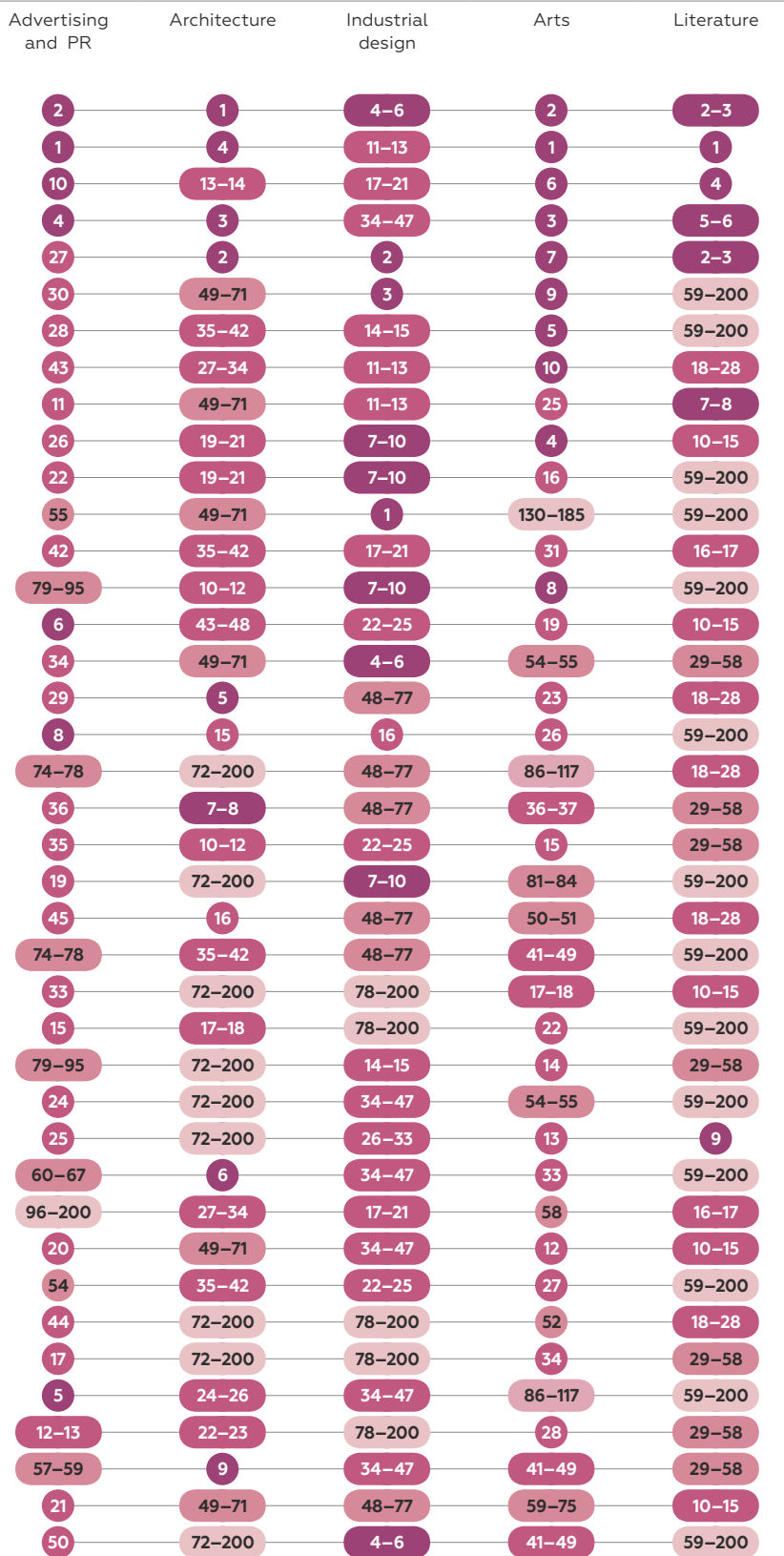
**Creative
Industries**

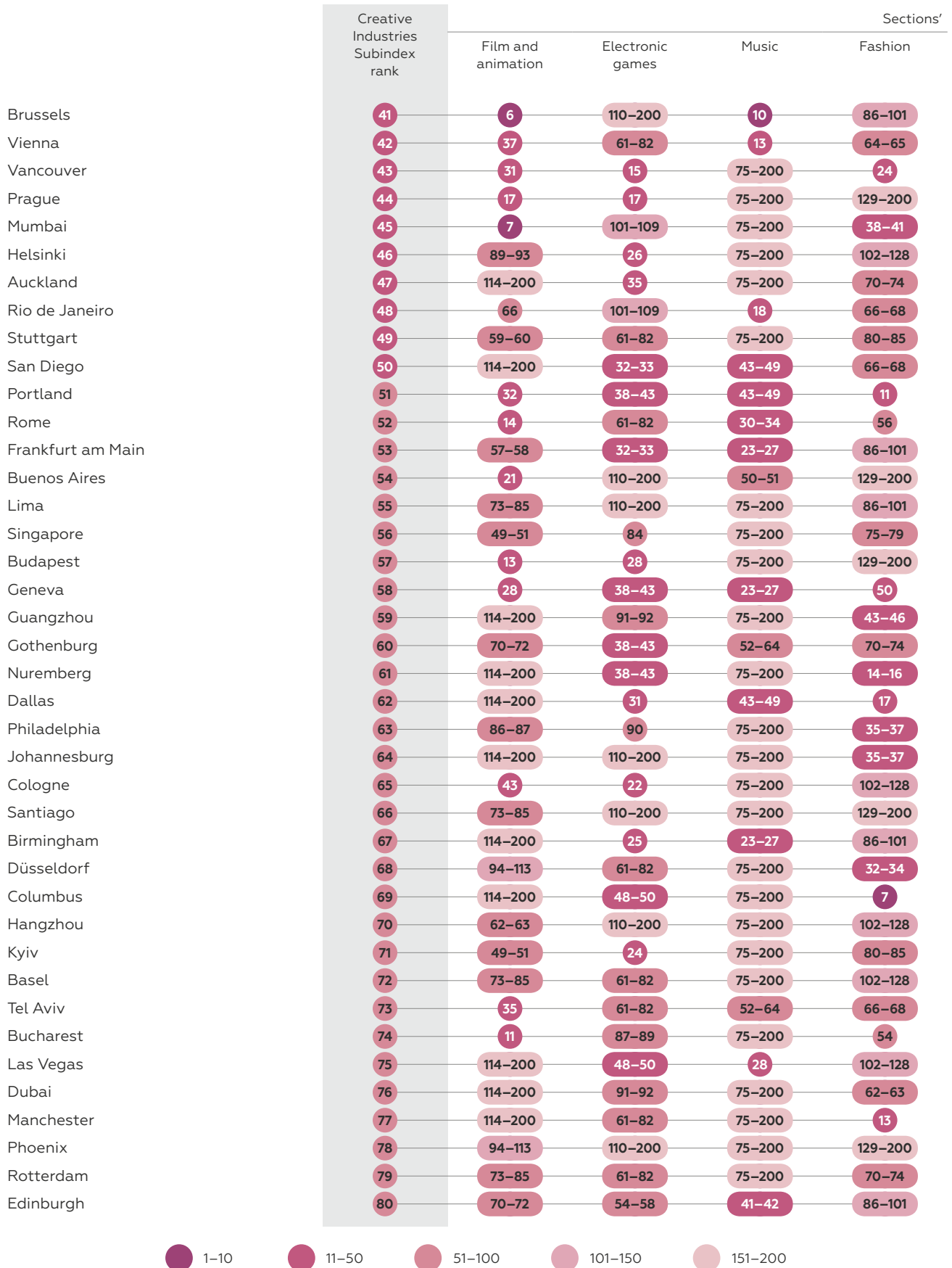
Cities' Ranking by the Creative Industries Subindex: 2023



3. CREATIVE INDUSTRIES

rankings





(continued)

ranks

Advertising and PR	Architecture	Industrial design	Arts	Literature
53	49–71	78–200	32	59–200
60–67	27–34	78–200	21	29–58
60–67	43–48	78–200	59–75	59–200
39	72–200	48–77	41–49	29–58
9	49–71	48–77	118–123	59–200
31–32	49–71	22–25	59–75	59–200
12–13	19–21	78–200	86–117	59–200
56	27–34	48–77	20	29–58
96–200	22–23	17–21	130–185	29–58
96–200	72–200	78–200	57	7–8
51–52	72–200	78–200	130–185	18–28
96–200	72–200	78–200	11	29–58
57–59	27–34	48–77	118–123	59–200
14	72–200	78–200	59–75	29–58
3	72–200	78–200	130–185	59–200
60–67	10–12	78–200	30	59–200
47–49	72–200	48–77	59–75	59–200
96–200	72–200	78–200	59–75	29–58
47–49	72–200	17–21	86–117	59–200
69–73	35–42	48–77	86–117	29–58
79–95	72–200	26–33	130–185	59–200
79–95	49–71	78–200	86–117	59–200
79–95	27–34	78–200	36–37	18–28
38	35–42	78–200	29	29–58
74–78	72–200	34–47	40	59–200
16	27–34	78–200	38	59–200
96–200	72–200	78–200	41–49	29–58
46	49–71	34–47	39	59–200
79–95	72–200	78–200	86–117	59–200
96–200	17–18	26–33	130–185	59–200
18	72–200	78–200	189–200	59–200
96–200	7–8	78–200	81–84	59–200
40–41	49–71	78–200	78–80	29–58
31–32	72–200	78–200	130–185	59–200
96–200	72–200	48–77	130–185	18–28
7	72–200	78–200	118–123	59–200
79–95	49–71	78–200	24	59–200
96–200	72–200	78–200	130–185	5–6
96–200	24–26	34–47	118–123	59–200
96–200	72–200	48–77	59–75	18–28



1–10



11–50



51–100

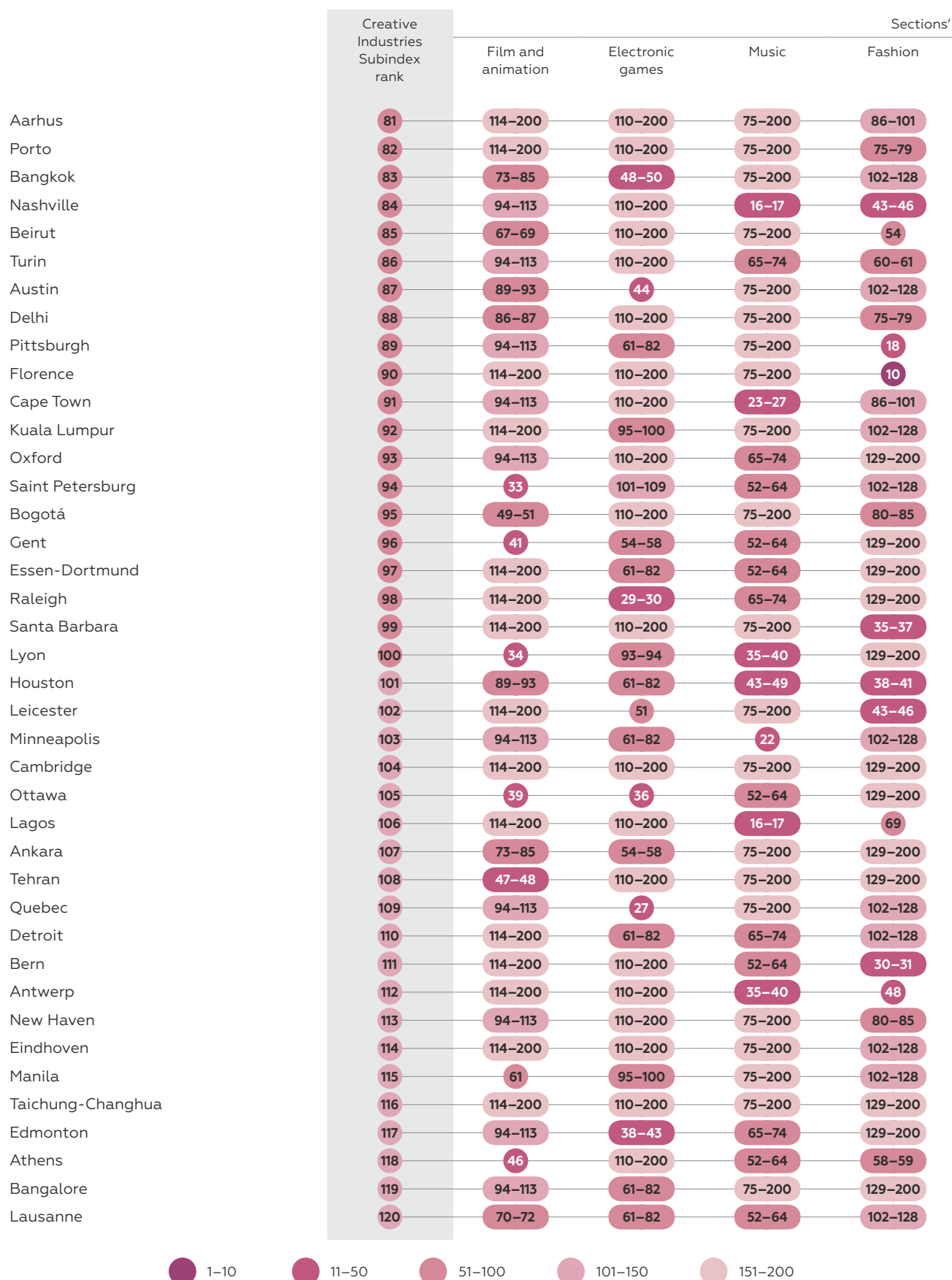


101–150



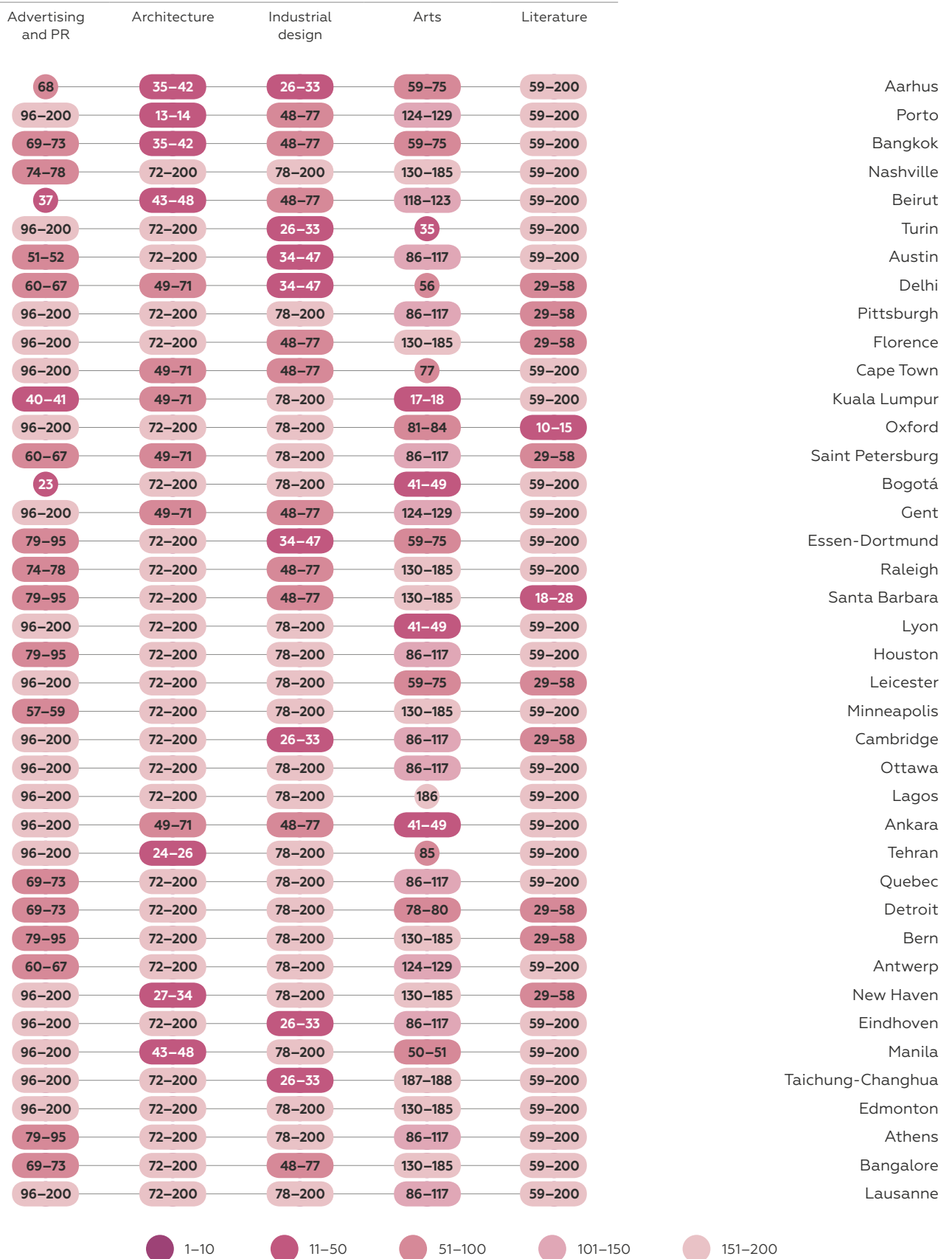
151–200

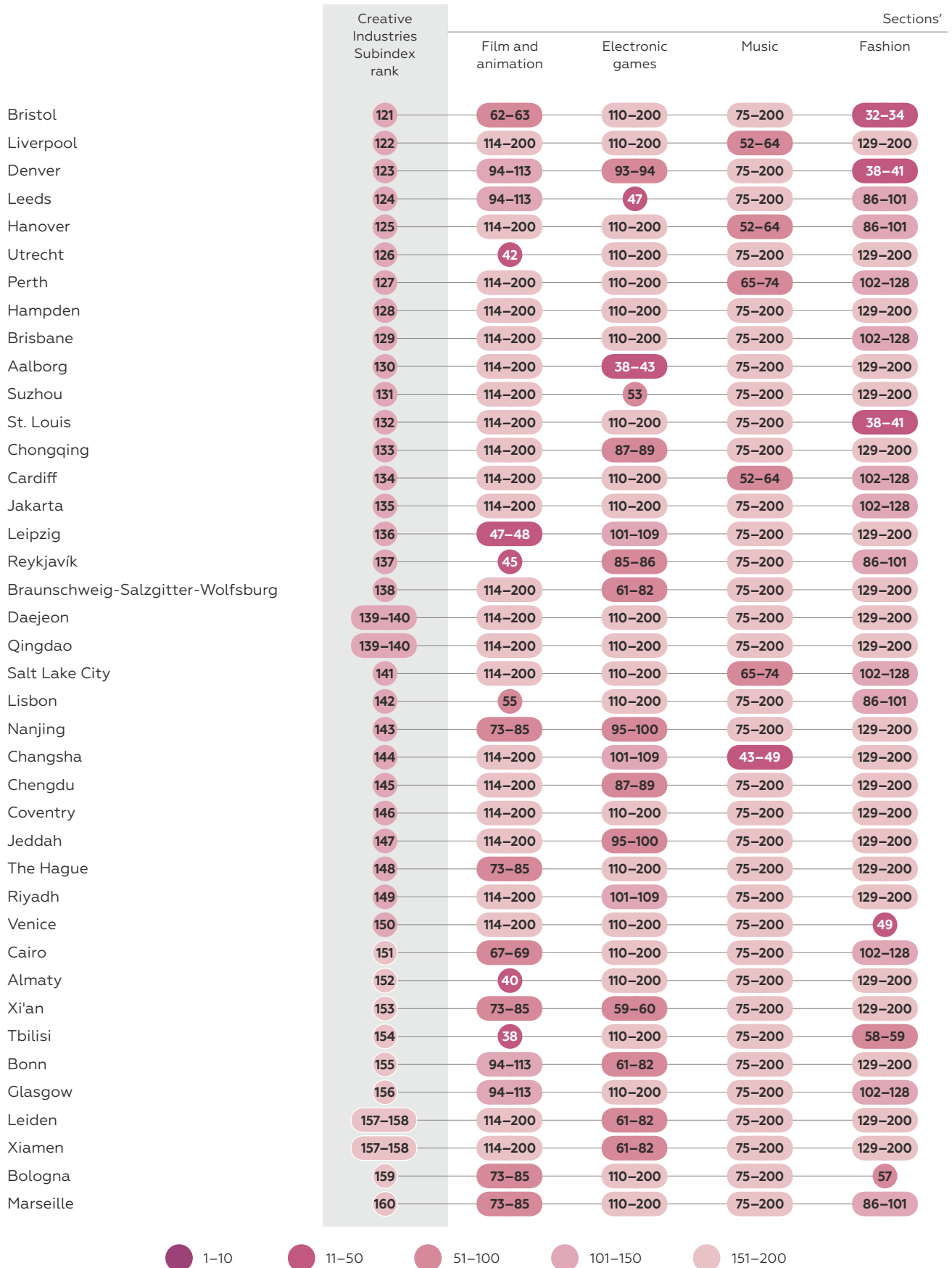
Brussels
Vienna
Vancouver
Prague
Mumbai
Helsinki
Auckland
Rio de Janeiro
Stuttgart
San Diego
Portland
Rome
Frankfurt am Main
Buenos Aires
Lima
Singapore
Budapest
Geneva
Guangzhou
Gothenburg
Nuremberg
Dallas
Philadelphia
Johannesburg
Cologne
Santiago
Birmingham
Düsseldorf
Columbus
Hangzhou
Kyiv
Basel
Tel Aviv
Bucharest
Las Vegas
Dubai
Manchester
Phoenix
Rotterdam
Edinburgh



(continued)

ranks





(continued)

ranks

Advertising and PR	Architecture	Industrial design	Arts	Literature
96–200	72–200	78–200	78–80	59–200
96–200	72–200	78–200	59–75	29–58
96–200	72–200	78–200	86–117	59–200
96–200	72–200	78–200	59–75	59–200
96–200	72–200	48–77	86–117	59–200
79–95	72–200	78–200	86–117	29–58
79–95	49–71	78–200	59–75	59–200
96–200	72–200	78–200	86–117	18–28
96–200	43–48	78–200	59–75	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	48–77	189–200	59–200
79–95	72–200	78–200	86–117	59–200
96–200	72–200	48–77	124–129	59–200
96–200	72–200	48–77	130–185	59–200
96–200	43–48	78–200	118–123	59–200
96–200	49–71	78–200	124–129	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	48–77	189–200	59–200
96–200	72–200	34–47	189–200	59–200
96–200	72–200	34–47	189–200	59–200
96–200	72–200	78–200	130–185	29–58
79–95	72–200	78–200	59–75	59–200
96–200	72–200	78–200	53	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	78–200	76	59–200
96–200	72–200	48–77	86–117	59–200
79–95	49–71	78–200	130–185	59–200
96–200	49–71	78–200	86–117	59–200
47–49	72–200	78–200	130–185	59–200
96–200	72–200	78–200	86–117	59–200
60–67	72–200	78–200	86–117	59–200
96–200	72–200	78–200	86–117	59–200
96–200	72–200	78–200	187–188	59–200
96–200	72–200	78–200	189–200	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	78–200	41–49	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	78–200	130–185	59–200
96–200	72–200	78–200	81–84	59–200

Bristol
 Liverpool
 Denver
 Leeds
 Hanover
 Utrecht
 Perth
 Hampden
 Brisbane
 Aalborg
 Suzhou
 St. Louis
 Chongqing
 Cardiff
 Jakarta
 Leipzig
 Reykjavik
 Braunschweig-Salzgitter-Wolfsburg
 Daejeon
 Qingdao
 Salt Lake City
 Lisbon
 Nanjing
 Changsha
 Chengdu
 Coventry
 Jeddah
 The Hague
 Riyadh
 Venice
 Cairo
 Almaty
 Xi'an
 Tbilisi
 Bonn
 Glasgow
 Leiden
 Xiamen
 Bologna
 Marseille



1–10



11–50



51–100



101–150



151–200



(continued)

Advertising and PR	Architecture	Industrial design	Arts	Literature	
96–200	72–200	78–200	59–75	59–200	Adelaide
96–200	72–200	78–200	86–117	59–200	Wuhan
96–200	72–200	78–200	130–185	59–200	Aberdeen
96–200	72–200	78–200	130–185	59–200	Santa Cruz
96–200	72–200	78–200	86–117	59–200	Malmö
96–200	72–200	78–200	130–185	59–200	Chennai
96–200	72–200	78–200	86–117	59–200	Brighton
96–200	72–200	78–200	86–117	59–200	València
96–200	72–200	78–200	86–117	59–200	Durham
96–200	72–200	78–200	130–185	59–200	Toulouse
96–200	72–200	78–200	130–185	59–200	Padua
96–200	72–200	78–200	124–129	59–200	Tianjin
96–200	72–200	78–200	130–185	59–200	Hamilton
96–200	72–200	78–200	130–185	59–200	Canberra
96–200	72–200	78–200	130–185	59–200	Boulder
96–200	72–200	78–200	130–185	59–200	Grenoble
96–200	72–200	78–200	130–185	59–200	Heidelberg
96–200	72–200	78–200	130–185	59–200	Groningen
96–200	72–200	78–200	130–185	59–200	Dalian
96–200	72–200	78–200	130–185	59–200	Ithaca
96–200	72–200	78–200	130–185	59–200	Cuyahoga
96–200	72–200	78–200	130–185	59–200	Kitchener
96–200	72–200	78–200	130–185	59–200	Cork
96–200	72–200	78–200	130–185	59–200	Leuven
96–200	72–200	78–200	130–185	59–200	Memphis
96–200	72–200	78–200	130–185	59–200	Nagoya
96–200	72–200	78–200	130–185	59–200	Nijmegen
96–200	72–200	78–200	130–185	59–200	Sacramento
96–200	72–200	78–200	130–185	59–200	Hsinchu
96–200	72–200	78–200	130–185	59–200	Washtenaw
96–200	72–200	78–200	130–185	59–200	Harbin
96–200	72–200	78–200	130–185	59–200	Tsukuba
96–200	72–200	78–200	130–185	59–200	Champaign
96–200	72–200	78–200	130–185	59–200	Exeter
96–200	72–200	78–200	189–200	59–200	Benton City
96–200	72–200	78–200	189–200	59–200	Rochester
96–200	72–200	78–200	189–200	59–200	Fuzhou
96–200	72–200	78–200	189–200	59–200	Hefei
96–200	72–200	78–200	189–200	59–200	Jinan
96–200	72–200	78–200	189–200	59–200	Zhenjiang

1–10
 11–50
 51–100
 101–150
 151–200

The development of creative industries in global cities vividly illustrates their ambivalent nature. On the one hand, they are the quintessence of a city’s artistic potential: from creators of advanced technologies to traditional artists. Inconceivable products and services emerge as a result of their collaboration, inspiring thinkers from other areas conduct bold experiments. On the other hand, creative industries are quite pragmatic: they struggle in cities with moderate personal incomes and gravitate toward capitals and huge agglomerations. This ambivalence makes creative industries an objective criterion of cities’ innovation attractiveness that places great emphasis on both the sophisticated supply and effective demand of new ideas.

<p>The creative sector plays an important role in securing the economic welfare of modern cities. Industries that grant such welfare not only single-handedly generate a considerable part of value added, they also produce an artistic reflection of their urban economy, which is attractive to tourists, skilled workers, and global brands.</p>	<ul style="list-style-type: none">● Film and animation (3 indicators)● Electronic games (4)● Music (3)● Fashion (2)● Advertising and PR (4)● Architecture (2)● Industrial design (1)● Arts (4)● Literature (1).
<p>For the purposes of evaluating the level of creative industries, we developed a relevant subindex for this study that includes 24 indicators grouped into nine sections:</p>	<p>The rank of the city in the Creative Industries Subindex shows the level of creative industries’ development in comparison to other centers of innovation.</p>

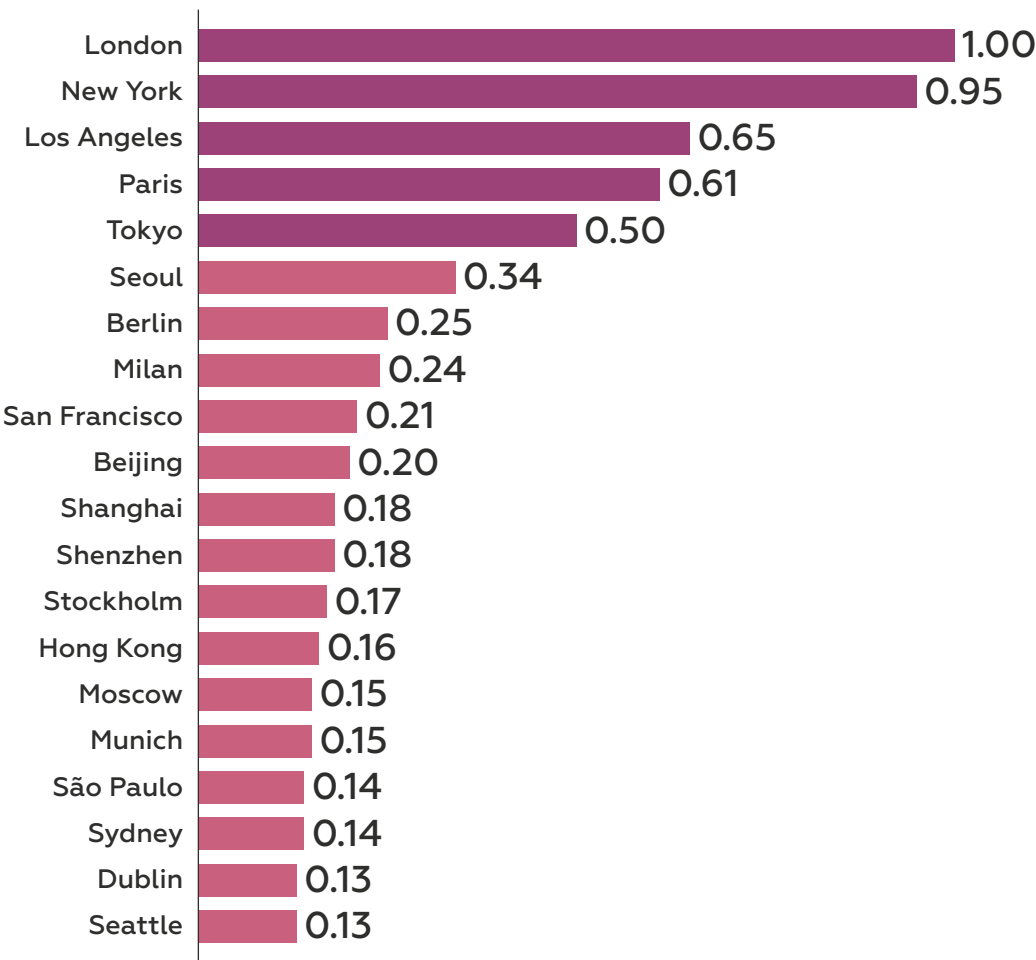
The Cube of Five

Mega-creative cities have a fusion of culture and new technologies

There are five cities in the world that by far outrun all other cities in terms of the development of creative industries: London, New York,

Los Angeles, Paris, and Tokyo (Figure 19). The latter megacity – Tokyo – has a twofold leadership gap with London, and the city ranked 6th –

Figure 19. Top 20 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises): 2023 (Normalized Estimate)

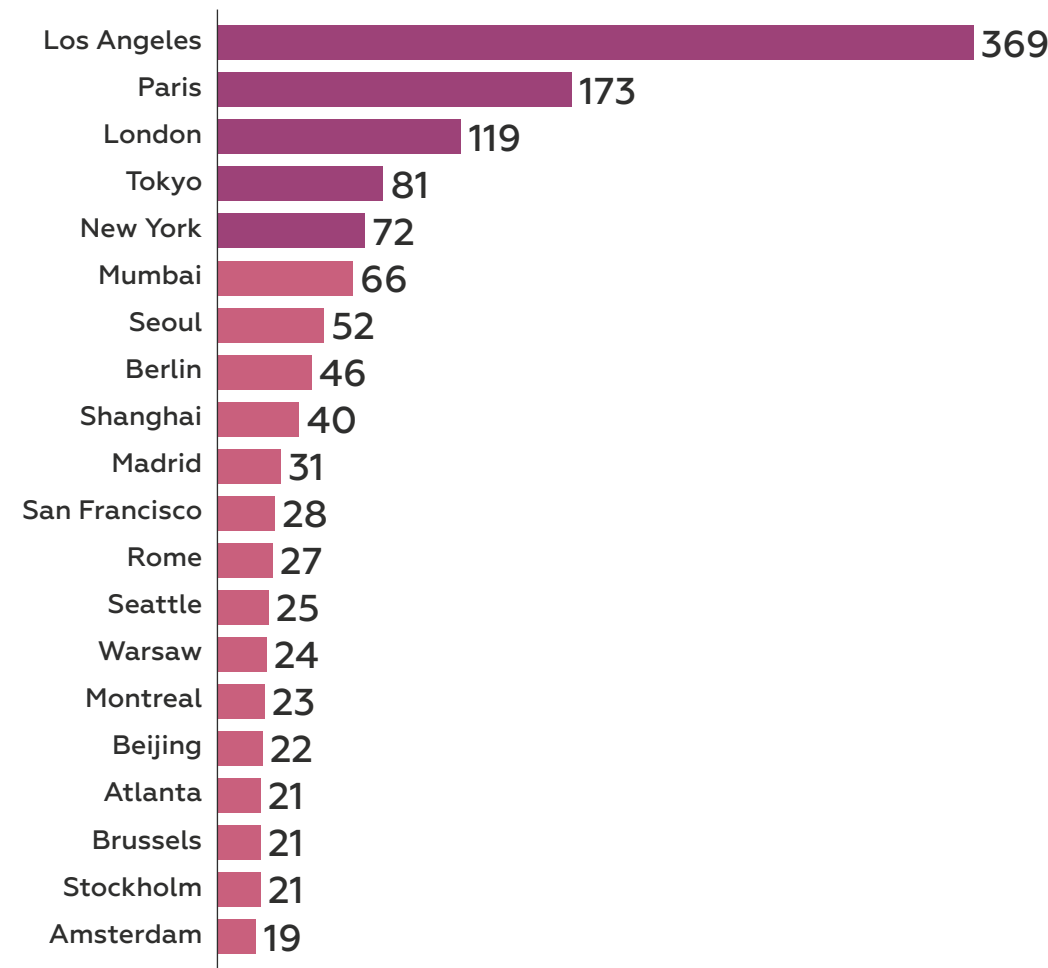


Sources: HSE University, based on FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa, IMDb, FIAPF, The Game Awards, Esports Earnings, Steam, Gamescom, Effie, PProvoke, Cannes Lions, D&AD, The Pritzker Architecture Prize, World Architecture Festival Awards, A' Design, iF, Red Dot, The Praemium Imperiale, Artprice, QS and THE, Wikipedia, Billboard, Spotify, and The International Opera Awards.

another Asian city, Seoul, – has a threefold leadership gap with the British capital. Each member city of the creative quintet is in the global top five in at least five creative industries. They also have a minimum of two cities from the top three in each creative industry.

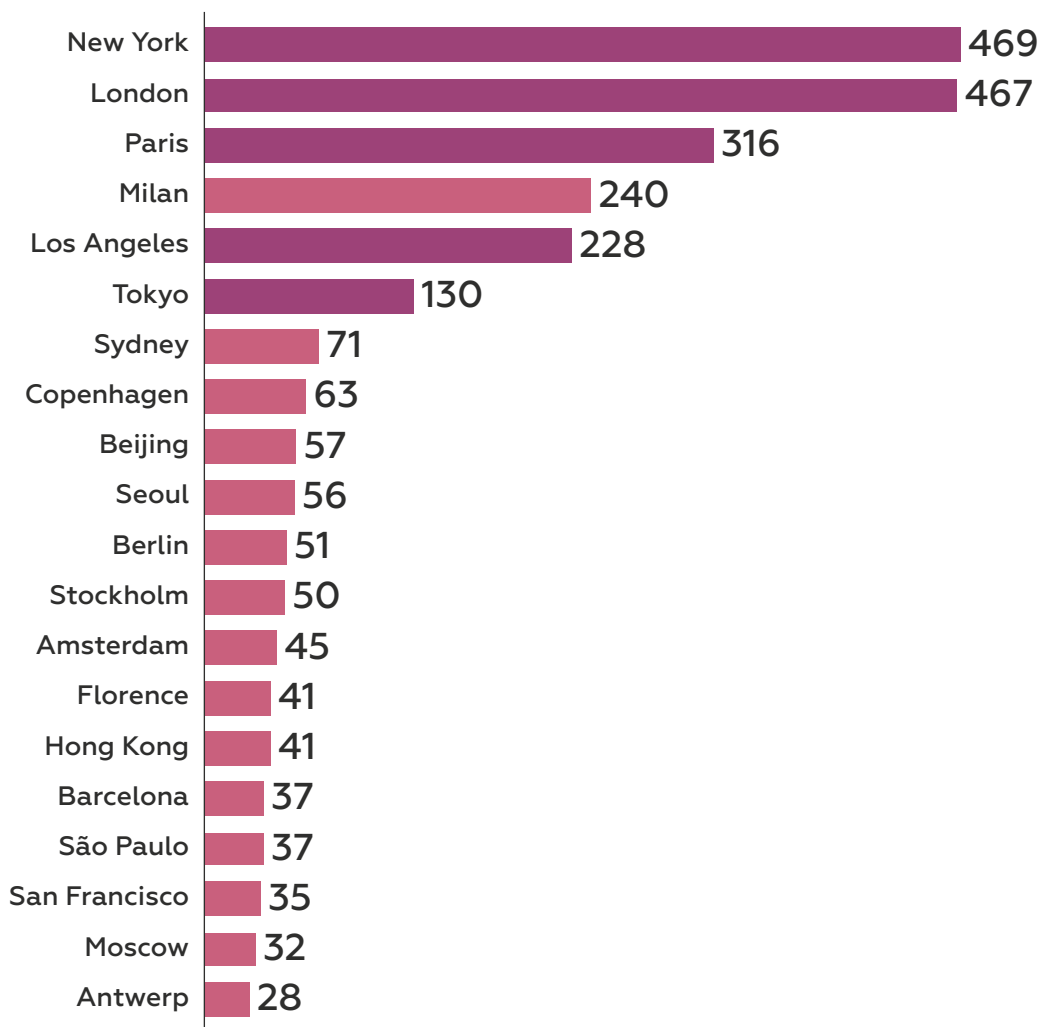
What sets mega-creative cities apart? They have developed an equally highly level of contemporary creative industries – film and animation, electronic games (Figure 20), creative activities with deeper historical roots (Figure 21), – and high tech (all cities leading in creative industries are in the top 15 of the Technological Development Subindex).

Figure 20. Top 20 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises) in Film and Animation and Electronic Games: 2023



Sources: HSE University, based on IMDb, FIAPF, The Game Awards, Esports Earnings, Steam, and Gamescom.

Figure 21. Top 20 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises) in Fashion, Architecture, Arts, and Literature: 2023



Sources: HSE University, based on FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa, Artprice, The Pritzker Architecture Prize, World Architecture Festival Awards, The Praemium Imperiale, QS and THE, and Wikipedia.

Mega-creative cities are also among the most densely populated and wealthy global centers.¹ On top of that, they all make up the nuclei of agglomerations with many satellites, the majority of which have

leaders of creative industries. For example, in all 39 localities of Greater Los Angeles it is possible to find at least one internationally recognized representative of the creative class. This means that their

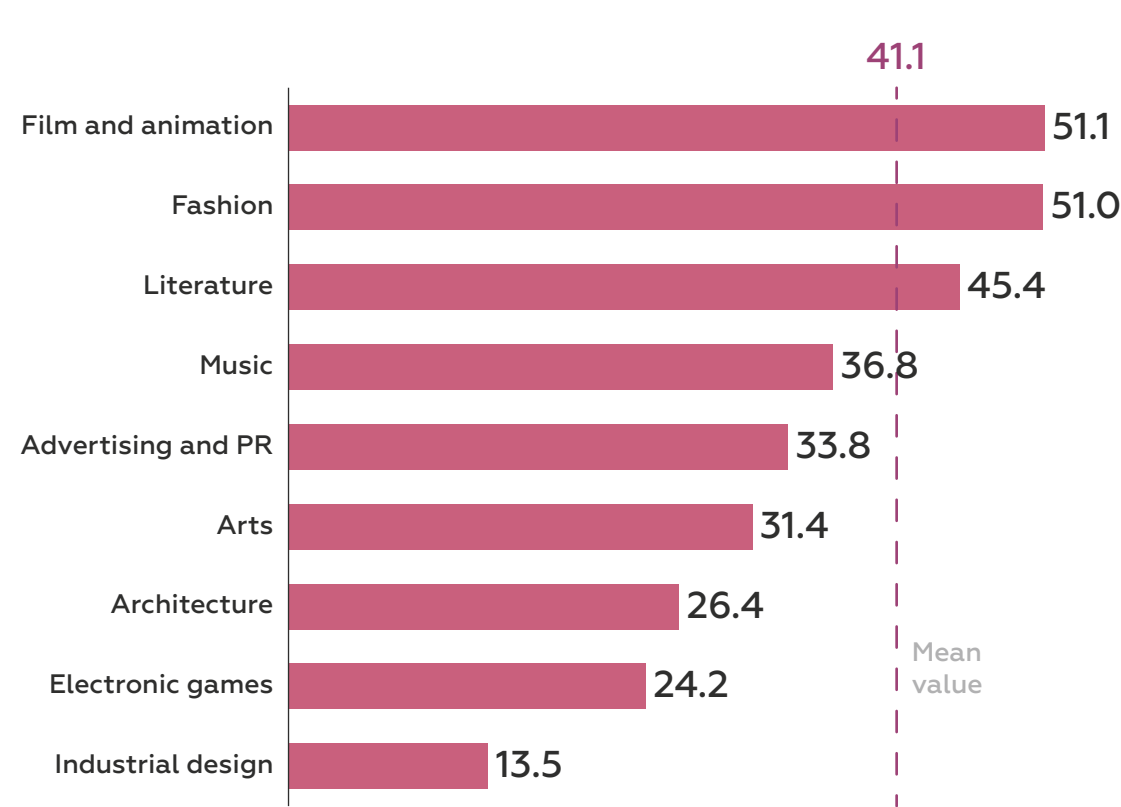
¹ OECD.Stat. Available at: https://stats.oecd.org/Index.aspx?datasetcode=FUA_CITY (Accessed: 16.12.2022).

mega-creativity goes hand in hand with powerful territorial and economic resources.

Mega-creative cities are demonstrating the strongest leadership in film, animation, and fashion (Figure 22), however, their importance in advertising and PR, literature, and music is also significant. For example, Paris alone has 21% of companies producing animation films that won international film

festival awards, and Los Angeles, home to global pop and R&B stars, – 20% of most downloadable songs. Leaders gravitate heavily toward these places and, among other reasons, it is happening because of the strong image the Creative Five cities have in some industries. For example, many fashion brands – DKNY, Temperley London, Burberry London – directly mention their cities in the brand names.

Figure 22. Share of Creative Leaders (Individuals and Enterprises) in the Top Five Mega-Creative HSE GCII Cities: 2023, %



Sources: HSE University, based on FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa, IMDb, FIAPF, The Game Awards, Esports Earnings, Steam, Gamescom, Effie, PProvoke, Cannes Lions, D&AD, The Pritzker Architecture Prize, World Architecture Festival Awards, A' Design, iF, Red Dot, The Praemium Imperiale, Artprice, QS, and THE, Wikipedia, Billboard, Spotify, and The International Opera Awards.

The Capital Opens Windows to a Shining World

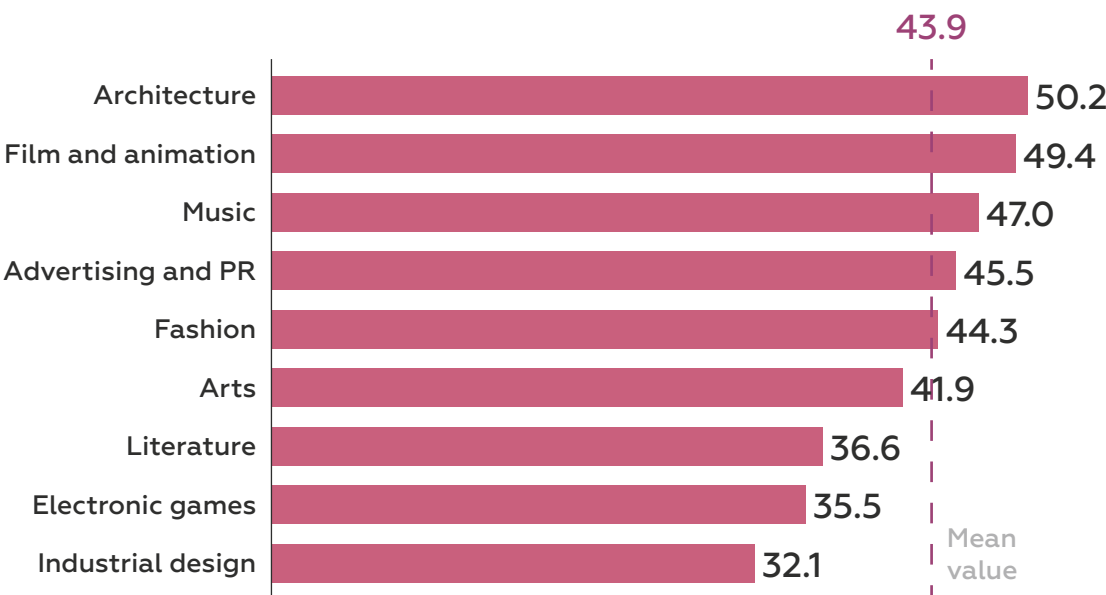
How do administrative centers attract creative leaders?

Capitals in our ratings have on average 63 leaders of creative industries, whereas for other cities this indicator is 2.5 times lower. In general, capitals have 43.9% of the total number of internationally recognized representatives of the creative economy.

At the same time, one could single out several activities – architecture, film and animation, music, advertising and

PR – that have a greater concentration of creative leaders namely in capitals (Figure 23). In advertising, this happens because their major clients – corporations – are usually located in capitals, and because of PR agencies that participate in their political campaigns. When it comes to architecture, film and animation, and music, they tend to have large scale projects that require public support from administrative centers.

Figure 23. Creative Leaders (Individuals and Enterprises) Residing in Capitals as a Percentage of the Total Number of Creative Leaders: 2023



Sources: HSE University, based on FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa, IMDb, FIAPF, The Game Awards, Esports Earnings, Steam, Gamescom, Effie, PProvoked, Cannes Lions, D&AD, The Pritzker Architecture Prize, World Architecture Festival Awards, A' Design, iF, Red Dot, The Praemium Imperiale, Artprice, QS and THE, Wikipedia, Billboard, Spotify, and The International Opera Awards.

Going “Supernova”

How ambitious cities are fighting for the best spot on the creative map of the world

Forty cities out of the top 50 by development level of the creative industries are located in OECD member states and have a longer history of capitalism. At the same time, countries with emerging market economies also have cities that shine brighter on the global creative arena. For example, among Asian cities there is Shenzhen – one of the top-performers

by the number of industrial design leaders; Shanghai and Hong Kong are in the top 10 of global fashion centers; and Mumbai – in film industry. Among Latin American cities, Lima is the third best city in advertising and PR, São Paulo is ranked 11th in the world by the number of best global albums recorded by their resident artists.



Innovations in Three Dimensions

Creative industries' growth in Chinese cities is based on the bond between traditions and modernity, sectoral diversity, and a wide geographical reach

China, same as the United States, dominates the list of top 20 cities with the highest level of creative industries. The most prominent cities include China's capital Beijing, multicultural Hong Kong and Shanghai, and one of newer cities of the Celestial Empire – Shenzhen. Especially strong are the positions of Chinese megacities in architecture and industrial design, where, apart from the four aforementioned cities, Hangzhou and Guangzhou have achieved great results and Beijing is even ranked 2nd among HSE GCII cities by the number of best-selling artists in auction sales. Another two Chinese cities – Nanjing and Shanghai – are ranked 9th and 10th by this indicator, respectively.

Such high ranking positions in creative industries are not coincidental; they are the result of different factors working together in a single system. Here are the most important of them.

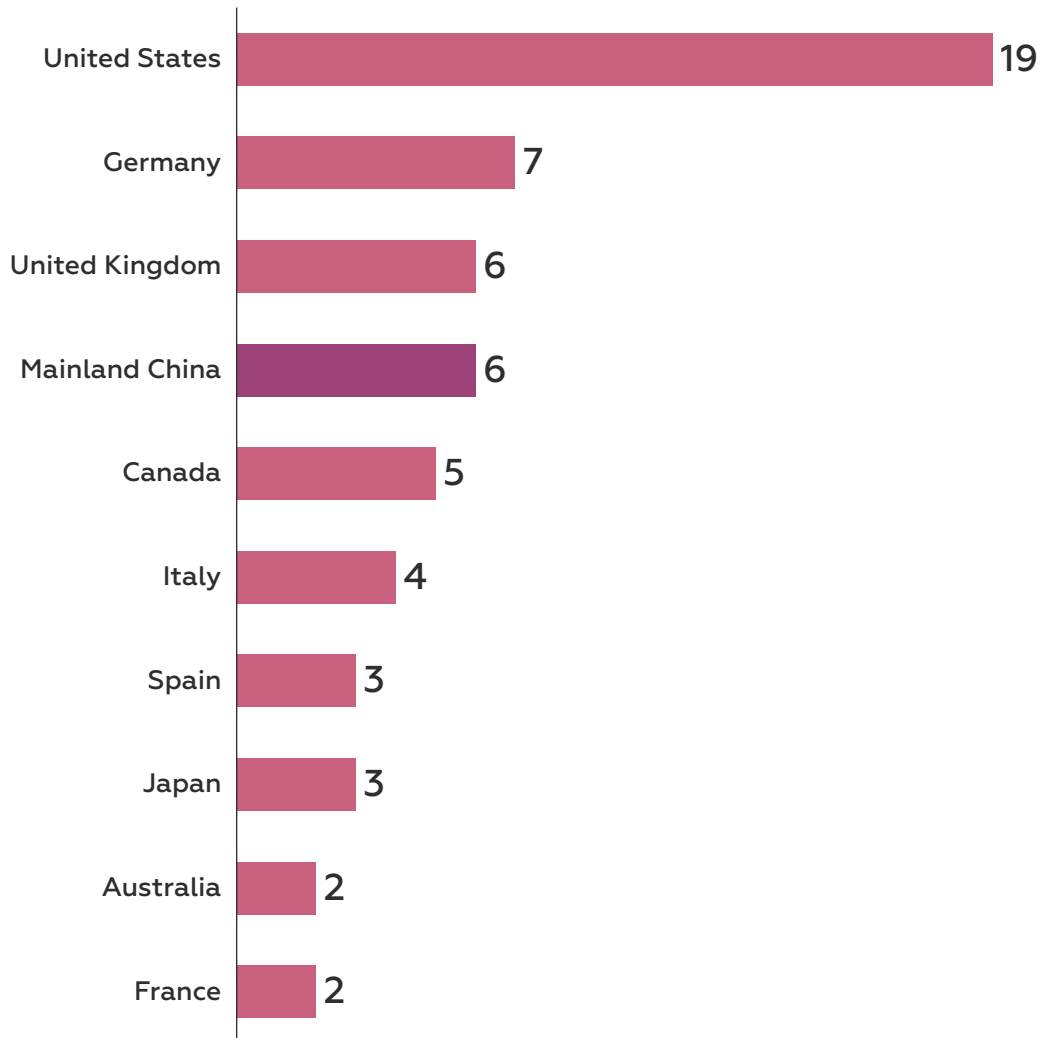
1. Integration of creative industries into the planned economy. In 2021, China's government presented a new 14th five-year development plan that

has kept the same focus on establishing an innovation economy. China has already made considerable achievements in this sphere, in particular – it has reached 1st place by the number of patent applications. In the new plan, culture is supposed to work as a soft power in the service of national goals. Therefore, the Culture Development Plan that elaborates upon the 14th five-year plan¹ declares a need to develop modern media industries, for example, by stimulating creatives to post their films, songs, video games, or creative writing on social network platforms.

2. Decentralization of the creative sector. The decentralization of culture and creative industries in China is stipulated in strategic documents, according to which Chinese regions are given a task to develop industrial development programs. On top of that, China has a considerable spatial diversification of the creative sector. Among all countries hosting the cities in our ranking, China is behind only the United States and Germany by the number of most creative centers (Figure 24).

¹ Cultural Development Plan for the "14th Five-Year Plan". China Law Translate. Available at: <https://www.chinalawtranslate.com/en/十四五文化发展规划/> (Accessed: 21.12.2022).

Figure 24. Countries of the Top 100 HSE GCII Cities by the Number of Creative Leaders (Individuals and Enterprises): 2023



Sources: HSE University, based on FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa, IMDb, FIAPF, The Game Awards, Esports Earnings, Steam, Gamescom, Effie, PProvoke, Cannes Lions, D&AD, The Pritzker Architecture Prize, World Architecture Festival Awards, A' Design, iF, Red Dot, The Praemium Imperiale, Artprice, QS and THE, Wikipedia, Billboard, and Spotify.

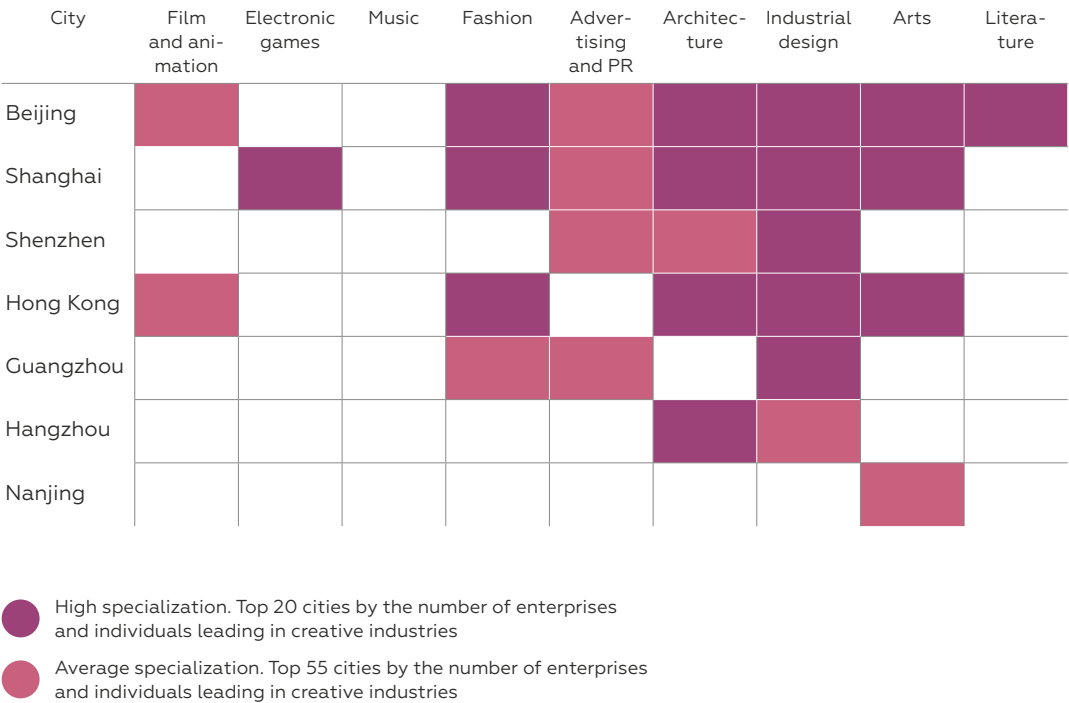
3. Creative specializations of cities. Despite the fact that most of the time Chinese cities specialize in visual arts – design, fine arts, and architecture, – they also reach high levels in other types of activities (Figure 25). For example, Shanghai

is an absolute leader among global cities by the number of e-sports tournaments. Since 2015, Shanghai has held eight tournaments in one of the most popular disciplines – Dota 2. The prize fund of the last 2019 tournament amounted to 34.2 million USD.

The development of e-sports in Shanghai has been one of the city's priorities since 2017.¹ In 2019, special rules were introduced for simplified travelling abroad for e-sports athletes registered in Shanghai.² Another Chinese city, Hong Kong, is in the HSE GCII top 10 by fashion. Hong Kong has branches of casual clothing brands (Bosideng and Esprit), as well as luxury brands (Chow Tai Fook Holding). A distinguishing feature

of this megacity is the story of how it went from a mass textile producer of the 1990s and a global shopping center of luxury brands of the 2000s to a place with growing concentration of contemporary independent designers that adhere to principles of environmental sustainability. For example, a company like Paper Shades produces spectacle frames from recycled paper.

Figure 25. Creative Specializations of the Selected HSE GCII Chinese Cities: 2023



Sources: HSE University, based on FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa, IMDb, FIAPF, The Game Awards, Esports Earnings, Steam, Gamescom, Effie, PRovoke, Cannes Lions, D&AD, The Pritzker Architecture Prize, World Architecture Festival Awards, A' Design, iF, Red Dot, The Praemium Imperiale, Artprice, QS and THE, Wikipedia, Billboard, and Spotify.

¹ Shanghai wants to be the world's 'e-sports capital'. Available at: <https://technode.com/2019/06/14/shanghai-wants-to-be-the-worlds-e-sports-capital/> (Accessed: 21.12.2022).

² Shanghai releases guidelines over eSports athlete registration and management. Available at: <https://news.cgtn.com/news/3d3d414f7955544f30457a6333566d54/index.html> (Accessed: 21.12.2022).

4. The spirit of history. Seven of 10 Chinese cities with the largest number of enterprises and individuals leading in creative industries used to be major political centers of China, and today they claim the unofficial status of ancient capitals.¹ For example, Nanjing, where fine arts are the most developed among all creative industries, is famous for eight exceptional painters who lived here in the second half of 17th century.² Today though, Nanjing is home to such recognized modern artists as Chang Hsueh-liang, Liu Dan, Ding Fang, and Lei Xu. Their art is not only contemporary and popular, it is also based on the heritage of traditional Chinese art.

Another Chinese city – Xi'an, where the Terracotta Army was buried in the 3rd century BC, – is now becoming an e-sports center³, occupying ranks

15th–18th by the number of virtual e-sports tournaments. Thus, from 2017 to 2021, the city hosted six e-sports tournaments with a total prize fund exceeding 10 million USD⁴; and in 2018, an industrial e-sports park project was commissioned.⁵

Therefore, the development of creative industries in China could not be called a coincidence or something achieved solely because of a planned economy. In addition, a huge role in Chinese cities' achievements could have been credited to a clear synchronization of creative policy measures on the national and regional levels, which helped identify and effectively support the diversified creative potential of various provinces that harmoniously combined the cultural heritage and realities of modern life.

¹ Historical capitals of China. Available at: https://en.wikipedia.org/wiki/Historical_capitals_of_China (Accessed: 21.12.2022).

² Eight Masters of Nanjing. China online museum. Available at: <https://www.comuseum.com/painting/schools/eight-masters-of-nanjing/> (Accessed: 23.12.2022).

³ Xi'an to Build Esports Cluster. Available at: <https://www.yicaiglobal.com/news/xian-to-build-esports-cluster> (Accessed: 21.12.2022).

⁴ Esports Earnings.

⁵ Walk in Xi'an Nice Block. Available at: <https://www.youtube.com/watch?v=WcsdANciSZ0> (Accessed: 21.12.2022).

No Artist Should Starve

Fair quality of life for an artist
is not a whim, it is a prerequisite
of a successful business

In all top 10 cities by the level of creative industries development, save for Beijing, the average salary after taxes¹ is a minimum of 1,800 USD, which is almost the same as in Madrid or Barcelona – with salaries of 1,934 and 1,966 USD and 26th and 33rd ranks in the Creative Industries Subindex, respectively.

HSE GCII cities with modest incomes demonstrate similarly modest achievements in the creative industries: their share among cities that scored lower in the corresponding subindex than 50th place is 40%. In the creative top 50, 27.5% of cities have labor remuneration lower than 1,800 USD per month.

¹ Numbeo, 2022.

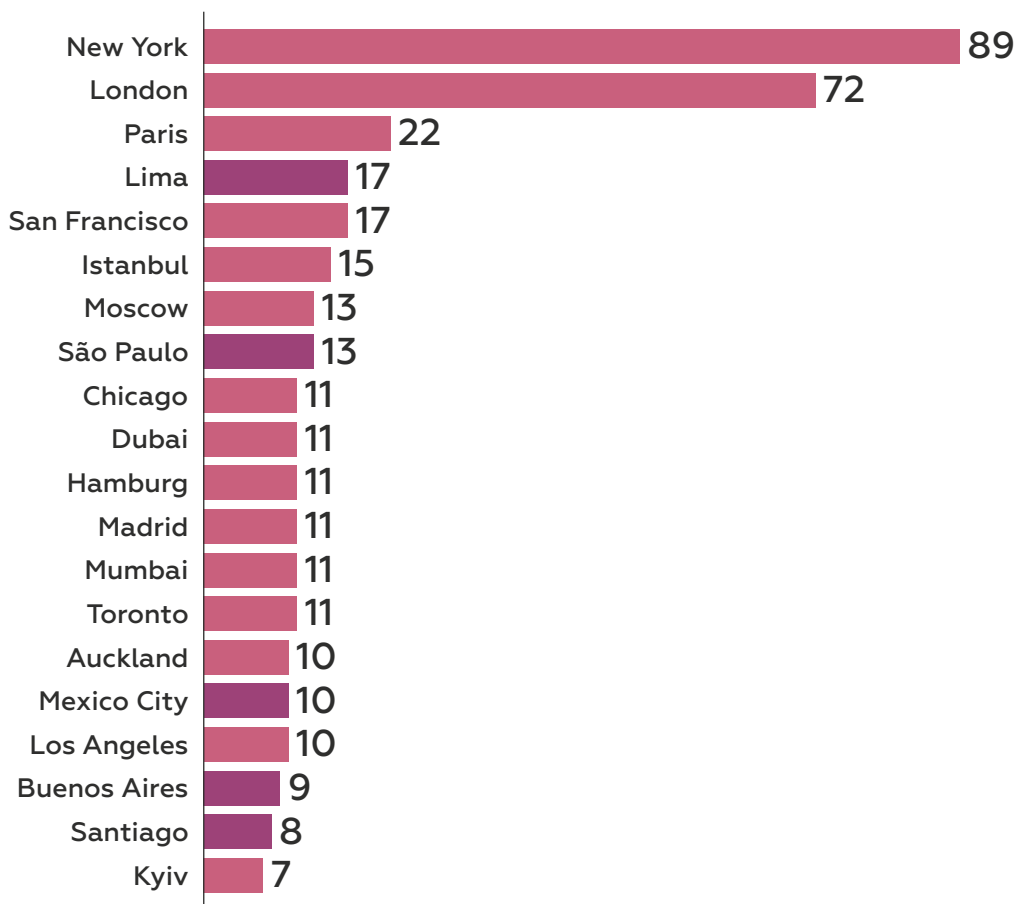
The Latin Quarter

Every fourth city in the Top 20 HSE GCII 2023 by advertising and PR is in Latin America

Among exceptionally successful cities in advertising and PR is Lima: the capital of Peru has made it to the top three of the corresponding rankings (Figure 26), outrunning all other HSE GCII 2023 cities by the number of most effective advertising agencies acknowledged by the

internationally recognized Effie Awards (16 companies). Another city, Brazil's São Paulo, yields only to New York, London, and Paris by the number of creative production agencies that won the most prestigious competition – Cannes Lions Awards (4).

Figure 26. Top 20 HSE GCII Cities in Advertising and PR: 2023



Source: HSE University, based on Effie, PProvoke, Cannes Lions, and D&AD.

How did Latin American cities that do not have high personal income achieve their success in such a profit-driven industry like advertising and PR?

The first key to success is associated with a considerable number of independent players on the market. In 2020, Buenos Aires became a top five city in HSE GCII 2023 by the number of the most effective advertising agencies not controlled by international holdings (eight companies), together with Lima that topped this rating. Independent advertising agencies are likelier to consider local context in their work and collaborate with one another. Thus, the 2022 Effie Awards were given to five advertising campaigns created by a consortium of three participants, and four to collaborations that emerged from the cooperation between two agencies.

The second success factor has a cultural and historical background: the predominance of verbal and graphic forms of exchanging information when there were no fully developed script systems in pre-Columbian America. Today, oral tradition is still playing an important role in day-to-day communication, creating space for unique authentic solutions in advertising, like the participation of ordinary

people in campaigns. For example, in an advertising campaign called “Mom knows what to choose” (Mamá sabe de selección)¹, launched by Tottus Supermarkets in 2018, the stars of the ad were the mothers of the Peru football team members that had won the qualifying matches for the World Cup. This ad also uses a clever pun: the phrase for “qualifying matches” in Spanish sounds like “selección”.

An important role in PR achievements of the cities in this study could be credited to the diversity of communication channels. Due to the warm climate and average level of digitalization (only 26% of Latin Americans shop online² and Internet coverage is about 69%³), the city still has outdoor advertising, hybrid and interactive campaigns, often in relation to large-scale sports events. For example, Plaza Vea Supermarket placed their retail outlets with exterior ads in all countries where the Peruvian team played.⁴ On top of that, television as a source of information is still popular with the Latin American population.⁵ According to the Media Consumption Latam Report, 93% of Latin Americans continue to watch the news on TV [Sherlock Communications, 2021]. Unlike the Internet, where one could easily stop ads after less than a minute of watch-

¹ ¡Mamá sabe de selección! Available at: <https://www.youtube.com/playlist?app=desktop&list=PLG64AGk5wNElgzZEJeKbbOgatkQ0vJ2Mi> (Accessed: 13.01.2023).

² The state of e-commerce in Latin America. Available at: <https://blogs.iadb.org/integration-trade/en/e-commerce-latin-america/> (Accessed: 13.01.2023).

³ Internet usage in Latin America – Statistics & Facts. Available at: <https://www.statista.com/topics/2432/internet-usage-in-latin-america/#topicOverview> (Accessed: 07.02.2023).

⁴ #Los18del2018: Plaza Vea en Rusia. Available at: <https://www.mercadonegro.pe/marketing/los18del2018-plazavea-en-rusia/> (Accessed: 13.01.2023).

⁵ Latinoamericanos se alejan de los medios tradicionales para informarse. Available at: <https://newsinamerica.com/pdcc/tecnologia/2021/latinoamericanos-se-alejan-de-los-medios-tradicionales-para-informarse/> (Accessed: 13.01.2023).

ing, the TV helps deliver video clips of up to 60 seconds to the audience, thus adding opportunities to develop PR.

Another component of Latin American cities' advances in advertising is its social focus. In 2017, a Cannes Lion was awarded to a provocative video called "A Love Song Written by a Murderer" whose goal was to attract attention to domestic violence.¹ A video titled "Argentina is not White" aimed at confronting

racial stereotypes received a record-high number of views on social networks and a nomination at the 2022 Cannes Festival.²

We cannot skip other factors that with a certain degree of probability uplifted the advertising industry in Latin America – a booming market of fast-moving consumer goods, a peculiar Ibero-American sense of humor, and the liberal regulatory management of the advertising market.

¹ A love song written by a murderer. Available at: <http://www.r0das.com/love-song> (Accessed: 13.01.2023).

² "La Argentina no es blanca", el cortometraje con el que David Gudiño busca ganar el Festival de Cannes. Available at: <https://cnnespanol.cnn.com/radio/2022/05/19/la-argentina-no-es-blanca-el-cortometraje-con-el-que-david-gudino-busca-ganar-el-festival-de-cannes/> (Accessed: 13.01.2023).

Venture Capital is Not Unique to Tech Innovators

Global centers of venture capital boosted creative economies

6 out of 10

cities in terms of the level of creative industries development— San Francisco, New York, London, Los Angeles, Beijing, and Paris – are additionally global venture capital centers (Table 2).

Not only are the cultural nuclei of these cities (arts and literature) highly developed, but also fashion, film and animation, advertising and PR. The link between fashion, film, and animation, on the one hand, and venture capital,

on the other, could be explained by the high capital-output ratio of those activities, meanwhile leadership in both advertising and PR and venture capital is more likely to have been brought by a common factor – the ultrahigh economic potential of those cities. Even today, there are unicorns among fashion companies that are both technological and expensive in and of themselves. For example, a San Francisco-based company called Rothy’s that produces accessories (with an estimated value of 1 billion USD) uses a double recycling technology, making products from materials that have been recovered from recycled used materials.

Table 2. Top 10 Cities in the Creative Industries Subindex and Startups and Venture Capital Section: 2023

Cities’ ranks in the Startups and Venture Capital Section	Cities’ ranks in the Creative Industries Subindex
1. San Francisco	1. London
2. New York	2. New York
3. London	3. Los Angeles
4. Los Angeles	4. Paris
5. Beijing	5. Tokyo
6. Boston	6. Seoul
7. Shanghai	7. Berlin
8. Delhi	8. Milan
9. Paris	9. San Francisco
10. Singapore	10. Beijing

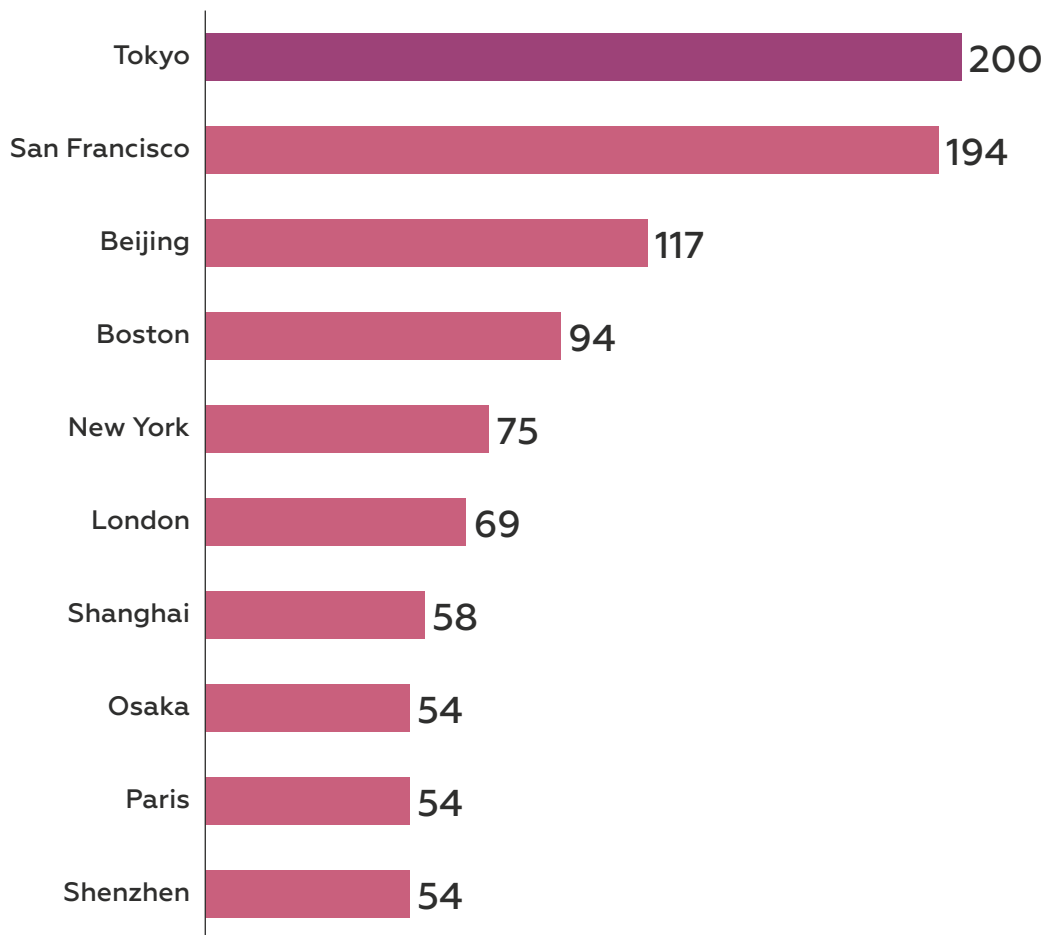
Source: HSE University.

The Animation Effect

How Tokyo combines the high tech of creative industries with the industrial creativity of high tech

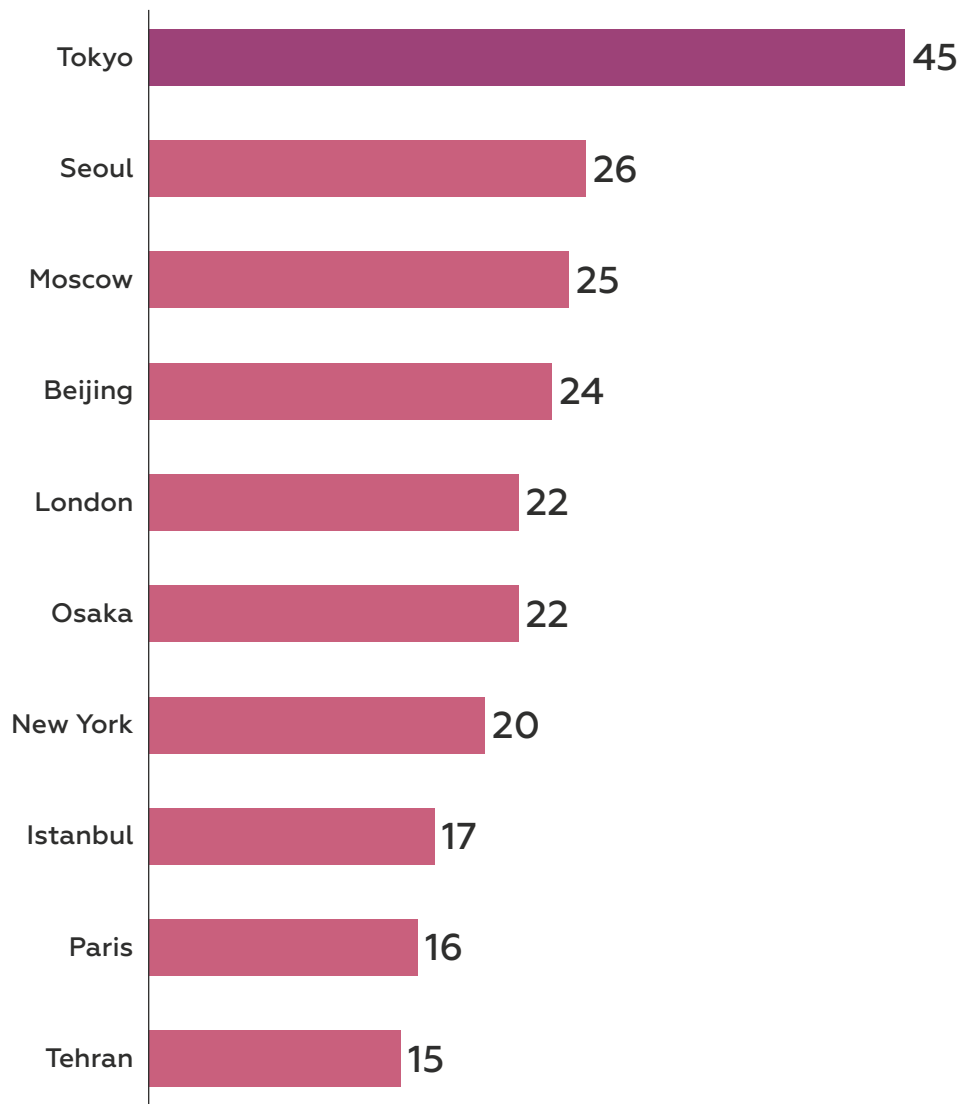
Tokyo is the main global center of the largest high tech businesses (over 200 companies in the city are sectoral leaders on the R&D Scoreboard) (Figure 27) and higher education (45 universities from QS, THE, or ARWU) (Figure 28).

Figure 27. Top 10 HSE GCII Cities by the Number of Leading Companies by R&D Expenditure: 2021



Source: R&D Scoreboard.

Figure 28. Top 10 HSE GCII Cities by the Number of Leading Universities: 2022

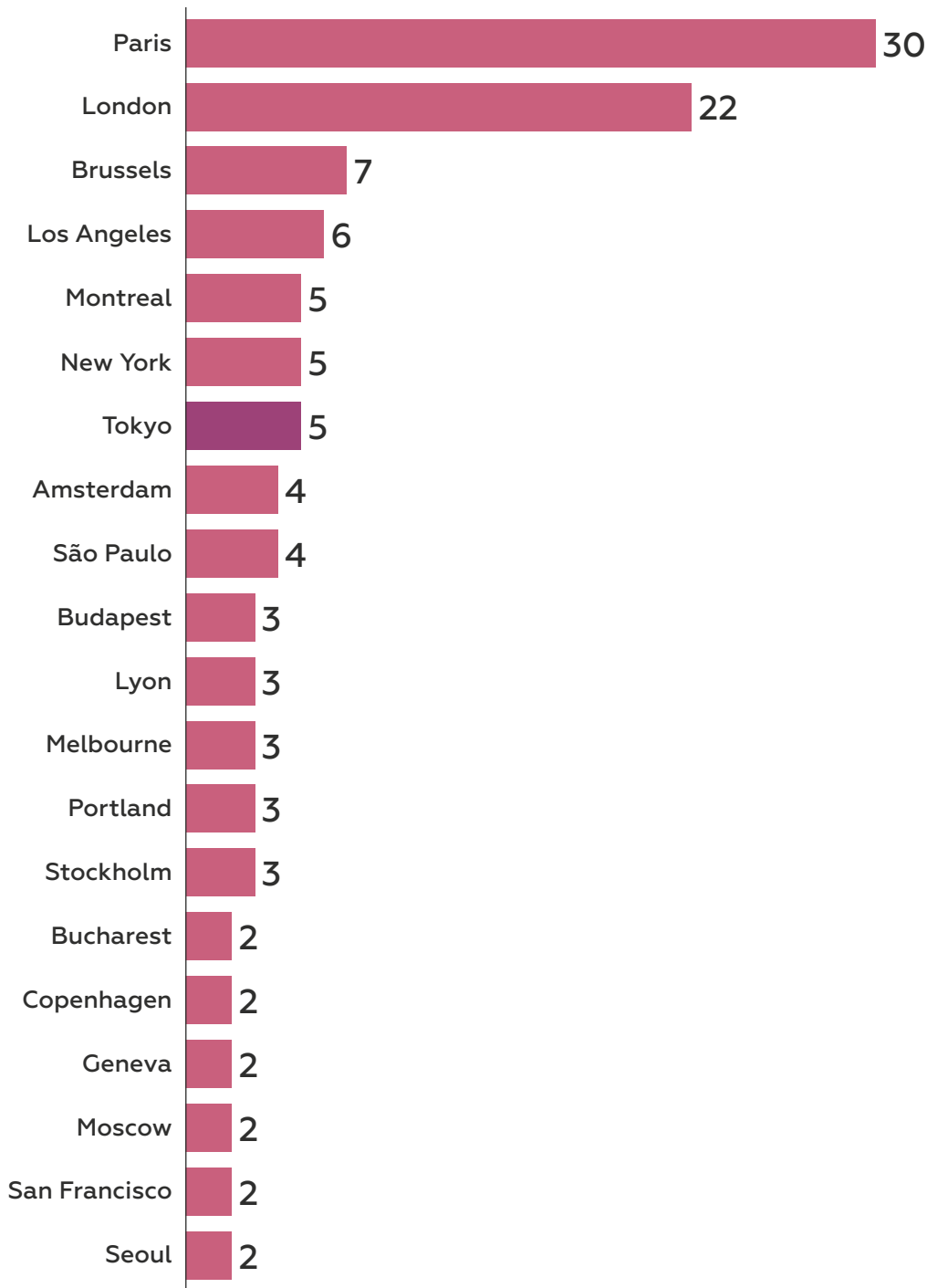


Source: QS, THE, and ARWU.

However, apart from international recognition of the high tech products of Japan, goods and services of the creative sector of the Land of the Rising Sun are no less successful on global markets and are concentrated,

first and foremost, in Tokyo. Japan’s capital is ranked 5th by the number of companies that won Annecy International Animation Film Festival awards (Figure 29) and by the number of developers of popular computer games.

Figure 29. Top 20 HSE GCII Cities by the Number of Animation Film Production Companies that Won International Festival Awards: 1960–2022



Source: Annecy International Animation Film Festival.

Anime plays a special role in securing the success of Japanese animation. The first works in this field were "Astro Boy", "Kimba the White Lion", and others produced by Tokyo-based Mushi Production and screened in the United States already in the 1960s. Later works, – first of all, "Akira", an animated cyberpunk action film produced by Tokyo Movie Shinsha in 1988, – was an international anime sensation of the 1990s and inspired many famous films, such as the Matrix quadrilogy.

The global success of anime could be attributed to several components. The first component is the technological progress of Japan and the 1980s economic boom that followed and brought about the mass distribution of domestic electronic technologies (TVs, VCR, game consoles) and increasing demand for content. Anime, which at that point had passed a twenty-year milestone, was able to fill this need. The trend of applying most advanced technologies in anime continues today. Thus, Toei, a company that produces such animated films, uses AI tools to speed up the coloring process.¹

The second key to success was to address issues and topics that usually lie beyond children's spheres of interest, for example in science or technology. Many creators of anime, especially in the space opera genre, use science fiction plots inspired by breakthroughs in high tech. For example, the "Legend of the Galactic Heroes" features space battles with special particles

called Zeffle that can cause explosions in space. At the same time, there are popular anime films and TV series dedicated to coming-of-age topics and friendship (for example, "My Teen Romantic Comedy SNAFU"), fights against criminals ("Ghost in the Shell"), and those that touch upon psychological and philosophical issues ("Evangelion"). Despite the fact that anime is mostly made for a mass audience, there are some works in this genre that won awards for Japan at the Annecy Festival, which is predominantly made of independent filmmaking enthusiasts. Among the most famous winners are "Lou Over the Wall", an animation film by Masaaki Yuasa, and a short film "Atama-yama" by Koji Yamamura, which is not an anime film per se, but has stylistic features of this genre.

The third component in anime's success was the active commercialization of anime images in adjacent creative industries, for example, in video gaming. A groundbreaking development of the first generation of 8-bit home video gaming consoles was, for the most part, made possible by adding highly appropriate gaming content ("Mega Man", "The Legend of Zelda"), that uses anime icons of Astro Boy from the anime of the same name, Son Goku from "Dragon Ball", and other characters. On top of that, we witness the reverse migration today: "The Final Fantasy" anime series was created as a spin-off of the successful RPG game (Computer Role-Playing Game).

¹ Japan's Toei Is Using AI Tools to Speed Up Animation Production. Available at: <https://www.cartoonbrew.com/tech/japans-toei-is-using-ai-tools-to-speed-up-animation-production-206801.html> (Accessed: 26.12.2022).

Finally, the anime industry owes its success to the use of effective art technologies. Already in the 1960s, one of the founding fathers of this genre – Tezuka Osamu advocated for the use of limited animation technology that helps considerably cut anime production expenses [Dushenko, Katasonova, 2014]. Limited animation tools include a lower number of frames per minute and less detailed drawings of background images. Today, the creation and wide-scale use of new anime and video game images are usually subjected to a stricter business logic aimed at using standard plots and characters of specific archetypes that

are popular with the target audience. This last success factor is not devoid of risks that may appear from an overly strong link between technologies and creative industries. As such, strong competition among commercially successful anime producers hampers the launch of innovative animation works on the market (even the legendary Hayao Miyazaki's Studio Ghibli has not always implemented their projects effectively, commercially speaking) or, vice versa, forces those studios that cannot keep up with the fluid market demand (one example – bankruptcy of Manglobe) from the market.

Creative Fusion

The city is a birthplace of most peculiar combinations of creative industries

There are examples when creative industries that share similar functions and close historical roots achieve a high level of development in global centers. For example, Hong Kong is in the top 10 by industrial design, architecture, and fashion – areas one could call “fashionable design”. But there are also cities, where the ones to achieve success are creatives producing completely different creative products. Among them is Stockholm, included in top 20 for fashion, electronic games, industrial design, literature, and music; Seattle, also included in the top 20 in fashion, electronic games, and literature; Rome, ranked 14th by film and animation, and 11th – in arts; São Paulo, ranked 8th by advertising

and PR, and 15th – in architecture. Such peculiar combinations often emerge when traditional creative activities, like fashion and architecture, become digitized or when advanced technologies are applied to more modern creative industries, like electronic games and films (for example, building informational modelling (BIM), augmented and virtual reality (AR/VR), and blockchain). In Amsterdam, ranked 11th by the number of companies participating in international electronic games trade shows and 12th – by the number of fashion brands, is developing the first-ever entirely digital fashion house The Fabricant¹ that uses NFT gaming experience.

¹ The Fabricant. Available at: <https://www.thefabricant.com> (Accessed: 16.12.2022).

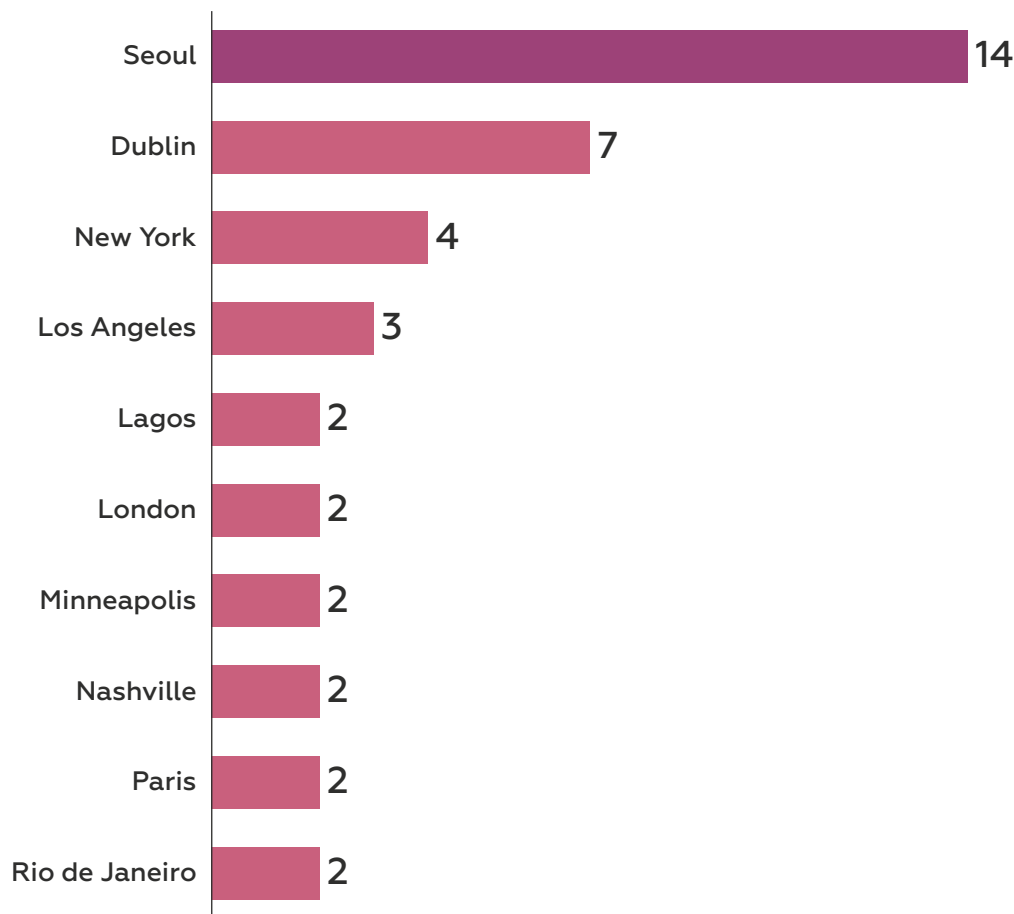
The Importance of Being Earnest

What is the reason behind the Seoul's spike in creativity?

Seoul is rightfully in 6th place among the most creative cities, and by some industries – industrial design, electronic games, and music – is even in the top five. Moreover, the

capital of South Korea outruns other megacities by the number of artists with the best musical albums (Figure 30), being one of several non-Anglo-Saxon cities in the top 10.

Figure 30. Top 10 HSE GCII Cities by the Number of Artists with the Best World Musical Albums: 2006–2020



Source: Billboard Year-End Charts: 2014–2021 World Albums.

Despite the fact that the three most successful creative industries in the Republic of Korea do not have many “kinship” ties (industrial design belongs to the category of functionally oriented creative industries, whereas music and electronic games are media industries), there are several common factors that were reckoned to have played an important role in their development.

1. Holistic participation of the government. In 2000, the Ministry of Culture, Sports and Tourism (MCST) for the Republic of Korea sponsored World Cyber Game Challenge – one of the first global e-sports tournaments¹, and invested a large amount of funds into the construction of the first e-sports arena in the world², located in close proximity to an electronics market in the Yongsan District. MCST also initiated the creation of KeSPA – Korea e-Sport Association that not only promotes e-sport events, but also defends the rights of e-sports athletes. Thus, in 2012, KeSPA regulated a minimum wage for players and the duration of their employment contracts.³ It is remarkable that video games in the Republic

of Korea are considered both a sport (KeSPA is a member of the National Olympic Committee) and a part of culture: in 2020, a law was adopted, under which this type of activity has become officially listed as a cultural activity, same as animation and music.⁴

The government’s participation is equally palpable in the music industry. Already in 1990s, MCST created a special division with the purpose of developing Korean popular music – K-pop.⁵ This division subsidized and promoted these areas on foreign markets, especially China and Japan. In particular, public support funds were used on making records, translating lyrics, and organizing international concerts.⁶ Despite the fact that today K-pop itself generates considerable revenue flows, public support of the industry is still ongoing and evolves to confront new threats. Thus, in 2021, during the COVID-19 pandemic, the Korean government sponsored online concerts⁷, and a year later the Seoul’s administration found a construction site for a specialized K-pop concert hall.⁸ The city authorities also initiated and commissioned

¹ Esports Around the World: South Korea. Available at: <https://esportsinsider.com/2022/05/esports-around-the-world-south-korea> (Accessed: 15.12.2022).

² e-Sports Stadium. Available at: https://english.visitseoul.net/tours/e-Sports-Stadium_/3376 (Accessed: 15.12.2022).

³ Korea e-Sports Association. Available at: https://en.wikipedia.org/wiki/Korea_e-Sports_Association (Accessed: 15.12.2022).

⁴ South Korea legally recognizes video games as a form of culture and art. Available at: <https://gameworldobserver.com/2022/09/09/south-korea-recognizes-video-games-as-culture-and-art> (Accessed: 15.12.2022).

⁵ Here’s How the South Korean Government Helped K-pop Rise to Global Fame. Available at: <https://www.tripzilla.com/korean-government-k-pop/110010> (Accessed: 15.12.2022).

⁶ Success without Design: Hallyu (Korean Wave) and Its Implications for Cultural Policy. Available at: <https://lib.ui.ac.id/file?file=digital/2017-5/20451665-1t700588.pdf> (Accessed: 15.12.2022).

⁷ Korean Government to Spend \$25 Million USD On Online K-Pop Concerts Next Year. Available at: <https://www.koreaboo.com/news/korean-government-spend-25-million-usd-online-kpop-concerts-next-year-including-building-online-concert-venue/> (Accessed: 15.12.2022).

⁸ Seoul City, Kakao agree to launch Korea’s 1st K-pop concert arena. Available at: https://www.koreatimes.co.kr/www/nation/2022/05/281_326778.html (Accessed: 15.12.2022).

the construction of the famous Dongdaemun Design Plaza – the largest art space specializing in design.

2. Creative industries as a mission.

Awardees of Billboard Music Awards and some of the most popular Korean idols – G-Dragon, August D, and RM – started their career when they were still teenagers and dedicated a lot of their time to studying dancing and performing arts. E-sports athletes are in top five most popular professions in Korea¹ and now have an education infrastructure including school and university courses.² In advertising and design, despite the lesser attention to those areas from the government, the most successful companies, like CHEIL Worldwide, HS Ad, and DAEHONG Communications, are included in large financial and industrial conglomerates – “chaebols” Samsung, LG, and Lotte, respectively, which HR policy revolves around the track record and experience of their workers.

3. Advanced business strategies.

Corporate spirit in the creative industries of the Republic of Korea is visible not only in advertising and design. K-pop groups are used as thoroughly thought-through investment projects. Those groups that introduce innovations into their music often become the most successful. For example,

2NE1 girl band chose a new, more impressive style of costumes, and NCT boy band uses many unusual sounds in their songs, for example sirens. K-pop projects are also not strangers to applying managerial and organizational innovations. For example, SuperM became the first ever pop group made up of participants from other groups, and the band EXO has no limit to the number of its members.

4. Active and positive media positioning. It was Seoul where the first TV channel appeared that broadcasts video games and related content – OGN (Ongamenet)³, and the role of media channels in the K-pop success story is hard to overestimate. There is a theory that active production and distribution of content by K-pop idols on various national and international social platforms helped them attract a large fanbase.⁴ Idols’ active sharing of everyday lives made their fans very emphatic and, as a result, actual fandoms have emerged. Such a phenomenon used to be typical for completely different creative industries: electronic games, films, animation, and literature (mostly, in fantasy and sci-fi genres). Remarkably, most K-pop idols demonstrate only socially approved behavior. For example, it is impossible to find a bureau with a rebellious streak among Korean design agencies that

¹ Inside the ‘Deadly Serious’ World of Esports in South Korea. Available at: <https://www.nytimes.com/2021/06/19/world/asia/south-korea-esports.html> (Accessed: 15.12.2022).

² Want to be a pro gamer? Look no further than Game Coach Academy. Available at: https://www.espn.com/esports/story/_/id/24754523/game-coach-academy-seoul-south-korea-max-kim (Accessed: 15.12.2022).

³ World’s 1st esports channel OGN up for sale; valued at \$8.9 million. Available at: [https://www.kedglobal.com/\[exclusive\]-e-sports-m-as/newsView/ked202105210007](https://www.kedglobal.com/[exclusive]-e-sports-m-as/newsView/ked202105210007) (Accessed: 15.12.2022).

⁴ How Social Media Helped K-Pop Become a Global Phenomenon. Available at: <https://www.nyucommclub.com/content/2021/11/24/how-social-media-helps-k-pop-become-a-global-phenomenon> (Accessed: 15.12.2022).

won international awards, and in 2021, the Cinderella Law¹ expired that was in force for 10 years, banning children's access to online games during the nighttime.

These success factors behind creative industries may seem different at a first glance, but they demonstrate one thing – a consistent technological approach from compa-

nies and their employees, as well as the public sector. Whether the high institutionalization of the creative sector and its adherence to business routines will threaten artistic expression and inspiration, is something we have yet to see. Meanwhile, Korean creative industries feel confident even when compared to their closest and most fierce competitors: China and Japan.

¹ South Korea to abandon 'Cinderella Law' that prevents minors from playing online games at night. Available at: <https://gameworldobserver.com/2021/08/25/south-korea-to-abandon-cinderella-law-that-prevents-minors-from-playing-online-games-at-night> (Accessed: 15.12.2022).

The Calling of the Heart

Creative leaders gravitate toward one another, rather than toward high tech stars

A great example of how different creative areas gravitate toward one another is when fashion designers outfit music and film stars in their clothes—just remember Vivienne Westwood and the Sex Pistols and how successful that collaboration was. At the same time, the cultural nucleus of creative industries, which includes arts and literature, is quite strongly tied not only to other adjacent activities, but also to science. Thus, the chances that cities with a prominent cultural nucleus¹ would have equally

developed creative industries and R&D is on average 17% higher when compared to other cities. The reason could be that literature, visual, and performing arts generate a special symbolic capital that works as an inspiration for creatives and scientists. In particular, there are cases when researchers became popular in the world of arts. For example, Nobel Prize laureates in Physics Walter Gilbert from Boston and in Physiology and Medicine Roger Guillemin from San Diego found themselves in arts.

In global cities, the high concentration² of leaders in several creative industries is 20% more frequent than the synergy of creative and high-tech leaders.

¹ The city is in the top 40 by the number of creative leaders in the cultural nucleus.

² The high concentration of creative leaders in the city means the city's inclusion in the top 40 by one of the indicators in the Creative Industries block. The high concentration of technological leaders in the city means the city's inclusion in the top 40 by one of the indicators in the Technological Development block.





4

Urban Environment

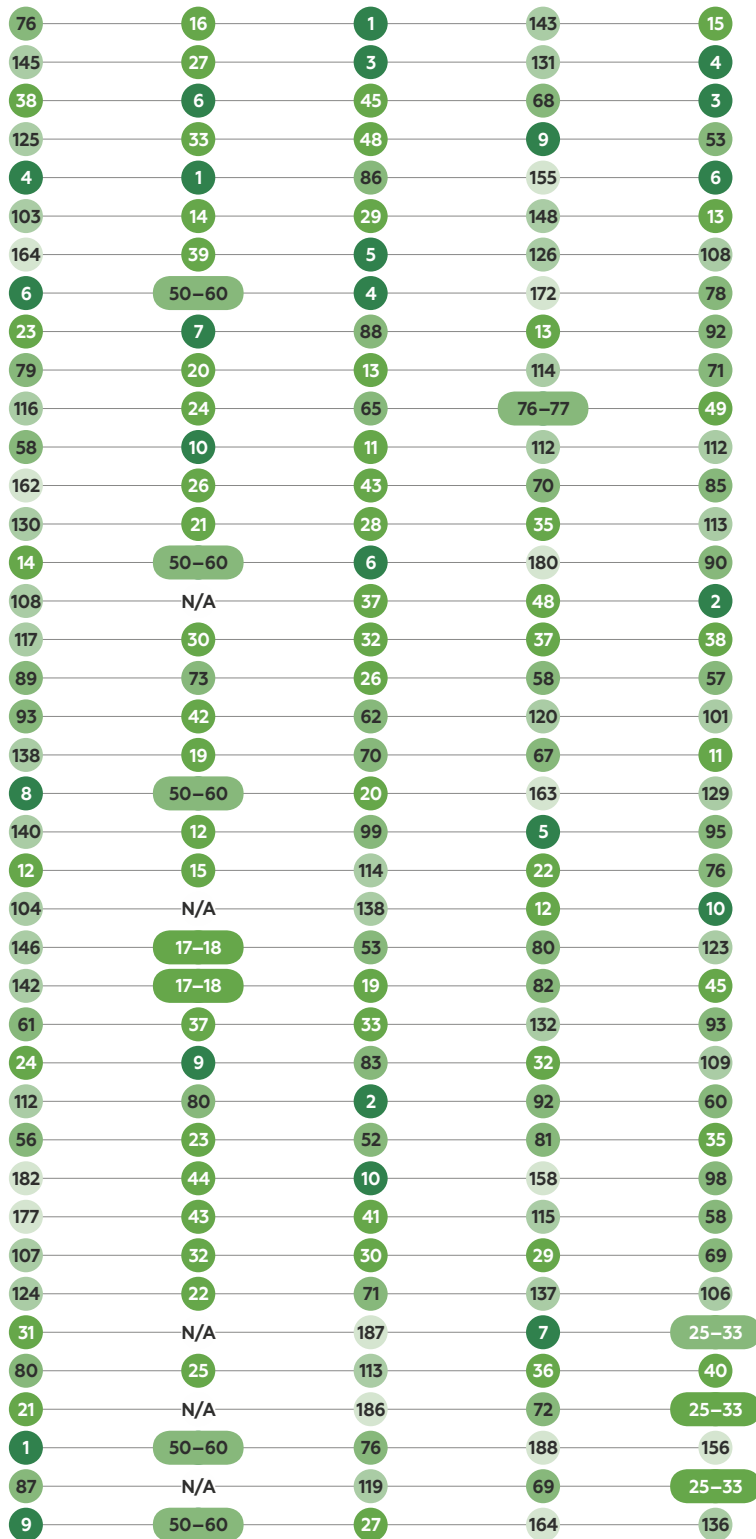
Cities' Ranking by the Urban Environment Subindex: 2023



4. URBAN ENVIRONMENT

ranks

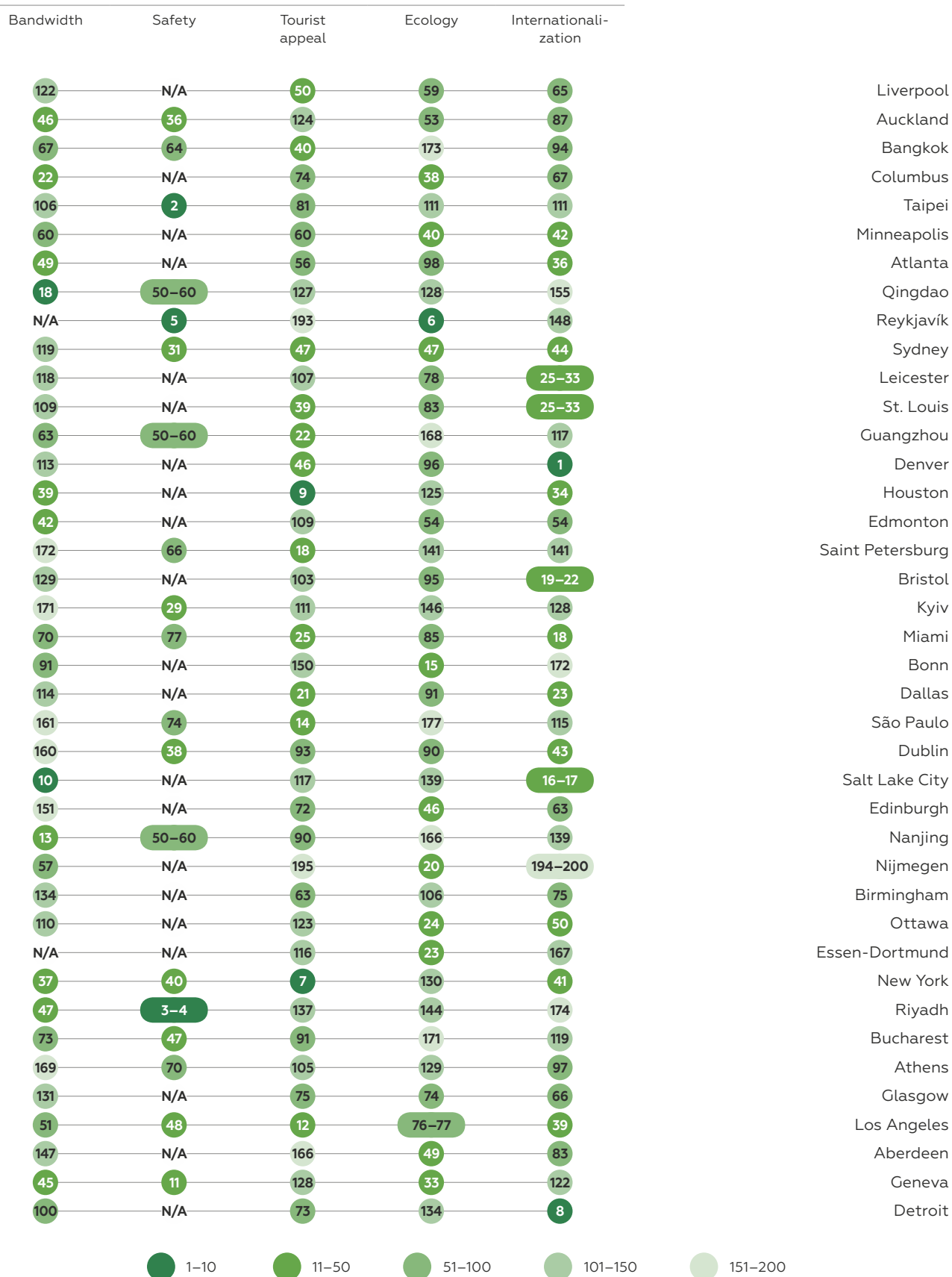
Bandwidth Safety Tourist appeal Ecology Internationalization





(continued)

ranks





(continued)

ranks

Bandwidth Safety Tourist appeal Ecology Internationali-
zation

66	N/A	118	25	74
126	N/A	100	30	19–22
30	N/A	136	57	79
77	N/A	104	117	55
36	8	134	11	130
137	N/A	8	122	88
133	N/A	120	113	25–33
15	N/A	42	154	125
N/A	N/A	192	41	81
167	69	89	152	96
62	N/A	142	64	16–17
29	N/A	31	75	62
71	N/A	161	4	162
40	62	55	43	68
135	3–4	139	157	163
3	N/A	168	2	183
173	N/A	184	18	84
123	N/A	144	3	61
48	N/A	156	17	138
158	28	59	140	103
127	N/A	131	101	82
34	50–60	57	169	152
25	50–60	51	189	147
94	N/A	106	73	132
17	N/A	58	79	52
166	78	44	156	135
53	N/A	146	99	9
128	N/A	163	8	176
102	N/A	143	34	187–190
75	N/A	200	39	25–33
72	N/A	197	19	169–171
55	N/A	49	124	47–48
41	N/A	158	27–28	80
65	N/A	16	87	7
96	N/A	129	94	127
153	N/A	125	14	182
101	45	172	121	25–33
82	82	17	108	37
35	N/A	68	119	51
98	79	84	161	124

1–10

11–50

51–100

101–150

151–200

Boulder
Perth
Durham
Las Vegas
Zürich
Osaka
Coventry
Hangzhou
Brighton
Kuala Lumpur
New Haven
Nashville
Malmö
Boston
Jeddah
Aalborg
Exeter
Canberra
Gothenburg
Brussels
Leeds
Chongqing
Wuhan
Porto
Austin
Rio de Janeiro
Sacramento
Heidelberg
Hanover
Kitchener
Leiden
Phoenix
Santa Cruz
Washington, D.C.
València
Leipzig
Hamilton
Chicago
Philadelphia
Santiago



(continued)

ranks

Bandwidth Safety Tourist appeal Ecology Internationali-
zation

43	N/A	36	71	46
170	34	24	149	107
120	N/A	97	66	178
157	N/A	165	65	70
64	50–60	102	136	143
132	N/A	175	97	160
33	N/A	92	89	151
26	N/A	176	27–28	175
105	N/A	85	63	159
155	N/A	66	60	118
150	35	34	153	100
121	N/A	82	88	157
74	N/A	61	61	47–48
111	N/A	182	21	194–200
144	N/A	77	118	91
20	N/A	67	103	73
188	67	148	165	150
68	N/A	152	16	137
11	N/A	181	44	153
148	N/A	151	42	59
2	N/A	126	N/A	5
176	84	178	138	64
143	N/A	132	45	192
168	N/A	69	102	72
192	13	133	193	121
52	41	15	109	14
81	N/A	190	52	181
69	N/A	171	31	146
N/A	N/A	194	56	77
189	61	169	184	89
90	N/A	173	1	169–171
136	N/A	177	62	19–22
85	N/A	121	86	165
99	N/A	54	50	56
83	N/A	35	142	131
180	71	108	192	104
185	63	167	175	177
184	68	170	183	102
183	65	155	170	134
187	72	122	187	99

San Diego
Rome
Düsseldorf
Cambridge
Changsha
Leuven
Toulouse
Eindhoven
Nagoya
Hamburg
Milan
Cologne
Portland
Braunschweig-Salzgitter-Wolfsburg
Manchester
Pittsburgh
Tbilisi
The Hague
Aarhus
Oxford
Cuyahoga
Johannesburg
Nuremberg
Memphis
Cairo
San Francisco
Groningen
Basel
Washtenaw
Mumbai
Bern
Santa Barbara
Xiamen
Seattle
Shenzhen
Delhi
Almaty
Bangalore
Chennai
Lima



	Urban Environment Subindex rank	Sections'		
		Cost of doing business	Cost of living	Mobility
Ankara	161	22	1	137
Jakarta	162	21	27	182
Mexico City	163	86	41	168
Stuttgart	164	84	74	78
Utrecht	165	125	142	129
Bogotá	166	99	11	172
Xi'an	167	40	4	181
Tehran	168	27	24	173
Rochester	169	178	132	193
Hsinchu	170	59	49	49
Cork	171	93	103	141
Lyon	172	159	107	101
Dalian	173	33	38	187
Taichung-Changhua	174	26	42	28
Raleigh	175	175	N/A	194–200
Gent	176	117	86	179
Cape Town	177	92	44	171
Jinan	178	31	23	190
Beirut	179	7	97	155
Grenoble	180	149	76	106
Tsukuba	181	121	54	194–200
Harbin	182	37	29	188
Lausanne	183	158	186	116
Hefei	184	41	39	191
Rotterdam	185	98	129	114
Florence	186	147	83	91
Bologna	187	153	62	89
Marseille	188	108	77	65
Padua	189	66	53	140
Antwerp	190	130	112	167
Venice	191	77	136	132
Fuzhou	192	186–187	40	189
Lagos	193	10–11	50	192
Tel Aviv	194	122	175	108
Manila	195	12	31	175
Turin	196	154	91	109
Zhenjiang	197	186–187	6	194–200
Benton City	198	145–146	N/A	194–200
Daejeon	199	10–11	N/A	194–200
Hampden	200	198	N/A	194–200

1–10

11–50

51–100

101–150

151–200

(continued)

ranks

Bandwidth	Safety	Tourist appeal	Ecology	Internationalization	
186	N/A	149	147	144	Ankara
190	76	64	185	114	Jakarta
178	75	78	179	105	Mexico City
154	N/A	96	100	173	Stuttgart
88	N/A	157	55	154	Utrecht
174	81	115	162	116	Bogotá
28	N/A	23	194	179–180	Xi'an
191	46	189	178	126	Tehran
54	N/A	183	104	19–22	Rochester
139	N/A	191	135	193	Hsinchu
141	N/A	198	51	186	Cork
44	N/A	38	116	179–180	Lyon
27	N/A	98	159	185	Dalian
152	N/A	180	182	164	Taichung-Changhua
5	N/A	112	N/A	12	Raleigh
78	N/A	141	93	142	Gent
181	86	159	84	86	Cape Town
16	N/A	145	174	194–200	Jinan
193	49	179	195	133	Beirut
50	N/A	164	123	191	Grenoble
95	N/A	188	10	184	Tsukuba
19	N/A	135	181	194–200	Harbin
92	N/A	174	26	149	Lausanne
32	N/A	95	176	161	Hefei
86	N/A	147	150	140	Rotterdam
175	N/A	101	107	145	Florence
156	N/A	154	127	158	Bologna
97	N/A	79	167	194–200	Marseille
165	N/A	162	145	194–200	Padua
59	N/A	130	133	187–190	Antwerp
159	N/A	80	151	166	Venice
84	N/A	94	110	187–190	Fuzhou
194	83	199	190	120	Lagos
163	N/A	153	105	169–171	Tel Aviv
179	85	160	191	110	Manila
149	N/A	140	160	168	Turin
7	N/A	87	186	194–200	Zhenjiang
N/A	N/A	196	N/A	25–33	Benton City
115	N/A	185	N/A	187–190	Daejeon
N/A	N/A	110	N/A	24	Hampden



1–10



11–50



51–100



101–150



151–200

All global innovation-attracting centers have high quality infrastructure and a cutting-edge urban environment. However, there are fairly significant differences between them that reveal two approaches to creating advantages over fellow competitors for talent and global innovation excellence. The first approach entails the rapid development of digital services and transport coupled with a high level of internationalization and diversity of cultural life. This approach is typical for cities such as New York, London, San Francisco, and Paris. The downsides of advanced infrastructural development and deep international integration are the high cost of living and doing business. This approach's limitations become the advantages of an alternative path that offers affordable conditions for entrepreneurship and residence. This path has been chosen by Moscow, Istanbul, Buenos Aires, and Seoul.

<p>The level of development and comfort of urban spaces for living, doing business, and creativity paints the city's image in the eyes of representatives of the innovative class. For their evaluation we used the Urban Environment Subindex. It includes 30 indicators grouped into eight sections:</p> <ul style="list-style-type: none">● Cost of doing business (5 indicators)● Cost of living (7)	<ul style="list-style-type: none">● Mobility (2)● Bandwidth (2)● Safety (2)● Tourist appeal (7)● Ecology (1)● Internationalization (4). <p>The city's rank in the corresponding sub-ranking revealed how different conditions in different world centers secure their success in the global pursuit of talent.</p>
---	---

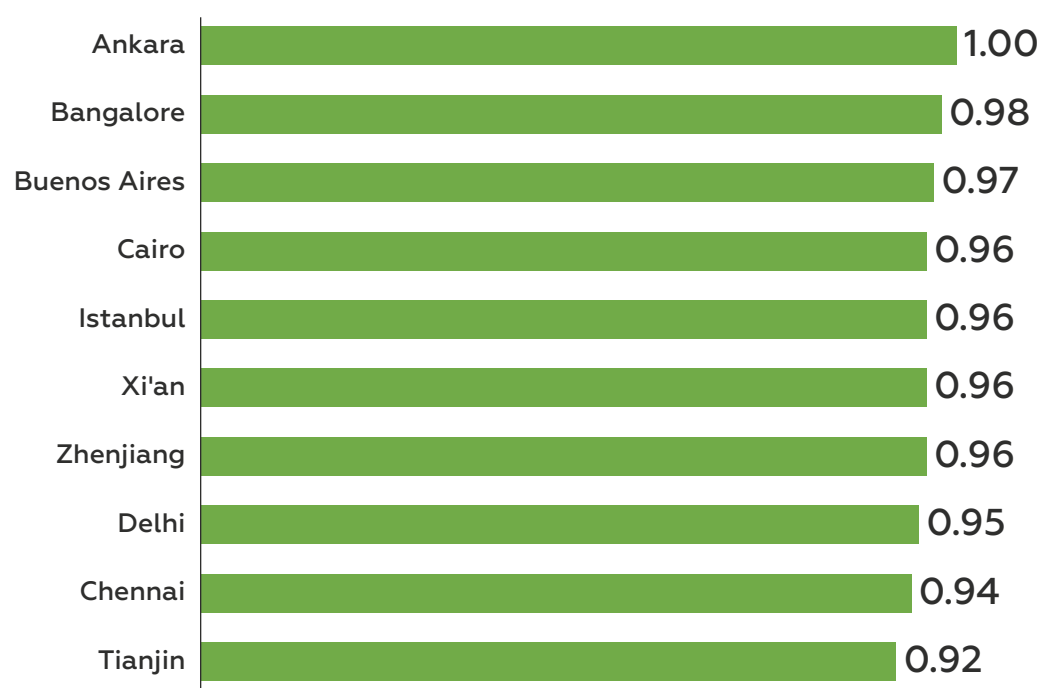
When Cutting Costs Leads to Cutting-Edge Innovation

Do cities with affordable living open windows of opportunities for innovators or create extra risks?

The defining factor of a city’s affordability for living and doing business (shown in Figures 31–32) is the quality of life in the country where it is located. In the upper ranks of the two corresponding sub-rankings, there are practically no cities from high-income countries

(excluding Budapest and Bucharest in the top 10 by the cost of doing business) and most of them are countries with higher income (Argentina, Brazil, China, Russia, and Türkiye), and below average (Egypt and India), according to the World Bank classification.¹

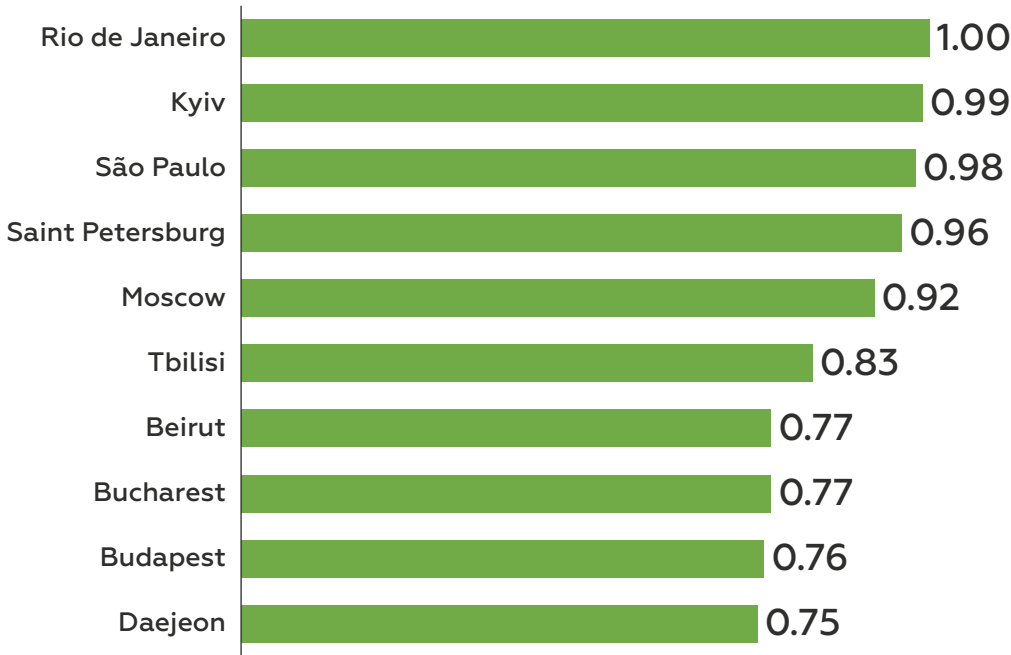
Figure 31. Top 10 HSE GCII Cities by the Cost of Living: 2022 (Normalized Estimate)



Source: HSE University.

¹ World Development Report 2022: Finance for an Equitable Recovery. The World Bank Group. Available at: <https://openknowledge.worldbank.org/bitstream/handle/10986/36883/9781464817304.pdf> (Accessed: 15.12.2022).
World Bank Country and Lending Groups. Available at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> (Accessed: 15.12.2022).

Figure 32. Top 10 HSE GCII Cities by the Cost of Doing Business: 2022 (Normalized Estimate)



Source: HSE University.

For example, an average lunch at low-cost food outlets in Chennai will cost 1 USD¹ and a cup of coffee – only 30 cents. Ankara draws people in by offering extremely affordable apartment rental costs (on average, 192 USD per month) and long-term living (263 and 100 USD for an expat and a local, respectively), and São Paulo and Rio de Janeiro does so with some of the lowest tax rates.

At the same time, the city’s attractiveness for innovators today is not limited to price factors alone. Moscow, for example, is ranked 1st among others by the development of innovation infrastructure. Bangalore is 21st

by venture capital development. Zhejiang is in the top 10 cities by the Internet speed and boasts a smart public transportation system created in cooperation with IBM.² Among them are megacities that made breakthroughs in the selected high tech and creative industries. For example, Istanbul is ranked 5th by advertising and PR and São Paulo is in the top 20 by five creative industries (fashion, film and animation, advertising and PR, architecture, and industrial design).

All mentioned cities, other than Buenos Aires, are at the bottom or even outside of the HSE GCII top 100 by the level

¹ Top 12 Budget Restaurants in Chennai Where Just Rs.100 Is Enough. Available at: <https://chennaimemes.in/top-12-budget-restaurants-in-chennai/> (Accessed: 21.12.2022).

² Chinese city taps IBM for transport tech upgrade. Available at: <https://www.zdnet.com/article/chinese-city-taps-ibm-for-transport-tech-upgrade/> (Accessed: 21.12.2022).

of openness (for example, Daejeon and Xi'an only have one or two international schools). That is why one can postulate with a certain degree of probability that one of the reasons behind the low cost of living and doing business is the lack of strong inflow of skilled foreign specialists and investors. New residents, whose appearance is evidence of a city's innovation development, inevitably provoke a price hike on real estate and consumer commodities markets. All traditional centers of innovation from the top 10 cities in the Technological Development Subindex once went through such internationalization and today they are proving to be quite expensive to live and do business. On the one hand, this creates a barrier for migrating talent, on the other hand, works as a natural filter screening most effective representatives of the innovative class.

Another feature of cities with very affordable conditions of living and doing business is the less-than-ideal ecological situation. For example, Delhi, Cairo, and Xi'an have some of the highest levels of environmental pollution (rank 192nd to 194th by the corresponding indicator). Often this low cost of living and business mean fewer cultural sites and less access to sports and other facilities. However, it should be noted that there may always be some exceptions. For example, Moscow, which was included in the top 10 cities by the cost of doing business, is at the same time one of the most attractive cities in the world for tourism (ranked 5th) due to a high concentration of tourist attractions (594 objects), recreational areas (88 places), and sports venues (eight stadiums). In a similar way, Istanbul combines a moderate cost of living with great tourist appeal (ranked 7th and 10th, respectively).

Therefore, low costs of living and doing business provide innovators with a window of opportunity along with other competitive advantages such cities can offer, like cultural and sports facilities. However, such affordability may be temporary and linked to some weaknesses in the urban environment.

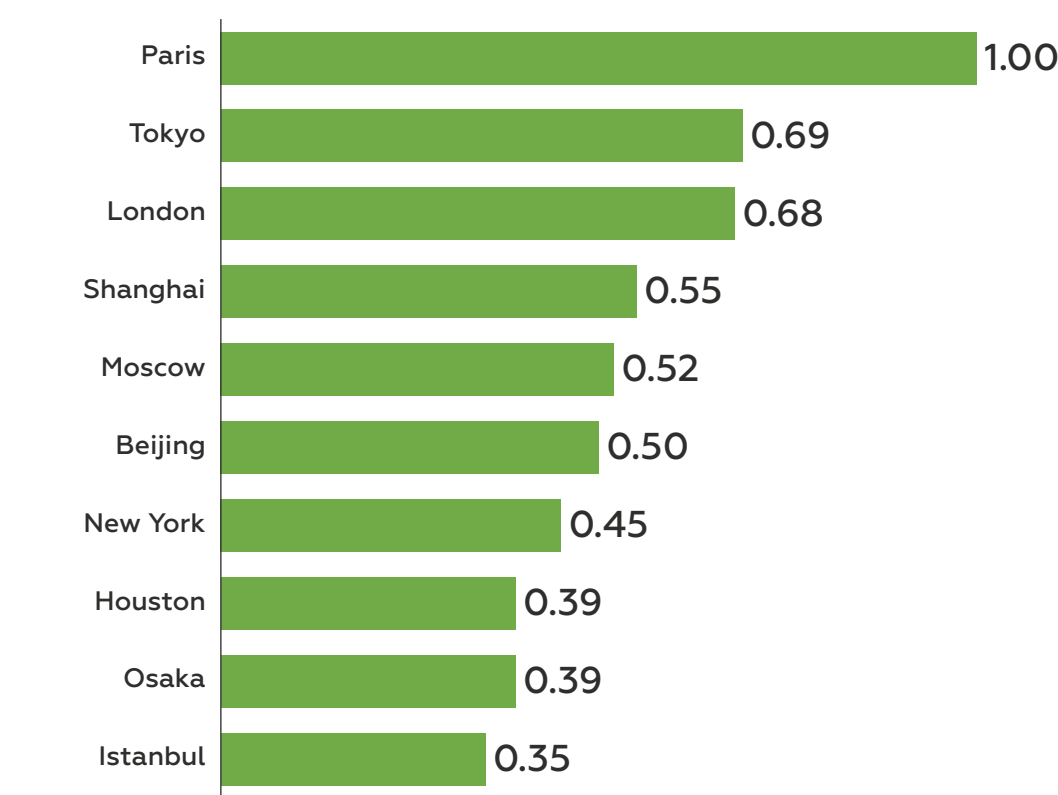
Tourism as an Attribute of Innovation Attractiveness

Travelers and innovators choose the same cities

According to our estimates, under otherwise equal conditions, locations with developed tourism and entertainment more often are chosen by technological entrepreneurs, and the majority of innovation-attractive

cities also become popular among tourists. Thus, seven global tourism centers from the top 10 are leaders in the overall HSE GCII 2023 ranking (Figure 33).

Figure 33. Top 10 HSE GCII Cities in Tourist Appeal: 2022 (Normalized Estimate)



Source: HSE University.



Apart from that, four out of ten cities in the top positions for tourist appeal – those with unique places, tourist attractions, recreational areas, museums, theatres, and stadiums (Table 3) – are included among the top 10 cities in the venture capital ranking, in particular – those cities in the top 10 by the number of unicorns (Paris, London, New York, and Los Angeles). On top of that, those four cities account for about 10% of places of cultural entertainment in all HSE GCII 2023 cities (2,425 unique places out of 20,822) and, simultaneously, about 18% of unicorns (218 out of 1,217). Such a phenomenon could be explained by the fact that

in those cities tourist attractions not only reflect key milestones in world history and culture, they also gain special meanings that the leaders of high tech and creative industries may find attractive. For example, Manhattan skyscrapers in New York are not only famous as tourist destinations, they also symbolize the progress of construction technologies. In addition, Montmartre in Paris continues to be a district where artists choose to live. Many innovators also prefer to settle down in cities with an advanced urban environment because they are capable of satiating their inquisitive minds on a daily basis and give a feeling of a perpetual journey.

Table 3. Top 10 HSE GCII Cities by Venues of Culture, Entertainment, and Sports: 2022

Rank	Overall Tourist Appeal	Unique places	Tourist attractions	Recreational areas	Museums and art galleries	Theatres	Stadiums
1	Paris	Paris	Paris	Tokyo	Tokyo	London	London
2	Tokyo	Tokyo	Tokyo	Osaka	Moscow	Moscow	Tokyo
3	London	Moscow	Moscow	Liverpool	London	Tokyo	Buenos Aires
4	Shanghai	Saint Petersburg	Osaka	Quebec	Osaka	New York	Moscow
5	Moscow	Osaka	Saint Petersburg	Saint Petersburg	Quebec	São Paulo	Seoul
6	Beijing	London	London	Rome	Saint Petersburg	Paris	Istanbul
7	New York	Milan	Barcelona	Venice	Seoul	Quebec	Osaka
8	Osaka	Rome	Liverpool	Moscow	New York	Rio de Janeiro	São Paulo
9	Houston	Guangzhou	Vienna	Beijing	Paris	Saint Petersburg	Paris
10	Istanbul	Madrid	Amsterdam	Taipei	Prague	Los Angeles	San Francisco

Source: HSE University.

Another interesting aspect to consider is that cities leading in tourist appeal have their own “infrastructure profile”. For example, Paris stands out for unique places¹ and tourist attractions, Tokyo is famous for recreational areas and museums, and London’s main specialty is theaters and stadiums. Moscow’s profile can be called universal: the Russian capital is ranked 2nd by the number of

theaters, museums, and art galleries, 3rd – by unique places and tourist attractions, and lags slightly behind top positions for the number of stadiums (ranked 4th) and recreational areas (8th). Each city that occupies top ranks by the aforementioned indicators is a historical center and a hot spot on the economic map of the world.

Cultural Profile of Moscow

ranked 2nd
by the number of theaters,
museums, and art galleries

ranked 4th
by the number of stadiums

ranked 3rd
by the number of unique places
and tourist attractions

ranked 8th
by the number
of recreational areas

¹ Places mentioned on Tripadvisor as Points of Interest & Landmarks or Mysterious Sites.

For Mobile Internet, Go to Scandinavia, for Broadband, Go to China

Which cities offer innovators the highest speeds for accessing the world wide web?

Among the top 10 cities in HSE GCII 2023 by mobile and broadband Internet speed, especially prominent are groups of Chinese cities and those of Scandinavian countries (Table 4).

Table 4. Top 10 HSE GCII Cities by the Speed of Mobile and Broadband Internet: 2022

Top 10 Cities by the Mobile Internet speed		Top 10 Cities by the Broadband Internet speed	
City	Country	City	Country
Tianjin	China	Tianjin	China
Aalborg	Denmark	Hong Kong	China
Aarhus	Denmark	Chengdu	China
Oslo	Norway	Beijing	China
Stockholm	Sweden	Suzhou	China
Hangzhou	China	Austin	United States
Eindhoven	Netherlands	Cuyahoga	United States
Copenhagen	Denmark	Shanghai	China
Salt Lake City	United States	Qingdao	China
Zhejiang	China	Dalian	China

Source: HSE University.

Chinese megacities occupy eight of ten top places by fixed broadband Internet speed, cities of Denmark, Norway, and Sweden occupy five out of ten by mobile Internet speed. The leadership of Scandinavian cities is tied to their advanced infrastructure, which was created with the participation of the

globally renowned telecommunications companies – Ericsson and Nokia. Chinese cities’ success, in turn, is secured by active policy measures: the Public Broadband China Strategy¹ adopted in 2013 includes measures to directly increase broadband Internet speed and lower relevant tariffs.

¹ CAICT. Broadband China Strategy and its Implementation. Available at: <https://www.unescap.org/sites/default/files/Broadband%20China%20Strategy.pdf> (Accessed: 21.12.2022).

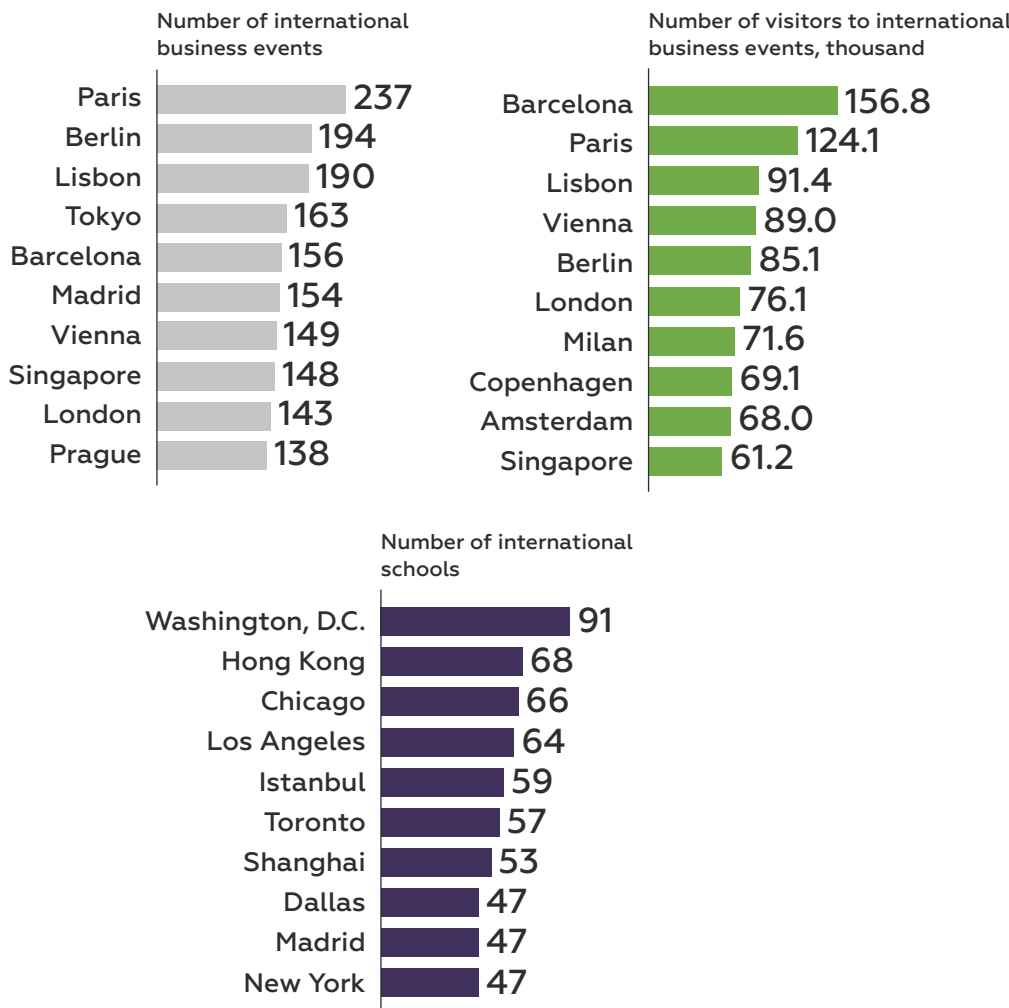
Here Flags of Foreign Nations All, by Waters New to Them Will Call¹

The most open cities in the world
and how to get to them

Cities leading by internationalization indicators (Figure 34) use their favorable conditions – geographical, administrative, economic – for preemptive expansion: Singapore is a crossroads of trade

routes between Northern and Southern Hemispheres, Washington, D.C. is the capital of the largest economy in the world¹, London and Hong Kong are global financial centers.

Figure 34. Top 10 HSE GCII Cities in Internationalization: 2022



Source: HSE University.

¹ Alexander Pushkin (1833) The Bronze Horseman: A Tale of Petersburg. Translated by Walter Arndt.

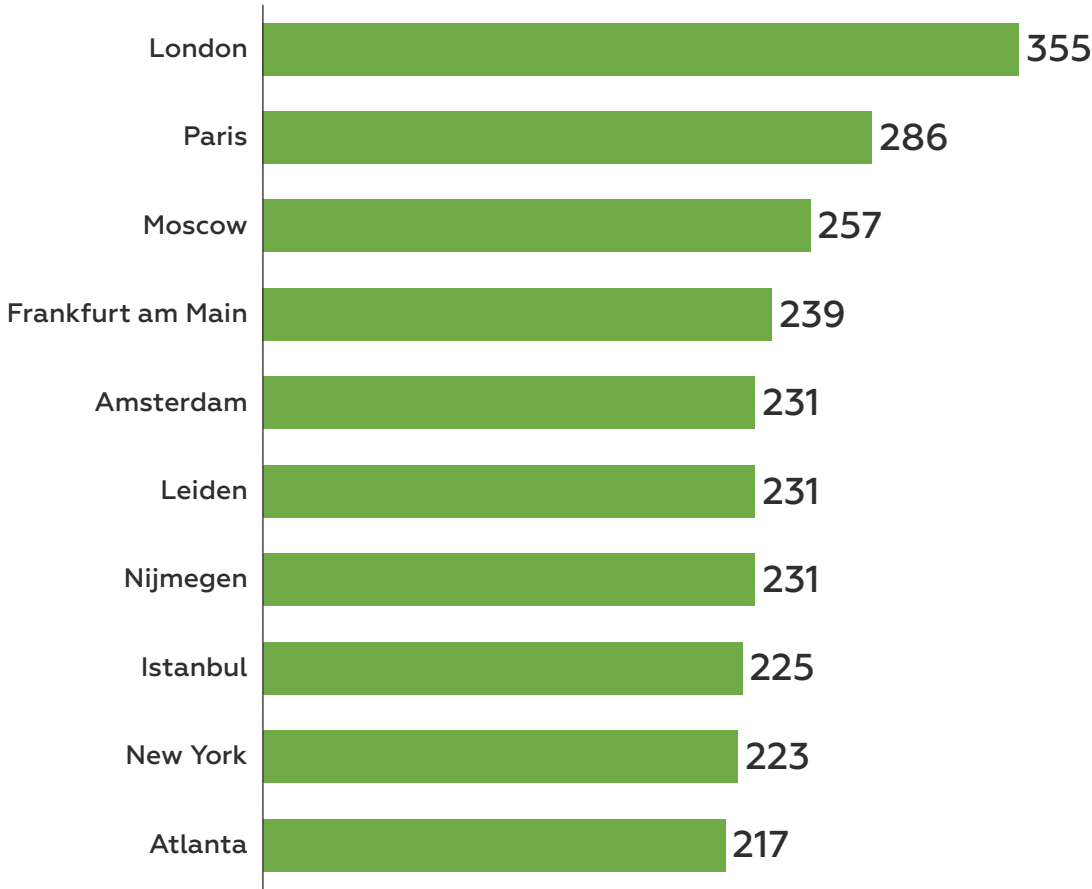
² IMF. GDP, current prices (2022). Available at: <https://www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/ADVEC/WEO WORLD> (Accessed: 21.12.2022).

Most open cities are also the safest (Singapore and Hong Kong are ranked 3rd and 6th by internationalization and 6th and 1st – by safety, respectively).

Interestingly, nine of the top 10 cities with the most visited international business events are located in European countries. Similarly, the top 10 most mobile cities are exclusively in European countries, including the

Netherlands (Nijmegen, Leiden, Amsterdam), Germany (Frankfurt am Main, Munich), United Kingdom (London), France (Paris), Belgium (Leuven), Spain (Barcelona), and Austria (Vienna). Europe’s domination on this list is secured, first and foremost, by a large number of international airports providing flights to several different directions (Figure 35).

Figure 35. Top 10 HSE GCII Cities by Air Traffic: 2022



Source: HSE University.

METHODOLOGY AND STATISTICAL AUDIT

Methodology

This ranking was created due to the need for an objective comprehensive measurement of cities’ innovation development on a global scale. The research methodology is based on the following principles:

- the equal representation of two key aspects of innovation – technology and creativity, as well as taking into account the characteristics of the urban environment
- the use of reliable data sources on global science leaders, technological entrepreneurs, and creatives: international platforms, aggregators, and rankings that comply with the requirements of transparency, verifiability, and wide coverage
- data collection for agglomerations.

Creation of the Database and Sample for HSE GCII 2023

In order to calculate the ranking and the associated indicators, a bulk of the data was collected and subjected to a qualitative evaluation in terms of the factors attracting leading participants of global innovation to the cities in question (Figure 36).

Figure 36. Algorithm for Calculating HSE GCII 2023



Source: HSE University.

In order to include all possible centers of innovation activity, the first stage involved creating a database of 2,769 unique locations from 135 countries with at least one innovation economy leader (individual or enterprise). This database included the indicators calculated with the help of various ratings and databases containing information on a limited number of exceptional representatives of the high tech and creative industries (Table 5).

Table 5. Indicators Forming a List of Localities for HSE GCII 2023

No.	Indicators reflecting the presence of innovation economy leaders	Number of innovation economy leaders	Number of localities with innovation economy leaders	Number of countries with innovation economy leaders
1	Leading companies by R&D expenditure	2,500	830	41
2	Unicorns	1,302	281	47
3	Leading universities	2,051	1,267	106
4	Leading R&D organizations	500	335	34
5	Highly cited researchers	6,332	820	76
6	Nobel Prize laureates and Fields Medal winners	384	142	43
7	Leading business schools	185	118	42
8	Clusters	71	63	27
9	Technology and science parks	306	251	77
10	Supercomputers	293	119	30
11	Top-rated film production companies (audience)	913	170	48
12	Film production companies that won international film festival awards	370	123	59
13	Animation film production companies that won international festival awards	155	59	27
14	The Game Awards winners	100	56	17
15	Largest e-sports tournaments	343	96	34
16	Developers of most popular computer games	83	59	21
17	Companies participating in electronic games trade shows	175	116	27
18	Artists with highest-grossing albums	77	45	23
19	Most-streamed artists	128	64	22
20	Best opera performers	164	61	23
21	Largest fashion companies	97	71	15

(continued)

No.	Indicators reflecting the presence of innovation economy leaders	Number of innovation economy leaders	Number of localities with innovation economy leaders	Number of countries with innovation economy leaders
22	Fashion brands	2,589	487	56
23	Most effective advertising agencies	198	61	47
24	Largest PR agencies	249	81	27
25	Creative production agencies	98	42	27
26	Top advertising agencies	106	41	24
27	Pritzker Architecture Prize laureates	50	28	19
28	Internationally recognized architects and architecture firms	232	102	43
29	Internationally recognized designers and design firms	367	169	41
30	Internationally recognized artists	163	54	29
31	Top artists by auction revenue	206	59	28
32	Most influential people in contemporary art	124	44	29
33	Leading higher education institutions in the arts	805	538	64
34	Best-selling authors	264	156	25
TOTAL		21,980	2,769	135

Source: HSE University.

It became obvious that innovations were not limited to administrative borders. As a way to capture innovation attractiveness more accurately, global cities were clustered into agglomerations, for which purpose the following approaches were used (Table 6):

- the inclusion of Functional Urban Areas (FUA) for OECD countries
- the use of national approaches to define agglomerations
- an independent definition of agglomerations based on additional auxiliary data sources.

Table 6. Agglomeration Approaches in Different Countries

No.	Agglomeration approach	Countries where this agglomeration approach was applied to cities	Number of localities with innovation economy leaders	Number of localities as agglomerations
1	Inclusion of Functional Urban Areas (FUA)	Australia, Austria, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, Norway, Poland, Portugal, Republic of Korea, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States of America	1,997	1,128 (of which 645 FUA)
2	Use of national approaches to define agglomerations	Brazil, India, South Africa	147	124 (of which 57 agglomerations)
3	Independent definition of agglomerations	Albania, Algeria, Andorra, Argentina, Armenia, Azerbaijan, Bahrain, Bangladesh, Barbados, Belarus, Bolivia, Bosnia and Herzegovina, Botswana, Brunei Darussalam, Bulgaria, Cambodia, China, Congo, Costa Rica, Croatia, Cuba, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Eswatini, Ethiopia, Fiji, Georgia, Ghana, Guatemala, Honduras, Indonesia, Iran, Iraq, Israel, Jamaica, Jordan, Kazakhstan, Kenya, Kosovo, Kuwait, Kyrgyzstan, Lebanon, Liechtenstein, Malaysia, Mali, Malta, Mauritania, Montenegro, Morocco, Mozambique, Monaco, Mongolia, Myanmar, Nepal, New Zealand, Niger, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Puerto Rico, Qatar, Republic of Moldova, Romania, Russian Federation, San Marino, Saudi Arabia, Senegal, Serbia, Singapore, Sri Lanka, State of Palestine, Sudan, Syrian Arab Republic, Thailand, Timor-Leste, Trinidad and Tobago, Tunisia, Türkiye, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Republic of Tanzania, Uruguay, Uzbekistan, Vatican City, Venezuela, Viet Nam	625	500 (of which 91 agglomerations)
TOTAL			2,769	1,752

Source: HSE University.

Note: data for functional urban areas are taken from the corresponding OECD classification (<https://www.oecd.org/regional/regional-statistics/functional-urban-areas.htm>). Some OECD countries' (Türkiye, Israel, New Zealand, and Costa Rica) information on FUA was not available, leading to authors' clustering of agglomerations independently. National approaches to singling out agglomerations in Brazil (<https://www.ibge.gov.br/>), South Africa (<https://www.statssa.gov.za/>), and India (<https://www.census2011.co.in/>) are based on the data taken from the official websites of responsible organizations undertaking statistical audits with a breakdown into these territories. The independent definition approach was performed based on the open source data concerning global agglomerations (<http://www.citypopulation.de/>).

Functional Urban Areas

This approach that creates functional urban areas was developed by the OECD together with Eurostat and helps one answer the question of where densely populated urban zones end and where less dense areas that are not yet integrated into a city's economy begin.

Functional urban areas were created after analyzing census-based information of where residents live and work, including how much they commute day-to-day from less urbanized zones to more urbanized areas (the nucleus). If the area has a specific level of connectivity, established according to individual specifications of each locality, the administrative districts are clustered into one functional urban area characterized by a shared economic space.

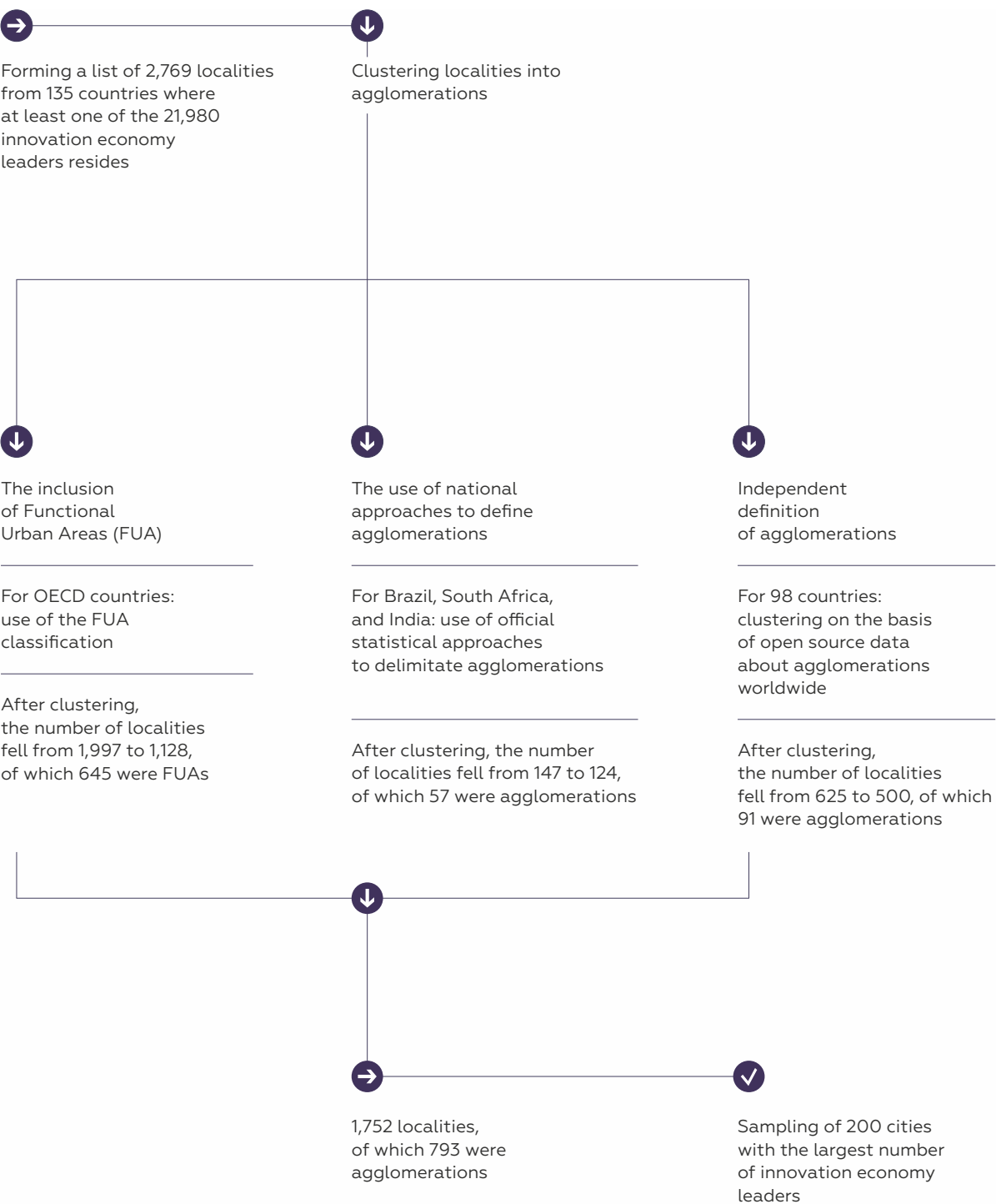
Since this approach is used in OECD countries, it allows one to conduct international comparisons of agglomerations – economic zones identified when one and the same methodology was applied. The obtained OECD classification contains information about 1,197 functional urban areas.

Source: Definition of Functional Urban Areas (FUA) for the OECD metropolitan database. Available at: <https://www.oecd.org/cfe/regionaldevelopment/Definition-of-Functional-Urban-Areas-for-the-OECD-metropolitan-database.pdf> (Accessed: 17.01.2023).

After this procedure was applied, the database shrunk to 1,752 areas – agglomerations and localities that do not form any kind of large urban entities and are not part of any of them. From this list, we selected 200 locations with the largest number of innovation economy leaders for the subsequent calculations and ranking within HSE GCII 2023 (Figure 37, Table 7).

For these cities we collected additional indicators, reflecting the quality of the urban environment, as well as a number of indicators in the Technological Development Subindex ("Startups", "Innovation support funds", "Patent activity", "Publication activity", "Co-working spaces", etc.).

Figure 37. City Sampling Algorithm of HSE GCII 2023



Source: HSE University.

Table 7. Agglomerations and Localities
in the Final Sample of HSE GCII 2023

Agglomeration	Localities within agglomeration	Agglomeration	Localities within agglomeration
1 London (United Kingdom)	Amersham, Borehamwood, Brentford, Edgware, Essex, Harpenden, Harrow, Hatfield, Hertfordshire, Kingston upon Thames, London, Reigate, Romford, Saffron Walden, Sutton, Teddington, Uxbridge, Watford, Woking	5 Paris (France)	Bezons, Boulogne-Billancourt, Bures-sur-Yvette, Cergy-Pontoise, Champs-sur-Marne, Charenton-le-Pont, Clamart, Clichy, Colombes, Courbevoie, Créteil, Eragny, Evry, Gif-sur-Yvette, Issy-les-Moulineaux, Le Plessis-Robinson, Lieusaint, Marne-la-Vallee, Massy, Montreuil, Montrouge, Nanterre, Neuilly-sur-Seine, Orsay, Palaiseau, Paris, Puteaux, Rocquencourt, Rueil-Malmaison, Saint-Denis, Saint-Ouen-sur-Seine, Suresnes, Tremblay-en-France, Vélizy-Villacoublay, Versailles, Villeblevin, Villejuif, Villepinte, Villetaneuse
2 New York, NY (United States)	Armonk, Berkeley Heights, Bridgewater Township, Chatham, Cranbury, East Hampton, Florham Park, Fort Lee, Franklin Lakes, Hackensack, Hempstead, Hoboken, Holmdel, Huntington, Islandia, Jericho, Jersey City, Kenilworth, Laurel Hollow, Mahwah, Maplewood, New Brunswick, New Hyde Park, New York, Newark, Parsippany, Pawling, Piscataway, Purchase, Roseland, Rye Brook, Saddle Brook, Secaucus, Short Hills, Somerset, South Plainfield, Stony Brook, Tarrytown, Tinton Falls, Upton, West Bay Shore, White Plains	6 San Francisco, CA (United States)	Alameda, Belmont, Berkeley, Burlingame, Concord, Cupertino, Danville, Dublin, Emeryville, Foster City, Fremont, Hayward, Hercules, Livermore, Los Altos, Los Gatos, Menlo Park, Milpitas, Mountain View, Nicasio, Novato, Oakland, Palo Alto, Pleasanton, Portola Valley, Redwood City, San Carlos, San Francisco, San José, San Mateo, San Rafael, San Ramon, Santa Clara, South San Francisco, Stanford, Sunnyvale, Walnut Creek
3 Tokyo (Japan)	Akishima, Atsugi, Bunkyo, Chiba, Chigasaki, Chofu, Chuoh, Fuchu, Hachioji, Hayama, Ichikawa, Isehara, Kawasaki, Kazo, Musashino, Narashino, Narita, Niiza, Nishitokyo, Noda, Oiso, Ome, Ota, Saitama, Tokyo, Wako, Yokohama		
4 Beijing (China)	Beijing, Langfang, Zhuozhou		

Rank in HSE GCII 2023

(continued)

Agglomeration	Localities within agglomeration	Agglomeration	Localities within agglomeration
7 Los Angeles, CA (United States)	Aliso Viejo, Altadena, Anaheim, Beverly Hills, Brea, Burbank, Chino, Compton, Costa Mesa, Culver City, El Segundo, Fontana, Glendale, Hawthorne, Huntington Park, Irvine, Lake Forest, Long Beach, Los Angeles, Malibu, Marina Del Rey, Monrovia, Newport Beach, Orange, Pasadena, Rancho Cucamonga, Riverside, San Clemente, Santa Ana, Santa Clarita, Santa Monica, Temecula, Torrance, Tustin, Universal City, Vernon, Walnut, West Hollywood, Westlake Village	13 Washington, D.C. (United States)	Adelphi, Alexandria, Annapolis, Ashburn, Baltimore, Beltsville, Bethesda, Bowie, Chantilly, Chevy Chase, College Park, Columbia, Fairfax, Falls Church, Fredericksburg, Gaithersburg, Germantown, Greenbelt, Herndon, Hunt Valley, Langley, McLean, Morningside, North Bethesda, Reston, Rockville, Silver Spring, Tysons Corner, Vienna, Washington, D.C.
8 Shanghai (China)	Shanghai	14 Shenzhen (China)	Shenzhen
9 Seoul (South Korea)	Ansan, Anyang, Bucheon, Goyang, Incheon, Seongnam, Seoul, Suwon, Yongin	15 Hong Kong (China)	Hong Kong
10 Moscow (Russia)	Dolgoprudny, Moscow	16 Stockholm (Sweden)	Danderyd, Stockholm, Täby, Tumba
11 Boston, MA (United States)	Acton, Andover, Bedford, Beverly, Billerica, Boston, Braintree, Cambridge, Chelmsford, Chestnut Hill, Danvers, Framingham, Lowell, Marlborough, Maynard, Medford, Natick, Newton, North Reading, Sharon, Somerville, Walpole, Waltham, Watertown, Wellesley, Westford, Wilmington, Woburn	17 Guangzhou (China)	Dongguan, Foshan, Guangzhou
12 Berlin (Germany)	Berlin, Großbeeren, Müncheberg, Nuthetal, Potsdam	18 Barcelona (Spain)	Badalona, Barcelona, Castelldefels, Mataró, Terrassa
		19 Madrid (Spain)	Alcalá de Henares, Alcobendas, Getafe, Leganes, Madrid, Móstoles, Tres Cantos
		20 Sydney (Australia)	Haymarket, Kensington, Milperra, Mosman, Ourimbah, Padstow, Penrith, Sydney
		21 Melbourne (Australia)	Burwood, Melbourne, Parkville

(continued)

Agglomeration	Localities within agglomeration
22 Singapore (Singapore)	Singapore
23 Munich (Germany)	Garching, Gilching, Landsberg am Lech, Martinsried, Munich, Neubiberg, Oberhaching, Olching, Planegg, Stockdorf, Taufkirchen, Unterföhring
24 Milan (Italy)	Bresso, Busto Arsizio, Cardano al Campo, Caronno Pertusella, Cernusco sul Naviglio, Concorezzo, Cusano Milanino, Ferno, Giussano, Inverigo, Legnano, Lomazzo, Meda, Milan, Monza, Pieve Emanuele, Rozzano, San Donato Milanese, Sovico
25 Osaka (Japan)	Ashiya, Daitō, Higashiōsaka, Ikoma, Kashihara, Kobe, Kyoto, Moriguchi, Nagaokakyō, Neyagawa, Nishinomiya, Osaka, Ōtsu, Sakai, Settsu, Suita
26 Dublin (Ireland)	Dublin, Dún Laoghaire-Rathdown, Maynooth, Swords, Wicklow
27 Suzhou (China)	Changzhou, Jiangyin, Kunshan, Suzhou, Wuxi, Yixing
28 Toronto (Canada)	Aurora, Burlington, Markham, Mississauga, Oshawa, Toronto
29 Copenhagen (Denmark)	Albertslund, Bagsværd, Ballerup, Brøndby, Charlottenlund, Copenhagen, Frederiksberg, Gentofte, Hedehusene, Helsingør, Hørsholm, Humlebæk, Kongens Lyngby, Lyngbe, Nivå, Roskilde, Smørumnedre, Tikøb

Agglomeration	Localities within agglomeration
30 São Paulo (Brazil)	Santo André, São Paulo
31 Montreal (Canada)	Dorval, Laval, Montreal
32 Amsterdam (Netherlands)	Almere, Amsterdam, Badhoevedorp, Haarlem, Hilversum, Hoofddorp, Lijnden, Uithoorn, Zaandam
33 Nanjing (China)	Nanjing, Xiaolingwei
34 Hangzhou (China)	Hangzhou, Jiande, Shaoxing
35 Istanbul (Turkey)	Istanbul, Maslak
36 Chicago, IL (United States)	Berwyn, Chicago, Downers Grove, Schaumburg
37 Taipei (China)	Keelung, New Taipei City, Taipei
38 Seattle, WA (United States)	Bellevue, Bothell, Everett, Kirkland, Redmond, Seattle
39 Vienna (Austria)	Gumpoldskirchen, Laxenburg, Vienna
40 Zürich (Switzerland)	Birmensdorf, Dübendorf, Opfikon, Hinwil, Männedorf, Niederweningen, Pfäffikon, Rümlang, Schlieren, Stäfa, Thalwil, Volketswil, Wollerau, Zürich

(continued)

Agglomeration	Localities within agglomeration
41 Philadelphia, PA (United States)	Ambler, Audubon, Bryn Mawr, Camden, Collegeville, Conshohocken, Ewing Township, Exton, Glassboro, Glen Mills, Haverford, King of Prussia, Malvern, New Castle, Pennsauken Township, Philadelphia, Plymouth Meeting, Pottsgrove, Princeton, Radnor, Solebury Township, Swarthmore, Wayne, Wilmington, Wynnewood, Yardley
42 Buenos Aires (Argentina)	Bernal, Buenos Aires, Pilar, San Martín
43 Warsaw (Poland)	Falenty, Warsaw
44 Atlanta, GA (United States)	Alpharetta, Atlanta, Duluth, Norcross
45 Brussels (Belgium)	Aalst, Brussels, Gembloux, Grand-Rosière, Halle, La Hulpe, Lasne, Ottignies-Louvain-la-Neuve, Wavre
46 Helsinki (Finland)	Espoo, Helsinki, Vantaa
47 Budapest (Hungary)	Budapest, Gödöllő
48 Oslo (Norway)	Asker, Bekkestua, Fornebu, Lysaker, Oslo
49 Vancouver (Canada)	Burnaby, Richmond, Vancouver
50 Prague (Czech Republic)	Prague, Průhonice

Agglomeration	Localities within agglomeration
51 Chengdu (China)	Chengdu
52 Miami, FL (United States)	Boca Raton, Coral Gables, Davie, Fort Lauderdale, Glen Ridge, Miami, Miami Beach, Palm Beach, Palm Beach Gardens, Pembroke Pines, Plantation, Pompano Beach, Tamarac, West Palm Beach
53 Houston, TX (United States)	Galveston, Houston, Spring, The Woodlands, Webster
54 Dallas, TX (United States)	Addison, Arlington, Dallas, Denton, Fort Worth, Irving, Plano, Richardson
55 San Diego, CA (United States)	Carlsbad, Encinitas, Poway, San Diego, Solana Beach
56 Tianjin (China)	Tianjin
57 Essen-Dortmund (Germany)	Bochum, Bönen, Dortmund, Duisburg, Essen, Gelsenkirchen, Mülheim an der Ruhr, Wesel
58 Dubai (United Arab Emirates)	Ajman, Dubai, Sharjah
59 Wuhan (China)	Wuhan
60 Lisbon (Portugal)	Almada, Lisbon

(continued)

Agglomeration	Localities within agglomeration
61 Frankfurt am Main (Germany)	Bad Homburg vor der Höhe, Bad Vilbel, Dreieich, Eschborn, Frankfurt am Main, Hanau, Neu-Isenburg, Offenbach am Main
62 Mumbai (India)	Karjat, Mumbai, Thane
63 Göteborg (Sweden)	Göteborg, Mölndal, Mölndycke
64 Quebec (Canada)	Lévis, Quebec
65 Rome (Italy)	Formello, Rome
66 Edinburgh (United Kingdom)	Bathgate, Edinburgh, Musselburgh
67 Hamburg (Germany)	Bad Oldesloe, Großhansdorf, Hamburg, Norderstedt, Rellingen, Tostedt
68 Geneva (Switzerland)	Bellevue, Eysins, Geneva, L'Abbaye, Meyrin, Montreux, Nyon, Plan-les-Ouates, Rolle, Vernier, Vevey
69 Qingdao (China)	Qingdao
70 Auckland (New Zealand)	Auckland
71 Austin, TX (United States)	Austin, Cedar Park, Round Rock, San Marcos
72 Mexico City (Mexico)	Mexico City, Naucalpan de Juárez

Agglomeration	Localities within agglomeration
73 Brisbane (Australia)	Brisbane, Nathan
74 Bogotá (Colombia)	Bogotá, Chía
75 Bangkok (Thailand)	Bangkok, Nakhon Pathom, Pathum Thani
76 Cambridge (United Kingdom)	Cambridge, Hinxton
77 Delhi (India)	Delhi, Faridabad, Gurugram, New Delhi, Noida
78 Rio de Janeiro (Brazil)	Niterói, Rio de Janeiro
79 Columbus, OH (United States)	Columbus, New Albany
80 Phoenix, AZ (United States)	Cave Creek, Chandler, Paradise Valley, Phoenix, Scottsdale, Tempe
81 Kuala Lumpur (Malaysia)	Bandar Baru Bangi, Bangi, Bukit Jalil, Cyberjaya, Gombak, Kajang, Kuala Lumpur, Petaling Jaya, Sepang, Seri Kembangan, Shah Alam, Subang Jaya
82 Saint Petersburg (Russia)	Saint Petersburg
83 Chongqing (China)	Chongqing
84 Denver, CO (United States)	Broomfield, Denver, Englewood, Golden, Greenwood Village, Westminster

(continued)

Agglomeration	Localities within agglomeration
85 Cairo (Egypt)	El Shorouk, Cairo, Giza, Helwan, New Cairo
86 Edmonton (Canada)	Edmonton
87 Minneapolis, MN (United States)	Eagan, Eden Prairie, Medina, Minneapolis, Red Wing, Saint Paul
88 Cardiff (United Kingdom)	Caerphilly, Cardiff
89 Portland, OR (United States)	Beaverton, Gresham, Hillsboro, Portland, Wilsonville
90 Kyiv (Ukraine)	Kyiv
91 Birmingham (United Kingdom)	Birmingham, Bromsgrove, Gaydon, Royal Leamington Spa, Solihull, Stratford-upon-Avon, Walsall, Wolverhampton
92 Adelaide (Australia)	Adelaide
93 Xi'an (China)	Xi'an, Xianyang
94 Liverpool (United Kingdom)	Lancaster, Liverpool, Ormskirk
95 Reykjavík (Iceland)	Garðabær, Reykjavík

Agglomeration	Localities within agglomeration
96 Detroit, MI (United States)	Auburn Hills, Bloomfield Hills, Clinton Township, Dearborn, Detroit, Northville, Novi, Rochester, Southfield, Troy, Van Buren Township
97 Santiago (Chile)	Santiago
98 Eindhoven (Netherlands)	Eindhoven, Helmond, Veldhoven
99 St. Louis, MO (United States)	Chesterfield, Olivette, St. Louis
100 Bucharest (Romania)	Bucharest, Buftea, Măgurele
101 València (Spain)	Benaguasil, Paterna, València
102 Changsha (China)	Changsha
103 Nagoya (Japan)	Anjō, Chiryū, Gifu, Kariya, Kasugai, Kiyosu, Nagakute, Nagoya, Ōbu, Ōgaki, Ōguchi, Seto, Toyoake, Toyota
104 Ankara (Turkey)	Ankara
105 Coventry (United Kingdom)	Coventry, Warwick
106 Nijmegen (Netherlands)	Nijmegen

(continued)

Agglomeration	Localities within agglomeration
107 Perth (Australia)	Fremantle, Joondalup, Perth
108 Durham, NC (United States)	Chapel Hill, Durham
109 Riyadh (Saudi Arabia)	Riyadh
110 Porto (Portugal)	Maia, Matosinhos, Porto
111 Ottawa (Canada)	Gatineau, Ottawa, Smiths Falls
112 Athens (Greece)	Athens, Kallithea
113 New Haven, CT (United States)	Bethany, Danbury, Milford, New Canaan, New Haven, Norwalk, Sandy Hook, Shelton, Stamford, Wallingford
114 Leicester (United Kingdom)	Leicester, Loughborough, Twycross
115 Bristol (United Kingdom)	Bristol, Chilcompton
116 Tehran (Iran)	Pardis, Tehran
117 Manchester (United Kingdom)	Bolton, Bury, Crewe, Manchester, Salford

Agglomeration	Localities within agglomeration
118 Ithaca, NY (United States)	Ithaca
119 Champaign, IL (United States)	Champaign, Urbana
120 Pittsburgh, PA (United States)	Canonsburg, Coraopolis, Monroeville, Pittsburgh
121 Düsseldorf (Germany)	Düsseldorf, Ratingen, Velbert
122 Stuttgart (Germany)	Ditzingen, Esslingen am Neckar, Gerlingen, Göppingen, Kirchheim unter Teck, Leonberg, Ludwigsburg, Nürtingen, Sindelfingen, Stuttgart, Waiblingen
123 Lyon (France)	Écully, Lyon, Villeurbanne
124 Cologne (Germany)	Cologne, Leverkusen
125 Lima (Peru)	Lima
126 Basel (Switzerland)	Allschwil, Basel, Hölstein, Muttenz, Reinach
127 Oxford (United Kingdom)	Abingdon, Didcot, Oxford
128 Salt Lake City, UT (United States)	Draper, Salt Lake City, South Jordan

(continued)

Agglomeration	Localities within agglomeration	Agglomeration	Localities within agglomeration
129 Glasgow (United Kingdom)	Glasgow, Hamilton, Paisley	141 Toulouse (France)	Toulouse
130 Las Vegas, NV (United States)	Boulder City, Henderson, Las Vegas, Paradise	142 Aberdeen (United Kingdom)	Aberdeen, Ellon
131 Nashville, TN (United States)	Nashville	143 Malmö (Sweden)	Lund, Malmö, Svedala, Trelleborg
132 Johannesburg (South Africa)	Johannesburg, Midrand	144 Nuremberg (Germany)	Erlangen, Fürth, Herzogenaurach, Nuremberg
133 Boulder, CO (United States)	Boulder	145 Tel Aviv (Israel)	Giv'atayim, Herzliya, Hod HaSharon, Holon, Kfar Saba, Lod, Or Yehuda, Petah Tikva, Ra'anana, Ramat Gan, Ramat HaSharon, Rehovot, Tel Aviv
134 Bonn (Germany)	Bonn, Siegburg	146 Aarhus (Denmark)	Åbyhøj, Aarhus
135 Hamilton (Canada)	Hamilton	147 Jeddah (Saudi Arabia)	Jeddah
136 Marseille (France)	Gémenos, Marseille	148 Canberra (Australia)	Canberra
137 Hsinchu (China)	Hsinchu, Zhubei	149 Xiamen (China)	Quanzhou, Xiamen
138 Heidelberg (Germany)	Heidelberg, Walldorf, Weinheim	150 Hanover (Germany)	Hanover
139 Bangalore (India)	Bangalore	151 Aalborg (Denmark)	Aalborg
140 Leeds (United Kingdom)	Bradford, Huddersfield, Leeds, Ossett, Wakefield		

(continued)

Agglomeration	Localities within agglomeration
152 Brighton (United Kingdom)	Brighton, Falmer
153 Exeter (United Kingdom)	Exeter
154 Kitchener (Canada)	Waterloo
155 Leiden (Netherlands)	Leiden
156 Sacramento, CA (United States)	Davis, Folsom
157 Leuven (Belgium)	Leuven
158 Leipzig (Germany)	Leipzig
159 Cuyahoga, OH (United States)	Avon Lake, Cleveland, Medina, Westlake, Wickliffe
160 Cape Town (South Africa)	Bellville, Cape Town
161 Braunschweig-Salzgitter-Wolfsburg (Germany)	Braunschweig, Salzgitter, Wolfsburg
162 Washtenaw, MI (United States)	Ann Arbor
163 Santa Barbara, CA (United States)	Carpinteria, Goleta, Montecito, Santa Barbara

Agglomeration	Localities within agglomeration
164 Hefei (China)	Hefei
165 Utrecht (Netherlands)	Utrecht, Bilthoven
166 Bern (Switzerland)	Bern, Biel, Burgdorf, Wünnewil-Flamatt, Nods, Saint-Imier
167 Santa Cruz, CA (United States)	Santa Cruz
168 Chennai (India)	Avadi, Chennai, Kattankulathur
169 The Hague (Netherlands)	De Lier, Delft, The Hague
170 Taichung-Changhua (China)	Changhua, Taichung
171 Rotterdam (Netherlands)	Dordrecht, Rotterdam, Rozenburg
172 Jakarta (Indonesia)	Bogor, Jakarta, West Jakarta
173 Gent (Belgium)	Aalter, Gent, Wetteren
174 Raleigh, NC (United States)	Cary, Morrisville, Raleigh
175 Bologna (Italy)	Bologna, Granarolo dell'Emilia, Ozzano dell'Emilia, San Lazzaro di Savena
176 Almaty (Kazakhstan)	Almaty

(continued)

	Agglomeration	Localities within agglomeration
177	Jinan (China)	Jinan
178	Cork (Ireland)	Cork
179	Lausanne (Switzerland)	Epalinges, Lausanne, Paudex, Prilly
180	Dalian (China)	Dalian
181	Groningen (Netherlands)	Groningen
182	Beirut (Lebanon)	Baabda, Beirut, Jounieh, Zouk Mikael
183	Tbilisi (Georgia)	Tbilisi
184	Harbin (China)	Harbin
185	Memphis, TN (United States)	Memphis
186	Turin (Italy)	Leini, Turin
187	Manila (Philippines)	Makati, Manila, Muntinlupa, Pasig, Quezon City, Santa Maria, Taguig
188	Florence (Italy)	Bagno a Ripoli, Fiesole, Florence, Montelupo Fiorentino, Sesto Fiorentino, Signa

	Agglomeration	Localities within agglomeration
189	Tsukuba (Japan)	Tsukuba
190	Grenoble (France)	Grenoble, Saint-Jean de Moirans
191	Rochester, MN (United States)	Rochester
192	Antwerp (Belgium)	Antwerp, Mortsel
193	Fuzhou (China)	Fuzhou
194	Lagos (Nigeria)	Lagos, Ota
195	Zhenjiang (China)	Danyang, Yangzhou, Zhenjiang
196	Padua (Italy)	Padua, Vigonza
197	Venice (Italy)	Mira, Venice
198	Daejeon (South Korea)	Daejeon
199	Benton City, WA (United States)	Richland
200	Hampden, MA (United States)	Amherst, Northampton

Structure and Indicator System of HSE GCII 2023

HSE GCII 2023 is based on ranking the cities in descending order by the values of the overall index that consists of three subindices:

- Technological Development (20 indicators, grouped into five sections)
- Creative Industries (24 indicators, grouped into nine sections)
- Urban Environment (30 indicators, grouped into eight sections).

The cities were ranked by each of these subindices and the corresponding sub-rankings were compiled.

The Technological Development Subindex measures a city's accumulated educational, research, and entrepreneurial potential, expressed as the number of technology and venture capital companies, universities and R&D organizations, innovation infrastructure facilities, and the number of publications and patents filed by city residents.

The Creative Industries Subindex measures the development level of different activities that make up the creative sector of the economy:

film and animation, electronic games, music, fashion, advertising and PR, architecture, industrial design, arts, and literature.

The Urban Environment Subindex gives a general evaluation of the level of comfort and infrastructure development in urban areas. It covers such aspects as the costs of doing business and living, mobility, bandwidth, safety, tourist appeal, ecology, and internationalization.

A number of indicators (e.g., costs of doing business and of living in the city) are composite, i.e., they are composed of lower-level indicators. A total of 74 unique indicators were used in the ranking (Table 8).

Table 8. Indicator System of HSE GCII 2023

No.	Indicator name	Description	Data source	Period
1. Technological Development				
1.1 Technology companies				
1.1.1	Leading companies by R&D expenditure	Number of headquarters of companies included on the R&D Scoreboard	R&D Scoreboard	2021
1.1.2	R&D expenditure of largest innovation companies	Total R&D expenditure of largest innovation companies, billion USD	HSE University, based on R&D Scoreboard	2021
1.2 Startups and venture capital				
1.2.1	Startups	Number of startups represented in international databases	Crunchbase, StartupBlink	2022
1.2.2	Unicorns	Number of young, fast growing companies (unicorns) Note: "unicorns" mean those satisfying the following criteria: 1) no more than 10 years old; 2) valuation of over 1 billion USD; not traded publicly and over 25% owned by the founders	Crunchbase, CB Insights	2022
1.2.3	Innovation support funds	Number of organizations providing financial support for innovation activities of companies Note: business angels, investment partners, pension funds, syndicates, and co-working spaces are not included.	Crunchbase (Investors)	2022
1.2.4	Business angels	Number of business angels	Crunchbase (Investors)	2022
1.2.5	Venture capital investment	Volume of seed-stage venture deals with city resident organizations, million USD Note: The following types of deals are included: Pre-Seed, Seed, Series A-J, Ventures – Series Unknown, Angel, Convertible Notes, Corporate Round, Equity Crowdfunding, and Private Equity	Crunchbase	2018–2022
1.3 Universities and R&D organizations				
1.3.1	Leading universities	Number of higher education institutions included in international rankings	QS, THE, ARWU	2022
1.3.2	Leading R&D organizations	Number of R&D organizations included in Nature Index	Nature	2021
1.3.3	Highly cited researchers	Number of highly cited researchers affiliated with city organizations	Clarivate	2021
1.3.4	Nobel Prize laureates and Fields Medal winners	Number of living Nobel Prize laureates and Fields Medal winners affiliated with city organizations	HSE University, based on the official websites of the Nobel Prize and International Mathematical Union	2021
1.3.5	Students	Number of students at higher education institutions included in QS, THE, or ARWU rankings	HSE University, based on open source data	2022

(continued)

No.	Indicator name	Description	Data source	Period
1.3.6	International students	Number of international students at higher education institutions included in QS, THE, or ARWU rankings	HSE University, based on open source data	2022
1.3.7	Leading business schools	Number of business schools included in the Financial Times	Financial Times	2021
1.4 Productivity of innovative class				
1.4.1	Patent activity	Number of patent applications filed by city residents	PATSTAT Global	2017–2019
1.4.2	Publication activity	Number of publications by authors residing in the city in scientific journals indexed in Scopus	Scopus	2016–2020
1.5 Innovation infrastructure				
1.5.1	Clusters	Number of cluster initiatives and organizations included in the TCI Network	TCI Network	2022
1.5.2	Technology and science parks	Number of technology and science parks included in International Association of Science Parks	International Association of Science Parks	2022
1.5.3	Co-working spaces	Number of co-working spaces included in StartupBlink	StartupBlink	2022
1.5.4	Supercomputers	Number of supercomputers included in TOP500	TOP500	2022
2. Creative Industries				
2.1 Film and animation				
2.1.1	Top-rated film production companies (audience)	Number of film production companies that have films included in IMDb Top 250 (overall)	IMDb	2021
2.1.2	Film production companies that won international film festival awards	Number of film production companies that won top prizes in international film festivals Note: Fifteen film festivals accredited and classified as “Competitive Feature Film Festivals” (as of 2022) by the International Federation of Film Producers Associations (FIAPF)	FIAPF and official websites of film festivals	2010–2021
2.1.3	Animation film production companies that won international festival awards	Number of animation film production companies that won top prizes in the Annecy International Animation Film Festival	Annecy International Animation Film Festival	1960–2022
2.2 Electronic games				
2.2.1	The Game Awards winners	Number of individuals and enterprises that won The Game Awards	The Game Awards	2018–2021
2.2.2	Largest e-sports tournaments	Number of e-sports tournament finals held in the city with the largest prizes	Esports Earnings	2005–2021
2.2.3	Developers of most popular computer games	Number of development companies whose games are in the top 100 by the number of Steam players	Steam	2021
2.2.4	Companies participating in electronic games trade shows	Number of companies participating in Gamescom	Gamescom	2021

(continued)

No.	Indicator name	Description	Data source	Period
2.3 Music				
2.3.1	Artists with highest-grossing albums	Number of artists included in the overall yearly ranking of Billboard World Album Charts	Billboard	2006–2020
2.3.2	Most-streamed artists	Most-streamed artists on Spotify	Spotify	2021
2.3.3	Best opera performers	Number of individuals and enterprises that won The International Opera Awards	The International Opera Awards	2014–2021
2.4 Fashion				
2.4.1	Largest fashion companies	Number of fashion companies included in Fashion United	Fashion United	2021
2.4.2	Fashion brands	Number of fashion brands represented on the websites of global online retailers	FARFETCH, NET-A-PORTER, Luisa Via Roma, Mytheresa	2021
2.5 Advertising and PR				
2.5.1	Most effective advertising agencies	Number of advertising agencies included the top 100 with at least one nomination for the Global Effie Awards Note: nomination in categories: Individual Agency Offices, Independent Agency Offices, Agency Holding Groups	Effie Awards	2020–2021
2.5.2	Largest PR agencies	Number of companies included in the Top 250 PR Agencies ranking	PRovoke Media	2021
2.5.3	Creative production agencies	Number of companies that won Cannes Lions awards	Cannes Lions International Festival of Creativity	2021
2.5.4	Top advertising agencies	Number of companies included in D&AD advertising agency rankings	D&AD	2021
2.6 Architecture				
2.6.1	Pritzker Architecture Prize laureates	Number of Pritzker Architecture Prize laureates who reside or resided in the city	The Pritzker	1979–2021
2.6.2	Internationally recognized architects and architecture firms	Number of individuals and enterprises that won World Architecture Festival Awards	World Architecture Festival Awards	2015–2021
2.7 Industrial design				
2.7.1	Internationally recognized designers and design firms	Number of individuals and enterprises included in international design awards and ratings	A' Design Award, iF Design Award, Red Dot Design Award	2020–2021
2.8 Arts				
2.8.1	Internationally recognized artists	Number of Praemium Imperiale laureates who reside or resided in the city	Official website of the Japan Art Association	2021
2.8.2	Top artists by auction revenue	Number of Artprice artists by auction revenue who reside or resided in the city	Artprice	2018–2020
2.8.3	Most influential people in contemporary art	Number of the most influential people in contemporary art included in the Power 100 ranking (artists, curators, gallery dealers, managers and founders of cultural institutions and others)	ArtReview	2021

(continued)

No.	Indicator name	Description	Data source	Period
2.8.4	Leading higher education institutions in the arts	Number of higher education institutions that participated in international rankings by categories of Art, Performing Arts, and Design	QS, THE	2022
2.9 Literature				
2.9.1	Best-selling authors	Number of authors, who reside or resided in the city, included in The Books Portal list of best-selling authors ever	Wikipedia (The Books portal)	2021
3. Urban Environment				
3.1 Cost of doing business				
3.1.1	Estimated tax			
3.1.1.1	Estimated tax on a 50,000 USD income	Estimated tax on a 50,000 USD income, USD	Nomad List	2022
3.1.1.2	Estimated tax on a 100,000 USD income	Estimated tax on a 100,000 USD income, USD	Nomad List	2022
3.1.1.3	Estimated tax on a 250,000 USD income	Estimated tax on a 250,000 USD income, USD	Nomad List	2022
3.1.1.4	Corporate income tax	Total income tax rate applied to large businesses	PwC	2022
3.1.2	Salary	Average employee salary, USD per month	Numbeo	2022
3.2 Cost of living				
3.2.1	Food prices			
3.2.1.1	European food basket	Total cost of foods required for a balanced diet with European food types per person, USD per month	Numbeo	2022
3.2.1.2	Asian food basket	Total cost of foods required for a balanced diet with Asian food types per person, USD per month	Numbeo	2022
3.2.1.3	Cup of coffee	Average cost of a cup of coffee in public places, USD	Nomad List	2022
3.2.1.4	Restaurant meal	Average cost of a meal at a restaurant, USD	Nomad List	2022
3.2.2	Apartment rental cost	Cost of renting a one-bedroom apartment in the city center, USD per month	Numbeo	2022
3.2.3	Cost of living for an expat	Cost of long-term residence in the city for an employed foreign citizen who rents housing in the city center and eats out, USD per month	Nomad List	2022
3.2.4	Cost of living for a local resident	Cost of long-term residence in the city for a local resident who rents housing outside the city center and eats at home, USD per month	Nomad List	2022
3.3 Mobility				
3.3.1	Air traffic	Number of direct airline routes from airports located within 50 km of the city	HSE University, based on OpenFlights	2022
3.3.2	Commute time	Average time spent by city residents to go to work using ground transportation, min.	Numbeo	2022

(continued)

No.	Indicator name	Description	Data source	Period
3.4 Bandwidth				
3.4.1	Mobile Internet speed	Median download speed for mobile devices, Mbit/s	Speedtest	2022
3.4.2	Fixed broadband Internet speed	Median download speed for fixed broadband service, Mbit/s	Speedtest	2022
3.5 Safety				
3.5.1	Homicide rate	Number of registered homicides per 100,000 population	STC Database	2021
3.5.2	Natural disaster risk	Natural disaster risk index based on data from the past 20 years	STC Database	2021
3.6 Tourist appeal				
3.6.1	International hotels	Number of hotels belonging to the largest international hotel chains	HSE University, based on Brand Finance	2022
3.6.2	Culture, entertainment, and sports			
3.6.2.1	Unique places	Number of unique places in the city listed by Tripadvisor as Points of Interest & Landmarks and Mysterious Sites	Tripadvisor	2022
3.6.2.2	Tourist attractions	Number of monuments and statues, historical sites, and observation decks in the city listed by Tripadvisor as Monuments & Statues	Tripadvisor	2022
3.6.2.3	Recreational areas	Number of fountains, piers, scenic walking areas, and viewpoints listed by Tripadvisor as Bridges, Observation Decks & Towers, Historic Walking Areas, and Piers & Boardwalks	Tripadvisor	2022
3.6.2.4	Museums and art galleries	Number of museums and art galleries in the city listed by Tripadvisor as Museums	Tripadvisor	2022
3.6.2.5	Theatres	Number of theaters in the city listed in Tripadvisor as Theaters	Tripadvisor	2022
3.6.2.6	Stadiums	Number of stadiums in the city with a capacity of over 10,000 spectators	World Stadiums	2022
3.7 Ecology				
3.7.1	Environmental pollution level	City Pollution Index, which measures the level of air pollution, quality and availability of drinking water, cleanness and tidiness, and other environmental factors	Numbeo	2022
3.8 Internationalization				
3.8.1	International schools	Number of institutions implementing international programs of primary general, basic general, and secondary general education Note: international schools accredited by the International Baccalaureate Organization	International Baccalaureate Organization	2022
3.8.2	English proficiency	English Proficiency Index	STC Database	2021
3.8.3	International business events	Number of international business events	International Congress and Convention Association	2019
3.8.4	Visitors to international business events	Number of visitors to international business events	International Congress and Convention Association	2019

Calculation of HSE GCII 2023

To achieve consistency and comparability of the HSE GCII 2023 indicators, their absolute values were normalized. Each indicator's absolute value was normalized using formula (1) or (2), depending on the indicator's effect on the overall HSE GCII score.

Indicators, whose scores increase innovation attractiveness of a city, were normalized according to the following formula:

$$x_i^{\text{norm}} = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}, \quad (1)$$

where x_i – is the city's indicator score;

x_{\max} – is the highest indicator score for all cities in the sample;

x_{\min} – is the lowest indicator score for all cities in the sample;

i – is the number of the city.

Normalized indicator scores range from 0 (for cities with the lowest indicator score) to 1 (for cities with the highest indicator score). Such indicators are: "Leading companies by R&D expenditure", "Startups", "Largest fashion companies", "Largest e-sports tournaments", etc.

Indicators, whose scores decrease innovation attractiveness of a city, were normalized according to the following formula:

$$x_i^{\text{norm}} = \frac{x_{\max} - x_i}{x_{\max} - x_{\min}}, \quad (2)$$

where x_i – is the city's indicator score;

x_{\max} – is the highest indicator score for all cities in the sample;

x_{\min} – is the lowest indicator score for all cities in the sample;

i – is the number of the city.

The normalized indicator scores range from 0 (for cities with the highest score) to 1 (for cities with the lowest score). Such indicators are: "Estimated tax", "Salary", "Food prices", "Apartment rental cost", "Cost of living for an expat", "Cost of living for a local resident", "Commute time", "Homicide rate", "Natural disaster risk", and "Environmental pollution level".

The normalized indicators were used to calculate the sections, subindices, and the overall HSE GCII 2023 score for each city.

The section score is the arithmetic mean of all normalized indicators in the section:

$$y_i^{\text{norm}} = \frac{\sum_1^n x_i^{\text{norm}}}{n} , \quad (3)$$

where x_i^{norm} – is the section score normalized using formula (1) or (2);

n – is the number of indicators in the section.

The subindex score is the arithmetic mean of all normalized indicators in the subindex:

$$z_i^{\text{norm}} = \frac{\sum_1^m y_i^{\text{norm}}}{m} , \quad (4)$$

where y_i^{norm} – is the subindex score normalized using formula (1);

m – is the number of sections in the subindex.

The overall HSE GCII 2023 score is the weighted value of all three subindices:

$$\begin{aligned} \text{HSE GCII 2023 score} = \\ = 0.4 \times Z_{\text{Technological Development}} + 0.4 \times Z_{\text{Creative Industries}} + 0.2 \times Z_{\text{Urban Environment}} , \end{aligned} \quad (5)$$

where $Z_{\text{Technological Development}}$ – is the Technological Development Subindex score calculated using formula (4);

$Z_{\text{Creative Industries}}$ – is the Creative Industries Subindex score calculated using formula (4);

$Z_{\text{Urban Environment}}$ – is the Urban Environment Subindex score calculated using formula (4).

When calculating HSE GCII 2023, different weights were used to balance the subindices, as they have a different number of indicators and sections. Bigger weights are used for the Technological Development and Creative Industries Subindices because they have a direct impact upon the key object of assessment – innovation attractiveness, which, among other things, is confirmed by the statistical audit.

In the case of an absence of data, the indicator was not calculated for the city and was not included when establishing the corresponding section value. Imputation of missing scores in the ranking was not performed.

Patent analysis

Another important element in calculating the Technological Development Subindex was the assessment of cities' patent activity using the key indicator – the number of patent applications filed by the city residents. PATSTAT Global was used as a data source, an aggregator of patent documents from most global patent agencies, including the largest – the United States Patent and Trademark Office (USPTO), European Patent Office (EPO), and Japan Patent Office (JPO). Patents were analyzed for a three-year period: from 2017 to 2019, inclusively.

In doing so, we could, on the one hand, evaluate the current situation (2019 was the latest year, for which complete data were published at the time of this study's calculations) and, on the other hand, avoid bias caused by random fluctuations in selected years. The number of patent applications is given as a total for the whole period. When analyzing the data, we kept track of the composition of the applicants. In some cases, this was adjusted to eliminate technical errors and distortions that could decrease the objectivity of our conclusions.

Publication analysis

Another aspect we considered when calculating the Technological Development Subindex was the number of publications done by authors (researchers) from the studied cities. For this task, the data was taken from the Scopus database. The word "publication" includes the following types of documents: an article, a review, a conference paper, a book or a chapter from a book, a letter to an editorial board, and a note. Patents were analyzed for a five-year period: from 2016 to 2020, inclusively.

The publication was added to a specific city if its author or one of the co-authors were affiliated with the city. The list of publications for each agglomeration was compiled by way of a "city" search query that

included all cities that were parts of a particular agglomeration. The Hong Kong and Singapore agglomerations were viewed as separate territories according to their representation in Scopus.

Statistical Audit

As part the statistical audit of the Overall Global Cities Innovation Index, we assessed the quality of the created database and the general consistency of the indicator system.

After conducting the audit, it can be affirmed that HSE GCII 2023 is a reliable tool for the measurement and comparison of the innovation attractiveness of global cities.

Quality Assessment of the Database and Indicators of HSE GCII 2023

During this statistical audit, the database of the Overall Global Cities Innovation Index underwent a quality assessment. Out of all 74 indicators, 68 (91.9%) contain the latest data as of 2021–2022. For six indicators, the data refer to earlier periods. Reasons for that, in particular, have to do with how much time it takes to update data sources (for example, the number of patent applications and publications) and with the COVID-19 pandemic (for example, this impact can be seen when it comes to such indicators as the number of international business events and their visitors).

There are several GCII indicators with no data for some cities. All indicators with missing scores fall under the Urban Environment Subindex (Table 9).

As it happens, 54 indicators (73% of the total) do not have missing scores. Indicators for 36 cities (18%) do not have

a single missing score, and the average number of missing scores per city is 4.5. Out of 14,800 entries in the database (74 indicators for 200 cities), 913 have missing scores (6.2%).

To evaluate this irregular distribution of innovation economy leaders among global cities, we calculated kurtosis and skewness coefficients. All Creative Industries Subindex indicators and 18 out of 20 Technological Development Subindex indicators (save for the number of leading universities and clusters) have high values for both coefficients (skewness – over 3, kurtosis – over 10). This means that there is a significant, irregular distribution of indicators' values for these subindices among the cities, further, a handful of them have the highest concentration of such leaders. In turn, 22 out of 30 Urban Environment Subindex indicators have low scores for the aforementioned coefficients, meaning they are more

Table 9. HSE GCII 2023 Indicators with Missing Scores

No.	Indicator	Number of agglomerations/ cities with missing scores in the final sample of the ranking	Share of agglomerations/cities with missing scores in the final sample of the ranking
1	Estimated tax on a \$50,000 income (included in the Estimated Tax composite indicator)	105	52.5
2	Estimated tax on a \$100,000 income (included in the Estimated Tax composite indicator)	105	52.5
3	Estimated tax on a \$250,000 income (included in the Estimated Tax composite indicator)	105	52.5
4	Salary	7	3.5
5	European food basket (included in the Food Prices composite indicator)	6	3.0
6	Asian food basket (included in the Food Prices composite indicator)	6	3.0
7	Cup of coffee (included in the Food Prices composite indicator)	17	8.5
8	Restaurant meal (included in the Food Prices composite indicator)	18	9.0
9	Apartment rental cost	7	3.5
10	Cost of living for an expat	18	9.0
11	Cost of living for a local resident	17	8.5
12	Commute time	15	7.5
13	Mobile Internet speed	15	7.5
14	Fixed broadband Internet speed	6	3.0
15	Homicide rate	114	57.0
16	Natural disaster risk	118	59.0
17	Environmental pollution level	5	2.5
18	English proficiency	59	29.5
19	International business events	47	23.5
20	Visitors to international business events	127	63.5

Source: HSE University.

equally distributed among global innovation centers. Exceptions are “Safety” and “Tourist appeal” section indicators (excluding the number of stadiums), which proves that the cities indeed differ significantly by

these indicators and, as with the “Tourist appeal” section indicators reflecting the number of cultural, entertainment and sports facilities, could point to their high correlation with the city population.

Despite the fact that the majority of indicators had high values for kurtosis and skewness coefficients, the authors refrained from using data-smoothing methods. In doing so, we wanted to highlight objective irregularity and the extreme concentration of the intellectual elite, apart from simply ranking the cities. Unsmoothed data provided a more precise evaluation of

gaps between cities and painted a fairer picture, reflecting both strengths and weaknesses.

This irregularity is also confirmed by the fact that 200 agglomerations and cities of the final HSE GCII 2023 sample are home to 79.8% of all identified innovation economy leaders (Table 10).

Table 10. Distribution of Innovation Economy Leaders by the Top 200 Cities of HSE GCII 2023

No.	Indicators reflecting the presence of innovation economy leaders	Number of innovation economy leaders	Number of innovation economy leaders in the final sample of the ranking	Share of innovation economy leaders in the final sample of the ranking
1	Leading companies by R&D expenditure	2,500	2,070	82.8
2	Unicorns	1,302	1,217	93.5
3	Leading universities	2,051	922	45.0
4	Leading R&D organizations	500	370	74.0
5	Highly cited researchers	6,332	5,356	84.6
6	Nobel Prize laureates and Fields Medal winners	384	334	87.0
7	Leading business schools	185	150	81.1
8	Clusters	71	36	50.7
9	Technology and science parks	306	133	43.5
10	Supercomputers	293	195	66.6
11	Top-rated film production companies (audience)	913	854	93.5
12	Film production companies that won international film festival awards	370	317	85.7
13	Animation film production companies that won international festival awards	155	142	91.6
14	The Game Awards winners	100	90	90.0
15	Largest e-sports tournaments	343	306	89.2
16	Developers of most popular computer games	83	66	79.5

(continued)

No.	Indicators reflecting the presence of innovation economy leaders	Number of innovation economy leaders	Number of innovation economy leaders in the final sample of the ranking	Share of innovation economy leaders in the final sample of the ranking
17	Companies participating in electronic games trade shows	175	130	74.3
18	Artists with highest-grossing albums	77	59	76.6
19	Most-streamed artists	128	101	78.9
20	Best opera performers	164	136	82.9
21	Largest fashion companies	97	76	78.4
22	Fashion brands	2,589	2,206	85.2
23	Most effective advertising agencies	198	174	87.9
24	Largest PR agencies	249	235	94.4
25	Creative production agencies	98	96	98.0
26	Top advertising agencies	106	102	96.2
27	Pritzker Architecture Prize laureates	50	44	88.0
28	Internationally recognized architects and architecture firms	232	187	80.6
29	Internationally recognized designers and design firms	367	296	80.7
30	Internationally recognized artists	163	148	90.8
31	Top artists by auction revenue	206	184	89.3
32	Most influential people in contemporary art	124	109	87.9
33	Leading higher education institutions in the arts	805	506	62.9
34	Best-selling authors	264	194	73.5
TOTAL		21,980	17,541	79.8

Source: HSE University.

Consistency Assessment of the Indicator System of HSE GCII 2023

At the various stages of preparing this Global Cities Innovation Index, a consistency assessment was applied to the indicator system. For this purpose, the correlations between different elements of the ranking were calculated (indicators, sections, subindices, or the overall HSE GCII score).

It was necessary to calculate the correlation between indicators to exclude duplicating indicators that increase some cities' positions in the ranking. For example, the

indicators "Domestic faculty" and "International faculty" were eliminated, which had a high correlation level (over 0.9) with the "Students" indicator, as well as the "Highest-rated films (critics)" indicator, which correlated with the "Highest-rated films (audience)" indicator. At the same time, we did not exclude the indicators with a high level of correlation that reflected related but not similar things (for example, "Startups" and "Venture capital investment", "Unicorns" and "Business angels").

The calculation of correlation coefficients between indicators and sections, subindices, or the overall HSE GCII 2023 demonstrated that all indicators have the strongest correlation with elements within their own category. However, there is a number of indicators, which have an insignificant negative correlation (under -0.3) with the overall HSE GCII score. These are the indicators from the "Cost of doing business", "Cost of living", and "Ecology" sections.

The same could be said about the sections. They correlate the most with their respective subindices and only three ("Cost of doing business", "Cost

of living", and "Ecology") have a negative correlation with the overall HSE GCII 2023 (Table 11).

Table 11. Correlation between Sections and Subindices and the Overall HSE GCII 2023

Section	Subindices			Overall HSE GCII 2023
	Technological Development	Creative Industries	Urban Environment	
Technology companies	0.802	0.533	0.222	0.689
Startups and venture capital	0.780	0.690	0.346	0.772
Universities and R&D organizations	0.884	0.737	0.553	0.893
Productivity of innovative class	0.758	0.357	0.376	0.626
Innovation infrastructure	0.618	0.312	0.328	0.524
Film and animation	0.437	0.741	0.324	0.612
Electronic games	0.492	0.712	0.346	0.633
Music	0.338	0.695	0.290	0.534
Fashion	0.504	0.851	0.331	0.696
Advertising and PR	0.546	0.791	0.419	0.712
Architecture	0.547	0.787	0.416	0.710
Industrial design	0.607	0.620	0.330	0.629
Arts	0.638	0.872	0.418	0.793
Literature	0.623	0.865	0.279	0.751
Cost of doing business	-0.116	-0.163	0.318	-0.057
Cost of living	-0.149	-0.235	0.215	-0.127
Mobility	0.579	0.425	0.632	0.621
Bandwidth	0.442	0.517	0.441	0.547
Safety	0.396	0.356	0.662	0.505
Tourist appeal	0.673	0.696	0.717	0.803
Ecology	-0.117	-0.042	0.097	-0.056
Internationalization	0.235	0.284	0.440	0.341

-0.235  0.919

Source: HSE University.

The overall HSE GCII 2023 has the highest correlation with the Technological Development and Creative Industries Subindices. The lowest correlation between other subindices and the overall HSE GCII is observed in the Urban Environment Subindex (Table 12), which proves the validity of using different weights when calculating the overall index.

Table 12. Correlation between Subindices and the Overall HSE GCII 2023

Subindices	Subindices			Overall HSE GCII 2023
	Technological Development	Creative Industries	Urban Environment	
Technological Development		0.690	0.493	0.919
Creative Industries	0.690		0.459	0.883
Urban Environment	0.493	0.459		0.675

-0.235

0.919

Source: HSE University.

Therefore, it is reasonable to conclude that the indicator system of HSE GCII 2023 is structurally consistent and unambiguous.

CITY PROFILES

London

1

Technological Development

Rank
5

Technology companies

8

Leading companies by R&D expenditure

6

R&D expenditure of largest innovation companies

11

Startups and venture capital

3

Startups

2

Unicorns

5–6

Innovation support funds

3

Business angels

3

Venture capital investment

6

Universities and R&D organizations

2

Leading universities

5–6

Leading R&D organizations

12–17

Highly cited researchers

6

Nobel Prize laureates and Fields Medal winners

11–12

Students

17

International students

1

Leading business schools

2–3

Productivity of innovative class

19

Patent activity

48

Publication activity

5

Innovation infrastructure

19

Clusters

29–200

Technology and science parks

9–15

Co-working spaces

8

Supercomputers

64–200

Creative Industries

Rank
1

Film and animation

3

Top-rated film production companies (audience)

4

Film production companies that won international film festival awards

3–4

Animation film production companies that won international festival awards

2

Electronic games

3

The Game Awards winners

7–10

Largest e-sports tournaments

4

Developers of most popular computer games

5–11

Companies participating in electronic games trade shows

2

Music

1

Artists with highest-grossing albums

5–10

Most-streamed artists

2

Best opera performers

1

Fashion

2

Largest fashion companies

3–5

Fashion brands

1

Advertising and PR

2

Most effective advertising agencies

24–29

Largest PR agencies

2

Creative production agencies

2

Top advertising agencies

2

Architecture

1

Pritzker Architecture Prize laureates

2–3

Internationally recognized architects and architecture firms

1

Industrial design

4–6

Internationally recognized designers and design firms

4–6

Arts

2

Internationally recognized artists

3

Top artists by auction revenue

3

Most influential people in contemporary art

2

Leading higher education institutions in the arts

1

Literature

2–3

Best-selling authors

2–3

Urban Environment

Rank
2

Cost of doing business

89

Estimated tax

25–33

Salary

143

Cost of living

182

Food prices

119

Apartment rental cost

183

Cost of living for an expat

171

Cost of living for a local resident

173

Mobility

3

Air traffic

1

Commute time

157

Bandwidth

145

Mobile Internet speed

112

Fixed broadband Internet speed

158

Safety

27

Homicide rate

43

Natural disaster risk

29

Tourist appeal

3

International hotels

5

Culture, entertainment, and sports

3

Ecology

131

Environmental pollution level

131

Internationalization

4

International schools

24–27

English proficiency

1–76

International business events

9

Visitors to international business events

6

Benchmarking against the leading city


New York



2

Technological Development	Rank 4	Creative Industries	Rank 2	Urban Environment	Rank 72
Technology companies 4		Film and animation 5		Cost of doing business 193	
Leading companies by R&D expenditure	5	Top-rated film production companies (audience)	5	Estimated tax	65–67
R&D expenditure of largest innovation companies	3	Film production companies that won international film festival awards	22–24	Salary	189
Startups and venture capital 2		Animation film production companies that won international festival awards	5–7	Cost of living 194	
Startups	3	Electronic games 20		Food prices	188
Unicorns	2	The Game Awards winners	7–10	Apartment rental cost	193
Innovation support funds	1	Largest e-sports tournaments	12–14	Cost of living for an expat	177
Business angels	2	Developers of most popular computer games	16–33	Cost of living for a local resident	182
Venture capital investment	3	Companies participating in electronic games trade shows	64–200	Mobility 17	
Universities and R&D organizations 1		Music 3		Air traffic	9
Leading universities	7	Artists with highest-grossing albums	3–4	Commute time	154
Leading R&D organizations	3	Most-streamed artists	3	Bandwidth 37	
Highly cited researchers	5	Best opera performers	2	Mobile Internet speed	79
Nobel Prize laureates and Fields Medal winners	3	Fashion 1		Fixed broadband Internet speed	29
Students	2	Largest fashion companies	1	Safety 40	
International students	5	Fashion brands	2	Homicide rate	63
Leading business schools	10–15	Advertising and PR 1		Natural disaster risk	34–39
Productivity of innovative class 15		Most effective advertising agencies	6–10	Tourist appeal 7	
Patent activity	22	Largest PR agencies	1	International hotels	7
Publication activity	7	Creative production agencies	1	Culture, entertainment, and sports	7
Innovation infrastructure 53		Top advertising agencies	1	Ecology 130	
Clusters	29–200	Architecture 4		Environmental pollution level	130
Technology and science parks	73–200	Pritzker Architecture Prize laureates	4	Internationalization 41	
Co-working spaces	12	Internationally recognized architects and architecture firms	3–4	International schools	8–10
Supercomputers	32–63	Industrial design 11–13		English proficiency	1–76
		Internationally recognized designers and design firms	11–13	International business events	43–44
		Arts 1		Visitors to international business events	49
		Internationally recognized artists	1		
		Top artists by auction revenue	1		
		Most influential people in contemporary art	1		
		Leading higher education institutions in the arts	2–3		
		Literature 1			
		Best-selling authors	1		

Benchmarking against the leading city



Tokyo

3

Technological Development

Rank
3

Technology companies

2

Leading companies by R&D expenditure
R&D expenditure of largest innovation companies

1
2

Startups and venture capital

11

Startups

10

Unicorns

30

Innovation support funds

12

Business angels

10

Venture capital investment

10

Universities and R&D organizations

7

Leading universities

1

Leading R&D organizations

4–5

Highly cited researchers

23–24

Nobel Prize laureates and Fields Medal winners

14–15

Students

6

International students

16

Leading business schools

36–80

Productivity of innovative class

6

Patent activity

8

Publication activity

6

Innovation infrastructure

3

Clusters

29–200

Technology and science parks

73–200

Co-working spaces

2

Supercomputers

3

Creative Industries

Rank
5

Film and animation

4

Top-rated film production companies (audience)

6

Film production companies that won international film festival awards

5–7

Animation film production companies that won international festival awards

5–7

Electronic games

5

The Game Awards winners

2

Largest e-sports tournaments

15–18

Developers of most popular computer games

5–11

Companies participating in electronic games trade shows

11–14

Music

30–34

Artists with highest-grossing albums

11–28

Most-streamed artists

14–37

Best opera performers

42–200

Fashion

6

Largest fashion companies

7–15

Fashion brands

6

Advertising and PR

27

Most effective advertising agencies

30–48

Largest PR agencies

10

Creative production agencies

19–38

Top advertising agencies

12–15

Architecture

2

Pritzker Architecture Prize laureates

1

Internationally recognized architects and architecture firms

9–12

Industrial design

2

Internationally recognized designers and design firms

2

Arts

7

Internationally recognized artists

4

Top artists by auction revenue

7

Most influential people in contemporary art

15–31

Leading higher education institutions in the arts

13–17

Literature

2–3

Best-selling authors

2–3

Urban Environment

Rank
29

Cost of doing business

166

Estimated tax

182–185

Salary

109

Cost of living

124

Food prices

166

Apartment rental cost

113

Cost of living for an expat

102

Cost of living for a local resident

124–125

Mobility

69

Air traffic

31

Commute time

146

Bandwidth

112

Mobile Internet speed

141

Fixed broadband Internet speed

68

Safety

80

Homicide rate

1–2

Natural disaster risk

83

Tourist appeal

2

International hotels

69–74

Culture, entertainment, and sports

1

Ecology

92

Environmental pollution level

92

Internationalization

60

International schools

21–23

English proficiency

111–114

International business events

4

Visitors to international business events

29

Benchmarking against the leading city

Beijing

4

Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	1		10		15
Technology companies	3	Film and animation	25	Cost of doing business	69
Leading companies by R&D expenditure	3	Top-rated film production companies (audience)	13–16	Estimated tax	115–146
R&D expenditure of largest innovation companies	4	Film production companies that won international film festival awards	15–18	Salary	48
Startups and venture capital	5	Animation film production companies that won international festival awards	43–200	Cost of living	105
Startups	13	Electronic games	37	Food prices	79
Unicorns	3	The Game Awards winners	35–200	Apartment rental cost	136
Innovation support funds	5	Largest e-sports tournaments	15–18	Cost of living for an expat	81
Business angels	44–45	Developers of most popular computer games	34–200	Cost of living for a local resident	89
Venture capital investment	2	Companies participating in electronic games trade shows	27–63	Mobility	24
Universities and R&D organizations	5	Music	75–200	Air traffic	11
Leading universities	4	Artists with highest-grossing albums	29–200	Commute time	158
Leading R&D organizations	2	Most-streamed artists	38–200	Bandwidth	14
Highly cited researchers	3	Best opera performers	42–200	Mobile Internet speed	37
Nobel Prize laureates and Fields Medal winners	27–40	Fashion	32–34	Fixed broadband Internet speed	4
Students	3	Largest fashion companies	16–42	Safety	50–60
International students	11	Fashion brands	60–71	Homicide rate	28–41
Leading business schools	36–80	Advertising and PR	26	Natural disaster risk	60–71
Productivity of innovative class	1	Most effective advertising agencies	14–18	Tourist appeal	6
Patent activity	5	Largest PR agencies	21–31	International hotels	3
Publication activity	1	Creative production agencies	39–200	Culture, entertainment, and sports	29
Innovation infrastructure	2	Top advertising agencies	16–38	Ecology	180
Clusters	29–200	Architecture	19–21	Environmental pollution level	180
Technology and science parks	1	Pritzker Architecture Prize laureates	25–200	Internationalization	90
Co-working spaces	88–103	Internationally recognized architects and architecture firms	9–12	International schools	16–17
Supercomputers	1	Industrial design	7–10	English proficiency	111–114
		Internationally recognized designers and design firms	7–10	International business events	26–29
		Arts	4	Visitors to international business events	20
		Internationally recognized artists	41–200		
		Top artists by auction revenue	2		
		Most influential people in contemporary art	8–11		
		Leading higher education institutions in the arts	6–8		
		Literature	10–15		
		Best-selling authors	10–15		

Benchmarking against the leading city

Paris

5

Technological Development

Rank
9

Technology companies

7

Leading companies by R&D expenditure	8–10
R&D expenditure of largest innovation companies	6

Startups and venture capital

9

Startups	8
Unicorns	10
Innovation support funds	11
Business angels	8
Venture capital investment	11

Universities and R&D organizations

4

Leading universities	9
Leading R&D organizations	6–9
Highly cited researchers	9
Nobel Prize laureates and Fields Medal winners	6–7
Students	10
International students	4
Leading business schools	2–3

Productivity of innovative class

21

Patent activity	32
Publication activity	12

Innovation infrastructure

21

Clusters	29–200
Technology and science parks	16–25
Co-working spaces	26–29
Supercomputers	5

Creative Industries

Rank
4

Film and animation

1

Top-rated film production companies (audience)	2
Film production companies that won international film festival awards	1
Animation film production companies that won international festival awards	1

Electronic games

12

The Game Awards winners	11–19
Largest e-sports tournaments	19–20
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	7–8

Music

5

Artists with highest-grossing albums	5–10
Most-streamed artists	14–37
Best opera performers	3–4

Fashion

4

Largest fashion companies	3–5
Fashion brands	3

Advertising and PR

4

Most effective advertising agencies	30–48
Largest PR agencies	5–6
Creative production agencies	3
Top advertising agencies	3–4

Architecture

3

Pritzker Architecture Prize laureates	2–3
Internationally recognized architects and architecture firms	17–26

Industrial design

34–47

Internationally recognized designers and design firms	34–47
---	-------

Arts

3

Internationally recognized artists	2
Top artists by auction revenue	5–6
Most influential people in contemporary art	4
Leading higher education institutions in the arts	2–3

Literature

5–6

Best-selling authors	5–6
----------------------	-----

Urban Environment

Rank
1

Cost of doing business

169

Estimated tax	189–191
Salary	92

Cost of living

139

Food prices	149
Apartment rental cost	131
Cost of living for an expat	137
Cost of living for a local resident	116

Mobility

7

Air traffic	2
Commute time	149

Bandwidth

76

Mobile Internet speed	103
Fixed broadband Internet speed	67

Safety

16

Homicide rate	48
Natural disaster risk	13

Tourist appeal

1

International hotels	1
Culture, entertainment, and sports	4

Ecology

143

Environmental pollution level	143
-------------------------------	-----

Internationalization

15

International schools	82–86
English proficiency	103–106
International business events	1
Visitors to international business events	2

Benchmarking against the leading city

San Francisco

6

Technological Development Rank 2

Technology companies	1
Leading companies by R&D expenditure	2
R&D expenditure of largest innovation companies	1
Startups and venture capital	1
Startups	1
Unicorns	1
Innovation support funds	2
Business angels	1
Venture capital investment	1
Universities and R&D organizations	9
Leading universities	49–65
Leading R&D organizations	18–23
Highly cited researchers	2
Nobel Prize laureates and Fields Medal winners	2
Students	85
International students	53
Leading business schools	16–35
Productivity of innovative class	11
Patent activity	13
Publication activity	10
Innovation infrastructure	12
Clusters	29–200
Technology and science parks	26–72
Co-working spaces	10–11
Supercomputers	2

Creative Industries Rank 9

Film and animation	26
Top-rated film production companies (audience)	13–16
Film production companies that won international film festival awards	39–46
Animation film production companies that won international festival awards	15–25
Electronic games	8
The Game Awards winners	4–6
Largest e-sports tournaments	21–27
Developers of most popular computer games	5–11
Companies participating in electronic games trade shows	9–10
Music	65–74
Artists with highest-grossing albums	29–200
Most-streamed artists	14–37
Best opera performers	42–200
Fashion	20
Largest fashion companies	16–42
Fashion brands	16–17
Advertising and PR	11
Most effective advertising agencies	49–200
Largest PR agencies	4
Creative production agencies	19–38
Top advertising agencies	5–6
Architecture	49–71
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61
Industrial design	11–13
Internationally recognized designers and design firms	11–13
Arts	25
Internationally recognized artists	16–40
Top artists by auction revenue	38–200
Most influential people in contemporary art	8–11
Leading higher education institutions in the arts	44–68
Literature	7–8
Best-selling authors	7–8

Urban Environment Rank 146

Cost of doing business	200
Estimated tax	89–91
Salary	193
Cost of living	195
Food prices	190
Apartment rental cost	192
Cost of living for an expat	182
Cost of living for a local resident	183
Mobility	160
Air traffic	46–47
Commute time	171
Bandwidth	52
Mobile Internet speed	85
Fixed broadband Internet speed	42
Safety	41
Homicide rate	69
Natural disaster risk	34–39
Tourist appeal	15
International hotels	31
Culture, entertainment, and sports	9
Ecology	109
Environmental pollution level	109
Internationalization	14
International schools	28
English proficiency	1–76
International business events	17
Visitors to international business events	16

Benchmarking against the leading city



Los Angeles

7

Technological Development

Rank
14

Technology companies

32

Leading companies by R&D expenditure	22
R&D expenditure of largest innovation companies	37

Startups and venture capital

4

Startups	4
Unicorns	5–6
Innovation support funds	4
Business angels	4
Venture capital investment	7

Universities and R&D organizations

14

Leading universities	43–48
Leading R&D organizations	12–17
Highly cited researchers	7
Nobel Prize laureates and Fields Medal winners	8–9
Students	39
International students	18
Leading business schools	16–35

Productivity of innovative class

23

Patent activity	27
Publication activity	16

Innovation infrastructure

95–98

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	31–36
Supercomputers	64–200

Creative Industries

Rank
3

Film and animation

2

Top-rated film production companies (audience)	1
Film production companies that won international film festival awards	2
Animation film production companies that won international festival awards	4

Electronic games

1

The Game Awards winners	1
Largest e-sports tournaments	1
Developers of most popular computer games	5–11
Companies participating in electronic games trade shows	1

Music

2

Artists with highest-grossing albums	3–4
Most-streamed artists	1
Best opera performers	42–200

Fashion

5

Largest fashion companies	16–42
Fashion brands	5

Advertising and PR

10

Most effective advertising agencies	49–200
Largest PR agencies	21–31
Creative production agencies	4–5
Top advertising agencies	3–4

Architecture

13–14

Pritzker Architecture Prize laureates	5–8
Internationally recognized architects and architecture firms	62–200

Industrial design

17–21

Internationally recognized designers and design firms	17–21
---	-------

Arts

6

Internationally recognized artists	16–40
Top artists by auction revenue	4
Most influential people in contemporary art	5–6
Leading higher education institutions in the arts	9–12

Literature

4

Best-selling authors	4
----------------------	---

Urban Environment

Rank
77

Cost of doing business

190

Estimated tax	89–91
Salary	185

Cost of living

189

Food prices	184
Apartment rental cost	187
Cost of living for an expat	165
Cost of living for a local resident	177

Mobility

166

Air traffic	22
Commute time	184

Bandwidth

51

Mobile Internet speed	73
Fixed broadband Internet speed	47

Safety

48

Homicide rate	72
Natural disaster risk	34–39

Tourist appeal

12

International hotels	19
Culture, entertainment, and sports	12

Ecology

76–77

Environmental pollution level	76–77
-------------------------------	-------

Internationalization

39

International schools	4
English proficiency	1–76
International business events	77–78
Visitors to international business events	57

Benchmarking against the leading city

Shanghai

8

Technological Development

Rank
6

Technology companies

10

Leading companies by R&D expenditure

7

R&D expenditure of largest innovation companies

21

Startups and venture capital

7

Startups

33

Unicorns

4

Innovation support funds

7

Business angels

66

Venture capital investment

4

Universities and R&D organizations

10

Leading universities

11–12

Leading R&D organizations

4–5

Highly cited researchers

18

Nobel Prize laureates and Fields Medal winners

41–77

Students

11

International students

20

Leading business schools

4

Productivity of innovative class

3

Patent activity

4

Publication activity

2

Innovation infrastructure

23

Clusters

29–200

Technology and science parks

4–8

Co-working spaces

65–76

Supercomputers

14–17

Creative Industries

Rank
11

Film and animation

88

Top-rated film production companies (audience)

34–39

Film production companies that won international film festival awards

71–200

Animation film production companies that won international festival awards

43–200

Electronic games

9

The Game Awards winners

7–10

Largest e-sports tournaments

2

Developers of most popular computer games

34–200

Companies participating in electronic games trade shows

27–63

Music

75–200

Artists with highest-grossing albums

29–200

Most-streamed artists

38–200

Best opera performers

42–200

Fashion

9

Largest fashion companies

7–15

Fashion brands

30–33

Advertising and PR

22

Most effective advertising agencies

11

Largest PR agencies

61–200

Creative production agencies

39–200

Top advertising agencies

39–200

Architecture

19–21

Pritzker Architecture Prize laureates

25–200

Internationally recognized architects and architecture firms

9–12

Industrial design

7–10

Internationally recognized designers and design firms

7–10

Arts

16

Internationally recognized artists

41–200

Top artists by auction revenue

10–12

Most influential people in contemporary art

32–200

Leading higher education institutions in the arts

9–12

Literature

59–200

Best-selling authors

59–200

Urban Environment

Rank
8

Cost of doing business

76

Estimated tax

115–146

Salary

51

Cost of living

75

Food prices

66

Apartment rental cost

118

Cost of living for an expat

52

Cost of living for a local resident

77

Mobility

64

Air traffic

16

Commute time

163

Bandwidth

6

Mobile Internet speed

14

Fixed broadband Internet speed

8

Safety

50–60

Homicide rate

28–41

Natural disaster risk

60–71

Tourist appeal

4

International hotels

2

Culture, entertainment, and sports

28

Ecology

172

Environmental pollution level

172

Internationalization

78

International schools

7

English proficiency

100–102

International business events

31

Visitors to international business events

36

Benchmarking against the leading city

Seoul



9

Technological Development

Rank
11

Technology companies

9

Leading companies by R&D expenditure	11–12
R&D expenditure of largest innovation companies	7

Startups and venture capital

30

Startups	36
Unicorns	17
Innovation support funds	25
Business angels	104–108
Venture capital investment	21

Universities and R&D organizations

8

Leading universities	2
Leading R&D organizations	6–9
Highly cited researchers	43–44
Nobel Prize laureates and Fields Medal winners	78–200
Students	7
International students	7
Leading business schools	10–15

Productivity of innovative class

9

Patent activity	11
Publication activity	8

Innovation infrastructure

58

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	42–52
Supercomputers	6–7

Creative Industries

Rank
6

Film and animation

8

Top-rated film production companies (audience)	11
Film production companies that won international film festival awards	8–9
Animation film production companies that won international festival awards	15–25

Electronic games

4

The Game Awards winners	4–6
Largest e-sports tournaments	3
Developers of most popular computer games	12–15
Companies participating in electronic games trade shows	3–6

Music

4

Artists with highest-grossing albums	1
Most-streamed artists	4–6
Best opera performers	42–200

Fashion

25

Largest fashion companies	43–200
Fashion brands	9

Advertising and PR

30

Most effective advertising agencies	14–18
Largest PR agencies	14–20
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

49–71

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61

Industrial design

3

Internationally recognized designers and design firms	3
---	---

Arts

9

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	15–31
Leading higher education institutions in the arts	4

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
27

Cost of doing business

16

Estimated tax	11–12
Salary	91

Cost of living

111

Food prices	185
Apartment rental cost	72
Cost of living for an expat	63
Cost of living for a local resident	99

Mobility

72

Air traffic	32
Commute time	147

Bandwidth

61

Mobile Internet speed	N/A
Fixed broadband Internet speed	74

Safety

37

Homicide rate	12–16
Natural disaster risk	48

Tourist appeal

33

International hotels	83–86
Culture, entertainment, and sports	13

Ecology

132

Environmental pollution level	132
-------------------------------	-----

Internationalization

93

International schools	93–103
English proficiency	99
International business events	12–13
Visitors to international business events	15

Benchmarking against the leading city

Moscow

10

Technological Development	Rank 7	Creative Industries	Rank 15	Urban Environment	Rank 7
Technology companies 111		Film and animation 24		Cost of doing business 5	
Leading companies by R&D expenditure 104–117		Top-rated film production companies (audience) 19–21		Estimated tax 3–4	
R&D expenditure of largest innovation companies 92		Film production companies that won international film festival awards 25–38		Salary 46	
Startups and venture capital 29		Animation film production companies that won international festival awards 15–25		Cost of living 72	
Startups 11		Electronic games 59–60		Food prices 61	
Unicorns 107–200		The Game Awards winners 35–200		Apartment rental cost 117	
Innovation support funds 33		Largest e-sports tournaments 15–18		Cost of living for an expat 66	
Business angels 37–38		Developers of most popular computer games 34–200		Cost of living for a local resident 61	
Venture capital investment 74		Companies participating in electronic games trade shows 64–200		Mobility 25	
Universities and R&D organizations 11		Music 11		Air traffic 3	
Leading universities 3		Artists with highest-grossing albums 29–200		Commute time 170	
Leading R&D organizations 41–82		Most-streamed artists 38–200		Bandwidth 164	
Highly cited researchers 146–151		Best opera performers 6–7		Mobile Internet speed 162	
Nobel Prize laureates and Fields Medal winners 13		Fashion 52		Fixed broadband Internet speed 119	
Students 13		Largest fashion companies 43–200		Safety 39	
International students 6		Fashion brands 20		Homicide rate 62	
Leading business schools 10–15		Advertising and PR 6		Natural disaster risk 32–33	
Productivity of innovative class 22		Most effective advertising agencies 3		Tourist appeal 5	
Patent activity 44		Largest PR agencies 21–31		International hotels 50	
Publication activity 11		Creative production agencies 19–38		Culture, entertainment, and sports 2	
Innovation infrastructure 1		Top advertising agencies 39–200		Ecology 126	
Clusters 1		Architecture 43–48		Environmental pollution level 126	
Technology and science parks 2		Pritzker Architecture Prize laureates 25–200		Internationalization 108	
Co-working spaces 1		Internationally recognized architects and architecture firms 27–34		International schools 21–23	
Supercomputers 10–13		Industrial design 22–25		English proficiency 119–122	
		Internationally recognized designers and design firms 22–25		International business events 62–63	
		Arts 19		Visitors to international business events N/A	
		Internationally recognized artists 7–8			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 27–43			
		Literature 10–15			
		Best-selling authors 10–15			

Benchmarking against the leading city



Boston

11

Technological Development

Rank
8

Technology companies

5

Leading companies by R&D expenditure

R&D expenditure of largest innovation companies

4

8

Startups and venture capital

6

Startups

7

Unicorns

8

Innovation support funds

6

Business angels

6

Venture capital investment

5

Universities and R&D organizations

6

Leading universities

20–24

Leading R&D organizations

6–9

Highly cited researchers

1

Nobel Prize laureates and Fields Medal winners

1

Students

33

International students

10

Leading business schools

81–200

Productivity of innovative class

14

Patent activity

25

Publication activity

4

Innovation infrastructure

67

Clusters

29–200

Technology and science parks

26–72

Co-working spaces

56–64

Supercomputers

18–31

Creative Industries

Rank
29

Film and animation

94–113

Top-rated film production companies (audience)

54–86

Film production companies that won international film festival awards

71–200

Animation film production companies that won international festival awards

43–200

Electronic games

45

The Game Awards winners

35–200

Largest e-sports tournaments

28–31

Developers of most popular computer games

16–33

Companies participating in electronic games trade shows

64–200

Music

30–34

Artists with highest-grossing albums

11–28

Most-streamed artists

14–37

Best opera performers

42–200

Fashion

29

Largest fashion companies

16–42

Fashion brands

41–44

Advertising and PR

25

Most effective advertising agencies

30–48

Largest PR agencies

5–6

Creative production agencies

9–18

Top advertising agencies

39–200

Architecture

72–200

Pritzker Architecture Prize laureates

25–200

Internationally recognized architects and architecture firms

62–200

Industrial design

26–33

Internationally recognized designers and design firms

26–33

Arts

13

Internationally recognized artists

16–40

Top artists by auction revenue

19–37

Most influential people in contemporary art

15–31

Leading higher education institutions in the arts

9–12

Literature

9

Best-selling authors

9

Urban Environment

Rank
94

Cost of doing business

189

Estimated tax

84

Salary

187

Cost of living

188

Food prices

160

Apartment rental cost

191

Cost of living for an expat

172

Cost of living for a local resident

174

Mobility

135

Air traffic

52–53

Commute time

161

Bandwidth

40

Mobile Internet speed

70

Fixed broadband Internet speed

36

Safety

62

Homicide rate

74

Natural disaster risk

34–39

Tourist appeal

55

International hotels

47

Culture, entertainment, and sports

66

Ecology

43

Environmental pollution level

43

Internationalization

68

International schools

87–92

English proficiency

1–76

International business events

55

Visitors to international business events

35

Benchmarking against the leading city

Berlin

12

Technological Development

Rank
21

Technology companies	97
Leading companies by R&D expenditure	91–103
R&D expenditure of largest innovation companies	96
Startups and venture capital	16
Startups	15
Unicorns	13–15
Innovation support funds	20
Business angels	12
Venture capital investment	12
Universities and R&D organizations	25
Leading universities	49–65
Leading R&D organizations	12–17
Highly cited researchers	25–26
Nobel Prize laureates and Fields Medal winners	22–26
Students	55
International students	27
Leading business schools	16–35
Productivity of innovative class	42
Patent activity	65
Publication activity	27
Innovation infrastructure	8
Clusters	8–28
Technology and science parks	16–25
Co-working spaces	10–11
Supercomputers	32–63

Creative Industries

Rank
7

Film and animation	15
Top-rated film production companies (audience)	8
Film production companies that won international film festival awards	10–11
Animation film production companies that won international festival awards	43–200
Electronic games	6
The Game Awards winners	11–19
Largest e-sports tournaments	5–6
Developers of most popular computer games	12–15
Companies participating in electronic games trade shows	3–6
Music	8
Artists with highest-grossing albums	11–28
Most-streamed artists	38–200
Best opera performers	5
Fashion	23
Largest fashion companies	16–42
Fashion brands	25–26
Advertising and PR	28
Most effective advertising agencies	49–200
Largest PR agencies	11–13
Creative production agencies	6–8
Top advertising agencies	16–38
Architecture	35–42
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	17–26
Industrial design	14–15
Internationally recognized designers and design firms	14–15
Arts	5
Internationally recognized artists	5
Top artists by auction revenue	5–6
Most influential people in contemporary art	3
Leading higher education institutions in the arts	13–17
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
26

Cost of doing business	94
Estimated tax	50–57
Salary	120
Cost of living	120
Food prices	92
Apartment rental cost	121
Cost of living for an expat	143
Cost of living for a local resident	83–86
Mobility	158
Air traffic	173–199
Commute time	88
Bandwidth	142
Mobile Internet speed	120
Fixed broadband Internet speed	133
Safety	17–18
Homicide rate	23–27
Natural disaster risk	15–17
Tourist appeal	19
International hotels	27–28
Culture, entertainment, and sports	19
Ecology	82
Environmental pollution level	82
Internationalization	45
International schools	87–92
English proficiency	89–91
International business events	2
Visitors to international business events	5

Benchmarking against the leading city

Washington, D.C.

13

Technological Development

Rank
10

Technology companies

29

Leading companies by R&D expenditure	21
R&D expenditure of largest innovation companies	30

Startups and venture capital

15

Startups	17
Unicorns	21–25
Innovation support funds	10
Business angels	11
Venture capital investment	22

Universities and R&D organizations

3

Leading universities	13–16
Leading R&D organizations	1
Highly cited researchers	4
Nobel Prize laureates and Fields Medal winners	4
Students	21
International students	17
Leading business schools	10–15

Productivity of innovative class

13

Patent activity	30
Publication activity	3

Innovation infrastructure

69

Clusters	29–200
Technology and science parks	26–72
Co-working spaces	65–76
Supercomputers	18–31

Creative Industries

Rank
25

Film and animation

59–60

Top-rated film production companies (audience)	54–86
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	26–42

Electronic games

10

The Game Awards winners	11–19
Largest e-sports tournaments	44–61
Developers of most popular computer games	5–11
Companies participating in electronic games trade shows	11–14

Music

41–42

Artists with highest-grossing albums	29–200
Most-streamed artists	14–37
Best opera performers	24–41

Fashion

30–31

Largest fashion companies	16–42
Fashion brands	52–59

Advertising and PR

33

Most effective advertising agencies	49–200
Largest PR agencies	3
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

17–18

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	6–8

Literature

10–15

Best-selling authors	10–15
----------------------	-------

Urban Environment

Rank
114

Cost of doing business

199

Estimated tax	175
Salary	186

Cost of living

191

Food prices	187
Apartment rental cost	180
Cost of living for an expat	178
Cost of living for a local resident	180

Mobility

42

Air traffic	20
Commute time	135

Bandwidth

65

Mobile Internet speed	75
Fixed broadband Internet speed	61

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

16

International hotels	18
Culture, entertainment, and sports	22

Ecology

87

Environmental pollution level	87
-------------------------------	----

Internationalization

7

International schools	1
English proficiency	1–76
International business events	50
Visitors to international business events	43

Benchmarking against the leading city

Shenzhen

14

Technological Development	Rank 12	Creative Industries	Rank 12	Urban Environment	Rank 155
Technology companies 6		Film and animation 114–200		Cost of doing business 85	
Leading companies by R&D expenditure 8–10		Top-rated film production companies (audience) 87–200		Estimated tax 115–146	
R&D expenditure of largest innovation companies 5		Film production companies that won international film festival awards 71–200		Salary 64	
Startups and venture capital 20		Animation film production companies that won international festival awards 43–200		Cost of living 58	
Startups 40		Electronic games 85–86		Food prices 54	
Unicorns 9		The Game Awards winners 20–34		Apartment rental cost 74	
Innovation support funds 14		Largest e-sports tournaments 32–43		Cost of living for an expat 43	
Business angels 98		Developers of most popular computer games 34–200		Cost of living for a local resident 60	
Venture capital investment 13		Companies participating in electronic games trade shows 64–200		Mobility 163	
Universities and R&D organizations 69		Music 75–200		Air traffic 173–199	
Leading universities 86–106		Artists with highest-grossing albums 29–200		Commute time 107	
Leading R&D organizations 41–82		Most-streamed artists 38–200		Bandwidth 83	
Highly cited researchers 60–62		Best opera performers 42–200		Mobile Internet speed 95	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 129–200		Fixed broadband Internet speed 70	
Students 120		Largest fashion companies 43–200		Safety N/A	
International students 194		Fashion brands 123–200		Homicide rate N/A	
Leading business schools 16–35		Advertising and PR 55		Natural disaster risk N/A	
Productivity of innovative class 5		Most effective advertising agencies 30–48		Tourist appeal 35	
Patent activity 2		Largest PR agencies 32–60		International hotels 23–24	
Publication activity 41		Creative production agencies 39–200		Culture, entertainment, and sports 79	
Innovation infrastructure 40		Top advertising agencies 39–200		Ecology 142	
Clusters 29–200		Architecture 49–71		Environmental pollution level 142	
Technology and science parks 26–72		Pritzker Architecture Prize laureates 25–200		Internationalization 131	
Co-working spaces 131–200		Internationally recognized architects and architecture firms 35–61		International schools 50–54	
Supercomputers 4		Industrial design 1		English proficiency N/A	
		Internationally recognized designers and design firms 1		International business events 85–86	
		Arts 130–185		Visitors to international business events N/A	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 114–185			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city

Hong Kong

15

Technological Development

Rank
24

Technology companies

18

Leading companies by R&D expenditure

15

R&D expenditure of largest innovation companies

29

1.2 Startups and venture capital

32

Startups

28

Unicorns

21–25

Innovation support funds

22–23

Business angels

41–42

Venture capital investment

31

Universities and R&D organizations

21

Leading universities

25–37

Leading R&D organizations

12–17

Highly cited researchers

15

Nobel Prize laureates and Fields Medal winners

78–200

Students

64

International students

15

Leading business schools

16–35

Productivity of innovative class

36

Patent activity

46

Publication activity

26

Innovation infrastructure

36

Clusters

29–200

Technology and science parks

16–25

Co-working spaces

13–14

Supercomputers

64–200

Creative Industries

Rank
14

Film and animation

23

Top-rated film production companies (audience)

17–18

Film production companies that won international film festival awards

19–21

Animation film production companies that won international festival awards

26–42

Electronic games

61–82

The Game Awards winners

35–200

Largest e-sports tournaments

62–200

Developers of most popular computer games

34–200

Companies participating in electronic games trade shows

27–63

Music

75–200

Artists with highest-grossing albums

29–200

Most-streamed artists

38–200

Best opera performers

42–200

Fashion

8

Largest fashion companies

6

Fashion brands

21–22

Advertising and PR

79–95

Most effective advertising agencies

49–200

Largest PR agencies

32–60

Creative production agencies

39–200

Top advertising agencies

39–200

Architecture

10–12

Pritzker Architecture Prize laureates

25–200

Internationally recognized architects and architecture firms

5–7

Industrial design

7–10

Internationally recognized designers and design firms

7–10

Arts

8

Internationally recognized artists

41–200

Top artists by auction revenue

38–200

Most influential people in contemporary art

5–6

Leading higher education institutions in the arts

5

Literature

59–200

Best-selling authors

59–200

Urban Environment

Rank
5

Cost of doing business

19

Estimated tax

8

Salary

114

Cost of living

167

Food prices

110

Apartment rental cost

185

Cost of living for an expat

109

Cost of living for a local resident

163

Mobility

88

Air traffic

39–40

Commute time

152

Bandwidth

4

Mobile Internet speed

40

Fixed broadband Internet speed

2

Safety

1

Homicide rate

6

Natural disaster risk

N/A

Tourist appeal

86

International hotels

109–112

Culture, entertainment, and sports

53

Ecology

155

Environmental pollution level

155

Internationalization

6

International schools

2

English proficiency

1–76

International business events

26–29

Visitors to international business events

24

Benchmarking against the leading city

Stockholm

16

Technological Development	Rank 25	Creative Industries	Rank 13	Urban Environment	Rank 9
Technology companies (28)		Film and animation (20)		Cost of doing business (104)	
Leading companies by R&D expenditure	24–25	Top-rated film production companies (audience)	22–26	Estimated tax	92–93
R&D expenditure of largest innovation companies	26	Film production companies that won international film festival awards	25–38	Salary	127
Startups and venture capital (28)		Animation film production companies that won international festival awards	10–14	Cost of living (133)	
Startups	37	Electronic games (13)		Food prices	137
Unicorns	37–39	The Game Awards winners	20–34	Apartment rental cost	145
Innovation support funds	28	Largest e-sports tournaments	21–27	Cost of living for an expat	115
Business angels	13	Developers of most popular computer games	2–4	Cost of living for a local resident	127
Venture capital investment	27	Companies participating in electronic games trade shows	27–63	Mobility (33)	
Universities and R&D organizations (62)		Music (14)		Air traffic	30
Leading universities	66–85	Artists with highest-grossing albums	29–200	Commute time	97–98
Leading R&D organizations	24–40	Most-streamed artists	4–6	Bandwidth (23)	
Highly cited researchers	63–65	Best opera performers	17–23	Mobile Internet speed	5
Nobel Prize laureates and Fields Medal winners	41–77	Fashion (12)		Fixed broadband Internet speed	94
Students	117	Largest fashion companies	16–42	Safety (7)	
International students	89	Fashion brands	11	Homicide rate	17–19
Leading business schools	36–80	Advertising and PR (42)		Natural disaster risk	6
Productivity of innovative class (56)		Most effective advertising agencies	49–200	Tourist appeal (88)	
Patent activity	54	Largest PR agencies	7–9	International hotels	93–101
Publication activity	58	Creative production agencies	39–200	Culture, entertainment, and sports	67
Innovation infrastructure (5)		Top advertising agencies	16–38	Ecology (13)	
Clusters	2–7	Architecture (35–42)		Environmental pollution level	13
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization (92)	
Co-working spaces	13–14	Internationally recognized architects and architecture firms	17–26	International schools	87–92
Supercomputers	18–31	Industrial design (17–21)		English proficiency	77–78
		Internationally recognized designers and design firms	17–21	International business events	26–29
		Arts (31)		Visitors to international business events	23
		Internationally recognized artists	16–40		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	18–26		
		Literature (16–17)			
		Best-selling authors	16–17		

Benchmarking against the leading city



Guangzhou

17

Technological Development	Rank 13	Creative Industries	Rank 59	Urban Environment	Rank 53
Technology companies 22		Film and animation 114–200		Cost of doing business 68	
Leading companies by R&D expenditure	16	Top-rated film production companies (audience)	87–200	Estimated tax	115–146
R&D expenditure of largest innovation companies	32	Film production companies that won international film festival awards	71–200	Salary	47
Startups and venture capital 47		Animation film production companies that won international festival awards	43–200	Cost of living 43	
Startups	66	Electronic games 91–92		Food prices	44
Unicorns	31–36	The Game Awards winners	35–200	Apartment rental cost	50
Innovation support funds	52	Largest e-sports tournaments	28–31	Cost of living for an expat	38
Business angels	141–148	Developers of most popular computer games	34–200	Cost of living for a local resident	41
Venture capital investment	26	Companies participating in electronic games trade shows	64–200	Mobility 35	
Universities and R&D organizations 22		Music 75–200		Air traffic	23
Leading universities	17–19	Artists with highest-grossing albums	29–200	Commute time	110
Leading R&D organizations	10–11	Most-streamed artists	38–200	Bandwidth 63	
Highly cited researchers	32–33	Best opera performers	42–200	Mobile Internet speed	84
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 43–46		Fixed broadband Internet speed	58
Students	12	Largest fashion companies	16–42	Safety 50–60	
International students	34	Fashion brands	123–200	Homicide rate	28–41
Leading business schools	81–200	Advertising and PR 47–49		Natural disaster risk	60–71
Productivity of innovative class 2		Most effective advertising agencies	24–29	Tourist appeal 22	
Patent activity	3	Largest PR agencies	61–200	International hotels	25
Publication activity	14	Creative production agencies	39–200	Culture, entertainment, and sports	26
Innovation infrastructure 61		Top advertising agencies	39–200	Ecology 168	
Clusters	29–200	Architecture 72–200		Environmental pollution level	168
Technology and science parks	16–25	Pritzker Architecture Prize laureates	25–200	Internationalization 117	
Co-working spaces	131–200	Internationally recognized architects and architecture firms	62–200	International schools	29–31
Supercomputers	18–31	Industrial design 17–21		English proficiency	134–136
		Internationally recognized designers and design firms	17–21	International business events	99–103
		Arts 86–117		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	69–113		
		Literature 59–200			
		Best-selling authors	59–200		

Benchmarking against the leading city

Barcelona

18

Technological Development

Rank
19

Technology companies	113
Leading companies by R&D expenditure	104–117
R&D expenditure of largest innovation companies	98
Startups and venture capital	35
Startups	18
Unicorns	77–106
Innovation support funds	40
Business angels	22
Venture capital investment	57
Universities and R&D organizations	27
Leading universities	38–42
Leading R&D organizations	41–82
Highly cited researchers	39–41
Nobel Prize laureates and Fields Medal winners	78–200
Students	30
International students	25
Leading business schools	10–15
Productivity of innovative class	50
Patent activity	101
Publication activity	36
Innovation infrastructure	4
Clusters	8–28
Technology and science parks	4–8
Co-working spaces	5
Supercomputers	32–63

Creative Industries

Rank
33

Film and animation	29
Top-rated film production companies (audience)	27–33
Film production companies that won international film festival awards	15–18
Animation film production companies that won international festival awards	43–200
Electronic games	29–30
The Game Awards winners	20–34
Largest e-sports tournaments	44–61
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	15–26
Music	30–34
Artists with highest-grossing albums	11–28
Most-streamed artists	14–37
Best opera performers	42–200
Fashion	47
Largest fashion companies	43–200
Fashion brands	13
Advertising and PR	54
Most effective advertising agencies	49–200
Largest PR agencies	21–31
Creative production agencies	39–200
Top advertising agencies	16–38
Architecture	35–42
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	17–26
Industrial design	22–25
Internationally recognized designers and design firms	22–25
Arts	27
Internationally recognized artists	16–40
Top artists by auction revenue	19–37
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	18–26
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
6

Cost of doing business	25
Estimated tax	23
Salary	68
Cost of living	100
Food prices	63
Apartment rental cost	101
Cost of living for an expat	125
Cost of living for a local resident	92
Mobility	9
Air traffic	19
Commute time	61
Bandwidth	103
Mobile Internet speed	152
Fixed broadband Internet speed	52
Safety	14
Homicide rate	9–11
Natural disaster risk	22–23
Tourist appeal	29
International hotels	57–60
Culture, entertainment, and sports	20
Ecology	148
Environmental pollution level	148
Internationalization	13
International schools	37
English proficiency	107–110
International business events	5
Visitors to international business events	1

Benchmarking against the leading city



Madrid

19

Technological Development

Rank
23

Technology companies

41

Leading companies by R&D expenditure	39–42
R&D expenditure of largest innovation companies	41

Startups and venture capital

37

Startups	31–32
Unicorns	45–59
Innovation support funds	31
Business angels	21
Venture capital investment	44

Universities and R&D organizations

15

Leading universities	17–19
Leading R&D organizations	24–40
Highly cited researchers	37–38
Nobel Prize laureates and Fields Medal winners	41–77
Students	20
International students	8
Leading business schools	5–9

Productivity of innovative class

38

Patent activity	98
Publication activity	22

Innovation infrastructure

35

Clusters	29–200
Technology and science parks	26–72
Co-working spaces	7
Supercomputers	64–200

Creative Industries

Rank
26

Film and animation

10

Top-rated film production companies (audience)	7
Film production companies that won international film festival awards	8–9
Animation film production companies that won international festival awards	26–42

Electronic games

46

The Game Awards winners	20–34
Largest e-sports tournaments	44–61
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63

Music

12

Artists with highest-grossing albums	11–28
Most-streamed artists	14–37
Best opera performers	11–16

Fashion

62–63

Largest fashion companies	43–200
Fashion brands	34–35

Advertising and PR

15

Most effective advertising agencies	49–200
Largest PR agencies	14–20
Creative production agencies	6–8
Top advertising agencies	5–6

Architecture

17–18

Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	27–34

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

22

Internationally recognized artists	16–40
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	13–17

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
10

Cost of doing business

75

Estimated tax	105
Salary	67

Cost of living

88

Food prices	59
Apartment rental cost	105
Cost of living for an expat	101
Cost of living for a local resident	75

Mobility

23

Air traffic	21
Commute time	96

Bandwidth

79

Mobile Internet speed	151
Fixed broadband Internet speed	31

Safety

20

Homicide rate	17–19
Natural disaster risk	22–23

Tourist appeal

13

International hotels	16
Culture, entertainment, and sports	17

Ecology

114

Environmental pollution level	114
-------------------------------	-----

Internationalization

71

International schools	8–10
English proficiency	100–102
International business events	6
Visitors to international business events	75

Benchmarking against the leading city

Sydney

20

Technological Development	Rank 18	Creative Industries	Rank 17	Urban Environment	Rank 50
Technology companies 74		Film and animation 44		Cost of doing business 165	
Leading companies by R&D expenditure	70–80	Top-rated film production companies (audience)	13–16	Estimated tax	78–83
R&D expenditure of largest innovation companies	57	Film production companies that won international film festival awards	71–200	Salary	173
Startups and venture capital 23		Animation film production companies that won international festival awards	26–42	Cost of living 171	
Startups	22	Electronic games 54–58		Food prices	148
Unicorns	60–76	The Game Awards winners	35–200	Apartment rental cost	172
Innovation support funds	22–23	Largest e-sports tournaments	62–200	Cost of living for an expat	146
Business angels	18	Developers of most popular computer games	16–33	Cost of living for a local resident	167
Venture capital investment	17	Companies participating in electronic games trade shows	64–200	Mobility 139	
Universities and R&D organizations 18		Music 35–40		Air traffic	70–71
Leading universities	49–65	Artists with highest-grossing albums	29–200	Commute time	155
Leading R&D organizations	24–40	Most-streamed artists	38–200	Bandwidth 119	
Highly cited researchers	10	Best opera performers	17–23	Mobile Internet speed	29
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 21–22		Fixed broadband Internet speed	174
Students	26	Largest fashion companies	43–200	Safety 31	
International students	3	Fashion brands	7–8	Homicide rate	12–16
Leading business schools	36–80	Advertising and PR 29		Natural disaster risk	42–44
Productivity of innovative class 44		Most effective advertising agencies	19–23	Tourist appeal 47	
Patent activity	89	Largest PR agencies	32–60	International hotels	38–39
Publication activity	33	Creative production agencies	39–200	Culture, entertainment, and sports	61
Innovation infrastructure 10		Top advertising agencies	12–15	Ecology 47	
Clusters	2–7	Architecture 5		Environmental pollution level	47
Technology and science parks	73–200	Pritzker Architecture Prize laureates	9–24	Internationalization 44	
Co-working spaces	65–76	Internationally recognized architects and architecture firms	2	International schools	47
Supercomputers	32–63	Industrial design 48–77		English proficiency	1–76
		Internationally recognized designers and design firms	48–77	International business events	23
		Arts 23		Visitors to international business events	28
		Internationally recognized artists	16–40		
		Top artists by auction revenue	13–18		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	18–26		
		Literature 18–28			
		Best-selling authors	18–28		

Benchmarking against the leading city



Melbourne

21

Technological Development

Rank
26

Technology companies

80

Leading companies by R&D expenditure 70–80

R&D expenditure of largest innovation companies 69

Startups and venture capital

43

Startups 42

Unicorns 40–41

Innovation support funds 47

Business angels 35

Venture capital investment 53

Universities and R&D organizations

13

Leading universities 25–37

Leading R&D organizations 24–40

Highly cited researchers 11

Nobel Prize laureates and Fields Medal winners 78–200

Students 16

International students 2

Leading business schools 81–200

Productivity of innovative class

49

Patent activity 99

Publication activity 34

Innovation infrastructure

25

Clusters 8–28

Technology and science parks 73–200

Co-working spaces 31–36

Supercomputers 64–200

Creative Industries

Rank
21

Film and animation

22

Top-rated film production companies (audience) 34–39

Film production companies that won international film festival awards 39–46

Animation film production companies that won international festival awards 10–14

Electronic games

34

The Game Awards winners 20–34

Largest e-sports tournaments 62–200

Developers of most popular computer games 34–200

Companies participating in electronic games trade shows 15–26

Music

30–34

Artists with highest-grossing albums 11–28

Most-streamed artists 14–37

Best opera performers 42–200

Fashion

60–61

Largest fashion companies 43–200

Fashion brands 30–33

Advertising and PR

35

Most effective advertising agencies 30–48

Largest PR agencies 32–60

Creative production agencies 9–18

Top advertising agencies 16–38

Architecture

10–12

Pritzker Architecture Prize laureates 25–200

Internationally recognized architects and architecture firms 5–7

Industrial design

22–25

Internationally recognized designers and design firms 22–25

Arts

15

Internationally recognized artists 41–200

Top artists by auction revenue 38–200

Most influential people in contemporary art 12–14

Leading higher education institutions in the arts 9–12

Literature

29–58

Best-selling authors 29–58

Urban Environment

Rank
17

Cost of doing business

118

Estimated tax 78–83

Salary 150

Cost of living

127

Food prices 118

Apartment rental cost 127

Cost of living for an expat 117

Cost of living for a local resident 142

Mobility

150

Air traffic 107–108

Commute time 134

Bandwidth 117

Mobile Internet speed 27

Fixed broadband Internet speed 175

Safety

30

Homicide rate 3

Natural disaster risk 42–44

Tourist appeal

32

International hotels 29–30

Culture, entertainment, and sports 39

Ecology

37

Environmental pollution level 37

Internationalization

38

International schools 12

English proficiency 1–76

International business events 46–47

Visitors to international business events 25

Benchmarking against the leading city

Singapore



22

Technological Development

Rank
20

Technology companies

61

Leading companies by R&D expenditure 51–57

R&D expenditure of largest innovation companies 74

Startups and venture capital

10

Startups 6

Unicorns 13–15

Innovation support funds 8

Business angels 19

Venture capital investment 16

Universities and R&D organizations

12

Leading universities 49–65

Leading R&D organizations 24–40

Highly cited researchers 12

Nobel Prize laureates and Fields Medal winners 78–200

Students 102

International students 49

Leading business schools 1

Productivity of innovative class

28

Patent activity 29

Publication activity 25

Innovation infrastructure

57

Clusters 29–200

Technology and science parks 26–72

Co-working spaces 26–29

Supercomputers 32–63

Creative Industries

Rank
56

Film and animation

49–51

Top-rated film production companies (audience) 87–200

Film production companies that won international film festival awards 25–38

Animation film production companies that won international festival awards 43–200

Electronic games

84

The Game Awards winners 35–200

Largest e-sports tournaments 19–20

Developers of most popular computer games 34–200

Companies participating in electronic games trade shows 64–200

Music

75–200

Artists with highest-grossing albums 29–200

Most-streamed artists 38–200

Best opera performers 42–200

Fashion

75–79

Largest fashion companies 43–200

Fashion brands 52–59

Advertising and PR

60–67

Most effective advertising agencies 30–48

Largest PR agencies 61–200

Creative production agencies 39–200

Top advertising agencies 39–200

Architecture

10–12

Pritzker Architecture Prize laureates 25–200

Internationally recognized architects and architecture firms 5–7

Industrial design

78–200

Internationally recognized designers and design firms 78–200

Arts

30

Internationally recognized artists 41–200

Top artists by auction revenue 38–200

Most influential people in contemporary art 12–14

Leading higher education institutions in the arts 27–43

Literature

59–200

Best-selling authors 59–200

Urban Environment

Rank
3

Cost of doing business

30

Estimated tax 7

Salary 155

Cost of living

176

Food prices 105

Apartment rental cost 184

Cost of living for an expat 153

Cost of living for a local resident 169

Mobility

83

Air traffic 41

Commute time 138

Bandwidth

38

Mobile Internet speed 114

Fixed broadband Internet speed 17

Safety

6

Homicide rate 1–2

Natural disaster risk 9

Tourist appeal

45

International hotels 45

Culture, entertainment, and sports 40

Ecology

68

Environmental pollution level 68

Internationalization

3

International schools 14

English proficiency 1–76

International business events 8

Visitors to international business events 10

Benchmarking against the leading city



Munich

23

Technological Development

Rank
32

Technology companies

19

Leading companies by R&D expenditure	28–29
R&D expenditure of largest innovation companies	14

Startups and venture capital

42

Startups	51
Unicorns	31–36
Innovation support funds	42
Business angels	23–24
Venture capital investment	40

Universities and R&D organizations

33

Leading universities	107–145
Leading R&D organizations	24–40
Highly cited researchers	8
Nobel Prize laureates and Fields Medal winners	27–40
Students	80
International students	40
Leading business schools	16–35

Productivity of innovative class

39

Patent activity	38
Publication activity	37

Innovation infrastructure

45

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	17
Supercomputers	8–9

Creative Industries

Rank
16

Film and animation

54

Top-rated film production companies (audience)	10
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

61–82

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63

Music

7

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	3–4

Fashion

64–65

Largest fashion companies	43–200
Fashion brands	36–40

Advertising and PR

34

Most effective advertising agencies	30–48
Largest PR agencies	11–13
Creative production agencies	19–38
Top advertising agencies	16–38

Architecture

49–71

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61

Industrial design

4–6

Internationally recognized designers and design firms	4–6
---	-----

Arts

54–55

Internationally recognized artists	16–40
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68

Literature

29–58

Best-selling authors	29–58
----------------------	-------

Urban Environment

Rank
14

Cost of doing business

95

Estimated tax	50–57
Salary	122

Cost of living

102

Food prices	145
Apartment rental cost	142
Cost of living for an expat	131
Cost of living for a local resident	2

Mobility

8

Air traffic	14
Commute time	79

Bandwidth

130

Mobile Internet speed	78
Fixed broadband Internet speed	147

Safety

21

Homicide rate	42
Natural disaster risk	15–17

Tourist appeal

28

International hotels	23–24
Culture, entertainment, and sports	50

Ecology

35

Environmental pollution level	35
-------------------------------	----

Internationalization

113

International schools	82–86
English proficiency	89–91
International business events	40
Visitors to international business events	59

Benchmarking against the leading city

Technological Development

Rank
39

Technology companies	69
Leading companies by R&D expenditure	58–64
R&D expenditure of largest innovation companies	63
Startups and venture capital	57
Startups	65
Unicorns	77–106
Innovation support funds	46
Business angels	41–42
Venture capital investment	84
Universities and R&D organizations	36
Leading universities	38–42
Leading R&D organizations	41–82
Highly cited researchers	60–62
Nobel Prize laureates and Fields Medal winners	78–200
Students	38
International students	44
Leading business schools	16–35
Productivity of innovative class	46
Patent activity	70
Publication activity	35
Innovation infrastructure	29
Clusters	29–200
Technology and science parks	4–8
Co-working spaces	37–39
Supercomputers	64–200

Creative Industries

Rank
8

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	61–82
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63
Music	9
Artists with highest-grossing albums	29–200
Most-streamed artists	9–13
Best opera performers	6–7
Fashion	3
Largest fashion companies	2
Fashion brands	4
Advertising and PR	43
Most effective advertising agencies	49–200
Largest PR agencies	21–31
Creative production agencies	19–38
Top advertising agencies	16–38
Architecture	27–34
Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	62–200
Industrial design	11–13
Internationally recognized designers and design firms	11–13
Arts	10
Internationally recognized artists	7–8
Top artists by auction revenue	38–200
Most influential people in contemporary art	15–31
Leading higher education institutions in the arts	13–17
Literature	18–28
Best-selling authors	18–28

Urban Environment

Rank
131

Cost of doing business	164
Estimated tax	194–198
Salary	65
Cost of living	150
Food prices	134
Apartment rental cost	128
Cost of living for an expat	164
Cost of living for a local resident	123
Mobility	60
Air traffic	44
Commute time	109
Bandwidth	150
Mobile Internet speed	143
Fixed broadband Internet speed	108
Safety	35
Homicide rate	23–27
Natural disaster risk	45–46
Tourist appeal	34
International hotels	57–60
Culture, entertainment, and sports	23
Ecology	153
Environmental pollution level	153
Internationalization	100
International schools	66–76
English proficiency	107–110
International business events	34–35
Visitors to international business events	7

Benchmarking against the leading city



Osaka



25

Technological Development

Rank
22

Technology companies

11

Leading companies by R&D expenditure

8–10

R&D expenditure of largest innovation companies

15

Startups and venture capital

102

Startups

81

Unicorns

107–200

Innovation support funds

105

Business angels

102–103

Venture capital investment

107

Universities and R&D organizations

24

Leading universities

5–6

Leading R&D organizations

24–40

Highly cited researchers

92–98

Nobel Prize laureates and Fields Medal winners

16–21

Students

18

International students

62

Leading business schools

81–200

Productivity of innovative class

24

Patent activity

19

Publication activity

21

Innovation infrastructure

49

Clusters

29–200

Technology and science parks

26–72

Co-working spaces

26–29

Supercomputers

14–17

Creative Industries

Rank
31

Film and animation

57–58

Top-rated film production companies (audience)

40–53

Film production companies that won international film festival awards

71–200

Animation film production companies that won international festival awards

26–42

Electronic games

19

The Game Awards winners

4–6

Largest e-sports tournaments

62–200

Developers of most popular computer games

16–33

Companies participating in electronic games trade shows

27–63

Music

75–200

Artists with highest-grossing albums

29–200

Most-streamed artists

38–200

Best opera performers

42–200

Fashion

26–28

Largest fashion companies

16–42

Fashion brands

36–40

Advertising and PR

96–200

Most effective advertising agencies

49–200

Largest PR agencies

61–200

Creative production agencies

39–200

Top advertising agencies

39–200

Architecture

27–34

Pritzker Architecture Prize laureates

9–24

Internationally recognized architects and architecture firms

62–200

Industrial design

17–21

Internationally recognized designers and design firms

17–21

Arts

58

Internationally recognized artists

16–40

Top artists by auction revenue

19–37

Most influential people in contemporary art

32–200

Leading higher education institutions in the arts

69–113

Literature

16–17

Best-selling authors

16–17

Urban Environment

Rank
86

Cost of doing business

148

Estimated tax

182–185

Salary

85

Cost of living

69

Food prices

93

Apartment rental cost

80

Cost of living for an expat

51

Cost of living for a local resident

57

Mobility

47

Air traffic

90

Commute time

37

Bandwidth

137

Mobile Internet speed

145

Fixed broadband Internet speed

84

Safety

N/A

Homicide rate

N/A

Natural disaster risk

N/A

Tourist appeal

8

International hotels

121

Culture, entertainment, and sports

5

Ecology

122

Environmental pollution level

122

Internationalization

88

International schools

50–54

English proficiency

N/A

International business events

15

Visitors to international business events

17

Benchmarking against the leading city

Dublin



26


Technological Development	Rank 30	Creative Industries	Rank 20	Urban Environment	Rank 64
Technology companies	30	Film and animation	65	Cost of doing business	107
Leading companies by R&D expenditure	24–25	Top-rated film production companies (audience)	27–33	Estimated tax	100–101
R&D expenditure of largest innovation companies	28	Film production companies that won international film festival awards	47–70	Salary	123
Startups and venture capital	50	Animation film production companies that won international festival awards	43–200	Cost of living	178
Startups	49	Electronic games	110–200	Food prices	106
Unicorns	37–39	The Game Awards winners	35–200	Apartment rental cost	176
Innovation support funds	53	Largest e-sports tournaments	62–200	Cost of living for an expat	175
Business angels	56	Developers of most popular computer games	34–200	Cost of living for a local resident	152
Venture capital investment	58	Companies participating in electronic games trade shows	64–200	Mobility	53
Universities and R&D organizations	47	Music	6	Air traffic	28–29
Leading universities	43–48	Artists with highest-grossing albums	2	Commute time	133
Leading R&D organizations	83–162	Most-streamed artists	14–37	Bandwidth	160
Highly cited researchers	99–104	Best opera performers	42–200	Mobile Internet speed	150
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	43–46	Fixed broadband Internet speed	126
Students	71	Largest fashion companies	16–42	Safety	38
International students	31	Fashion brands	123–200	Homicide rate	28–41
Leading business schools	16–35	Advertising and PR	36	Natural disaster risk	49
Productivity of innovative class	80	Most effective advertising agencies	49–200	Tourist appeal	93
Patent activity	66	Largest PR agencies	32–60	International hotels	122–128
Publication activity	80	Creative production agencies	9–18	Culture, entertainment, and sports	54
Innovation infrastructure	9	Top advertising agencies	12–15	Ecology	90
Clusters	2–7	Architecture	7–8	Environmental pollution level	90
Technology and science parks	73–200	Pritzker Architecture Prize laureates	5–8	Internationalization	43
Co-working spaces	42–52	Internationally recognized architects and architecture firms	35–61	International schools	115–129
Supercomputers	64–200	Industrial design	48–77	English proficiency	1–76
		Internationally recognized designers and design firms	48–77	International business events	18
		Arts	36–37	Visitors to international business events	14
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	18–26		
		Literature	29–58		
		Best-selling authors	29–58		

Benchmarking against the leading city



Technological Development	Rank 15	Creative Industries	Rank 131	Urban Environment	Rank 40
Technology companies	27	Film and animation	114–200	Cost of doing business	49
Leading companies by R&D expenditure	17	Top-rated film production companies (audience)	87–200	Estimated tax	115–146
R&D expenditure of largest innovation companies	45	Film production companies that won international film festival awards	71–200	Salary	36
Startups and venture capital	64	Animation film production companies that won international festival awards	43–200	Cost of living	25
Startups	125	Electronic games	53	Food prices	29
Unicorns	42–44	The Game Awards winners	35–200	Apartment rental cost	19
Innovation support funds	58	Largest e-sports tournaments	12–14	Cost of living for an expat	31
Business angels	156–169	Developers of most popular computer games	34–200	Cost of living for a local resident	24–25
Venture capital investment	32	Companies participating in electronic games trade shows	64–200	Mobility	92
Universities and R&D organizations	53	Music	75–200	Air traffic	173–199
Leading universities	66–85	Artists with highest-grossing albums	29–200	Commute time	18
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth	9
Highly cited researchers	55–59	Best opera performers	42–200	Mobile Internet speed	21
Nobel Prize laureates and Fields Medal winners	78–200	Fashion	129–200	Fixed broadband Internet speed	5
Students	62	Largest fashion companies	43–200	Safety	50–60
International students	160	Fashion brands	123–200	Homicide rate	28–41
Leading business schools	16–35	Advertising and PR	96–200	Natural disaster risk	60–71
Productivity of innovative class	4	Most effective advertising agencies	49–200	Tourist appeal	27
Patent activity	1	Largest PR agencies	61–200	International hotels	17
Publication activity	49	Creative production agencies	39–200	Culture, entertainment, and sports	63
Innovation infrastructure	123	Top advertising agencies	39–200	Ecology	164
Clusters	29–200	Architecture	72–200	Environmental pollution level	164
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	136
Co-working spaces	131–200	Internationally recognized architects and architecture firms	62–200	International schools	48–49
Supercomputers	18–31	Industrial design	48–77	English proficiency	123–133
		Internationally recognized designers and design firms	48–77	International business events	116–122
		Arts	189–200	Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	186–200		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city



Technological Development	Rank 29	Creative Industries	Rank 35	Urban Environment	Rank 30
Technology companies 72		Film and animation 52–53		Cost of doing business 179	
Leading companies by R&D expenditure	65–69	Top-rated film production companies (audience)	22–26	Estimated tax	154–157
R&D expenditure of largest innovation companies	58	Film production companies that won international film festival awards	71–200	Salary	165
Startups and venture capital 13		Animation film production companies that won international festival awards	26–42	Cost of living 149	
Startups	9	Electronic games 21		Food prices	121
Unicorns	26–29	The Game Awards winners	20–34	Apartment rental cost	162
Innovation support funds	13	Largest e-sports tournaments	62–200	Cost of living for an expat	129
Business angels	16	Developers of most popular computer games	16–33	Cost of living for a local resident	140
Venture capital investment	33	Companies participating in electronic games trade shows	15–26	Mobility 84	
Universities and R&D organizations 20		Music 20		Air traffic	24
Leading universities	66–85	Artists with highest-grossing albums	11–28	Commute time	160
Leading R&D organizations	41–82	Most-streamed artists	14–37	Bandwidth 56	
Highly cited researchers	30	Best opera performers	24–41	Mobile Internet speed	53
Nobel Prize laureates and Fields Medal winners	41–77	Fashion 26–28		Fixed broadband Internet speed	64
Students	37	Largest fashion companies	16–42	Safety 23	
International students	9	Fashion brands	36–40	Homicide rate	44
Leading business schools	5–9	Advertising and PR 17		Natural disaster risk	19–21
Productivity of innovative class 43		Most effective advertising agencies	30–48	Tourist appeal 52	
Patent activity	61	Largest PR agencies	11–13	International hotels	48–49
Publication activity	28	Creative production agencies	6–8	Culture, entertainment, and sports	51
Innovation infrastructure 73		Top advertising agencies	7–11	Ecology 81	
Clusters	29–200	Architecture 72–200		Environmental pollution level	81
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 35	
Co-working spaces	23–24	Internationally recognized architects and architecture firms	62–200	International schools	6
Supercomputers	32–63	Industrial design 78–200		English proficiency	1–76
		Internationally recognized designers and design firms	78–200	International business events	43–44
		Arts 34		Visitors to international business events	48
		Internationally recognized artists	9–15		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	27–43		
		Literature 29–58			
		Best-selling authors	29–58		

Benchmarking against the leading city



Copenhagen

29

Technological Development

Rank
35

Technology companies

31

Leading companies by R&D expenditure	23
R&D expenditure of largest innovation companies	33

Startups and venture capital

52

Startups	50
Unicorns	60–76
Innovation support funds	59
Business angels	34
Venture capital investment	56

Universities and R&D organizations

82

Leading universities	66–85
Leading R&D organizations	41–82
Highly cited researchers	43–44
Nobel Prize laureates and Fields Medal winners	41–77
Students	95
International students	57
Leading business schools	81–200

Productivity of innovative class

66

Patent activity	75
Publication activity	61

Innovation infrastructure

13

Clusters	2–7
Technology and science parks	73–200
Co-working spaces	77–87
Supercomputers	64–200

Creative Industries

Rank
30

Film and animation

18

Top-rated film production companies (audience)	19–21
Film production companies that won international film festival awards	19–21
Animation film production companies that won international festival awards	15–25

Electronic games

52

The Game Awards winners	11–19
Largest e-sports tournaments	32–43
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200

Music

75–200

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

21–22

Largest fashion companies	43–200
Fashion brands	7–8

Advertising and PR

60–67

Most effective advertising agencies	30–48
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

6

Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	3–4

Industrial design

34–47

Internationally recognized designers and design firms	34–47
---	-------

Arts

33

Internationally recognized artists	16–40
Top artists by auction revenue	38–200
Most influential people in contemporary art	15–31
Leading higher education institutions in the arts	27–43

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
23

Cost of doing business

167

Estimated tax	159–161
Salary	146

Cost of living

187

Food prices	181
Apartment rental cost	159
Cost of living for an expat	181
Cost of living for a local resident	176

Mobility

19

Air traffic	43
Commute time	42

Bandwidth

12

Mobile Internet speed	8
Fixed broadband Internet speed	35

Safety

15

Homicide rate	28–41
Natural disaster risk	14

Tourist appeal

114

International hotels	173
Culture, entertainment, and sports	46

Ecology

22

Environmental pollution level	22
-------------------------------	----

Internationalization

76

International schools	130–147
English proficiency	83
International business events	12–13
Visitors to international business events	8

Benchmarking against the leading city

São Paulo



30

Technological Development	Rank 38	Creative Industries	Rank 18	Urban Environment	Rank 63
Technology companies 138		Film and animation 19		Cost of doing business 3	
Leading companies by R&D expenditure 118–146		Top-rated film production companies (audience) 54–86		Estimated tax 5–6	
R&D expenditure of largest innovation companies 137		Film production companies that won international film festival awards 39–46		Salary 15	
Startups and venture capital 26		Animation film production companies that won international festival awards 8–9		Cost of living 30	
Startups 23		Electronic games 95–100		Food prices 32	
Unicorns 20		The Game Awards winners 35–200		Apartment rental cost 37	
Innovation support funds 37		Largest e-sports tournaments 32–43		Cost of living for an expat 21–22	
Business angels 30		Developers of most popular computer games 34–200		Cost of living for a local resident 30	
Venture capital investment 23		Companies participating in electronic games trade shows 64–200		Mobility 162	
Universities and R&D organizations 26		Music 43–49		Air traffic 59	
Leading universities 25–37		Artists with highest-grossing albums 11–28		Commute time 168	
Leading R&D organizations 83–162		Most-streamed artists 38–200		Bandwidth 161	
Highly cited researchers 138–145		Best opera performers 42–200		Mobile Internet speed 166	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 19		Fixed broadband Internet speed 91	
Students 14		Largest fashion companies 16–42		Safety 74	
International students 121		Fashion brands 15		Homicide rate 79	
Leading business schools 5–9		Advertising and PR 8		Natural disaster risk 40–41	
Productivity of innovative class 57		Most effective advertising agencies 19–23		Tourist appeal 14	
Patent activity 148		Largest PR agencies 14–20		International hotels 21	
Publication activity 45		Creative production agencies 4–5		Culture, entertainment, and sports 14	
Innovation infrastructure 59–60		Top advertising agencies 7–11		Ecology 177	
Clusters 29–200		Architecture 15		Environmental pollution level 177	
Technology and science parks 73–200		Pritzker Architecture Prize laureates 9–24		Internationalization 115	
Co-working spaces 15–16		Internationally recognized architects and architecture firms 17–26		International schools 41–42	
Supercomputers 32–63		Industrial design 16		English proficiency 115–118	
		Internationally recognized designers and design firms 16		International business events 45	
		Arts 26		Visitors to international business events 53	
		Internationally recognized artists 9–15			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 15–31			
		Leading higher education institutions in the arts 27–43			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city



Montreal

31

Technological Development

Rank
52

Technology companies

82

Leading companies by R&D expenditure	70–80
R&D expenditure of largest innovation companies	81

Startups and venture capital

49

Startups	54–55
Unicorns	45–59
Innovation support funds	45
Business angels	40
Venture capital investment	51

Universities and R&D organizations

35

Leading universities	66–85
Leading R&D organizations	41–82
Highly cited researchers	63–65
Nobel Prize laureates and Fields Medal winners	78–200
Students	43
International students	14
Leading business schools	16–35

Productivity of innovative class

55

Patent activity	92
Publication activity	44

Innovation infrastructure

62

Clusters	29–200
Technology and science parks	26–72
Co-working spaces	37–39
Supercomputers	32–63

Creative Industries

Rank
24

Film and animation

16

Top-rated film production companies (audience)	27–33
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	5–7

Electronic games

7

The Game Awards winners	20–34
Largest e-sports tournaments	28–31
Developers of most popular computer games	5–11
Companies participating in electronic games trade shows	3–6

Music

43–49

Artists with highest-grossing albums	11–28
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

26–28

Largest fashion companies	16–42
Fashion brands	36–40

Advertising and PR

74–78

Most effective advertising agencies	49–200
Largest PR agencies	21–31
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

35–42

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	17–26

Industrial design

48–77

Internationally recognized designers and design firms	48–77
---	-------

Arts

41–49

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	27–43

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
20

Cost of doing business

124

Estimated tax	154–157
Salary	98

Cost of living

121

Food prices	91
Apartment rental cost	102
Cost of living for an expat	162
Cost of living for a local resident	73

Mobility

117

Air traffic	65–67
Commute time	128

Bandwidth

138

Mobile Internet speed	96
Fixed broadband Internet speed	145

Safety

19

Homicide rate	22
Natural disaster risk	19–21

Tourist appeal

70

International hotels	82
Culture, entertainment, and sports	47

Ecology

67

Environmental pollution level	67
-------------------------------	----

Internationalization

11

International schools	15
English proficiency	1–76
International business events	24–25
Visitors to international business events	11

Benchmarking against the leading city

Amsterdam

32

Technological Development	Rank 55	Creative Industries	Rank 23	Urban Environment	Rank 18
Technology companies 34		Film and animation 9		Cost of doing business 113	
Leading companies by R&D expenditure	31–36	Top-rated film production companies (audience)	22–26	Estimated tax	85–88
R&D expenditure of largest innovation companies	25	Film production companies that won international film festival awards	15–18	Salary	144
Startups and venture capital 24		Animation film production companies that won international festival awards	8–9	Cost of living 177	
Startups	12	Electronic games 23		Food prices	154
Unicorns	31–36	The Game Awards winners	35–200	Apartment rental cost	163
Innovation support funds	30	Largest e-sports tournaments	44–61	Cost of living for an expat	174
Business angels	29	Developers of most popular computer games	34–200	Cost of living for a local resident	156
Venture capital investment	38	Companies participating in electronic games trade shows	11–14	Mobility 6	
Universities and R&D organizations 67		Music 15		Air traffic	5–7
Leading universities	107–145	Artists with highest-grossing albums	29–200	Commute time	58
Leading R&D organizations	41–82	Most-streamed artists	14–37	Bandwidth 89	
Highly cited researchers	28	Best opera performers	9–10	Mobile Internet speed	43
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 42		Fixed broadband Internet speed	106
Students	106	Largest fashion companies	43–200	Safety 73	
International students	70	Fashion brands	12	Homicide rate	52
Leading business schools	36–80	Advertising and PR 45		Natural disaster risk	80
Productivity of innovative class 62		Most effective advertising agencies	30–48	Tourist appeal 26	
Patent activity	82	Largest PR agencies	32–60	International hotels	42–44
Publication activity	57	Creative production agencies	39–200	Culture, entertainment, and sports	21
Innovation infrastructure 68		Top advertising agencies	16–38	Ecology 58	
Clusters	29–200	Architecture 16		Environmental pollution level	58
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 57	
Co-working spaces	31–36	Internationally recognized architects and architecture firms	8	International schools	66–76
Supercomputers	14–17	Industrial design 48–77		English proficiency	77–78
		Internationally recognized designers and design firms	48–77	International business events	16
		Arts 50–51		Visitors to international business events	9
		Internationally recognized artists	41–200		
		Top artists by auction revenue	13–18		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature 18–28			
		Best-selling authors	18–28		

Benchmarking against the leading city



Nanjing



33

Technological Development

Rank
16

Technology companies

60

Leading companies by R&D expenditure 51–57

R&D expenditure of largest innovation companies 64

Startups and venture capital

62

Startups 128

Unicorns 21–25

Innovation support funds 87

Business angels 156–169

Venture capital investment 34

Universities and R&D organizations

19

Leading universities 11–12

Leading R&D organizations 6–9

Highly cited researchers 20–21

Nobel Prize laureates and Fields Medal winners 78–200

Students 8

International students 51

Leading business schools 81–200

Productivity of innovative class

7

Patent activity 9

Publication activity 9

Innovation infrastructure

47

Clusters 29–200

Technology and science parks 9–15

Co-working spaces 131–200

Supercomputers 18–31

Creative Industries

Rank
143

Film and animation

73–85

Top-rated film production companies (audience) 87–200

Film production companies that won international film festival awards 47–70

Animation film production companies that won international festival awards 43–200

Electronic games

95–100

The Game Awards winners 35–200

Largest e-sports tournaments 32–43

Developers of most popular computer games 34–200

Companies participating in electronic games trade shows 64–200

Music

75–200

Artists with highest-grossing albums 29–200

Most-streamed artists 38–200

Best opera performers 42–200

Fashion

129–200

Largest fashion companies 43–200

Fashion brands 123–200

Advertising and PR

96–200

Most effective advertising agencies 49–200

Largest PR agencies 61–200

Creative production agencies 39–200

Top advertising agencies 39–200

Architecture

72–200

Pritzker Architecture Prize laureates 25–200

Internationally recognized architects and architecture firms 62–200

Industrial design

78–200

Internationally recognized designers and design firms 78–200

Arts

53

Internationally recognized artists 41–200

Top artists by auction revenue 9

Most influential people in contemporary art 32–200

Leading higher education institutions in the arts 69–113

Literature

59–200

Best-selling authors 59–200

Urban Environment

Rank
67

Cost of doing business

62

Estimated tax 115–146

Salary 43

Cost of living

17

Food prices 21

Apartment rental cost 42

Cost of living for an expat 7

Cost of living for a local resident 11

Mobility

133

Air traffic 111

Commute time 116

Bandwidth

13

Mobile Internet speed 18

Fixed broadband Internet speed 13

Safety

50–60

Homicide rate 28–41

Natural disaster risk 60–71

Tourist appeal

90

International hotels 67–68

Culture, entertainment, and sports 116

Ecology

166

Environmental pollution level 166

Internationalization

139

International schools 82–86

English proficiency 123–133

International business events 80–81

Visitors to international business events N/A

Benchmarking against the leading city

Hangzhou

34

Technological Development	Rank 17	Creative Industries	Rank 70	Urban Environment	Rank 88
Technology companies 12		Film and animation 62–63		Cost of doing business 70	
Leading companies by R&D expenditure	11–12	Top-rated film production companies (audience)	87–200	Estimated tax	115–146
R&D expenditure of largest innovation companies	17	Film production companies that won international film festival awards	71–200	Salary	49
Startups and venture capital 27		Animation film production companies that won international festival awards	26–42	Cost of living 26	
Startups	54–55	Electronic games 110–200		Food prices	36
Unicorns	11	The Game Awards winners	35–200	Apartment rental cost	39
Innovation support funds	29	Largest e-sports tournaments	62–200	Cost of living for an expat	18
Business angels	128–131	Developers of most popular computer games	34–200	Cost of living for a local resident	12
Venture capital investment	9	Companies participating in electronic games trade shows	64–200	Mobility 130	
Universities and R&D organizations 71		Music 75–200		Air traffic	88–89
Leading universities	49–65	Artists with highest-grossing albums	29–200	Commute time	126
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth 15	
Highly cited researchers	42	Best opera performers	42–200	Mobile Internet speed	6
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 102–128		Fixed broadband Internet speed	40
Students	46	Largest fashion companies	43–200	Safety N/A	
International students	71	Fashion brands	91–122	Homicide rate	N/A
Leading business schools	81–200	Advertising and PR 96–200		Natural disaster risk	N/A
Productivity of innovative class 8		Most effective advertising agencies	49–200	Tourist appeal 42	
Patent activity	6	Largest PR agencies	61–200	International hotels	26
Publication activity	19	Creative production agencies	39–200	Culture, entertainment, and sports	93
Innovation infrastructure 65		Top advertising agencies	39–200	Ecology 154	
Clusters	29–200	Architecture 17–18		Environmental pollution level	154
Technology and science parks	73–200	Pritzker Architecture Prize laureates	9–24	Internationalization 125	
Co-working spaces	77–87	Internationally recognized architects and architecture firms	27–34	International schools	55
Supercomputers	6–7	Industrial design 26–33		English proficiency	N/A
		Internationally recognized designers and design firms	26–33	International business events	64
		Arts 130–185		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	114–185		
		Literature 59–200			
		Best-selling authors	59–200		

Benchmarking against the leading city



Technological Development

Rank
36

Technology companies

85

Leading companies by R&D expenditure	70–80
R&D expenditure of largest innovation companies	102

Startups and venture capital

51

Startups	48
Unicorns	45–59
Innovation support funds	60
Business angels	36
Venture capital investment	72

Universities and R&D organizations

23

Leading universities	8
Leading R&D organizations	163–200
Highly cited researchers	178–182
Nobel Prize laureates and Fields Medal winners	78–200
Students	9
International students	22
Leading business schools	16–35

Productivity of innovative class

70

Patent activity	102
Publication activity	60

Innovation infrastructure

39

Clusters	29–200
Technology and science parks	4–8
Co-working spaces	88–103
Supercomputers	64–200

Creative Industries

Rank
36

Film and animation

30

Top-rated film production companies (audience)	12
Film production companies that won international film festival awards	22–24
Animation film production companies that won international festival awards	43–200

Electronic games

110–200

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200

Music

75–200

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

53

Largest fashion companies	43–200
Fashion brands	21–22

Advertising and PR

5

Most effective advertising agencies	2
Largest PR agencies	61–200
Creative production agencies	19–38
Top advertising agencies	39–200

Architecture

24–26

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	13–16

Industrial design

34–47

Internationally recognized designers and design firms	34–47
---	-------

Arts

86–117

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
31

Cost of doing business

23

Estimated tax	107–108
Salary	7

Cost of living

7

Food prices	5
Apartment rental cost	15
Cost of living for an expat	5
Cost of living for a local resident	4

Mobility

50

Air traffic	8
Commute time	175–176

Bandwidth

182

Mobile Internet speed	155
Fixed broadband Internet speed	188

Safety

44

Homicide rate	51
Natural disaster risk	52

Tourist appeal

10

International hotels	11
Culture, entertainment, and sports	16

Ecology

158

Environmental pollution level	158
-------------------------------	-----

Internationalization

98

International schools	5
English proficiency	138
International business events	42
Visitors to international business events	40

Benchmarking against the leading city

Chicago

36

Technological Development	Rank 28	Creative Industries	Rank 32	Urban Environment	Rank 118
Technology companies 17		Film and animation 89–93		Cost of doing business 177	
Leading companies by R&D expenditure 19–20		Top-rated film production companies (audience) 40–53		Estimated tax 94	
R&D expenditure of largest innovation companies 20		Film production companies that won international film festival awards 71–200		Salary 177	
Startups and venture capital 14		Animation film production companies that won international festival awards 43–200		Cost of living 172	
Startups 20		Electronic games 83		Food prices 158	
Unicorns 16		The Game Awards winners 11–19		Apartment rental cost 177	
Innovation support funds 9		Largest e-sports tournaments 62–200		Cost of living for an expat 151	
Business angels 15		Developers of most popular computer games 34–200		Cost of living for a local resident 157	
Venture capital investment 25		Companies participating in electronic games trade shows 64–200		Mobility 176	
Universities and R&D organizations 29		Music 21		Air traffic 173–199	
Leading universities 25–37		Artists with highest-grossing albums 29–200		Commute time 141	
Leading R&D organizations 18–23		Most-streamed artists 7–8		Bandwidth 82	
Highly cited researchers 16		Best opera performers 24–41		Mobile Internet speed 51	
Nobel Prize laureates and Fields Medal winners 10		Fashion 86–101		Fixed broadband Internet speed 96	
Students 48		Largest fashion companies 43–200		Safety 82	
International students 35		Fashion brands 72–90		Homicide rate 84	
Leading business schools 81–200		Advertising and PR 20		Natural disaster risk 34–39	
Productivity of innovative class 32		Most effective advertising agencies 30–48		Tourist appeal 17	
Patent activity 39		Largest PR agencies 7–9		International hotels 12	
Publication activity 24		Creative production agencies 19–38		Culture, entertainment, and sports 27	
Innovation infrastructure 70		Top advertising agencies 7–11		Ecology 108	
Clusters 29–200		Architecture 49–71		Environmental pollution level 108	
Technology and science parks 73–200		Pritzker Architecture Prize laureates 25–200		Internationalization 37	
Co-working spaces 26–29		Internationally recognized architects and architecture firms 35–61		International schools 3	
Supercomputers 18–31		Industrial design 34–47		English proficiency 1–76	
		Internationally recognized designers and design firms 34–47		International business events 59–60	
		Arts 12		Visitors to international business events 63	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 19–37			
		Most influential people in contemporary art 8–11			
		Leading higher education institutions in the arts 13–17			
		Literature 10–15			
		Best-selling authors 10–15			

Benchmarking against the leading city



Taipei



37

Technological Development

Rank
37

Technology companies

14

Leading companies by R&D expenditure

13

R&D expenditure of largest innovation companies

27

Startups and venture capital

55

Startups

43

Unicorns

107–200

Innovation support funds

55

Business angels

87–89

Venture capital investment

100

Universities and R&D organizations

44

Leading universities

13–16

Leading R&D organizations

41–82

Highly cited researchers

138–145

Nobel Prize laureates and Fields Medal winners

41–77

Students

36

International students

41

Leading business schools

81–200

Productivity of innovative class

45

Patent activity

43

Publication activity

40

Innovation infrastructure

55

Clusters

29–200

Technology and science parks

73–200

Co-working spaces

9

Supercomputers

64–200

Creative Industries

Rank
40

Film and animation

89–93

Top-rated film production companies (audience)

40–53

Film production companies that won international film festival awards

71–200

Animation film production companies that won international festival awards

43–200

Electronic games

101–109

The Game Awards winners

35–200

Largest e-sports tournaments

44–61

Developers of most popular computer games

34–200

Companies participating in electronic games trade shows

64–200

Music

75–200

Artists with highest-grossing albums

29–200

Most-streamed artists

38–200

Best opera performers

42–200

Fashion

86–101

Largest fashion companies

43–200

Fashion brands

72–90

Advertising and PR

50

Most effective advertising agencies

30–48

Largest PR agencies

61–200

Creative production agencies

39–200

Top advertising agencies

16–38

Architecture

72–200

Pritzker Architecture Prize laureates

25–200

Internationally recognized architects and architecture firms

62–200

Industrial design

4–6

Internationally recognized designers and design firms

4–6

Arts

41–49

Internationally recognized artists

41–200

Top artists by auction revenue

38–200

Most influential people in contemporary art

32–200

Leading higher education institutions in the arts

27–43

Literature

59–200

Best-selling authors

59–200

Urban Environment

Rank
45

Cost of doing business

34

Estimated tax

68–77

Salary

59

Cost of living

73

Food prices

135

Apartment rental cost

53

Cost of living for an expat

53

Cost of living for a local resident

74

Mobility

144

Air traffic

156–158

Commute time

87

Bandwidth

106

Mobile Internet speed

123

Fixed broadband Internet speed

76

Safety

2

Homicide rate

57–58

Natural disaster risk

1

Tourist appeal

81

International hotels

151–155

Culture, entertainment, and sports

32

Ecology

111

Environmental pollution level

111

Internationalization

111

International schools

87–92

English proficiency

123–133

International business events

22

Visitors to international business events

27

Benchmarking against the leading city

Technological Development	Rank 33	Creative Industries	Rank 19	Urban Environment	Rank 154
Technology companies 15		Film and animation 94–113		Cost of doing business 195	
Leading companies by R&D expenditure	30	Top-rated film production companies (audience)	54–86	Estimated tax	37–41
R&D expenditure of largest innovation companies	10	Film production companies that won international film festival awards	71–200	Salary	192
Startups and venture capital 19		Animation film production companies that won international festival awards	43–200	Cost of living 180	
Startups	25	Electronic games 2		Food prices	182
Unicorns	18	The Game Awards winners	3	Apartment rental cost	179
Innovation support funds	24	Largest e-sports tournaments	8–11	Cost of living for an expat	155
Business angels	9	Developers of most popular computer games	1	Cost of living for a local resident	154
Venture capital investment	20	Companies participating in electronic games trade shows	11–14	Mobility 126	
Universities and R&D organizations 87		Music 52–64		Air traffic	57
Leading universities	107–145	Artists with highest-grossing albums	29–200	Commute time	145
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth 99	
Highly cited researchers	22	Best opera performers	24–41	Mobile Internet speed	67
Nobel Prize laureates and Fields Medal winners	27–40	Fashion 14–16		Fixed broadband Internet speed	102
Students	107	Largest fashion companies	7–15	Safety N/A	
International students	83	Fashion brands	60–71	Homicide rate	N/A
Leading business schools	81–200	Advertising and PR 74–78		Natural disaster risk	N/A
Productivity of innovative class 41		Most effective advertising agencies	49–200	Tourist appeal 54	
Patent activity	33	Largest PR agencies	21–31	International hotels	40–41
Publication activity	43	Creative production agencies	39–200	Culture, entertainment, and sports	74
Innovation infrastructure 26		Top advertising agencies	39–200	Ecology 50	
Clusters	8–28	Architecture 72–200		Environmental pollution level	50
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 56	
Co-working spaces	42–52	Internationally recognized architects and architecture firms	62–200	International schools	66–76
Supercomputers	32–63	Industrial design 48–77		English proficiency	1–76
		Internationally recognized designers and design firms	48–77	International business events	99–103
		Arts 86–117		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	69–113		
		Literature 18–28			
		Best-selling authors	18–28		

Benchmarking against the leading city



Technological
DevelopmentRank
83

Technology companies	105
Leading companies by R&D expenditure	91–103
R&D expenditure of largest innovation companies	116
Startups and venture capital	66
Startups	73
Unicorns	45–59
Innovation support funds	61
Business angels	60
Venture capital investment	73
Universities and R&D organizations	48
Leading universities	49–65
Leading R&D organizations	18–23
Highly cited researchers	37–38
Nobel Prize laureates and Fields Medal winners	22–26
Students	99
International students	52
Leading business schools	81–200
Productivity of innovative class	60
Patent activity	81
Publication activity	53
Innovation infrastructure	117–119
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	65–76
Supercomputers	32–63

Creative Industries

Rank
42

Film and animation	37
Top-rated film production companies (audience)	19–21
Film production companies that won international film festival awards	25–38
Animation film production companies that won international festival awards	43–200
Electronic games	61–82
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63
Music	13
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	8
Fashion	64–65
Largest fashion companies	43–200
Fashion brands	36–40
Advertising and PR	60–67
Most effective advertising agencies	30–48
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	27–34
Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	21
Internationally recognized artists	16–40
Top artists by auction revenue	19–37
Most influential people in contemporary art	15–31
Leading higher education institutions in the arts	18–26
Literature	29–58
Best-selling authors	29–58

Urban Environment

Rank
4

Cost of doing business	106
Estimated tax	148
Salary	80
Cost of living	93
Food prices	113
Apartment rental cost	86
Cost of living for an expat	79
Cost of living for a local resident	87–88
Mobility	10
Air traffic	34
Commute time	32
Bandwidth	125
Mobile Internet speed	124
Fixed broadband Internet speed	90
Safety	33
Homicide rate	57–58
Natural disaster risk	27
Tourist appeal	48
International hotels	63–66
Culture, entertainment, and sports	30
Ecology	9
Environmental pollution level	9
Internationalization	53
International schools	87–92
English proficiency	84–88
International business events	7
Visitors to international business events	4

Benchmarking against the leading city

Technological Development	Rank 56	Creative Industries	Rank 27	Urban Environment	Rank 85
Technology companies 39		Film and animation 56		Cost of doing business 173	
Leading companies by R&D expenditure	31–36	Top-rated film production companies (audience)	40–53	Estimated tax	14
R&D expenditure of largest innovation companies	53	Film production companies that won international film festival awards	39–46	Salary	191
Startups and venture capital 45		Animation film production companies that won international festival awards	43–200	Cost of living 192	
Startups	47	Electronic games 16		Food prices	195
Unicorns	45–59	The Game Awards winners	35–200	Apartment rental cost	178
Innovation support funds	41	Largest e-sports tournaments	62–200	Cost of living for an expat	163
Business angels	26–27	Developers of most popular computer games	16–33	Cost of living for a local resident	175
Venture capital investment	76	Companies participating in electronic games trade shows	7–8	Mobility 31	
Universities and R&D organizations 41		Music 35–40		Air traffic	37–38
Leading universities	107–145	Artists with highest-grossing albums	29–200	Commute time	80
Leading R&D organizations	18–23	Most-streamed artists	38–200	Bandwidth 36	
Highly cited researchers	34	Best opera performers	17–23	Mobile Internet speed	61
Nobel Prize laureates and Fields Medal winners	14–15	Fashion 75–79		Fixed broadband Internet speed	38
Students	133	Largest fashion companies	43–200	Safety 8	
International students	61	Fashion brands	52–59	Homicide rate	4–5
Leading business schools	36–80	Advertising and PR 79–95		Natural disaster risk	11–12
Productivity of innovative class 63		Most effective advertising agencies	49–200	Tourist appeal 134	
Patent activity	91	Largest PR agencies	32–60	International hotels	93–101
Publication activity	56	Creative production agencies	39–200	Culture, entertainment, and sports	153
Innovation infrastructure 76–77		Top advertising agencies	39–200	Ecology 11	
Clusters	29–200	Architecture 72–200		Environmental pollution level	11
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization 130	
Co-working spaces	42–52	Internationally recognized architects and architecture firms	62–200	International schools	87–92
Supercomputers	64–200	Industrial design 14–15		English proficiency	115–118
		Internationally recognized designers and design firms	14–15	International business events	51–52
		Arts 14		Visitors to international business events	67
		Internationally recognized artists	41–200		
		Top artists by auction revenue	19–37		
		Most influential people in contemporary art	7		
		Leading higher education institutions in the arts	27–43		
		Literature 29–58			
		Best-selling authors	29–58		

Benchmarking against the leading city



Philadelphia

41

Technological Development

Rank
27

Technology companies

23

Leading companies by R&D expenditure	18
R&D expenditure of largest innovation companies	31

Startups and venture capital

33

Startups	30
Unicorns	40–41
Innovation support funds	18
Business angels	32
Venture capital investment	35

Universities and R&D organizations

16

Leading universities	25–37
Leading R&D organizations	18–23
Highly cited researchers	13
Nobel Prize laureates and Fields Medal winners	5
Students	52
International students	60
Leading business schools	36–80

Productivity of innovative class

29

Patent activity	40
Publication activity	20

Innovation infrastructure

120–122

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	53–55
Supercomputers	64–200

Creative Industries

Rank
63

Film and animation

86–87

Top-rated film production companies (audience)	27–33
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

90

The Game Awards winners	20–34
Largest e-sports tournaments	44–61
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200

Music

75–200

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

35–37

Largest fashion companies	16–42
Fashion brands	72–90

Advertising and PR

79–95

Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

27–34

Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

36–37

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	18–26

Literature

18–28

Best-selling authors	18–28
----------------------	-------

Urban Environment

Rank
119

Cost of doing business

160

Estimated tax	96
Salary	172

Cost of living

163

Food prices	183
Apartment rental cost	169
Cost of living for an expat	112
Cost of living for a local resident	143

Mobility

74

Air traffic	42
Commute time	132

Bandwidth

35

Mobile Internet speed	45
Fixed broadband Internet speed	48

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

68

International hotels	69–74
Culture, entertainment, and sports	55

Ecology

119

Environmental pollution level	119
-------------------------------	-----

Internationalization

51

International schools	43–46
English proficiency	1–76
International business events	108–110
Visitors to international business events	N/A

Benchmarking against the leading city

Buenos Aires



42

Technological Development	Rank 50	Creative Industries	Rank 54	Urban Environment	Rank 32
Technology companies	124	Film and animation	21	Cost of doing business	24
Leading companies by R&D expenditure	118–146	Top-rated film production companies (audience)	27–33	Estimated tax	111
R&D expenditure of largest innovation companies	99	Film production companies that won international film festival awards	15–18	Salary	8
Startups and venture capital	85	Animation film production companies that won international festival awards	26–42	Cost of living	3
Startups	72	Electronic games	110–200	Food prices	7
Unicorns	77–106	The Game Awards winners	35–200	Apartment rental cost	9
Innovation support funds	96–98	Largest e-sports tournaments	62–200	Cost of living for an expat	3
Business angels	70–71	Developers of most popular computer games	34–200	Cost of living for a local resident	3
Venture capital investment	101	Companies participating in electronic games trade shows	64–200	Mobility	165
Universities and R&D organizations	28	Music	50–51	Air traffic	94
Leading universities	13–16	Artists with highest-grossing albums	29–200	Commute time	165
Leading R&D organizations	83–162	Most-streamed artists	9–13	Bandwidth	177
Highly cited researchers	178–182	Best opera performers	42–200	Mobile Internet speed	170
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	129–200	Fixed broadband Internet speed	167
Students	4	Largest fashion companies	43–200	Safety	43
International students	144	Fashion brands	123–200	Homicide rate	71
Leading business schools	36–80	Advertising and PR	14	Natural disaster risk	30–31
Productivity of innovative class	155	Most effective advertising agencies	5	Tourist appeal	41
Patent activity	170	Largest PR agencies	61–200	International hotels	113–115
Publication activity	145	Creative production agencies	19–38	Culture, entertainment, and sports	15
Innovation infrastructure	46	Top advertising agencies	39–200	Ecology	115
Clusters	29–200	Architecture	72–200	Environmental pollution level	115
Technology and science parks	16–25	Pritzker Architecture Prize laureates	25–200	Internationalization	58
Co-working spaces	23–24	Internationally recognized architects and architecture firms	62–200	International schools	20
Supercomputers	64–200	Industrial design	78–200	English proficiency	100–102
		Internationally recognized designers and design firms	78–200	International business events	11
		Arts	59–75	Visitors to international business events	13
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature	29–58		
		Best-selling authors	29–58		

Benchmarking against the leading city



Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	94		28		34
Technology companies	133	Film and animation	12	Cost of doing business	20
Leading companies by R&D expenditure	118–146	Top-rated film production companies (audience)	22–26	Estimated tax	36
R&D expenditure of largest innovation companies	130	Film production companies that won international film festival awards	3–4	Salary	45
Startups and venture capital	78	Animation film production companies that won international festival awards	26–42	Cost of living	36
Startups	76	Electronic games	11	Food prices	31
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	45
Innovation support funds	69	Largest e-sports tournaments	62–200	Cost of living for an expat	39
Business angels	65	Developers of most popular computer games	16–33	Cost of living for a local resident	35
Venture capital investment	115	Companies participating in electronic games trade shows	3–6	Mobility	70
Universities and R&D organizations	75	Music	23–27	Air traffic	58
Leading universities	49–65	Artists with highest-grossing albums	29–200	Commute time	95
Leading R&D organizations	83–162	Most-streamed artists	38–200	Bandwidth	124
Highly cited researchers	159–166	Best opera performers	11–16	Mobile Internet speed	147
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	86–101	Fixed broadband Internet speed	69
Students	50	Largest fashion companies	43–200	Safety	22
International students	82	Fashion brands	72–90	Homicide rate	9–11
Leading business schools	36–80	Advertising and PR	24	Natural disaster risk	25
Productivity of innovative class	74	Most effective advertising agencies	12–13	Tourist appeal	71
Patent activity	152	Largest PR agencies	61–200	International hotels	93–101
Publication activity	64	Creative production agencies	39–200	Culture, entertainment, and sports	41
Innovation infrastructure	95–98	Top advertising agencies	16–38	Ecology	137
Clusters	29–200	Architecture	72–200	Environmental pollution level	137
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	106
Co-working spaces	31–36	Internationally recognized architects and architecture firms	62–200	International schools	48–49
Supercomputers	64–200	Industrial design	34–47	English proficiency	92–94
		Internationally recognized designers and design firms	34–47	International business events	36
		Arts	54–55	Visitors to international business events	44
		Internationally recognized artists	16–40		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city

Technological Development	Rank 68	Creative Industries	Rank 34	Urban Environment	Rank 47
Technology companies 64		Film and animation 52–53		Cost of doing business 150	
Leading companies by R&D expenditure	51–57	Top-rated film production companies (audience)	22–26	Estimated tax	63
R&D expenditure of largest innovation companies	79	Film production companies that won international film festival awards	71–200	Salary	171
Startups and venture capital 34		Animation film production companies that won international festival awards	26–42	Cost of living 137	
Startups	29	Electronic games 14		Food prices	107
Unicorns	37–39	The Game Awards winners	35–200	Apartment rental cost	173
Innovation support funds	26–27	Largest e-sports tournaments	5–6	Cost of living for an expat	98
Business angels	20	Developers of most popular computer games	2–4	Cost of living for a local resident	122
Venture capital investment	39	Companies participating in electronic games trade shows	64–200	Mobility 16	
Universities and R&D organizations 55		Music 50–51		Air traffic	10
Leading universities	86–106	Artists with highest-grossing albums	29–200	Commute time	143
Leading R&D organizations	41–82	Most-streamed artists	9–13	Bandwidth 49	
Highly cited researchers	27	Best opera performers	42–200	Mobile Internet speed	100
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 14–16		Fixed broadband Internet speed	34
Students	67	Largest fashion companies	7–15	Safety N/A	
International students	48	Fashion brands	60–71	Homicide rate	N/A
Leading business schools	36–80	Advertising and PR 44		Natural disaster risk	N/A
Productivity of innovative class 51		Most effective advertising agencies	49–200	Tourist appeal 56	
Patent activity	51	Largest PR agencies	32–60	International hotels	35
Publication activity	47	Creative production agencies	9–18	Culture, entertainment, and sports	96
Innovation infrastructure 117–119		Top advertising agencies	39–200	Ecology 98	
Clusters	29–200	Architecture 72–200		Environmental pollution level	98
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 36	
Co-working spaces	65–76	Internationally recognized architects and architecture firms	62–200	International schools	18–19
Supercomputers	32–63	Industrial design 78–200		English proficiency	1–76
		Internationally recognized designers and design firms	78–200	International business events	93–96
		Arts 52		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	15–31		
		Leading higher education institutions in the arts	44–68		
		Literature 18–28			
		Best-selling authors	18–28		

Benchmarking against the leading city



Brussels

45

Technological Development

Rank
40

Technology companies

54

Leading companies by R&D expenditure	58–64
R&D expenditure of largest innovation companies	51

Startups and venture capital

75

Startups	94
Unicorns	60–76
Innovation support funds	63
Business angels	55
Venture capital investment	77

Universities and R&D organizations

46

Leading universities	86–106
Leading R&D organizations	41–82
Highly cited researchers	68–70
Nobel Prize laureates and Fields Medal winners	27–40
Students	91
International students	39
Leading business schools	16–35

Productivity of innovative class

89

Patent activity	103
Publication activity	76

Innovation infrastructure

16

Clusters	8–28
Technology and science parks	9–15
Co-working spaces	65–76
Supercomputers	64–200

Creative Industries

Rank
41

Film and animation

6

Top-rated film production companies (audience)	17–18
Film production companies that won international film festival awards	12–14
Animation film production companies that won international festival awards	3

Electronic games

110–200

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200

Music

10

Artists with highest-grossing albums	11–28
Most-streamed artists	14–37
Best opera performers	9–10

Fashion

86–101

Largest fashion companies	43–200
Fashion brands	72–90

Advertising and PR

53

Most effective advertising agencies	49–200
Largest PR agencies	21–31
Creative production agencies	19–38
Top advertising agencies	39–200

Architecture

49–71

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

32

Internationally recognized artists	16–40
Top artists by auction revenue	13–18
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	27–43

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
100

Cost of doing business

137

Estimated tax	173
Salary	93

Cost of living

94

Food prices	82
Apartment rental cost	98
Cost of living for an expat	97
Cost of living for a local resident	91

Mobility

36

Air traffic	25–27
Commute time	114

Bandwidth

158

Mobile Internet speed	131
Fixed broadband Internet speed	157

Safety

28

Homicide rate	54
Natural disaster risk	24

Tourist appeal

59

International hotels	57–60
Culture, entertainment, and sports	44

Ecology

140

Environmental pollution level	140
-------------------------------	-----

Internationalization

103

International schools	82–86
English proficiency	84–88
International business events	24–25
Visitors to international business events	46

Benchmarking against the leading city

Technological Development	Rank 72	Creative Industries	Rank 46	Urban Environment	Rank 22
Technology companies 36		Film and animation 89–93		Cost of doing business 96	
Leading companies by R&D expenditure	31–36	Top-rated film production companies (audience)	40–53	Estimated tax	102
R&D expenditure of largest innovation companies	35	Film production companies that won international film festival awards	71–200	Salary	99
Startups and venture capital 48		Animation film production companies that won international festival awards	43–200	Cost of living 143	
Startups	53	Electronic games 26		Food prices	156
Unicorns	45–59	The Game Awards winners	11–19	Apartment rental cost	107
Innovation support funds	44	Largest e-sports tournaments	62–200	Cost of living for an expat	140
Business angels	39	Developers of most popular computer games	16–33	Cost of living for a local resident	133
Venture capital investment	59	Companies participating in electronic games trade shows	27–63	Mobility 41	
Universities and R&D organizations 73		Music 75–200		Air traffic	68–69
Leading universities	107–145	Artists with highest-grossing albums	29–200	Commute time	50
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth 140	
Highly cited researchers	78–79	Best opera performers	42–200	Mobile Internet speed	97
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 102–128		Fixed broadband Internet speed	150
Students	132	Largest fashion companies	43–200	Safety 12	
International students	134	Fashion brands	91–122	Homicide rate	23–27
Leading business schools	16–35	Advertising and PR 31–32		Natural disaster risk	8
Productivity of innovative class 88		Most effective advertising agencies	14–18	Tourist appeal 99	
Patent activity	57	Largest PR agencies	61–200	International hotels	122–128
Publication activity	96	Creative production agencies	19–38	Culture, entertainment, and sports	62
Innovation infrastructure 64		Top advertising agencies	39–200	Ecology 5	
Clusters	29–200	Architecture 49–71		Environmental pollution level	5
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization 95	
Co-working spaces	40–41	Internationally recognized architects and architecture firms	35–61	International schools	77–81
Supercomputers	32–63	Industrial design 22–25		English proficiency	81–82
		Internationally recognized designers and design firms	22–25	International business events	20–21
		Arts 59–75		Visitors to international business events	34
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature 59–200			
		Best-selling authors	59–200		

Benchmarking against the leading city



Budapest

47

Technological Development	Rank 63	Creative Industries	Rank 57	Urban Environment	Rank 19
Technology companies 129		Film and animation 13		Cost of doing business 9	
Leading companies by R&D expenditure 118–146		Top-rated film production companies (audience) 87–200		Estimated tax 24	
R&D expenditure of largest innovation companies 125		Film production companies that won international film festival awards 10–11		Salary 35	
Startups and venture capital 109		Animation film production companies that won international festival awards 10–14		Cost of living 20	
Startups 99–100		Electronic games 28		Food prices 22	
Unicorns 107–200		The Game Awards winners 35–200		Apartment rental cost 26	
Innovation support funds 84		Largest e-sports tournaments 21–27		Cost of living for an expat 21–22	
Business angels 122–127		Developers of most popular computer games 16–33		Cost of living for a local resident 20	
Venture capital investment 133		Companies participating in electronic games trade shows 27–63		Mobility 121	
Universities and R&D organizations 95		Music 75–200		Air traffic 78–80	
Leading universities 38–42		Artists with highest-grossing albums 29–200		Commute time 123	
Leading R&D organizations 83–162		Most-streamed artists 38–200		Bandwidth 93	
Highly cited researchers 171–177		Best opera performers 42–200		Mobile Internet speed 144	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 129–200		Fixed broadband Internet speed 53	
Students 58		Largest fashion companies 43–200		Safety 42	
International students 56		Fashion brands 123–200		Homicide rate 47	
Leading business schools 81–200		Advertising and PR 47–49		Natural disaster risk 53	
Productivity of innovative class 131		Most effective advertising agencies 24–29		Tourist appeal 62	
Patent activity 165		Largest PR agencies 61–200		International hotels 89–92	
Publication activity 122		Creative production agencies 39–200		Culture, entertainment, and sports 31	
Innovation infrastructure 17		Top advertising agencies 39–200		Ecology 120	
Clusters 8–28		Architecture 72–200		Environmental pollution level 120	
Technology and science parks 26–72		Pritzker Architecture Prize laureates 25–200		Internationalization 101	
Co-working spaces 18		Internationally recognized architects and architecture firms 62–200		International schools 77–81	
Supercomputers 64–200		Industrial design 48–77		English proficiency 84–88	
		Internationally recognized designers and design firms 48–77		International business events 30	
		Arts 59–75		Visitors to international business events 32	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 44–68			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city

Technological Development	Rank 82	Creative Industries	Rank 38	Urban Environment	Rank 28
Technology companies 57		Film and animation 36		Cost of doing business 120	
Leading companies by R&D expenditure	46–50	Top-rated film production companies (audience)	54–86	Estimated tax	103–104
R&D expenditure of largest innovation companies	75	Film production companies that won international film festival awards	25–38	Salary	134
Startups and venture capital 54		Animation film production companies that won international festival awards	26–42	Cost of living 170	
Startups	61	Electronic games 54–58		Food prices	180
Unicorns	42–44	The Game Awards winners	35–200	Apartment rental cost	144
Innovation support funds	51	Largest e-sports tournaments	62–200	Cost of living for an expat	169
Business angels	51–52	Developers of most popular computer games	16–33	Cost of living for a local resident	149
Venture capital investment	79	Companies participating in electronic games trade shows	64–200	Mobility 39	
Universities and R&D organizations 116		Music 35–40		Air traffic	50–51
Leading universities	107–145	Artists with highest-grossing albums	29–200	Commute time	68
Leading R&D organizations	83–162	Most-streamed artists	38–200	Bandwidth 24	
Highly cited researchers	92–98	Best opera performers	17–23	Mobile Internet speed	4
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 70–74		Fixed broadband Internet speed	101
Students	154	Largest fashion companies	43–200	Safety 9	
International students	120	Fashion brands	46–51	Homicide rate	20
Leading business schools	36–80	Advertising and PR 57–59		Natural disaster risk	7
Productivity of innovative class 111		Most effective advertising agencies	49–200	Tourist appeal 83	
Patent activity	114	Largest PR agencies	14–20	International hotels	93–101
Publication activity	103	Creative production agencies	39–200	Culture, entertainment, and sports	57
Innovation infrastructure 41–42		Top advertising agencies	39–200	Ecology 32	
Clusters	8–28	Architecture 9		Environmental pollution level	32
Technology and science parks	73–200	Pritzker Architecture Prize laureates	9–24	Internationalization 109	
Co-working spaces	104–130	Internationally recognized architects and architecture firms	13–16	International schools	93–103
Supercomputers	64–200	Industrial design 34–47		English proficiency	80
		Internationally recognized designers and design firms	34–47	International business events	37
		Arts 41–49		Visitors to international business events	42
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	27–43		
		Literature 29–58			
		Best-selling authors	29–58		

Benchmarking against the leading city



Technological Development

Rank
80

Technology companies	93
Leading companies by R&D expenditure	81–90
R&D expenditure of largest innovation companies	108
Startups and venture capital	38
Startups	34
Unicorns	31–36
Innovation support funds	36
Business angels	33
Venture capital investment	46
Universities and R&D organizations	54
Leading universities	107–145
Leading R&D organizations	41–82
Highly cited researchers	48–52
Nobel Prize laureates and Fields Medal winners	78–200
Students	76
International students	21
Leading business schools	36–80
Productivity of innovative class	75
Patent activity	86
Publication activity	70
Innovation infrastructure	111–113
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	88–103
Supercomputers	18–31

Creative Industries

Rank
43

Film and animation	31
Top-rated film production companies (audience)	40–53
Film production companies that won international film festival awards	39–46
Animation film production companies that won international festival awards	15–25
Electronic games	15
The Game Awards winners	7–10
Largest e-sports tournaments	44–61
Developers of most popular computer games	2–4
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	24
Largest fashion companies	16–42
Fashion brands	30–33
Advertising and PR	60–67
Most effective advertising agencies	30–48
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	43–48
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	27–34
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	59–75
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
36

Cost of doing business	168
Estimated tax	158
Salary	147
Cost of living	160
Food prices	127
Apartment rental cost	164
Cost of living for an expat	145
Cost of living for a local resident	148
Mobility	112
Air traffic	84
Commute time	111
Bandwidth	80
Mobile Internet speed	76
Fixed broadband Internet speed	78
Safety	25
Homicide rate	49
Natural disaster risk	19–21
Tourist appeal	113
International hotels	118–120
Culture, entertainment, and sports	81
Ecology	36
Environmental pollution level	36
Internationalization	40
International schools	29–31
English proficiency	1–76
International business events	34–35
Visitors to international business events	22

Benchmarking against the leading city



Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	109		44		13
Technology companies	139	Film and animation	17	Cost of doing business	29
Leading companies by R&D expenditure	118–146	Top-rated film production companies (audience)	34–39	Estimated tax	42–49
R&D expenditure of largest innovation companies	138	Film production companies that won international film festival awards	12–14	Salary	61
Startups and venture capital	94	Animation film production companies that won international festival awards	15–25	Cost of living	67
Startups	92	Electronic games	17	Food prices	51
Unicorns	77–106	The Game Awards winners	20–34	Apartment rental cost	70
Innovation support funds	83	Largest e-sports tournaments	62–200	Cost of living for an expat	95
Business angels	73–74	Developers of most popular computer games	5–11	Cost of living for a local resident	63
Venture capital investment	113	Companies participating in electronic games trade shows	27–63	Mobility	56
Universities and R&D organizations	77	Music	75–200	Air traffic	65–67
Leading universities	49–65	Artists with highest-grossing albums	29–200	Commute time	72
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth	162
Highly cited researchers	138–145	Best opera performers	42–200	Mobile Internet speed	125
Nobel Prize laureates and Fields Medal winners	78–200	Fashion	129–200	Fixed broadband Internet speed	170
Students	63	Largest fashion companies	43–200	Safety	26
International students	30	Fashion brands	123–200	Homicide rate	45
Leading business schools	81–200	Advertising and PR	39	Natural disaster risk	26
Productivity of innovative class	77	Most effective advertising agencies	24–29	Tourist appeal	43
Patent activity	171	Largest PR agencies	32–60	International hotels	122–128
Publication activity	69	Creative production agencies	19–38	Culture, entertainment, and sports	11
Innovation infrastructure	120–122	Top advertising agencies	39–200	Ecology	70
Clusters	29–200	Architecture	72–200	Environmental pollution level	70
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	85
Co-working spaces	53–55	Internationally recognized architects and architecture firms	62–200	International schools	66–76
Supercomputers	64–200	Industrial design	48–77	English proficiency	84–88
		Internationally recognized designers and design firms	48–77	International business events	10
		Arts	41–49	Visitors to international business events	19
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	27–43		
		Literature	29–58		
		Best-selling authors	29–58		

Benchmarking against the leading city



Chengdu



51

Technological Development

Rank
51

Technology companies	66
Leading companies by R&D expenditure	58–64
R&D expenditure of largest innovation companies	60
Startups and venture capital	93
Startups	117–118
Unicorns	45–59
Innovation support funds	99–100
Business angels	156–169
Venture capital investment	55
Universities and R&D organizations	76
Leading universities	49–65
Leading R&D organizations	41–82
Highly cited researchers	60–62
Nobel Prize laureates and Fields Medal winners	78–200
Students	31
International students	112
Leading business schools	81–200
Productivity of innovative class	16
Patent activity	15
Publication activity	17
Innovation infrastructure	134–140
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	131–200
Supercomputers	32–63

Creative Industries

Rank
145

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	87–89
The Game Awards winners	35–200
Largest e-sports tournaments	21–27
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	129–200
Largest fashion companies	43–200
Fashion brands	123–200
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	76
Internationally recognized artists	41–200
Top artists by auction revenue	13–18
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
21

Cost of doing business	45
Estimated tax	115–146
Salary	32
Cost of living	18
Food prices	19
Apartment rental cost	22
Cost of living for an expat	17
Cost of living for a local resident	22
Mobility	29
Air traffic	49
Commute time	47
Bandwidth	8
Mobile Internet speed	38
Fixed broadband Internet speed	3
Safety	50–60
Homicide rate	28–41
Natural disaster risk	60–71
Tourist appeal	20
International hotels	8
Culture, entertainment, and sports	137
Ecology	163
Environmental pollution level	163
Internationalization	129
International schools	58–61
English proficiency	123–133
International business events	69–72
Visitors to international business events	N/A

Benchmarking against the leading city



Technological Development

Rank
79

Technology companies	81
Leading companies by R&D expenditure	70–80
R&D expenditure of largest innovation companies	72
Startups and venture capital	18
Startups	16
Unicorns	21–25
Innovation support funds	17
Business angels	17
Venture capital investment	28
Universities and R&D organizations	88
Leading universities	66–85
Leading R&D organizations	83–162
Highly cited researchers	159–166
Nobel Prize laureates and Fields Medal winners	78–200
Students	60
International students	76
Leading business schools	36–80
Productivity of innovative class	76
Patent activity	50
Publication activity	105
Innovation infrastructure	95–98
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	31–36
Supercomputers	64–200

Creative Industries

Rank
39

Film and animation	73–85
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	43–200
Electronic games	101–109
The Game Awards winners	35–200
Largest e-sports tournaments	44–61
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	19
Artists with highest-grossing albums	11–28
Most-streamed artists	7–8
Best opera performers	42–200
Fashion	51
Largest fashion companies	43–200
Fashion brands	19
Advertising and PR	21
Most effective advertising agencies	30–48
Largest PR agencies	14–20
Creative production agencies	9–18
Top advertising agencies	7–11
Architecture	49–71
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61
Industrial design	48–77
Internationally recognized designers and design firms	48–77
Arts	59–75
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68
Literature	10–15
Best-selling authors	10–15

Urban Environment

Rank
60

Cost of doing business	142
Estimated tax	62
Salary	167
Cost of living	184
Food prices	168
Apartment rental cost	188
Cost of living for an expat	173
Cost of living for a local resident	164
Mobility	87
Air traffic	35–36
Commute time	156
Bandwidth	70
Mobile Internet speed	122
Fixed broadband Internet speed	49
Safety	77
Homicide rate	82
Natural disaster risk	34–39
Tourist appeal	25
International hotels	15
Culture, entertainment, and sports	59
Ecology	85
Environmental pollution level	85
Internationalization	18
International schools	13
English proficiency	1–76
International business events	80–81
Visitors to international business events	N/A

Benchmarking against the leading city



Houston

53

Technological Development

Rank
45

Technology companies

51

Leading companies by R&D expenditure	51–57
R&D expenditure of largest innovation companies	49

Startups and venture capital

39

Startups	35
Unicorns	45–59
Innovation support funds	26–27
Business angels	43
Venture capital investment	36

Universities and R&D organizations

37

Leading universities	43–48
Leading R&D organizations	12–17
Highly cited researchers	20–21
Nobel Prize laureates and Fields Medal winners	27–40
Students	98
International students	117
Leading business schools	36–80

Productivity of innovative class

30

Patent activity	28
Publication activity	31

Innovation infrastructure

78

Clusters	29–200
Technology and science parks	26–72
Co-working spaces	65–76
Supercomputers	32–63

Creative Industries

Rank
101

Film and animation

89–93

Top-rated film production companies (audience)	40–53
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

61–82

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63

Music

43–49

Artists with highest-grossing albums	11–28
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

38–41

Largest fashion companies	16–42
Fashion brands	91–122

Advertising and PR

79–95

Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

86–117

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
55

Cost of doing business

174

Estimated tax	37–41
Salary	179

Cost of living

151

Food prices	151
Apartment rental cost	146
Cost of living for an expat	123
Cost of living for a local resident	147

Mobility

38

Air traffic	17
Commute time	144

Bandwidth

39

Mobile Internet speed	90
Fixed broadband Internet speed	25

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

9

International hotels	4
Culture, entertainment, and sports	68

Ecology

125

Environmental pollution level	125
-------------------------------	-----

Internationalization

34

International schools	18–19
English proficiency	1–76
International business events	89
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development

Rank
54

Technology companies	37
Leading companies by R&D expenditure	31–36
R&D expenditure of largest innovation companies	39
Startups and venture capital	25
Startups	26
Unicorns	31–36
Innovation support funds	15
Business angels	23–24
Venture capital investment	37
Universities and R&D organizations	51
Leading universities	49–65
Leading R&D organizations	41–82
Highly cited researchers	53–54
Nobel Prize laureates and Fields Medal winners	16–21
Students	40
International students	46
Leading business schools	81–200
Productivity of innovative class	54
Patent activity	42
Publication activity	63
Innovation infrastructure	76–77
Clusters	29–200
Technology and science parks	26–72
Co-working spaces	42–52
Supercomputers	64–200

Creative Industries

Rank
62

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	31
The Game Awards winners	35–200
Largest e-sports tournaments	7
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63
Music	43–49
Artists with highest-grossing albums	11–28
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	17
Largest fashion companies	7–15
Fashion brands	91–122
Advertising and PR	79–95
Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	49–71
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
62

Cost of doing business	185
Estimated tax	37–41
Salary	188
Cost of living	152
Food prices	165
Apartment rental cost	168
Cost of living for an expat	116
Cost of living for a local resident	120
Mobility	11
Air traffic	13
Commute time	94
Bandwidth	114
Mobile Internet speed	91
Fixed broadband Internet speed	97
Safety	N/A
Homicide rate	N/A
Natural disaster risk	N/A
Tourist appeal	21
International hotels	10
Culture, entertainment, and sports	70
Ecology	91
Environmental pollution level	91
Internationalization	23
International schools	8–10
English proficiency	1–76
International business events	138–142
Visitors to international business events	N/A

Benchmarking against the leading city



San Diego

55

Technological Development

Rank
42

Technology companies

13

Leading companies by R&D expenditure	14
R&D expenditure of largest innovation companies	22

Startups and venture capital

31

Startups	31–32
Unicorns	21–25
Innovation support funds	38
Business angels	25
Venture capital investment	19

Universities and R&D organizations

39

Leading universities	86–106
Leading R&D organizations	24–40
Highly cited researchers	14
Nobel Prize laureates and Fields Medal winners	11–12
Students	72
International students	55
Leading business schools	81–200

Productivity of innovative class

52

Patent activity	34
Publication activity	68

Innovation infrastructure

117–119

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	65–76
Supercomputers	32–63

Creative Industries

Rank
50

Film and animation

114–200

Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

32–33

The Game Awards winners	35–200
Largest e-sports tournaments	32–43
Developers of most popular computer games	16–33
Companies participating in electronic games trade shows	27–63

Music

43–49

Artists with highest-grossing albums	11–28
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

66–68

Largest fashion companies	43–200
Fashion brands	41–44

Advertising and PR

96–200

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

57

Internationally recognized artists	9–15
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113

Literature

7–8

Best-selling authors	7–8
----------------------	-----

Urban Environment

Rank
121

Cost of doing business

188

Estimated tax	89–91
Salary	183

Cost of living

183

Food prices	161
Apartment rental cost	190
Cost of living for an expat	167
Cost of living for a local resident	172

Mobility

113

Air traffic	109–110
Commute time	86

Bandwidth

43

Mobile Internet speed	101
Fixed broadband Internet speed	30

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

36

International hotels	20
Culture, entertainment, and sports	102

Ecology

71

Environmental pollution level	71
-------------------------------	----

Internationalization

46

International schools	38–40
English proficiency	1–76
International business events	85–86
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 43	Creative Industries	Rank 172	Urban Environment	Rank 38
Technology companies 86		Film and animation 114–200		Cost of doing business 39	
Leading companies by R&D expenditure	70–80	Top-rated film production companies (audience)	87–200	Estimated tax	115–146
R&D expenditure of largest innovation companies	104	Film production companies that won international film festival awards	71–200	Salary	25
Startups and venture capital 147		Animation film production companies that won international festival awards	43–200	Cost of living 10	
Startups	176–178	Electronic games 110–200		Food prices	12
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	6–7
Innovation support funds	117–118	Largest e-sports tournaments	62–200	Cost of living for an expat	12
Business angels	180–200	Developers of most popular computer games	34–200	Cost of living for a local resident	16
Venture capital investment	109	Companies participating in electronic games trade shows	64–200	Mobility 123	
Universities and R&D organizations 80		Music 75–200		Air traffic	114
Leading universities	66–85	Artists with highest-grossing albums	29–200	Commute time	92
Leading R&D organizations	24–40	Most-streamed artists	38–200	Bandwidth 1	
Highly cited researchers	63–65	Best opera performers	42–200	Mobile Internet speed	1
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 129–200		Fixed broadband Internet speed	1
Students	54	Largest fashion companies	43–200	Safety 50–60	
International students	105	Fashion brands	123–200	Homicide rate	28–41
Leading business schools	81–200	Advertising and PR 96–200		Natural disaster risk	60–71
Productivity of innovative class 10		Most effective advertising agencies	49–200	Tourist appeal 76	
Patent activity	7	Largest PR agencies	61–200	International hotels	54–56
Publication activity	23	Creative production agencies	39–200	Culture, entertainment, and sports	108
Innovation infrastructure 134–140		Top advertising agencies	39–200	Ecology 188	
Clusters	29–200	Architecture 72–200		Environmental pollution level	188
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 156	
Co-working spaces	131–200	Internationally recognized architects and architecture firms	62–200	International schools	130–147
Supercomputers	32–63	Industrial design 78–200		English proficiency	123–133
		Internationally recognized designers and design firms	78–200	International business events	133–136
		Arts 124–129		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	19–37		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	114–185		
		Literature 59–200			
		Best-selling authors	59–200		

Benchmarking against the leading city



Essen-Dortmund

57

Technological Development

Rank
47

Technology companies

59

Leading companies by R&D expenditure	51–57
R&D expenditure of largest innovation companies	62

Startups and venture capital

134

Startups	130
Unicorns	107–200
Innovation support funds	127–129
Business angels	116–121
Venture capital investment	150

Universities and R&D organizations

65

Leading universities	86–106
Leading R&D organizations	24–40
Highly cited researchers	138–145
Nobel Prize laureates and Fields Medal winners	27–40
Students	51
International students	42
Leading business schools	81–200

Productivity of innovative class

91

Patent activity	67
Publication activity	88

Innovation infrastructure

14

Clusters	2–7
Technology and science parks	73–200
Co-working spaces	104–130
Supercomputers	64–200

Creative Industries

Rank
97

Film and animation

114–200

Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

61–82

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63

Music

52–64

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	24–41

Fashion

129–200

Largest fashion companies	43–200
Fashion brands	123–200

Advertising and PR

79–95

Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

34–47

Internationally recognized designers and design firms	34–47
---	-------

Arts

59–75

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
71

Cost of doing business

58

Estimated tax	16–22
Salary	112

Cost of living

56

Food prices	49
Apartment rental cost	77
Cost of living for an expat	N/A
Cost of living for a local resident	N/A

Mobility

79

Air traffic	25–27
Commute time	N/A

Bandwidth

N/A

Mobile Internet speed	N/A
Fixed broadband Internet speed	N/A

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

116

International hotels	195
Culture, entertainment, and sports	35

Ecology

23

Environmental pollution level	23
-------------------------------	----

Internationalization

167

International schools	104–114
English proficiency	N/A
International business events	123–126
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 93	Creative Industries	Rank 76	Urban Environment	Rank 12
Technology companies	147–200	Film and animation	114–200	Cost of doing business	13
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	87–200	Estimated tax	1
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	71–200	Salary	161
Startups and venture capital	40	Animation film production companies that won international festival awards	43–200	Cost of living	168
Startups	27	Electronic games	91–92	Food prices	94
Unicorns	45–59	The Game Awards winners	35–200	Apartment rental cost	156
Innovation support funds	34	Largest e-sports tournaments	28–31	Cost of living for an expat	149
Business angels	37–38	Developers of most popular computer games	34–200	Cost of living for a local resident	178
Venture capital investment	50	Companies participating in electronic games trade shows	64–200	Mobility	14
Universities and R&D organizations	94	Music	75–200	Air traffic	12
Leading universities	49–65	Artists with highest-grossing albums	29–200	Commute time	119
Leading R&D organizations	163–200	Most-streamed artists	38–200	Bandwidth	58
Highly cited researchers	193–200	Best opera performers	42–200	Mobile Internet speed	17
Nobel Prize laureates and Fields Medal winners	78–200	Fashion	62–63	Fixed broadband Internet speed	99
Students	192	Largest fashion companies	43–200	Safety	10
International students	88	Fashion brands	34–35	Homicide rate	46
Leading business schools	16–35	Advertising and PR	7	Natural disaster risk	5
Productivity of innovative class	187	Most effective advertising agencies	4	Tourist appeal	11
Patent activity	167	Largest PR agencies	61–200	International hotels	6
Publication activity	185	Creative production agencies	9–18	Culture, entertainment, and sports	48
Innovation infrastructure	66	Top advertising agencies	39–200	Ecology	112
Clusters	29–200	Architecture	72–200	Environmental pollution level	112
Technology and science parks	16–25	Pritzker Architecture Prize laureates	25–200	Internationalization	112
Co-working spaces	88–103	Internationally recognized architects and architecture firms	62–200	International schools	21–23
Supercomputers	64–200	Industrial design	78–200	English proficiency	111–114
		Internationally recognized designers and design firms	78–200	International business events	77–78
		Arts	118–123	Visitors to international business events	45
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	15–31		
		Leading higher education institutions in the arts	114–185		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city



Wuhan

59

Technological Development

Rank
31

Technology companies	45
Leading companies by R&D expenditure	37–38
R&D expenditure of largest innovation companies	56
Startups and venture capital	110
Startups	131
Unicorns	60–76
Innovation support funds	94–95
Business angels	180–200
Venture capital investment	71
Universities and R&D organizations	30
Leading universities	25–37
Leading R&D organizations	10–11
Highly cited researchers	32–33
Nobel Prize laureates and Fields Medal winners	78–200
Students	15
International students	66
Leading business schools	81–200
Productivity of innovative class	12
Patent activity	14
Publication activity	13
Innovation infrastructure	162–200
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	131–200
Supercomputers	64–200

Creative Industries

Rank
162

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	95–100
The Game Awards winners	35–200
Largest e-sports tournaments	32–43
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	129–200
Largest fashion companies	43–200
Fashion brands	123–200
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
103

Cost of doing business	48
Estimated tax	115–146
Salary	34
Cost of living	21
Food prices	20
Apartment rental cost	33
Cost of living for an expat	13
Cost of living for a local resident	27
Mobility	125
Air traffic	95–97
Commute time	117
Bandwidth	25
Mobile Internet speed	59
Fixed broadband Internet speed	23
Safety	50–60
Homicide rate	28–41
Natural disaster risk	60–71
Tourist appeal	51
International hotels	38–39
Culture, entertainment, and sports	71
Ecology	189
Environmental pollution level	189
Internationalization	147
International schools	104–114
English proficiency	123–133
International business events	113–115
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development

Rank
73

Technology companies	131
Leading companies by R&D expenditure	118–146
R&D expenditure of largest innovation companies	127
Startups and venture capital	103
Startups	99–100
Unicorns	107–200
Innovation support funds	86
Business angels	87–89
Venture capital investment	123
Universities and R&D organizations	56
Leading universities	66–85
Leading R&D organizations	83–162
Highly cited researchers	159–166
Nobel Prize laureates and Fields Medal winners	78–200
Students	70
International students	45
Leading business schools	16–35
Productivity of innovative class	105
Patent activity	197
Publication activity	86
Innovation infrastructure	44
Clusters	29–200
Technology and science parks	16–25
Co-working spaces	19–20
Supercomputers	64–200

Creative Industries

Rank
142

Film and animation	55
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	26–42
Electronic games	110–200
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	86–101
Largest fashion companies	43–200
Fashion brands	72–90
Advertising and PR	79–95
Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	59–75
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
11

Cost of doing business	109
Estimated tax	192
Salary	39
Cost of living	57
Food prices	33
Apartment rental cost	84
Cost of living for an expat	69
Cost of living for a local resident	52
Mobility	66
Air traffic	52–53
Commute time	102
Bandwidth	116
Mobile Internet speed	72
Fixed broadband Internet speed	125
Safety	24
Homicide rate	7–8
Natural disaster risk	28
Tourist appeal	65
International hotels	102–104
Culture, entertainment, and sports	33
Ecology	76–77
Environmental pollution level	76–77
Internationalization	49
International schools	115–129
English proficiency	95–98
International business events	3
Visitors to international business events	3

Benchmarking against the leading city



Frankfurt am Main

61

Technological Development

Rank
105

Technology companies

48

Leading companies by R&D expenditure	46–50
R&D expenditure of largest innovation companies	48

Startups and venture capital

95

Startups	167
Unicorns	77–106
Innovation support funds	56–57
Business angels	62–63
Venture capital investment	89

Universities and R&D organizations

84

Leading universities	146–199
Leading R&D organizations	83–162
Highly cited researchers	129–137
Nobel Prize laureates and Fields Medal winners	41–77
Students	127
International students	107
Leading business schools	16–35

Productivity of innovative class

140

Patent activity	90
Publication activity	142

Innovation infrastructure

111–113

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	88–103
Supercomputers	18–31

Creative Industries

Rank
53

Film and animation

57–58

Top-rated film production companies (audience)	40–53
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	26–42

Electronic games

32–33

The Game Awards winners	35–200
Largest e-sports tournaments	32–43
Developers of most popular computer games	16–33
Companies participating in electronic games trade shows	27–63

Music

23–27

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	11–16

Fashion

86–101

Largest fashion companies	43–200
Fashion brands	72–90

Advertising and PR

57–59

Most effective advertising agencies	49–200
Largest PR agencies	14–20
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

27–34

Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	62–200

Industrial design

48–77

Internationally recognized designers and design firms	48–77
---	-------

Arts

118–123

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	15–31
Leading higher education institutions in the arts	114–185

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
25

Cost of doing business

103

Estimated tax	50–57
Salary	138

Cost of living

96

Food prices	85
Apartment rental cost	115
Cost of living for an expat	80
Cost of living for a local resident	87–88

Mobility

2

Air traffic	4
Commute time	23

Bandwidth

146

Mobile Internet speed	128
Fixed broadband Internet speed	138

Safety

17–18

Homicide rate	23–27
Natural disaster risk	15–17

Tourist appeal

53

International hotels	42–44
Culture, entertainment, and sports	69

Ecology

80

Environmental pollution level	80
-------------------------------	----

Internationalization

123

International schools	93–103
English proficiency	89–91
International business events	74–76
Visitors to international business events	65

Benchmarking against the leading city

Mumbai

62

Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	49		45		150
Technology companies	44	Film and animation	7	Cost of doing business	46
Leading companies by R&D expenditure	39–42	Top-rated film production companies (audience)	3	Estimated tax	115–146
R&D expenditure of largest innovation companies	44	Film production companies that won international film festival awards	47–70	Salary	33
Startups and venture capital	12	Animation film production companies that won international festival awards	26–42	Cost of living	19
Startups	21	Electronic games	101–109	Food prices	10
Unicorns	19	The Game Awards winners	35–200	Apartment rental cost	34
Innovation support funds	21	Largest e-sports tournaments	44–61	Cost of living for an expat	27
Business angels	5	Developers of most popular computer games	34–200	Cost of living for a local resident	32
Venture capital investment	8	Companies participating in electronic games trade shows	64–200	Mobility	178
Universities and R&D organizations	42	Music	75–200	Air traffic	73
Leading universities	86–106	Artists with highest-grossing albums	29–200	Commute time	181
Leading R&D organizations	24–40	Most-streamed artists	38–200	Bandwidth	189
Highly cited researchers	183–192	Best opera performers	42–200	Mobile Internet speed	185
Nobel Prize laureates and Fields Medal winners	78–200	Fashion	38–41	Fixed broadband Internet speed	183
Students	173	Largest fashion companies	16–42	Safety	61
International students	196–200	Fashion brands	91–122	Homicide rate	23–27
Leading business schools	5–9	Advertising and PR	9	Natural disaster risk	74–77
Productivity of innovative class	82	Most effective advertising agencies	12–13	Tourist appeal	169
Patent activity	83	Largest PR agencies	32–60	International hotels	170–172
Publication activity	75	Creative production agencies	9–18	Culture, entertainment, and sports	134
Innovation infrastructure	95–98	Top advertising agencies	7–11	Ecology	184
Clusters	29–200	Architecture	49–71	Environmental pollution level	184
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	89
Co-working spaces	31–36	Internationally recognized architects and architecture firms	35–61	International schools	11
Supercomputers	64–200	Industrial design	48–77	English proficiency	81–82
		Internationally recognized designers and design firms	48–77	International business events	111–112
		Arts	118–123	Visitors to international business events	N/A
		Internationally recognized artists	16–40		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	114–185		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city

Göteborg

63

Technological Development

Rank
57

Technology companies

50

Leading companies by R&D expenditure	58–64
R&D expenditure of largest innovation companies	42

Startups and venture capital

132

Startups	129
Unicorns	77–106
Innovation support funds	135
Business angels	104–108
Venture capital investment	132

Universities and R&D organizations

149

Leading universities	107–145
Leading R&D organizations	41–82
Highly cited researchers	125–128
Nobel Prize laureates and Fields Medal winners	78–200
Students	164
International students	126
Leading business schools	81–200

Productivity of innovative class

133

Patent activity	125
Publication activity	128

Innovation infrastructure

11

Clusters	8–28
Technology and science parks	4–8
Co-working spaces	56–64
Supercomputers	64–200

Creative Industries

Rank
60

Film and animation

70–72

Top-rated film production companies (audience)	54–86
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	43–200

Electronic games

38–43

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	15–26

Music

52–64

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	24–41

Fashion

70–74

Largest fashion companies	43–200
Fashion brands	46–51

Advertising and PR

69–73

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	16–38

Architecture

35–42

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	17–26

Industrial design

48–77

Internationally recognized designers and design firms	48–77
---	-------

Arts

86–117

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113

Literature

29–58

Best-selling authors	29–58
----------------------	-------

Urban Environment

Rank
99

Cost of doing business

123

Estimated tax	147
Salary	108

Cost of living

87

Food prices	83
Apartment rental cost	95
Cost of living for an expat	77
Cost of living for a local resident	94

Mobility

57

Air traffic	120–122
Commute time	27

Bandwidth

48

Mobile Internet speed	16
Fixed broadband Internet speed	95

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

156

International hotels	151–155
Culture, entertainment, and sports	124

Ecology

17

Environmental pollution level	17
-------------------------------	----

Internationalization

138

International schools	115–129
English proficiency	N/A
International business events	61
Visitors to international business events	47

Benchmarking against the leading city

Technological Development	Rank 98	Creative Industries	Rank 109	Urban Environment	Rank 16
Technology companies 146		Film and animation 94–113		Cost of doing business 162	
Leading companies by R&D expenditure 118–146		Top-rated film production companies (audience) 54–86		Estimated tax 154–157	
R&D expenditure of largest innovation companies 146		Film production companies that won international film festival awards 71–200		Salary 141	
Startups and venture capital 44		Animation film production companies that won international festival awards 43–200		Cost of living 55	
Startups 39		Electronic games 27		Food prices 68	
Unicorns 107–200		The Game Awards winners 11–19		Apartment rental cost 63	
Innovation support funds 39		Largest e-sports tournaments 62–200		Cost of living for an expat 47	
Business angels 141–148		Developers of most popular computer games 34–200		Cost of living for a local resident 40	
Venture capital investment 43		Companies participating in electronic games trade shows 15–26		Mobility 115	
Universities and R&D organizations 138		Music 75–200		Air traffic 160	
Leading universities 107–145		Artists with highest-grossing albums 29–200		Commute time 39	
Leading R&D organizations 83–162		Most-streamed artists 38–200		Bandwidth 108	
Highly cited researchers 152–158		Best opera performers 42–200		Mobile Internet speed 94	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 102–128		Fixed broadband Internet speed 93	
Students 77		Largest fashion companies 43–200		Safety N/A	
International students 73		Fashion brands 91–122		Homicide rate N/A	
Leading business schools 81–200		Advertising and PR 69–73		Natural disaster risk N/A	
Productivity of innovative class 175		Most effective advertising agencies 49–200		Tourist appeal 37	
Patent activity 133		Largest PR agencies 61–200		International hotels 133–139	
Publication activity 176		Creative production agencies 39–200		Culture, entertainment, and sports 8	
Innovation infrastructure 51		Top advertising agencies 16–38		Ecology 48	
Clusters 29–200		Architecture 72–200		Environmental pollution level 48	
Technology and science parks 9–15		Pritzker Architecture Prize laureates 25–200		Internationalization 2	
Co-working spaces 131–200		Internationally recognized architects and architecture firms 62–200		International schools 36	
Supercomputers 32–63		Industrial design 78–200		English proficiency 1–76	
		Internationally recognized designers and design firms 78–200		International business events N/A	
		Arts 86–117		Visitors to international business events N/A	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 69–113			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city



Rome

65

Technological Development

Rank
59

Technology companies	68
Leading companies by R&D expenditure	65–69
R&D expenditure of largest innovation companies	54
Startups and venture capital	130
Startups	115–116
Unicorns	107–200
Innovation support funds	127–129
Business angels	98–101
Venture capital investment	143
Universities and R&D organizations	45
Leading universities	86–106
Leading R&D organizations	18–23
Highly cited researchers	110–118
Nobel Prize laureates and Fields Medal winners	27–40
Students	44
International students	68
Leading business schools	36–80
Productivity of innovative class	26
Patent activity	24
Publication activity	30
Innovation infrastructure	126
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	65–76
Supercomputers	64–200

Creative Industries

Rank
52

Film and animation	14
Top-rated film production companies (audience)	9
Film production companies that won international film festival awards	5–7
Animation film production companies that won international festival awards	43–200
Electronic games	61–82
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63
Music	30–34
Artists with highest-grossing albums	11–28
Most-streamed artists	14–37
Best opera performers	42–200
Fashion	56
Largest fashion companies	43–200
Fashion brands	25–26
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	11
Internationally recognized artists	6
Top artists by auction revenue	38–200
Most influential people in contemporary art	15–31
Leading higher education institutions in the arts	18–26
Literature	29–58
Best-selling authors	29–58

Urban Environment

Rank
122

Cost of doing business	152
Estimated tax	194–198
Salary	56
Cost of living	138
Food prices	100
Apartment rental cost	106
Cost of living for an expat	157
Cost of living for a local resident	135
Mobility	30
Air traffic	15
Commute time	140
Bandwidth	170
Mobile Internet speed	153
Fixed broadband Internet speed	165
Safety	34
Homicide rate	17–19
Natural disaster risk	45–46
Tourist appeal	24
International hotels	54–56
Culture, entertainment, and sports	10
Ecology	149
Environmental pollution level	149
Internationalization	107
International schools	77–81
English proficiency	111–114
International business events	20–21
Visitors to international business events	31

Benchmarking against the leading city

Technological Development	Rank 75	Creative Industries	Rank 80	Urban Environment	Rank 66
Technology companies	147–200	Film and animation	70–72	Cost of doing business	63
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	54–86	Estimated tax	25–33
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	47–70	Salary	110
Startups and venture capital	101	Animation film production companies that won international festival awards	43–200	Cost of living	153
Startups	93	Electronic games	54–58	Food prices	80
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	109
Innovation support funds	94–95	Largest e-sports tournaments	62–200	Cost of living for an expat	176
Business angels	75	Developers of most popular computer games	16–33	Cost of living for a local resident	137
Venture capital investment	110	Companies participating in electronic games trade shows	64–200	Mobility	40
Universities and R&D organizations	81	Music	41–42	Air traffic	68–69
Leading universities	49–65	Artists with highest-grossing albums	29–200	Commute time	46
Leading R&D organizations	83–162	Most-streamed artists	14–37	Bandwidth	151
Highly cited researchers	48–52	Best opera performers	24–41	Mobile Internet speed	136
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	86–101	Fixed broadband Internet speed	129
Students	108	Largest fashion companies	43–200	Safety	N/A
International students	26	Fashion brands	72–90	Homicide rate	N/A
Leading business schools	81–200	Advertising and PR	96–200	Natural disaster risk	N/A
Productivity of innovative class	104	Most effective advertising agencies	49–200	Tourist appeal	72
Patent activity	127	Largest PR agencies	61–200	International hotels	105–108
Publication activity	93	Creative production agencies	39–200	Culture, entertainment, and sports	37
Innovation infrastructure	32	Top advertising agencies	39–200	Ecology	46
Clusters	8–28	Architecture	72–200	Environmental pollution level	46
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	63
Co-working spaces	88–103	Internationally recognized architects and architecture firms	62–200	International schools	148–172
Supercomputers	18–31	Industrial design	48–77	English proficiency	1–76
		Internationally recognized designers and design firms	48–77	International business events	33
		Arts	59–75	Visitors to international business events	41
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature	18–28		
		Best-selling authors	18–28		

Benchmarking against the leading city



Hamburg

67

Technological Development

Rank
135

Technology companies

52

Leading companies by R&D expenditure	43–45
R&D expenditure of largest innovation companies	76

1.2 Startups and venture capital

59

Startups	62
Unicorns	60–76
Innovation support funds	56–57
Business angels	48
Venture capital investment	83

Universities and R&D organizations

164

Leading universities	107–145
Leading R&D organizations	83–162
Highly cited researchers	146–151
Nobel Prize laureates and Fields Medal winners	41–77
Students	146
International students	128
Leading business schools	81–200

Productivity of innovative class

98

Patent activity	78
Publication activity	94

Innovation infrastructure

111–113

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	88–103
Supercomputers	18–31

Creative Industries

Rank
22

Film and animation

67–69

Top-rated film production companies (audience)	40–53
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	43–200

Electronic games

18

The Game Awards winners	35–200
Largest e-sports tournaments	21–27
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	9–10

Music

35–40

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	17–23

Fashion

75–79

Largest fashion companies	43–200
Fashion brands	52–59

Advertising and PR

19

Most effective advertising agencies	19–23
Largest PR agencies	7–9
Creative production agencies	9–18
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

7–10

Internationally recognized designers and design firms	7–10
---	------

Arts

81–84

Internationally recognized artists	41–200
Top artists by auction revenue	19–37
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
130

Cost of doing business

88

Estimated tax	50–57
Salary	107

Cost of living

123

Food prices	102
Apartment rental cost	125
Cost of living for an expat	113
Cost of living for a local resident	138

Mobility

76

Air traffic	70–71
Commute time	91

Bandwidth

155

Mobile Internet speed	137
Fixed broadband Internet speed	134

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

66

International hotels	63–66
Culture, entertainment, and sports	64

Ecology

60

Environmental pollution level	60
-------------------------------	----

Internationalization

118

International schools	115–129
English proficiency	N/A
International business events	56
Visitors to international business events	18

Benchmarking against the leading city

Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	81		58		79
Technology companies	42	Film and animation	28	Cost of doing business	138
Leading companies by R&D expenditure	43–45	Top-rated film production companies (audience)	87–200	Estimated tax	10
R&D expenditure of largest innovation companies	38	Film production companies that won international film festival awards	25–38	Salary	190
Startups and venture capital	89	Animation film production companies that won international festival awards	15–25	Cost of living	190
Startups	110–111	Electronic games	38–43	Food prices	193
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	182
Innovation support funds	64–65	Largest e-sports tournaments	62–200	Cost of living for an expat	160
Business angels	61	Developers of most popular computer games	34–200	Cost of living for a local resident	179
Venture capital investment	124	Companies participating in electronic games trade shows	15–26	Mobility	20
Universities and R&D organizations	43	Music	23–27	Air traffic	54–55
Leading universities	146–199	Artists with highest-grossing albums	29–200	Commute time	25
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth	45
Highly cited researchers	110–118	Best opera performers	11–16	Mobile Internet speed	77
Nobel Prize laureates and Fields Medal winners	6–7	Fashion	50	Fixed broadband Internet speed	41
Students	184	Largest fashion companies	43–200	Safety	11
International students	108	Fashion brands	18	Homicide rate	7–8
Leading business schools	36–80	Advertising and PR	96–200	Natural disaster risk	11–12
Productivity of innovative class	96	Most effective advertising agencies	49–200	Tourist appeal	128
Patent activity	55	Largest PR agencies	61–200	International hotels	105–108
Publication activity	112	Creative production agencies	39–200	Culture, entertainment, and sports	122
Innovation infrastructure	141–145	Top advertising agencies	39–200	Ecology	33
Clusters	29–200	Architecture	72–200	Environmental pollution level	33
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	122
Co-working spaces	88–103	Internationally recognized architects and architecture firms	62–200	International schools	82–86
Supercomputers	64–200	Industrial design	78–200	English proficiency	92–94
		Internationally recognized designers and design firms	78–200	International business events	62–63
		Arts	59–75	Visitors to international business events	72
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature	29–58		
		Best-selling authors	29–58		

Benchmarking against the leading city



Technological Development

Rank
69

Technology companies

77

Leading companies by R&D expenditure 70–80

R&D expenditure of largest innovation companies 65

Startups and venture capital

141

Startups 176–178

Unicorns 60–76

Innovation support funds 139–140

Business angels 180–200

Venture capital investment 145

Universities and R&D organizations

91

Leading universities 49–65

Leading R&D organizations 41–82

Highly cited researchers 105–109

Nobel Prize laureates and Fields Medal winners 78–200

Students 32

International students 165

Leading business schools 81–200

Productivity of innovative class

20

Patent activity 12

Publication activity 48

Innovation infrastructure

162–200

Clusters 29–200

Technology and science parks 73–200

Co-working spaces 131–200

Supercomputers 64–200

Creative Industries

Rank
139–140

Film and animation

114–200

Top-rated film production companies (audience) 87–200

Film production companies that won international film festival awards 71–200

Animation film production companies that won international festival awards 43–200

Electronic games

110–200

The Game Awards winners 35–200

Largest e-sports tournaments 62–200

Developers of most popular computer games 34–200

Companies participating in electronic games trade shows 64–200

Music

75–200

Artists with highest-grossing albums 29–200

Most-streamed artists 38–200

Best opera performers 42–200

Fashion

129–200

Largest fashion companies 43–200

Fashion brands 123–200

Advertising and PR

96–200

Most effective advertising agencies 49–200

Largest PR agencies 61–200

Creative production agencies 39–200

Top advertising agencies 39–200

Architecture

72–200

Pritzker Architecture Prize laureates 25–200

Internationally recognized architects and architecture firms 62–200

Industrial design

34–47

Internationally recognized designers and design firms 34–47

Arts

189–200

Internationally recognized artists 41–200

Top artists by auction revenue 38–200

Most influential people in contemporary art 32–200

Leading higher education institutions in the arts 186–200

Literature

59–200

Best-selling authors 59–200

Urban Environment

Rank
48

Cost of doing business

51

Estimated tax 115–146

Salary 37

Cost of living

15

Food prices 17

Apartment rental cost 5

Cost of living for an expat 37

Cost of living for a local resident 17–18

Mobility

86

Air traffic 112–113

Commute time 65

Bandwidth

18

Mobile Internet speed 47

Fixed broadband Internet speed 9

Safety

50–60

Homicide rate 28–41

Natural disaster risk 60–71

Tourist appeal

127

International hotels 80–81

Culture, entertainment, and sports 175

Ecology

128

Environmental pollution level 128

Internationalization

155

International schools 130–147

English proficiency 123–133

International business events 127–132

Visitors to international business events N/A

Benchmarking against the leading city



Technological Development

Rank
152

Technology companies

117

Leading companies by R&D expenditure 104–117

R&D expenditure of largest innovation companies 123

Startups and venture capital

88

Startups 71

Unicorns 107–200

Innovation support funds 89–90

Business angels 76–78

Venture capital investment 122

Universities and R&D organizations

118

Leading universities 107–145

Leading R&D organizations 83–162

Highly cited researchers 119–124

Nobel Prize laureates and Fields Medal winners 78–200

Students 118

International students 36

Leading business schools 81–200

Productivity of innovative class

148

Patent activity 126

Publication activity 140

Innovation infrastructure

131–133

Clusters 29–200

Technology and science parks 73–200

Co-working spaces 77–87

Supercomputers 64–200

Creative Industries

Rank
47

Film and animation

114–200

Top-rated film production companies (audience) 87–200

Film production companies that won international film festival awards 71–200

Animation film production companies that won international festival awards 43–200

Electronic games

35

The Game Awards winners 35–200

Largest e-sports tournaments 62–200

Developers of most popular computer games 12–15

Companies participating in electronic games trade shows 64–200

Music

75–200

Artists with highest-grossing albums 29–200

Most-streamed artists 38–200

Best opera performers 42–200

Fashion

70–74

Largest fashion companies 43–200

Fashion brands 46–51

Advertising and PR

12–13

Most effective advertising agencies 6–10

Largest PR agencies 32–60

Creative production agencies 19–38

Top advertising agencies 16–38

Architecture

19–21

Pritzker Architecture Prize laureates 25–200

Internationally recognized architects and architecture firms 9–12

Industrial design 78–200

Internationally recognized designers and design firms 78–200

Arts

86–117

Internationally recognized artists 41–200

Top artists by auction revenue 38–200

Most influential people in contemporary art 32–200

Leading higher education institutions in the arts 69–113

Literature 59–200

Best-selling authors 59–200

Urban Environment

Rank
42

Cost of doing business

135

Estimated tax 167–169

Salary 102

Cost of living

118

Food prices 141

Apartment rental cost 134

Cost of living for an expat 87

Cost of living for a local resident 102–103

Mobility

138

Air traffic 123–125

Commute time 115

Bandwidth

46

Mobile Internet speed 44

Fixed broadband Internet speed 63

Safety

36

Homicide rate 9–11

Natural disaster risk 47

Tourist appeal

124

International hotels 93–101

Culture, entertainment, and sports 128

Ecology

53

Environmental pollution level 53

Internationalization

87

International schools 62–64

English proficiency 1–76

International business events 79

Visitors to international business events 71

Benchmarking against the leading city



Technological Development

Rank
58

Technology companies

24

Leading companies by R&D expenditure	28–29
R&D expenditure of largest innovation companies	18

Startups and venture capital

22

Startups	19
Unicorns	26–29
Innovation support funds	19
Business angels	14
Venture capital investment	29

Universities and R&D organizations

93

Leading universities	107–145
Leading R&D organizations	83–162
Highly cited researchers	48–52
Nobel Prize laureates and Fields Medal winners	27–40
Students	111
International students	124
Leading business schools	36–80

Productivity of innovative class

78

Patent activity	52
Publication activity	98

Innovation infrastructure

75

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	56–64
Supercomputers	10–13

Creative Industries

Rank
87

Film and animation

89–93

Top-rated film production companies (audience)	40–53
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

44

The Game Awards winners	11–19
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63

Music

75–200

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

102–128

Largest fashion companies	43–200
Fashion brands	91–122

Advertising and PR

51–52

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	19–38
Top advertising agencies	16–38

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

34–47

Internationally recognized designers and design firms	34–47
---	-------

Arts

86–117

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
105

Cost of doing business

182

Estimated tax	37–41
Salary	184

Cost of living

174

Food prices	144
Apartment rental cost	181
Cost of living for an expat	150
Cost of living for a local resident	160

Mobility

128

Air traffic	128–129
Commute time	90

Bandwidth

17

Mobile Internet speed	42
Fixed broadband Internet speed	6

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

58

International hotels	36–37
Culture, entertainment, and sports	98

Ecology

79

Environmental pollution level	79
-------------------------------	----

Internationalization

52

International schools	41–42
English proficiency	1–76
International business events	143–147
Visitors to international business events	N/A

Benchmarking against the leading city

Mexico City

72

Technological Development	Rank 67	Creative Industries	Rank 37	Urban Environment	Rank 163
Technology companies 147–200		Film and animation 27		Cost of doing business 86	
Leading companies by R&D expenditure 147–200		Top-rated film production companies (audience) 34–39		Estimated tax 180	
R&D expenditure of largest innovation companies 147–200		Film production companies that won international film festival awards 12–14		Salary 23	
Startups and venture capital 53		Animation film production companies that won international festival awards 43–200		Cost of living 41	
Startups 59		Electronic games 101–109		Food prices 43	
Unicorns 31–36		The Game Awards winners 35–200		Apartment rental cost 59	
Innovation support funds 66–67		Largest e-sports tournaments 44–61		Cost of living for an expat 26	
Business angels 58–59		Developers of most popular computer games 34–200		Cost of living for a local resident 36	
Venture capital investment 48		Companies participating in electronic games trade shows 64–200		Mobility 168	
Universities and R&D organizations 32		Music 29		Air traffic 60–61	
Leading universities 25–37		Artists with highest-grossing albums 11–28		Commute time 175–176	
Leading R&D organizations 83–162		Most-streamed artists 38–200		Bandwidth 178	
Highly cited researchers 183–192		Best opera performers 24–41		Mobile Internet speed 168	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 80–85		Fixed broadband Internet speed 173	
Students 5		Largest fashion companies 43–200		Safety 75	
International students 65		Fashion brands 60–71		Homicide rate 77	
Leading business schools 36–80		Advertising and PR 12–13		Natural disaster risk 57	
Productivity of innovative class 103		Most effective advertising agencies 6–10		Tourist appeal 78	
Patent activity 184		Largest PR agencies 32–60		International hotels 87–88	
Publication activity 84		Creative production agencies 19–38		Culture, entertainment, and sports 56	
Innovation infrastructure 92–94		Top advertising agencies 16–38		Ecology 179	
Clusters 29–200		Architecture 22–23		Environmental pollution level 179	
Technology and science parks 26–72		Pritzker Architecture Prize laureates 9–24		Internationalization 105	
Co-working spaces 88–103		Internationally recognized architects and architecture firms 35–61		International schools 24–27	
Supercomputers 64–200		Industrial design 78–200		English proficiency 119–122	
		Internationally recognized designers and design firms 78–200		International business events 38	
		Arts 28		Visitors to international business events 38	
		Internationally recognized artists 16–40			
		Top artists by auction revenue 10–12			
		Most influential people in contemporary art 15–31			
		Leading higher education institutions in the arts 44–68			
		Literature 29–58			
		Best-selling authors 29–58			

Benchmarking against the leading city



Technological Development

Rank
86

Technology companies

143

Leading companies by R&D expenditure	118–146
R&D expenditure of largest innovation companies	143

Startups and venture capital

79

Startups	67
Unicorns	77–106
Innovation support funds	111–112
Business angels	82–83
Venture capital investment	66

Universities and R&D organizations

40

Leading universities	86–106
Leading R&D organizations	41–82
Highly cited researchers	25–26
Nobel Prize laureates and Fields Medal winners	78–200
Students	56
International students	13
Leading business schools	36–80

Productivity of innovative class

79

Patent activity	141
Publication activity	71

Innovation infrastructure

162–200

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	131–200
Supercomputers	64–200

Creative Industries

Rank
129

Film and animation

114–200

Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

110–200

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200

Music

75–200

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

102–128

Largest fashion companies	43–200
Fashion brands	91–122

Advertising and PR

96–200

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

43–48

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	27–34

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

59–75

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
33

Cost of doing business

126

Estimated tax	78–83
Salary	154

Cost of living

135

Food prices	132
Apartment rental cost	138
Cost of living for an expat	118
Cost of living for a local resident	131

Mobility

142

Air traffic	103–104
Commute time	130

Bandwidth

107

Mobile Internet speed	23
Fixed broadband Internet speed	176

Safety

32

Homicide rate	21
Natural disaster risk	42–44

Tourist appeal

30

International hotels	14
Culture, entertainment, and sports	109

Ecology

29


Environmental pollution level	29
-------------------------------	----

Internationalization

69

International schools	65
English proficiency	1–76
International business events	59–60
Visitors to international business events	39

Benchmarking against the leading city



Technological Development	Rank 34	Creative Industries	Rank 95	Urban Environment	Rank 166
Technology companies	147–200	Film and animation	49–51	Cost of doing business	99
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	87–200	Estimated tax	193
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	25–38	Salary	4
Startups and venture capital	81	Animation film production companies that won international festival awards	43–200	Cost of living	11
Startups	74–75	Electronic games	110–200	Food prices	14
Unicorns	60–76	The Game Awards winners	35–200	Apartment rental cost	13
Innovation support funds	113–116	Largest e-sports tournaments	62–200	Cost of living for an expat	6
Business angels	84	Developers of most popular computer games	34–200	Cost of living for a local resident	15
Venture capital investment	67	Companies participating in electronic games trade shows	64–200	Mobility	172
Universities and R&D organizations	38	Music	75–200	Air traffic	85
Leading universities	25–37	Artists with highest-grossing albums	29–200	Commute time	173
Leading R&D organizations	163–200	Most-streamed artists	38–200	Bandwidth	174
Highly cited researchers	183–192	Best opera performers	42–200	Mobile Internet speed	184
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	80–85	Fixed broadband Internet speed	118
Students	45	Largest fashion companies	43–200	Safety	81
International students	184	Fashion brands	60–71	Homicide rate	81
Leading business schools	5–9	Advertising and PR	23	Natural disaster risk	72
Productivity of innovative class	171	Most effective advertising agencies	14–18	Tourist appeal	115
Patent activity	188	Largest PR agencies	61–200	International hotels	93–101
Publication activity	169	Creative production agencies	9–18	Culture, entertainment, and sports	111
Innovation infrastructure	7	Top advertising agencies	39–200	Ecology	162
Clusters	2–7	Architecture	72–200	Environmental pollution level	162
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization	116
Co-working spaces	42–52	Internationally recognized architects and architecture firms	62–200	International schools	32–33
Supercomputers	64–200	Industrial design	78–200	English proficiency	137
		Internationally recognized designers and design firms	78–200	International business events	48–49
		Arts	41–49	Visitors to international business events	60
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	27–43		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city



Technological Development

Rank
106

Technology companies

147–200

Leading companies by R&D expenditure 147–200

R&D expenditure of largest innovation companies 147–200

Startups and venture capital

97

Startups 102

Unicorns 60–76

Innovation support funds 96–98

Business angels 69

Venture capital investment 98

Universities and R&D organizations

92

Leading universities 25–37

Leading R&D organizations 163–200

Highly cited researchers 183–192

Nobel Prize laureates and Fields Medal winners 78–200

Students 23

International students 156

Leading business schools 81–200

Productivity of innovative class

90

Patent activity 155

Publication activity 74

Innovation infrastructure

80–81

Clusters 29–200

Technology and science parks 26–72

Co-working spaces 56–64

Supercomputers 64–200

Creative Industries

Rank
83

Film and animation

73–85

Top-rated film production companies (audience) 87–200

Film production companies that won international film festival awards 47–70

Animation film production companies that won international festival awards 43–200

Electronic games

48–50

The Game Awards winners 35–200

Largest e-sports tournaments 8–11

Developers of most popular computer games 34–200

Companies participating in electronic games trade shows 64–200

Music

75–200

Artists with highest-grossing albums 29–200

Most-streamed artists 38–200

Best opera performers 42–200

Fashion

102–128

Largest fashion companies 43–200

Fashion brands 91–122

Advertising and PR

69–73

Most effective advertising agencies 49–200

Largest PR agencies 61–200

Creative production agencies 39–200

Top advertising agencies 16–38

Architecture

35–42

Pritzker Architecture Prize laureates 25–200

Internationally recognized architects and architecture firms 17–26

Industrial design

48–77

Internationally recognized designers and design firms 48–77

Arts

59–75

Internationally recognized artists 41–200

Top artists by auction revenue 38–200

Most influential people in contemporary art 32–200

Leading higher education institutions in the arts 44–68

Literature

59–200

Best-selling authors 59–200

Urban Environment

Rank
43

Cost of doing business

15

Estimated tax 68–77

Salary 17

Cost of living

45

Food prices 45

Apartment rental cost 40

Cost of living for an expat 34–35

Cost of living for a local resident 49

Mobility

107

Air traffic 33

Commute time 162

Bandwidth

67

Mobile Internet speed 157

Fixed broadband Internet speed 12

Safety

64

Homicide rate 55

Natural disaster risk 58

Tourist appeal

40

International hotels 32–33

Culture, entertainment, and sports 65

Ecology

173

Environmental pollution level 173

Internationalization

94

International schools 56–57

English proficiency 134–136

International business events 14

Visitors to international business events 12

Benchmarking against the leading city

Technological Development

Rank
53

Technology companies	56
Leading companies by R&D expenditure	91–103
R&D expenditure of largest innovation companies	34
Startups and venture capital	98
Startups	108
Unicorns	77–106
Innovation support funds	104
Business angels	79–81
Venture capital investment	64
Universities and R&D organizations	31
Leading universities	107–145
Leading R&D organizations	24–40
Highly cited researchers	19
Nobel Prize laureates and Fields Medal winners	8–9
Students	136
International students	54
Leading business schools	16–35
Productivity of innovative class	53
Patent activity	63
Publication activity	50
Innovation infrastructure	79
Clusters	29–200
Technology and science parks	26–72
Co-working spaces	131–200
Supercomputers	18–31

Creative Industries

Rank
104

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	110–200
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	129–200
Largest fashion companies	43–200
Fashion brands	123–200
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	26–33
Internationally recognized designers and design firms	26–33
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	29–58
Best-selling authors	29–58

Urban Environment

Rank
124

Cost of doing business	81
Estimated tax	25–33
Salary	128
Cost of living	131
Food prices	71
Apartment rental cost	158
Cost of living for an expat	120
Cost of living for a local resident	144
Mobility	156
Air traffic	173–199
Commute time	84
Bandwidth	157
Mobile Internet speed	149
Fixed broadband Internet speed	117
Safety	N/A
Homicide rate	N/A
Natural disaster risk	N/A
Tourist appeal	165
International hotels	133–139
Culture, entertainment, and sports	179
Ecology	65
Environmental pollution level	65
Internationalization	70
International schools	130–147
English proficiency	1–76
International business events	104–107
Visitors to international business events	N/A

Benchmarking against the leading city



Technological Development

Rank
46

Technology companies	101
Leading companies by R&D expenditure	91–103
R&D expenditure of largest innovation companies	110
Startups and venture capital	8
Startups	5
Unicorns	12
Innovation support funds	35
Business angels	7
Venture capital investment	15
Universities and R&D organizations	101
Leading universities	20–24
Leading R&D organizations	83–162
Highly cited researchers	146–151
Nobel Prize laureates and Fields Medal winners	78–200
Students	61
International students	152
Leading business schools	81–200
Productivity of innovative class	47
Patent activity	138
Publication activity	32
Innovation infrastructure	43
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	6
Supercomputers	32–63

Creative Industries

Rank
88

Film and animation	86–87
Top-rated film production companies (audience)	27–33
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	110–200
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	75–79
Largest fashion companies	43–200
Fashion brands	52–59
Advertising and PR	60–67
Most effective advertising agencies	30–48
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	49–71
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	35–61
Industrial design	34–47
Internationally recognized designers and design firms	34–47
Arts	56
Internationally recognized artists	41–200
Top artists by auction revenue	19–37
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	44–68
Literature	29–58
Best-selling authors	29–58

Urban Environment

Rank
156

Cost of doing business	35
Estimated tax	115–146
Salary	19
Cost of living	8
Food prices	8
Apartment rental cost	3
Cost of living for an expat	8
Cost of living for a local resident	10
Mobility	180
Air traffic	56
Commute time	183
Bandwidth	180
Mobile Internet speed	179
Fixed broadband Internet speed	163
Safety	71
Homicide rate	68
Natural disaster risk	74–77
Tourist appeal	108
International hotels	118–120
Culture, entertainment, and sports	78
Ecology	192
Environmental pollution level	192
Internationalization	104
International schools	34–35
English proficiency	79
International business events	65
Visitors to international business events	68

Benchmarking against the leading city

Rio de Janeiro

78

Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	100		48		106
Technology companies	135	Film and animation	66	Cost of doing business	1
Leading companies by R&D expenditure	118–146	Top-rated film production companies (audience)	34–39	Estimated tax	5–6
R&D expenditure of largest innovation companies	132	Film production companies that won international film festival awards	47–70	Salary	5
Startups and venture capital	111	Animation film production companies that won international festival awards	43–200	Cost of living	35
Startups	101	Electronic games	101–109	Food prices	27
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	18
Innovation support funds	91–93	Largest e-sports tournaments	44–61	Cost of living for an expat	42
Business angels	90–91	Developers of most popular computer games	34–200	Cost of living for a local resident	48
Venture capital investment	116	Companies participating in electronic games trade shows	64–200	Mobility	183
Universities and R&D organizations	135	Music	18	Air traffic	112–113
Leading universities	66–85	Artists with highest-grossing albums	5–10	Commute time	172
Leading R&D organizations	163–200	Most-streamed artists	14–37	Bandwidth	166
Highly cited researchers	167–170	Best opera performers	42–200	Mobile Internet speed	172
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	66–68	Fixed broadband Internet speed	110
Students	42	Largest fashion companies	43–200	Safety	78
International students	177	Fashion brands	41–44	Homicide rate	83
Leading business schools	81–200	Advertising and PR	56	Natural disaster risk	40–41
Productivity of innovative class	95	Most effective advertising agencies	49–200	Tourist appeal	44
Patent activity	164	Largest PR agencies	32–60	International hotels	69–74
Publication activity	77	Creative production agencies	19–38	Culture, entertainment, and sports	24
Innovation infrastructure	50	Top advertising agencies	39–200	Ecology	156
Clusters	29–200	Architecture	27–34	Environmental pollution level	156
Technology and science parks	26–72	Pritzker Architecture Prize laureates	9–24	Internationalization	135
Co-working spaces	37–39	Internationally recognized architects and architecture firms	62–200	International schools	66–76
Supercomputers	10–13	Industrial design	48–77	English proficiency	119–122
		Internationally recognized designers and design firms	48–77	International business events	69–72
		Arts	20	Visitors to international business events	64
		Internationally recognized artists	16–40		
		Top artists by auction revenue	10–12		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	18–26		
		Literature	29–58		
		Best-selling authors	29–58		

Benchmarking against the leading city



Technological Development

Rank
146

Technology companies	84
Leading companies by R&D expenditure	81–90
R&D expenditure of largest innovation companies	70
Startups and venture capital	77
Startups	85
Unicorns	77–106
Innovation support funds	85
Business angels	96–97
Venture capital investment	42
Universities and R&D organizations	134
Leading universities	107–145
Leading R&D organizations	83–162
Highly cited researchers	129–137
Nobel Prize laureates and Fields Medal winners	78–200
Students	66
International students	90
Leading business schools	81–200
Productivity of innovative class	92
Patent activity	87
Publication activity	82
Innovation infrastructure	131–133
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	77–87
Supercomputers	64–200

Creative Industries

Rank
69

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	48–50
The Game Awards winners	35–200
Largest e-sports tournaments	8–11
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	7
Largest fashion companies	3–5
Fashion brands	123–200
Advertising and PR	79–95
Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
44

Cost of doing business	156
Estimated tax	97–99
Salary	169
Cost of living	104
Food prices	129
Apartment rental cost	110
Cost of living for an expat	65
Cost of living for a local resident	105–106
Mobility	63
Air traffic	138
Commute time	21
Bandwidth	22
Mobile Internet speed	52
Fixed broadband Internet speed	22
Safety	N/A
Homicide rate	N/A
Natural disaster risk	N/A
Tourist appeal	74
International hotels	54–56
Culture, entertainment, and sports	103
Ecology	38
Environmental pollution level	38
Internationalization	67
International schools	77–81
English proficiency	1–76
International business events	148–153
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 76	Creative Industries	Rank 78	Urban Environment	Rank 112
Technology companies 38		Film and animation 94–113		Cost of doing business 180	
Leading companies by R&D expenditure	31–36	Top-rated film production companies (audience)	54–86	Estimated tax	153
R&D expenditure of largest innovation companies	47	Film production companies that won international film festival awards	71–200	Salary	170
Startups and venture capital 46		Animation film production companies that won international festival awards	43–200	Cost of living 122	
Startups	41	Electronic games 110–200		Food prices	130
Unicorns	42–44	The Game Awards winners	35–200	Apartment rental cost	153
Innovation support funds	49	Largest e-sports tournaments	62–200	Cost of living for an expat	93
Business angels	44–45	Developers of most popular computer games	34–200	Cost of living for a local resident	107
Venture capital investment	52	Companies participating in electronic games trade shows	64–200	Mobility 58	
Universities and R&D organizations 70		Music 75–200		Air traffic	60–61
Leading universities	146–199	Artists with highest-grossing albums	29–200	Commute time	76–77
Leading R&D organizations	41–82	Most-streamed artists	38–200	Bandwidth 55	
Highly cited researchers	99–104	Best opera performers	42–200	Mobile Internet speed	63
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 129–200		Fixed broadband Internet speed	59
Students	124	Largest fashion companies	43–200	Safety N/A	
International students	87	Fashion brands	123–200	Homicide rate	N/A
Leading business schools	16–35	Advertising and PR 96–200		Natural disaster risk	N/A
Productivity of innovative class 83		Most effective advertising agencies	49–200	Tourist appeal 49	
Patent activity	49	Largest PR agencies	61–200	International hotels	34
Publication activity	121	Creative production agencies	39–200	Culture, entertainment, and sports	85
Innovation infrastructure 74		Top advertising agencies	39–200	Ecology 124	
Clusters	29–200	Architecture 72–200		Environmental pollution level	124
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization 47–48	
Co-working spaces	56–64	Internationally recognized architects and architecture firms	62–200	International schools	38–40
Supercomputers	32–63	Industrial design 78–200		English proficiency	1–76
		Internationally recognized designers and design firms	78–200	International business events	104–107
		Arts 130–185		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	114–185		
		Literature 5–6			
		Best-selling authors	5–6		

Benchmarking against the leading city



Kuala Lumpur



81

Technological Development	Rank 84	Creative Industries	Rank 92	Urban Environment	Rank 90
Technology companies	147–200	Film and animation	114–200	Cost of doing business	50
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	87–200	Estimated tax	112–114
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	71–200	Salary	44
Startups and venture capital	67	Animation film production companies that won international festival awards	43–200	Cost of living	37
Startups	60	Electronic games	95–100	Food prices	39
Unicorns	77–106	The Game Awards winners	35–200	Apartment rental cost	23
Innovation support funds	72–74	Largest e-sports tournaments	32–43	Cost of living for an expat	33
Business angels	64	Developers of most popular computer games	34–200	Cost of living for a local resident	47
Venture capital investment	75	Companies participating in electronic games trade shows	64–200	Mobility	104
Universities and R&D organizations	52	Music	75–200	Air traffic	46–47
Leading universities	13–16	Artists with highest-grossing albums	29–200	Commute time	142
Leading R&D organizations	163–200	Most-streamed artists	38–200	Bandwidth	167
Highly cited researchers	92–98	Best opera performers	42–200	Mobile Internet speed	165
Nobel Prize laureates and Fields Medal winners	78–200	Fashion	102–128	Fixed broadband Internet speed	132
Students	27	Largest fashion companies	43–200	Safety	69
International students	33	Fashion brands	91–122	Homicide rate	67
Leading business schools	81–200	Advertising and PR	40–41	Natural disaster risk	60–71
Productivity of innovative class	65	Most effective advertising agencies	19–23	Tourist appeal	89
Patent activity	180	Largest PR agencies	61–200	International hotels	69–74
Publication activity	54	Creative production agencies	39–200	Culture, entertainment, and sports	97
Innovation infrastructure	83–89	Top advertising agencies	39–200	Ecology	152
Clusters	29–200	Architecture	49–71	Environmental pollution level	152
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization	96
Co-working spaces	65–76	Internationally recognized architects and architecture firms	35–61	International schools	62–64
Supercomputers	64–200	Industrial design	78–200	English proficiency	84–88
		Internationally recognized designers and design firms	78–200	International business events	26–29
		Arts	17–18	Visitors to international business events	26
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	6–8		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city

Saint Petersburg

82

Technological Development	Rank	Creative Industries	Rank	Urban Environment	Rank
	104		94		57
Technology companies	147–200	Film and animation	33	Cost of doing business	4
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	87–200	Estimated tax	3–4
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	39–46	Salary	30
Startups and venture capital	142	Animation film production companies that won international festival awards	15–25	Cost of living	46
Startups	140	Electronic games	101–109	Food prices	48
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	56
Innovation support funds	162–164	Largest e-sports tournaments	44–61	Cost of living for an expat	41
Business angels	102–103	Developers of most popular computer games	34–200	Cost of living for a local resident	34
Venture capital investment	173	Companies participating in electronic games trade shows	64–200	Mobility	147
Universities and R&D organizations	83	Music	52–64	Air traffic	48
Leading universities	38–42	Artists with highest-grossing albums	29–200	Commute time	166
Leading R&D organizations	163–200	Most-streamed artists	38–200	Bandwidth	172
Highly cited researchers	171–177	Best opera performers	24–41	Mobile Internet speed	171
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	102–128	Fixed broadband Internet speed	137
Students	87	Largest fashion companies	43–200	Safety	66
International students	63	Fashion brands	91–122	Homicide rate	76
Leading business schools	36–80	Advertising and PR	60–67	Natural disaster risk	32–33
Productivity of innovative class	61	Most effective advertising agencies	30–48	Tourist appeal	18
Patent activity	131	Largest PR agencies	61–200	International hotels	174–177
Publication activity	51	Creative production agencies	39–200	Culture, entertainment, and sports	6
Innovation infrastructure	101–108	Top advertising agencies	39–200	Ecology	141
Clusters	29–200	Architecture	49–71	Environmental pollution level	141
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization	141
Co-working spaces	131–200	Internationally recognized architects and architecture firms	35–61	International schools	115–129
Supercomputers	64–200	Industrial design	78–200	English proficiency	119–122
		Internationally recognized designers and design firms	78–200	International business events	N/A
		Arts	86–117	Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	69–113		
		Literature	29–58		
		Best-selling authors	29–58		

Benchmarking against the leading city



Chongqing



83

Technological Development

Rank
60

Technology companies

89

Leading companies by R&D expenditure	81–90
R&D expenditure of largest innovation companies	85

Startups and venture capital

137

Startups	171–172
Unicorns	45–59
Innovation support funds	166–169
Business angels	180–200
Venture capital investment	127

Universities and R&D organizations

107

Leading universities	66–85
Leading R&D organizations	41–82
Highly cited researchers	152–158
Nobel Prize laureates and Fields Medal winners	78–200
Students	49
International students	138
Leading business schools	81–200

Productivity of innovative class

18

Patent activity	10
Publication activity	39

Innovation infrastructure

101–108

Clusters	29–200
Technology and science parks	26–72
Co-working spaces	131–200
Supercomputers	64–200

Creative Industries

Rank
133

Film and animation

114–200

Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

87–89

The Game Awards winners	35–200
Largest e-sports tournaments	21–27
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200

Music

75–200

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

129–200

Largest fashion companies	43–200
Fashion brands	123–200

Advertising and PR

96–200

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

48–77

Internationally recognized designers and design firms	48–77
---	-------

Arts

124–129

Internationally recognized artists	41–200
Top artists by auction revenue	19–37
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	114–185

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
102

Cost of doing business

55–56

Estimated tax	115–146
Salary	40–41

Cost of living

13

Food prices	11
Apartment rental cost	67–68
Cost of living for an expat	10
Cost of living for a local resident	8

Mobility

169

Air traffic	65–67
Commute time	174

Bandwidth

34

Mobile Internet speed	41
Fixed broadband Internet speed	45

Safety

50–60

Homicide rate	28–41
Natural disaster risk	60–71

Tourist appeal

57

International hotels	32–33
Culture, entertainment, and sports	126

Ecology

169

Environmental pollution level	169
-------------------------------	-----

Internationalization

152

International schools	115–129
English proficiency	123–133
International business events	123–126
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development

Rank
88

Technology companies	62
Leading companies by R&D expenditure	51–57
R&D expenditure of largest innovation companies	77
Startups and venture capital	36
Startups	38
Unicorns	26–29
Innovation support funds	32
Business angels	31
Venture capital investment	30
Universities and R&D organizations	172
Leading universities	86–106
Leading R&D organizations	163–200
Highly cited researchers	74–77
Nobel Prize laureates and Fields Medal winners	78–200
Students	116
International students	157
Leading business schools	81–200
Productivity of innovative class	68
Patent activity	45
Publication activity	83
Innovation infrastructure	59–60
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	15–16
Supercomputers	32–63

Creative Industries

Rank
123

Film and animation	94–113
Top-rated film production companies (audience)	54–86
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	93–94
The Game Awards winners	20–34
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	38–41
Largest fashion companies	16–42
Fashion brands	91–122
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
54

Cost of doing business	176
Estimated tax	59–60
Salary	180
Cost of living	169
Food prices	162
Apartment rental cost	175
Cost of living for an expat	138
Cost of living for a local resident	159
Mobility	21
Air traffic	18
Commute time	103
Bandwidth	113
Mobile Internet speed	80
Fixed broadband Internet speed	107
Safety	N/A
Homicide rate	N/A
Natural disaster risk	N/A
Tourist appeal	46
International hotels	29–30
Culture, entertainment, and sports	94
Ecology	96
Environmental pollution level	96
Internationalization	1
International schools	24–27
English proficiency	1–76
International business events	N/A
Visitors to international business events	N/A

Benchmarking against the leading city



Technological Development

Rank
44

Technology companies	147–200
Leading companies by R&D expenditure	147–200
R&D expenditure of largest innovation companies	147–200
Startups and venture capital	68
Startups	46
Unicorns	107–200
Innovation support funds	81–82
Business angels	98–101
Venture capital investment	99
Universities and R&D organizations	17
Leading universities	20–24
Leading R&D organizations	163–200
Highly cited researchers	183–192
Nobel Prize laureates and Fields Medal winners	78–200
Students	1
International students	12
Leading business schools	81–200
Productivity of innovative class	81
Patent activity	189
Publication activity	72
Innovation infrastructure	83–89
Clusters	29–200
Technology and science parks	26–72
Co-working spaces	77–87
Supercomputers	64–200

Creative Industries

Rank
151

Film and animation	67–69
Top-rated film production companies (audience)	40–53
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	43–200
Electronic games	110–200
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	102–128
Largest fashion companies	43–200
Fashion brands	91–122
Advertising and PR	60–67
Most effective advertising agencies	30–48
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
145

Cost of doing business	18
Estimated tax	106
Salary	2
Cost of living	5
Food prices	6
Apartment rental cost	2
Cost of living for an expat	4
Cost of living for a local resident	6
Mobility	164
Air traffic	74–75
Commute time	167
Bandwidth	192
Mobile Internet speed	176
Fixed broadband Internet speed	190
Safety	13
Homicide rate	53
Natural disaster risk	10
Tourist appeal	133
International hotels	140–144
Culture, entertainment, and sports	88
Ecology	193
Environmental pollution level	193
Internationalization	121
International schools	32–33
English proficiency	123–133
International business events	84
Visitors to international business events	66

Benchmarking against the leading city

Technological Development	Rank 90	Creative Industries	Rank 117	Urban Environment	Rank 56
Technology companies	147–200	Film and animation	94–113	Cost of doing business	155
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	54–86	Estimated tax	149
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	71–200	Salary	139
Startups and venture capital	106	Animation film production companies that won international festival awards	43–200	Cost of living	79
Startups	74–75	Electronic games	38–43	Food prices	77
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	92
Innovation support funds	130	Largest e-sports tournaments	62–200	Cost of living for an expat	57
Business angels	116–121	Developers of most popular computer games	34–200	Cost of living for a local resident	100–101
Venture capital investment	126	Companies participating in electronic games trade shows	15–26	Mobility	97
Universities and R&D organizations	157	Music	65–74	Air traffic	136–137
Leading universities	146–199	Artists with highest-grossing albums	29–200	Commute time	54
Leading R&D organizations	83–162	Most-streamed artists	14–37	Bandwidth	42
Highly cited researchers	129–137	Best opera performers	42–200	Mobile Internet speed	68
Nobel Prize laureates and Fields Medal winners	41–77	Fashion	129–200	Fixed broadband Internet speed	39
Students	155	Largest fashion companies	43–200	Safety	N/A
International students	85	Fashion brands	123–200	Homicide rate	N/A
Leading business schools	81–200	Advertising and PR	96–200	Natural disaster risk	N/A
Productivity of innovative class	124	Most effective advertising agencies	49–200	Tourist appeal	109
Patent activity	149	Largest PR agencies	61–200	International hotels	75–77
Publication activity	113	Creative production agencies	39–200	Culture, entertainment, and sports	155
Innovation infrastructure	31	Top advertising agencies	39–200	Ecology	54
Clusters	8–28	Architecture	72–200	Environmental pollution level	54
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization	54
Co-working spaces	40–41	Internationally recognized architects and architecture firms	62–200	International schools	43–46
Supercomputers	64–200	Industrial design	78–200	English proficiency	1–76
		Internationally recognized designers and design firms	78–200	International business events	143–147
		Arts	130–185	Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	114–185		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city



Minneapolis

87

Technological Development

Rank
122

Technology companies

47

Leading companies by R&D expenditure	43–45
R&D expenditure of largest innovation companies	52

Startups and venture capital

60

Startups	68
Unicorns	77–106
Innovation support funds	50
Business angels	58–59
Venture capital investment	60

Universities and R&D organizations

123

Leading universities	146–199
Leading R&D organizations	83–162
Highly cited researchers	68–70
Nobel Prize laureates and Fields Medal winners	22–26
Students	105
International students	114
Leading business schools	81–200

Productivity of innovative class

84

Patent activity	58
Publication activity	92

Innovation infrastructure

127–130

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	104–130
Supercomputers	32–63

Creative Industries

Rank
103

Film and animation

94–113

Top-rated film production companies (audience)	54–86
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

61–82

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	27–63

Music

22

Artists with highest-grossing albums	5–10
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

102–128

Largest fashion companies	43–200
Fashion brands	91–122

Advertising and PR

57–59

Most effective advertising agencies	49–200
Largest PR agencies	14–20
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

130–185

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	114–185

Literature

59–200

Best-selling authors	59–200
----------------------	--------

Urban Environment

Rank
46

Cost of doing business

170

Estimated tax	95
Salary	174

Cost of living

140

Food prices	155
Apartment rental cost	143
Cost of living for an expat	114
Cost of living for a local resident	126

Mobility

43

Air traffic	39–40
Commute time	104

Bandwidth

60

Mobile Internet speed	34
Fixed broadband Internet speed	77

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

60

International hotels	48–49
Culture, entertainment, and sports	73

Ecology

40

Environmental pollution level	40
-------------------------------	----

Internationalization

42

International schools	24–27
English proficiency	1–76
International business events	127–132
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 114	Creative Industries	Rank 134	Urban Environment	Rank 39
Technology companies 147–200		Film and animation 114–200		Cost of doing business 32	
Leading companies by R&D expenditure 147–200		Top-rated film production companies (audience) 87–200		Estimated tax 25–33	
R&D expenditure of largest innovation companies 147–200		Film production companies that won international film festival awards 71–200		Salary 79	
Startups and venture capital 152		Animation film production companies that won international festival awards 43–200		Cost of living 145	
Startups 141		Electronic games 110–200		Food prices 101	
Unicorns 107–200		The Game Awards winners 35–200		Apartment rental cost 93	
Innovation support funds 170–177		Largest e-sports tournaments 62–200		Cost of living for an expat 180	
Business angels 128–131		Developers of most popular computer games 34–200		Cost of living for a local resident 90	
Venture capital investment 165		Companies participating in electronic games trade shows 64–200		Mobility 98	
Universities and R&D organizations 150		Music 52–64		Air traffic 155	
Leading universities 107–145		Artists with highest-grossing albums 29–200		Commute time 35	
Leading R&D organizations 83–162		Most-streamed artists 38–200		Bandwidth 87	
Highly cited researchers 125–128		Best opera performers 24–41		Mobile Internet speed 25	
Nobel Prize laureates and Fields Medal winners 41–77		Fashion 102–128		Fixed broadband Internet speed 143	
Students 144		Largest fashion companies 43–200		Safety N/A	
International students 86		Fashion brands 91–122		Homicide rate N/A	
Leading business schools 81–200		Advertising and PR 96–200		Natural disaster risk N/A	
Productivity of innovative class 176		Most effective advertising agencies 49–200		Tourist appeal 119	
Patent activity 162		Largest PR agencies 61–200		International hotels 93–101	
Publication activity 175		Creative production agencies 39–200		Culture, entertainment, and sports 117	
Innovation infrastructure 41–42		Top advertising agencies 39–200		Ecology 69	
Clusters 8–28		Architecture 72–200		Environmental pollution level 69	
Technology and science parks 73–200		Pritzker Architecture Prize laureates 25–200		Internationalization 25–33	
Co-working spaces 104–130		Internationally recognized architects and architecture firms 62–200		International schools 173–200	
Supercomputers 64–200		Industrial design 48–77		English proficiency 1–76	
		Internationally recognized designers and design firms 48–77		International business events N/A	
		Arts 130–185		Visitors to international business events N/A	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 114–185			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city



Technological Development

Rank
87

Technology companies

92

Leading companies by R&D expenditure	81–90
R&D expenditure of largest innovation companies	101

Startups and venture capital

58

Startups	56–57
Unicorns	107–200
Innovation support funds	54
Business angels	47
Venture capital investment	69

Universities and R&D organizations

173

Leading universities	107–145
Leading R&D organizations	83–162
Highly cited researchers	125–128
Nobel Prize laureates and Fields Medal winners	78–200
Students	147
International students	164
Leading business schools	81–200

Productivity of innovative class

116

Patent activity	56
Publication activity	143

Innovation infrastructure

33–34

Clusters	8–28
Technology and science parks	73–200
Co-working spaces	42–52
Supercomputers	64–200

Creative Industries

Rank
51

Film and animation

32

Top-rated film production companies (audience)	54–86
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	10–14

Electronic games

38–43

The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	15–26

Music

43–49

Artists with highest-grossing albums	11–28
Most-streamed artists	38–200
Best opera performers	42–200

Fashion

11

Largest fashion companies	7–15
Fashion brands	45–46

Advertising and PR

51–52

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	19–38
Top advertising agencies	16–38

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

130–185

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	114–185

Literature

18–28

Best-selling authors	18–28
----------------------	-------

Urban Environment

Rank
133

Cost of doing business

181

Estimated tax	165
Salary	159

Cost of living

185

Food prices	186
Apartment rental cost	167
Cost of living for an expat	179
Cost of living for a local resident	165

Mobility

99

Air traffic	105
Commute time	82

Bandwidth

74

Mobile Internet speed	65
Fixed broadband Internet speed	81

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

61

International hotels	46
Culture, entertainment, and sports	87

Ecology

61

Environmental pollution level	61
-------------------------------	----

Internationalization

47–48

International schools	38–40
English proficiency	1–76
International business events	104–107
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 151	Creative Industries	Rank 71	Urban Environment	Rank 59
Technology companies	147–200	Film and animation	49–51	Cost of doing business	2
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	87–200	Estimated tax	2
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	25–38	Salary	22
Startups and venture capital	92	Animation film production companies that won international festival awards	43–200	Cost of living	33
Startups	64	Electronic games	24	Food prices	16
Unicorns	107–200	The Game Awards winners	11–19	Apartment rental cost	48
Innovation support funds	125–126	Largest e-sports tournaments	44–61	Cost of living for an expat	34–35
Business angels	98–101	Developers of most popular computer games	34–200	Cost of living for a local resident	29
Venture capital investment	176	Companies participating in electronic games trade shows	15–26	Mobility	153
Universities and R&D organizations	191	Music	75–200	Air traffic	93
Leading universities	86–106	Artists with highest-grossing albums	29–200	Commute time	150
Leading R&D organizations	163–200	Most-streamed artists	38–200	Bandwidth	171
Highly cited researchers	193–200	Best opera performers	42–200	Mobile Internet speed	161
Nobel Prize laureates and Fields Medal winners	78–200	Fashion	80–85	Fixed broadband Internet speed	152
Students	166	Largest fashion companies	43–200	Safety	29
International students	190	Fashion brands	60–71	Homicide rate	59–60
Leading business schools	81–200	Advertising and PR	18	Natural disaster risk	18
Productivity of innovative class	160	Most effective advertising agencies	6–10	Tourist appeal	111
Patent activity	192	Largest PR agencies	61–200	International hotels	178–184
Publication activity	150	Creative production agencies	39–200	Culture, entertainment, and sports	38
Innovation infrastructure	56	Top advertising agencies	39–200	Ecology	146
Clusters	29–200	Architecture	72–200	Environmental pollution level	146
Technology and science parks	26–72	Pritzker Architecture Prize laureates	25–200	Internationalization	128
Co-working spaces	21	Internationally recognized architects and architecture firms	62–200	International schools	115–129
Supercomputers	64–200	Industrial design	78–200	English proficiency	103–106
		Internationally recognized designers and design firms	78–200	International business events	N/A
		Arts	189–200	Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	186–200		
		Literature	59–200		
		Best-selling authors	59–200		

Benchmarking against the leading city



Birmingham

91

Technological Development

Rank
144

Technology companies

100

Leading companies by R&D expenditure	91–103
R&D expenditure of largest innovation companies	106

Startups and venture capital

116

Startups	104
Unicorns	77–106
Innovation support funds	113–116
Business angels	122–127
Venture capital investment	125

Universities and R&D organizations

102

Leading universities	66–85
Leading R&D organizations	83–162
Highly cited researchers	152–158
Nobel Prize laureates and Fields Medal winners	78–200
Students	78
International students	32
Leading business schools	81–200

Productivity of innovative class

108

Patent activity	135
Publication activity	95

Innovation infrastructure

162–200

Clusters	29–200
Technology and science parks	73–200
Co-working spaces	131–200
Supercomputers	64–200

Creative Industries

Rank
67

Film and animation

114–200

Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200

Electronic games

25

The Game Awards winners	20–34
Largest e-sports tournaments	32–43
Developers of most popular computer games	12–15
Companies participating in electronic games trade shows	64–200

Music

23–27

Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	11–16

Fashion

86–101

Largest fashion companies	43–200
Fashion brands	72–90

Advertising and PR

96–200

Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200

Architecture

72–200

Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200

Industrial design

78–200

Internationally recognized designers and design firms	78–200
---	--------

Arts

41–49

Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	27–43

Literature

29–58

Best-selling authors	29–58
----------------------	-------

Urban Environment

Rank
69

Cost of doing business

78

Estimated tax	42–49
Salary	89

Cost of living

52

Food prices	41
Apartment rental cost	89
Cost of living for an expat	N/A
Cost of living for a local resident	N/A

Mobility

71

Air traffic	76–77
Commute time	83

Bandwidth

134

Mobile Internet speed	93
Fixed broadband Internet speed	135

Safety

N/A

Homicide rate	N/A
Natural disaster risk	N/A

Tourist appeal

63

International hotels	122–128
Culture, entertainment, and sports	25

Ecology

106

Environmental pollution level	106
-------------------------------	-----

Internationalization

75

International schools	130–147
English proficiency	1–76
International business events	127–132
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 147	Creative Industries	Rank 161	Urban Environment	Rank 24
Technology companies 147–200		Film and animation 114–200		Cost of doing business 128	
Leading companies by R&D expenditure	147–200	Top-rated film production companies (audience)	87–200	Estimated tax	78–83
R&D expenditure of largest innovation companies	147–200	Film production companies that won international film festival awards	71–200	Salary	157
Startups and venture capital 139		Animation film production companies that won international festival awards	43–200	Cost of living 99	
Startups	138	Electronic games 110–200		Food prices	73
Unicorns	107–200	The Game Awards winners	35–200	Apartment rental cost	104
Innovation support funds	144–147	Largest e-sports tournaments	62–200	Cost of living for an expat	85
Business angels	122–127	Developers of most popular computer games	34–200	Cost of living for a local resident	113
Venture capital investment	167	Companies participating in electronic games trade shows	64–200	Mobility 68	
Universities and R&D organizations 106		Music 75–200		Air traffic	149–151
Leading universities	86–106	Artists with highest-grossing albums	29–200	Commute time	20
Leading R&D organizations	83–162	Most-streamed artists	38–200	Bandwidth 104	
Highly cited researchers	73	Best opera performers	42–200	Mobile Internet speed	20
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 86–101		Fixed broadband Internet speed	178
Students	92	Largest fashion companies	43–200	Safety N/A	
International students	38	Fashion brands	72–90	Homicide rate	N/A
Leading business schools	81–200	Advertising and PR 96–200		Natural disaster risk	N/A
Productivity of innovative class 138		Most effective advertising agencies	49–200	Tourist appeal 138	
Patent activity	177	Largest PR agencies	61–200	International hotels	105–108
Publication activity	127	Creative production agencies	39–200	Culture, entertainment, and sports	156
Innovation infrastructure 120–122		Top advertising agencies	39–200	Ecology 12	
Clusters	29–200	Architecture 72–200		Environmental pollution level	12
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 10	
Co-working spaces	53–55	Internationally recognized architects and architecture firms	62–200	International schools	58–61
Supercomputers	64–200	Industrial design 78–200		English proficiency	1–76
		Internationally recognized designers and design firms	78–200	International business events	N/A
		Arts 59–75		Visitors to international business events	N/A
		Internationally recognized artists	41–200		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	44–68		
		Literature 59–200			
		Best-selling authors	59–200		

Benchmarking against the leading city



Technological Development

Rank
41

Technology companies	83
Leading companies by R&D expenditure	70–80
R&D expenditure of largest innovation companies	87
Startups and venture capital	183
Startups	190–191
Unicorns	107–200
Innovation support funds	144–147
Business angels	180–200
Venture capital investment	164
Universities and R&D organizations	34
Leading universities	20–24
Leading R&D organizations	12–17
Highly cited researchers	48–52
Nobel Prize laureates and Fields Medal winners	78–200
Students	19
International students	81
Leading business schools	81–200
Productivity of innovative class	17
Patent activity	18
Publication activity	15
Innovation infrastructure	162–200
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	131–200
Supercomputers	64–200

Creative Industries

Rank
153

Film and animation	73–85
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	43–200
Electronic games	59–60
The Game Awards winners	35–200
Largest e-sports tournaments	15–18
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	129–200
Largest fashion companies	43–200
Fashion brands	123–200
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	187–188
Internationally recognized artists	41–200
Top artists by auction revenue	19–37
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	186–200
Literature	59–200
Best-selling authors	59–200

Urban Environment


Rank
167

Cost of doing business	40
Estimated tax	115–146
Salary	27
Cost of living	4
Food prices	3
Apartment rental cost	8
Cost of living for an expat	N/A
Cost of living for a local resident	7
Mobility	181
Air traffic	173–199
Commute time	151
Bandwidth	28
Mobile Internet speed	88
Fixed broadband Internet speed	15
Safety	N/A
Homicide rate	N/A
Natural disaster risk	N/A
Tourist appeal	23
International hotels	9
Culture, entertainment, and sports	118
Ecology	194
Environmental pollution level	194
Internationalization	179–180
International schools	130–147
English proficiency	N/A
International business events	N/A
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 139	Creative Industries	Rank 122	Urban Environment	Rank 41
Technology companies 147–200		Film and animation 114–200		Cost of doing business 43	
Leading companies by R&D expenditure 147–200		Top-rated film production companies (audience) 87–200		Estimated tax 42–49	
R&D expenditure of largest innovation companies 147–200		Film production companies that won international film festival awards 71–200		Salary 71	
Startups and venture capital 154		Animation film production companies that won international festival awards 43–200		Cost of living 82	
Startups 143		Electronic games 110–200		Food prices 72	
Unicorns 107–200		The Game Awards winners 35–200		Apartment rental cost 76	
Innovation support funds 165		Largest e-sports tournaments 62–200		Cost of living for an expat 86	
Business angels 141–148		Developers of most popular computer games 34–200		Cost of living for a local resident 83–86	
Venture capital investment 151		Companies participating in electronic games trade shows 64–200		Mobility 110	
Universities and R&D organizations 89		Music 52–64		Air traffic 117	
Leading universities 49–65		Artists with highest-grossing albums 29–200		Commute time 74	
Leading R&D organizations 41–82		Most-streamed artists 38–200		Bandwidth 122	
Highly cited researchers 85–87		Best opera performers 24–41		Mobile Internet speed 58	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 129–200		Fixed broadband Internet speed 151	
Students 89		Largest fashion companies 43–200		Safety N/A	
International students 43		Fashion brands 123–200		Homicide rate N/A	
Leading business schools 81–200		Advertising and PR 96–200		Natural disaster risk N/A	
Productivity of innovative class 115		Most effective advertising agencies 49–200		Tourist appeal 50	
Patent activity 132		Largest PR agencies 61–200		International hotels 129–132	
Publication activity 106		Creative production agencies 39–200		Culture, entertainment, and sports 18	
Innovation infrastructure 146–161		Top advertising agencies 39–200		Ecology 59	
Clusters 29–200		Architecture 72–200		Environmental pollution level 59	
Technology and science parks 73–200		Pritzker Architecture Prize laureates 25–200		Internationalization 65	
Co-working spaces 104–130		Internationally recognized architects and architecture firms 62–200		International schools 115–129	
Supercomputers 64–200		Industrial design 78–200		English proficiency 1–76	
		Internationally recognized designers and design firms 78–200		International business events 97–98	
		Arts 59–75		Visitors to international business events N/A	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 44–68			
		Literature 29–58			
		Best-selling authors 29–58			

Benchmarking against the leading city



Technological Development

Rank
126

Technology companies	137
Leading companies by R&D expenditure	118–146
R&D expenditure of largest innovation companies	135
Startups and venture capital	120
Startups	112
Unicorns	77–106
Innovation support funds	113–116
Business angels	149–155
Venture capital investment	95
Universities and R&D organizations	198
Leading universities	107–145
Leading R&D organizations	163–200
Highly cited researchers	183–192
Nobel Prize laureates and Fields Medal winners	78–200
Students	191
International students	187
Leading business schools	81–200
Productivity of innovative class	198
Patent activity	174–176
Publication activity	197
Innovation infrastructure	30
Clusters	8–28
Technology and science parks	26–72
Co-working spaces	131–200
Supercomputers	64–200

Creative Industries

Rank
137

Film and animation	45
Top-rated film production companies (audience)	34–39
Film production companies that won international film festival awards	25–38
Animation film production companies that won international festival awards	43–200
Electronic games	85–86
The Game Awards winners	20–34
Largest e-sports tournaments	32–43
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	86–101
Largest fashion companies	43–200
Fashion brands	72–90
Advertising and PR	96–200
Most effective advertising agencies	49–200
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	130–185
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	114–185
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
49

Cost of doing business	110
Estimated tax	68–77
Salary	140
Cost of living	157
Food prices	178
Apartment rental cost	157
Cost of living for an expat	126
Cost of living for a local resident	141
Mobility	61
Air traffic	165–166
Commute time	10
Bandwidth	N/A
Mobile Internet speed	N/A
Fixed broadband Internet speed	N/A
Safety	5
Homicide rate	4–5
Natural disaster risk	4
Tourist appeal	193
International hotels	188–194
Culture, entertainment, and sports	182
Ecology	6
Environmental pollution level	6
Internationalization	148
International schools	148–172
English proficiency	N/A
International business events	66
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 113	Creative Industries	Rank 110	Urban Environment	Rank 80
Technology companies 33		Film and animation 114–200		Cost of doing business 115	
Leading companies by R&D expenditure	37–38	Top-rated film production companies (audience)	87–200	Estimated tax	64
R&D expenditure of largest innovation companies	19	Film production companies that won international film festival awards	71–200	Salary	149
Startups and venture capital 71		Animation film production companies that won international festival awards	43–200	Cost of living 98	
Startups	89	Electronic games 61–82		Food prices	125
Unicorns	45–59	The Game Awards winners	35–200	Apartment rental cost	120
Innovation support funds	71	Largest e-sports tournaments	62–200	Cost of living for an expat	61
Business angels	72	Developers of most popular computer games	34–200	Cost of living for a local resident	80
Venture capital investment	49	Companies participating in electronic games trade shows	27–63	Mobility 102	
Universities and R&D organizations 162		Music 65–74		Air traffic	35–36
Leading universities	86–106	Artists with highest-grossing albums	29–200	Commute time	159
Leading R&D organizations	83–162	Most-streamed artists	14–37	Bandwidth 100	
Highly cited researchers	178–182	Best opera performers	42–200	Mobile Internet speed	56
Nobel Prize laureates and Fields Medal winners	78–200	Fashion 102–128		Fixed broadband Internet speed	124
Students	114	Largest fashion companies	43–200	Safety N/A	
International students	130	Fashion brands	91–122	Homicide rate	N/A
Leading business schools	81–200	Advertising and PR 69–73		Natural disaster risk	N/A
Productivity of innovative class 71		Most effective advertising agencies	49–200	Tourist appeal 73	
Patent activity	35	Largest PR agencies	61–200	International hotels	51
Publication activity	141	Creative production agencies	39–200	Culture, entertainment, and sports	125
Innovation infrastructure 134–140		Top advertising agencies	16–38	Ecology 134	
Clusters	29–200	Architecture 72–200		Environmental pollution level	134
Technology and science parks	73–200	Pritzker Architecture Prize laureates	25–200	Internationalization 8	
Co-working spaces	131–200	Internationally recognized architects and architecture firms	62–200	International schools	50–54
Supercomputers	32–63	Industrial design 78–200		English proficiency	1–76
		Internationally recognized designers and design firms	78–200	International business events	N/A
		Arts 78–80		Visitors to international business events	N/A
		Internationally recognized artists	16–40		
		Top artists by auction revenue	38–200		
		Most influential people in contemporary art	32–200		
		Leading higher education institutions in the arts	69–113		
		Literature 29–58			
		Best-selling authors	29–58		

Benchmarking against the leading city



Santiago



97

Technological Development

Rank
111

Technology companies	147–200
Leading companies by R&D expenditure	147–200
R&D expenditure of largest innovation companies	147–200
Startups and venture capital	82
Startups	69
Unicorns	60–76
Innovation support funds	89–90
Business angels	87–89
Venture capital investment	96
Universities and R&D organizations	57
Leading universities	17–19
Leading R&D organizations	163–200
Highly cited researchers	178–182
Nobel Prize laureates and Fields Medal winners	78–200
Students	25
International students	102
Leading business schools	36–80
Productivity of innovative class	121
Patent activity	147
Publication activity	110
Innovation infrastructure	141–145
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	88–103
Supercomputers	64–200

Creative Industries

Rank
66

Film and animation	73–85
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	47–70
Animation film production companies that won international festival awards	43–200
Electronic games	110–200
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	129–200
Largest fashion companies	43–200
Fashion brands	123–200
Advertising and PR	16
Most effective advertising agencies	6–10
Largest PR agencies	61–200
Creative production agencies	39–200
Top advertising agencies	16–38
Architecture	27–34
Pritzker Architecture Prize laureates	9–24
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	38
Internationally recognized artists	16–40
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	27–43
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
120

Cost of doing business	53
Estimated tax	162–163
Salary	20
Cost of living	22
Food prices	38
Apartment rental cost	25
Cost of living for an expat	19
Cost of living for a local resident	17–18
Mobility	143
Air traffic	130
Commute time	112–113
Bandwidth	98
Mobile Internet speed	175
Fixed broadband Internet speed	20
Safety	79
Homicide rate	56
Natural disaster risk	82
Tourist appeal	84
International hotels	116–117
Culture, entertainment, and sports	43
Ecology	161
Environmental pollution level	161
Internationalization	124
International schools	62–64
English proficiency	115–118
International business events	N/A
Visitors to international business events	N/A

Benchmarking against the leading city

Technological Development	Rank 78	Creative Industries	Rank 114	Urban Environment	Rank 128
Technology companies 46		Film and animation 114–200		Cost of doing business 105	
Leading companies by R&D expenditure 81–90		Top-rated film production companies (audience) 87–200		Estimated tax 85–88	
R&D expenditure of largest innovation companies 40		Film production companies that won international film festival awards 71–200		Salary 129	
Startups and venture capital 121		Animation film production companies that won international festival awards 43–200		Cost of living 154	
Startups 88		Electronic games 110–200		Food prices 164	
Unicorns 107–200		The Game Awards winners 35–200		Apartment rental cost 119	
Innovation support funds 139–140		Largest e-sports tournaments 62–200		Cost of living for an expat 166	
Business angels 170–179		Developers of most popular computer games 34–200		Cost of living for a local resident 134	
Venture capital investment 108		Companies participating in electronic games trade shows 64–200		Mobility 45	
Universities and R&D organizations 190		Music 75–200		Air traffic 100	
Leading universities 146–199		Artists with highest-grossing albums 29–200		Commute time 26	
Leading R&D organizations 83–162		Most-streamed artists 38–200		Bandwidth 26	
Highly cited researchers 171–177		Best opera performers 42–200		Mobile Internet speed 7	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 102–128		Fixed broadband Internet speed 86	
Students 196		Largest fashion companies 43–200		Safety N/A	
International students 174		Fashion brands 91–122		Homicide rate N/A	
Leading business schools 81–200		Advertising and PR 96–200		Natural disaster risk N/A	
Productivity of innovative class 128		Most effective advertising agencies 49–200		Tourist appeal 176	
Patent activity 47		Largest PR agencies 61–200		International hotels 156–161	
Publication activity 177		Creative production agencies 39–200		Culture, entertainment, and sports 174	
Innovation infrastructure 18		Top advertising agencies 39–200		Ecology 27–28	
Clusters 8–28		Architecture 72–200		Environmental pollution level 27–28	
Technology and science parks 26–72		Pritzker Architecture Prize laureates 25–200		Internationalization 175	
Co-working spaces 22		Internationally recognized architects and architecture firms 62–200		International schools 148–172	
Supercomputers 64–200		Industrial design 26–33		English proficiency N/A	
		Internationally recognized designers and design firms 26–33		International business events 108–110	
		Arts 86–117		Visitors to international business events N/A	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 69–113			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city



Technological Development

Rank
132

Technology companies	95
Leading companies by R&D expenditure	91–103
R&D expenditure of largest innovation companies	84
Startups and venture capital	84
Startups	91
Unicorns	107–200
Innovation support funds	70
Business angels	68
Venture capital investment	81
Universities and R&D organizations	99
Leading universities	86–106
Leading R&D organizations	83–162
Highly cited researchers	31
Nobel Prize laureates and Fields Medal winners	78–200
Students	141
International students	141
Leading business schools	36–80
Productivity of innovative class	100
Patent activity	72
Publication activity	100
Innovation infrastructure	146–161
Clusters	29–200
Technology and science parks	73–200
Co-working spaces	104–130
Supercomputers	64–200

Creative Industries

Rank
132

Film and animation	114–200
Top-rated film production companies (audience)	87–200
Film production companies that won international film festival awards	71–200
Animation film production companies that won international festival awards	43–200
Electronic games	110–200
The Game Awards winners	35–200
Largest e-sports tournaments	62–200
Developers of most popular computer games	34–200
Companies participating in electronic games trade shows	64–200
Music	75–200
Artists with highest-grossing albums	29–200
Most-streamed artists	38–200
Best opera performers	42–200
Fashion	38–41
Largest fashion companies	16–42
Fashion brands	91–122
Advertising and PR	79–95
Most effective advertising agencies	49–200
Largest PR agencies	32–60
Creative production agencies	39–200
Top advertising agencies	39–200
Architecture	72–200
Pritzker Architecture Prize laureates	25–200
Internationally recognized architects and architecture firms	62–200
Industrial design	78–200
Internationally recognized designers and design firms	78–200
Arts	86–117
Internationally recognized artists	41–200
Top artists by auction revenue	38–200
Most influential people in contemporary art	32–200
Leading higher education institutions in the arts	69–113
Literature	59–200
Best-selling authors	59–200

Urban Environment

Rank
52

Cost of doing business	136
Estimated tax	115–146
Salary	132
Cost of living	110
Food prices	128
Apartment rental cost	111
Cost of living for an expat	96
Cost of living for a local resident	111
Mobility	52
Air traffic	102
Commute time	36
Bandwidth	109
Mobile Internet speed	127
Fixed broadband Internet speed	75
Safety	N/A
Homicide rate	N/A
Natural disaster risk	N/A
Tourist appeal	39
International hotels	22
Culture, entertainment, and sports	104
Ecology	83
Environmental pollution level	83
Internationalization	25–33
International schools	173–200
English proficiency	1–76
International business events	N/A
Visitors to international business events	N/A

Benchmarking against the leading city

Bucharest

100

Technological Development	Rank 165	Creative Industries	Rank 74	Urban Environment	Rank 74
Technology companies 147–200		Film and animation 11		Cost of doing business 8	
Leading companies by R&D expenditure 147–200		Top-rated film production companies (audience) 40–53		Estimated tax 34	
R&D expenditure of largest innovation companies 147–200		Film production companies that won international film festival awards 5–7		Salary 26	
Startups and venture capital 112		Animation film production companies that won international festival awards 15–25		Cost of living 32	
Startups 90		Electronic games 87–89		Food prices 40	
Unicorns 107–200		The Game Awards winners 35–200		Apartment rental cost 28	
Innovation support funds 101–102		Largest e-sports tournaments 21–27		Cost of living for an expat 32	
Business angels 96–97		Developers of most popular computer games 34–200		Cost of living for a local resident 23	
Venture capital investment 141		Companies participating in electronic games trade shows 64–200		Mobility 145	
Universities and R&D organizations 187		Music 75–200		Air traffic 95–97	
Leading universities 86–106		Artists with highest-grossing albums 29–200		Commute time 139	
Leading R&D organizations 163–200		Most-streamed artists 38–200		Bandwidth 73	
Highly cited researchers 183–192		Best opera performers 42–200		Mobile Internet speed 146	
Nobel Prize laureates and Fields Medal winners 78–200		Fashion 54		Fixed broadband Internet speed 32	
Students 112		Largest fashion companies 43–200		Safety 47	
International students 189		Fashion brands 23–24		Homicide rate 28–41	
Leading business schools 81–200		Advertising and PR 31–32		Natural disaster risk 56	
Productivity of innovative class 150		Most effective advertising agencies 14–18		Tourist appeal 91	
Patent activity 195		Largest PR agencies 61–200		International hotels 133–139	
Publication activity 138		Creative production agencies 19–38		Culture, entertainment, and sports 42	
Innovation infrastructure 80–81		Top advertising agencies 39–200		Ecology 171	
Clusters 29–200		Architecture 72–200		Environmental pollution level 171	
Technology and science parks 26–72		Pritzker Architecture Prize laureates 25–200		Internationalization 119	
Co-working spaces 56–64		Internationally recognized architects and architecture firms 62–200		International schools 66–76	
Supercomputers 64–200		Industrial design 78–200		English proficiency 95–98	
		Internationally recognized designers and design firms 78–200		International business events 57	
		Arts 130–185		Visitors to international business events 61	
		Internationally recognized artists 41–200			
		Top artists by auction revenue 38–200			
		Most influential people in contemporary art 32–200			
		Leading higher education institutions in the arts 114–185			
		Literature 59–200			
		Best-selling authors 59–200			

Benchmarking against the leading city



References

- Anderson S. (2022) Immigrant Entrepreneurs and U.S. Billion Dollar Companies. National Foundation for American Policy. NFAP Policy Brief. Available at: <https://nfap.com/wp-content/uploads/2022/07/2022-BILLION-DOLLAR-STARTUPS.NFAP-Policy-Brief.2022.pdf> (Accessed: 09.11.2022).
- Department for Business, Energy and Industrial Strategy (2021) UK Innovation Strategy. Leading the future by creating it. Available at: <https://www.gov.uk/government/publications/uk-innovation-strategy-leading-the-future-by-creating-it> (Accessed: 11.01.2023).
- Dushenko K., Katasonova E. (2014) Anime, or Japanese animation // Vestnik kulturologii. Vol. 2 (69). P. 182–186. [In Russian].
- Eriksson M., Niitamo V. P., Kulkki S. (2005) State-of-the-art in utilizing Living Labs approach to user-centric ICT innovation-a European approach. Centre for Knowledge and Innovation Research. Available at: https://www.academia.edu/download/50573062/stateofheart_livinglabs_eriksson2005.pdf (Accessed: 18.11.2022).
- Etzkowitz H., Leydesdorff L. (1995) The Triple Helix--University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development // EASST Review. Vol. 14(1). P. 14–19.
- Government of India (2021) Evolution of Startup India. Capturing the 5-Year Story. Available at: https://www.startupindia.gov.in/content/dam/invest-india/Templates/public/5_years_Achievement_report%20_%20PRINT.pdf (Accessed: 22.12.2022).
- HSE University (2022) Global “pool” of unicorns went up by 30% within a year. Science, Technology, Innovation Issue Briefs. Available at: <https://issek.hse.ru/news/647490282.html> (Accessed: 10.01.2023). [In Russian].
- Kutsenko E., Tyurchev K., Ostashchenko T. (2022) Relocation as a Driver of Innovative Activity: A Global Study of Unicorn Founders’ Migration // Foresight and STI Governance. Vol. 16(4). P. 6–23.
- Minasyan N. (2020) Talent attraction and retention. Desk study supported by UNDP Kolba Lab. Available at: <https://kolba.am/wp-content/uploads/2021/12/Talent-attraction-and-retention.pdf> (Accessed: 18.12.2022).
- OECD (2018) PTPR-PLG of Shenzhen, People’s Republic of China. Production transformation policy review. Peer learning group meeting. Key outcomes. Available at: <https://www.oecd.org/dev/PTPR-PLG-of-Shenzhen-DEV-GB-2018-7.pdf> (Accessed: 10.01.2023).
- Paavola J-M., Rasmussen R., Kinnunen A. (2020) Talent Attraction and Work-related Residence Permit Process Models in Comparison Countries. Available at: https://julkaisut.valtioneuvosto.fi/bitstream/10024/162601/1/TEAS_2020_54.pdf (Accessed: 18.12.2022).
- Patil S., Wadajkar V. (2021) Indian Startups: Shining Unicorns // Vidyabharati International Interdisciplinary Research Journal. Vol. 12(2). P. 357–360.

REFERENCES

Sherlock Communications (2021) Latam Media Consumption Report 2021. Available at: https://www.sherlockcomms.com/es/informe-medios-latam/?utm_source=ebook&utm_medium=pr&utm_campaign=mediareport (Accessed: 13.01.2023).

Startup Genome (2022) The Global Startup Ecosystem Report GSER 2022. Available at: <https://startupgenome.com/reports/gser2022> (Accessed: 18.12.2022).

UNCTAD (2022) Handbook of Statistics 2022. Available at: <https://hbs.unctad.org/total-and-urban-population/> (Accessed: 26.01.2023).

Wang G. Y. (2022) Talent Migration in Knowledge Economy: The Case of China's Silicon Valley, Shenzhen // Journal of International Migration and Integration. Vol. 23(3). P. 1175–1196.

World Economic Forum (2022) Cities and Urbanization. This chart shows the impact rising urbanization will have on the world. Available at: <https://www.weforum.org/agenda/2022/04/global-urbanization-material-consumption/> (Accessed: 13.01.2023).

HSE Global Cities Innovation Index: 2023

Translated by M. Rukhalenko

Editors M. Sokolova and M. Rukhalenko

Proofreading C. Montgomery

Art director O. Vasiliev

Design G. Podzolkova, A. Sevodneva and I. Tsygankov

Illustrations T. Kasimova

Desk-top editing T. Koltsova and V. Puchkov

Format 60×90 1/8. Print sheet 39.0. Pressrun 70 copies

National Research University Higher School of Economics
20 Myasnitskaya st., Moscow, 101000, Russia