





2016 | CBRE Research

# **EXECUTIVE SUMMARY**

The technology sector has been one of the strongest drivers of European office markets over recent years. In this report, we invite commercial real estate investors and technology companies to explore our insights into the location and character of tech hubs across Europe; to enhance understanding of the fundamental characteristics of tech clusters; and to identify future opportunities among highperforming, and emerging, tech cities.

- Employment in the technology sector across Europe grew by nearly 9% in the period 2010-15, compared with around 5.5% for a broader mix of office-based employment. While the growth rates of both measures are expected to slow over the next five years, the technology sector will continue to outperform. This will remain a major driver of office markets: the sector's contribution to office take-up has exceeded that of banking and finance for the past four years.
- There are 35 cities across Europe where technology employment totals at least 40,000 people. Across this group of markets as a whole the technology sector also represents a higher proportion of total office - based employment than is the case in other markets; and a higher sector concentration than their respective countries.
- The technology sector covers a range of diverse activities, often with different locational requirements, and some cities also have clear subsector specialisms. The three areas of software, technology hardware and web services account for nearly two-thirds of current demand in the sector, with software being the largest single component. Demand from all three sub-sectors is evident in most office markets.

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- Despite this some markets display disproportionate focus on certain activities: software and web services in London; digital advertising in Berlin; IT Services in Budapest; and software in Dublin.
- We develop a ranking of European Tech Cities based on their employment, growth and demand credentials, their propensity to generate startups and new patents, and their attractiveness for technology students and graduates.



Ran	k i	City

London
Paris
Berlin
Munich
Madrid
Dublin
Budapest
Bucharest
Istanbul
Tel Aviv
Copenhagen
Stockholm
Amsterdam
Moscow
Barcelona
Vienna
Rome
Milan
UK Thames Valley
Halainki

• Market scale clearly favours conurbations such as London, Paris, Madrid and Moscow, while measures of sector concentration are high in Dublin and Thames Valley, UK. Recent tech employment growth has been particularly rapid in London, Berlin, Vienna, Dublin and Munich and notably in a group of fast-growing emerging markets: Budapest, Bucharest, Istanbul and Tel Aviv. Several of this last group are also evolving from process-outsourcing markets into viable destinations for more higher-value functions. Forecast employment growth is also high in Dublin, Madrid, Barcelona, Copenhagen and Rome. Current demand and indicators of innovation are high in a number of cities including London, Paris, Berlin, Amsterdam and Stockholm.

• Outside the list of the top twenty markets, there is a further group of cities with strong potential. Warsaw, Hamburg and Sofia are increasingly important technology hubs; Turin, Utrecht and Cologne have high concentrations of employment in the sector while Lyon and Zurich are expected to see stronger growth in tech employment than some larger markets. Individual location and investment decisions should take account of this changing landscape.

Ranking based on: ICT Employment '000s, 2015), Location Quotients, historic and forecast ICT employment growth, CBRE Active Requirements (2015), ICT Patents (2012), Global Start-Up Ecosystem Ranking (2015), QS Best Student Cities (2016) and the European Digital City Index (2015). See Appendix for details.

# 0.2 INTRODUCTION

The technology sector is a diverse and fastgrowing, often highly-innovative, set of activities that is having a marked impact on European office markets. Moreover, the widespread adoption of new technologies in a whole range of other sectors (among them banking, insurance, travel and retail) means that the boundaries and influence of the sector are becoming wider.

#### Sector Employment Growth

Workplace-based employment change, EU-28



Based on employment in SIC J "Information & Communication". Source: Oxford Economics, September 2016

Over the 2010-15 period employment growth in the technology sector exceeded that for officebased employment as a whole, growing by nearly 9%, compared with around 5.5% for office-based employment as a whole. The same relativity is likely to hold over the next five years as well, reflecting more rapid growth in technology output than is expected in other office-based activities.

This is consistent with expected output (GVA) growth of around 3.2% per annum over the next five years compared with 1.5%-2.5% for most other office-based sectors.

2016 - 20% change



**Sector Growth Profiles** 

EU-28 GVA Growth 2016 - 20 % pa



Even at aggregate level, the impact of this growth on office markets is noticeable. Across a group of major European office markets, the proportion of leasing accounted for by technology companies has grown steadily through the post-recession recovery period, rising from under 10% in 2008-09 to over 16% in 2015, and surpassing the contribution of the banking & finance industry during this period.

#### Banking and Finance and Technology Take-up



Source: CBRE Research, 2016

This hints at a wider tendency. While technology companies' location decisions respond to many of the same factors as other industries – accessibility, cost, access to skilled labour, quality of urban environment - and are therefore mostly located in the major cities, there are sometimes distinct local factors that have a disproportionate impact on the technology sector. These include, for instance, the presence of major technological universities and research establishments, supportive regional policy environments and access to international transport infrastructure. As a result there are some distinctive features in the spatial distribution of the technology sector – reflected in the widespread attempts to market some of the main clusters as "Silicon" Valley/Glen/Roundabout/Fen/Boulevard.

Source: Oxford Economics, September 2016

\*Data for London, Vienna, Paris, Brussels, Prague, Zagreb, Frankfurt, Hamburg, Munich, Berlin, Budapest, Warsaw, Moscow, Bratislava, Barcelona and Dublin

There are some major internationally-important office markets, such as Frankfurt and Brussels, which have relatively small technology sectors; and other smaller markets where total office-based employment is low, but the technology sector accounts for a very high proportion. Examples including Heidelberg, Germany; Tallinn, Estonia, and Brno, Czech Republic. Because of the high concentration of tech activity in these economies, this group includes a number of cities or large towns that are potentially attractive to other occupiers, and to investors – the main challenge is their relatively small size, and hence lack of critical mass, and in some cases high degree of specialism in one narrow activity (e.g. Toulouse in aerospace) that restricts their broader appeal.



## 0.3 SECTOR DISTRIBUTION AT CITY LEVEL

Detailed analysis of the employment structure of the main European office markets shows that there are 35 European cities with at least 40,000 technology jobs. On average across this group of cities the technology sector accounts for around 16% of office-based employment (or roughly one in every six office-based jobs), compared with just over 10% for a longer list of almost 100 cities with smaller office markets. So it is not just the absolute size of the technology sector that marks these cities out, but the fact that the sector also represents a relatively high proportion of the city's office employment base compared with other cities.

Despite this there isn't a straightforward relationship between sector size in a city and its contribution to office-based employment. The technology sector in Moscow for instance, while clearly large, accounts for less than 6% of overall office-based employment while in some of the smaller markets such as Stockholm, Sofia, Helsinki and - notably - the UK Thames Valley, the corresponding figure is over 20%.

#### Technology as a Proportion of Total Office-based Employment, 2015



<sup>1</sup>Based on employment in SIC J "Information & Communication". Cities based on NUTS3 or combinations of NUTS3 areas

### ().4LOCATION QUOTIENTS

There are also differences at national level in the importance of the sector but, even here, the 35 top cities display higher levels of sector concentration. This is assessed using location quotients (LQ) that measure the sector's contribution to office-based employment at city level compared with the same contribution at national level. An LQ of greater than 1 indicates a higher concentration of tech sector employment in the city than in the country as a whole, and vice versa.

The 35 largest markets have an average sector LQ of over 1.4 and all except Moscow and Manchester have an LQ of more than 1. When examining the remaining 97 cities, the average LQ is 1 and the majority (54) have an LQ of less than 1, indicating a

#### **Technology Sector Location Quotients, 2015**



Source: Oxford Economics, September 2016

lower technology concentration at city level than at respective national levels.

What results is a core group of "tech" cities in Europe that display:

- high absolute numbers of jobs in the technology sector
- a higher technolovgy sector share of office-based employment than is typical of other markets, and;
- a higher concentration of tech sector employment than displayed by the country as a whole

This is reflected in the European Tech City ranking in the following section which has been created by combining these employment factors with data on active requirements and a range of other indicators.

# 0.5 EUROPEAN TECH RANKING

The ranking of technology hubs derived below takes account of current market scale; the technology status of each city in a national context as measured by location quotients; recent and forecast employment growth in the technology sector; active requirements in the sector; indicators of a city's propensity to generate start-ups and new patents; and finally its attractiveness for technology students and graduates.

Market scale, measured by existing technology sector employment, captures the fact that tech firms tend to be drawn towards existing tech clusters since they have abundant skilled labour, supporting infrastructure and financial and advisory functions. London and Paris, with 430,000 and 383,000 technology sector employees respectively, dominate and rank first and second on this factor as they do in overall terms. Other large markets, notably Moscow and to a lesser extent Rome and Milan, rank lower than their existing scale alone would suggest. Conversely, Dublin and Copenhagen, and to a lesser extent Amsterdam and Vienna, all rank relatively high in overall terms despite being ranked outside the top twenty on size alone.

As noted above there is a tendency for the large markets as a group to have higher **concentrations of technology employment** than their corresponding national figures. In some cases, these are the main or only technology hubs in the country, Dublin being a notable example. Equally, very large conurbations with a diversified occupier base will often have lower concentrations in any specific sector – London, Berlin and Moscow come into this category. At the other extreme the list includes some markets that are far smaller in absolute terms but which contain very high concentrations of technology employment, such as the Thames Valley in the UK.

**Employment growth** in the technology sector has far exceeded that of office-based employment as a whole over the past five years, and is also expected to do so over the next five years, albeit by a smaller margin. At city level, markets that have seen particularly rapid growth in the recent past include London and the adjacent Thames Valley market, Berlin, Vienna, Dublin and Munich as well as a group of fast-growing emerging markets: Budapest, Bucharest, Istanbul and Tel Aviv. For a number of reasons including labour force upskilling, several of these are evolving from process-outsourcing markets into viable destinations for more higher-value functions. Forecast growth also favours this latter group of evolving markets, along with Dublin, Madrid, Barcelona, Copenhagen and Rome.

Active **requirements** - a manifestation of short term demand pressures – are dominated by London, Paris and Berlin reflecting the status of these markets as mature centres with well-established and diverse existing technology platforms. Among the smaller but similarly mature tech markets Dublin, Amsterdam and Barcelona feature strongly. Budapest and Bucharest are also attracting growing interest, consistent with their employment outlook. We also examined a range of **innovation measures**, capturing the outcomes of technology R&D at city level. These measures are considered in conjunction with locations' attractiveness to start-up and student activity, which are also indicators for the degree of innovation in a city. Hi-tech patent applications to the European Patent Office (EPO) are dominated by Paris, London and Munich, though other German cities also feature strongly. Innovation rankings consistently regard London, Paris and Berlin as premier start-up hubs, as well as Tel Aviv, Moscow and Stockholm. Perhaps unsurprisingly, the best student hubs tend to be located in capital or major European cities, particularly in the west, amplifying these cities' overall standing as innovative technology clusters.

капк	Cify
1	London
2	Paris
3	Berlin
4	Munich
5	Madrid
6	Dublin
7	Budapest
8	Bucharest
9	Istanbul
10	Tel Aviv
=11	Copenhagen
=11	Stockholm
13	Amsterdam
14	Moscow
15	Barcelona
16	Vienna
17	Rome
18	Milan
19	UK Thames Valley
20	Helsinki

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Ranking based on: ICT Employment '000s, 2015), Location Quotients, historic and forecast ICT employment growth, CBRE Active Requirements (2015), ICT Patents (2012), Global Start-Up Ecosystem Ranking (2015), QS Best Student Cities (2016) and the European Digital City Index (2015). See Appendix for details.



# 0.6 TECHNOLOGY SECTOR ACTIVE REQUIREMENTS

While it is tempting to view the technology sector as a single industry grouping, in reality it comprises a mixture of different activities, often with differing city and building-type preferences.

A closer look at CBRE active requirement data (2015-16) enables a division of the technology sector into sub-sectors, which allows deeper investigation into city specialisms.

Technology Sector Active Requirements, 2015 - 2016

3%

6%

Technology companies in the software, technology hardware and web services sub-sectors made up 61% of total technology sector active requirements between 2015 and 2016. Of this, the software sub-sector makes up over a quarter of total sectoral requirements. This type of analysis serves as an indicator of the<br/>sector's appeal in various cities. Of the 68 cities across<br/>the region with active requirements over this period,<br/>Paris attracts by far the most interest and, along with<br/>London, stands apart from the rest of the region.Despite this, there is no single sub-sector activity that<br/>can be found in more than about half of all cities.<br/>However, perhaps a reason for the high representation<br/>of software and technology hardware requirements

Software and technology hardware requirements are distributed across around 50% of the 68 cities in the region, while e-commerce, web services and IT services also have widespread prevalence (found in 30-40% of cities). There seems to be a link between the total number of active requirements and the proportion of cities that each sub-sector is found in.

# 8% 27%

19%



#### **Distribution of Active Requirements**



Source: CBRE Research, 2016

Source: CBRE Research, 2016

15%

11%

11%

However, perhaps a reason for the high representation of software and technology hardware requirements is that they encompass a broader range of business activities, and also include a higher proportion of larger incumbent tech firms than other sub-sectors. One would expect these larger MNC's to have a multi-market scope which would explain their wider prevalence across the region.

# 0.7 CITY SUB-SECTOR SPECIALISMS

The evidence highlighted above indicates a degree of locational specialism among the subsectors of technology. This is clearly important at local level for leasing and investment strategy. In assessing the geographical distribution of technology activity, we explore the mix of active requirements by sub-sector in each city. Looking at the top ten cities, a few key insights can be gleaned:

- The balance of active requirements across subsectors in Paris is much more even than in London, where software and web services take up most of the sub-sector mix.
- In Paris, the top three sub-sectors account for 16-17% each of the total structure, whereas in London a higher proportion of web services requirements

#### **City Sub-Sector Specialisms**

Software Technology Hardware Web Services E-commerce IT Services Digital / Advertising / Marketing / Media Other 100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0% London Berlin Bucharest Tel Aviv Dublin Amsterdam Budapest Barcelona Copenhagen Paris

12

detract from the technology hardware and e-commerce sectors.

- Digital advertising takes its greatest share in Berlin; while IT services requirements have a greater proportion in Budapest.
- Apart from Paris, Barcelona is the next most diverse city with companies from nine out of the ten subsectors having active requirements. Dublin has the least diverse mix, yet still ranks as the sixth most attractive city due to requirements from the software sub-sector.
- The diversity of business activities and types within the software and technology hardware sub-sectors could be a reason why, in comparison to other subsectors, they take up a considerable share of the total industry mix.

# 0.8 TECH CLUSTER RENTAL PERFORMANCE

The underlying sustained increase in short and This indicates a gap in performance between core long term demand for these tech clusters is submarkets and tech submarkets, led by leasing reflected in solid rental performance in areas demand from the creative/tech industry which, so far in of tech concentration. In London, for example, 2016, has been the most active sector in London. while core city locations have seen positive rental growth, fringe locations with higher The same is true of Berlin, where the last ten years concentrations of tech clustering often see higher has seen non-CBD locations outperform the CBD in rates of rental growth. From 2006-15, the City terms of rental growth. Analysis of the City-East and core (City of London and EC4) experienced rental City-West areas of the city show rental growth rates of growth of 6.3% and 5.9% respectively, while City 43.2% between 2005 and 2015, in comparison to just fringe locations such as Spitalfields/Whitechapel 8.7% for the CBD itself<sup>4</sup>. More recently, average rents in City-East have increased 51% since the end of 2015, and Clerkenwell, recorded rental growth of 17.5% and 12.9% respectively. Similar differences in compared to 31% for the market as a whole. core-fringe rental growth rates can be seen in the West End office market, although not to the same Amsterdam demonstrates a similar trend. The centre extent. of the city (including the IJ River Banks where a higher

### London Core and Fringe Rental Growth, 2006-2015

Area	% Growth 2006-15
City Core	
City of London	6.3
EC4	5.9
City Fringe	
Spitalfields/Whitechapel	17.5
Clerkenwell	12.9

Source: MSCI, CBRE, 2016

Amsterdam demonstrates a similar trend. The centre of the city (including the IJ River Banks where a higher concentration of tech activity can be found) have seen rents almost completely converge with the premium prime city rent series. Furthermore, for a brief period in 2010-11 this sub-market outperformed prime rents, recording year-on-year rental growth of over 25% in a year when prime rental growth remained subdued.

Other examples exist where the trajectory of rental growth in those areas dominated by tech occupiers differs from that of the city's "prime" district. Typically the absolute level of rental cost will remain lower in the former – which is itself a driver for cost-sensitive start-ups – but periods of more rapid growth can both narrow the gap and support strong income growth for early investors in such areas.

<sup>4</sup>CBRE, 2015, 'Berlin – Germany's start-up capital'.



Other' Includes: Telecom Services, Gaming and Coworking" Source: CBRE Research, 2016

#### Amsterdam Prime Rent and Tech Hub Sub-market Rent



Source: CBRE Research, 2016

#### Amsterdam Rental Growth (y-on-y change)



Source: CBRE Research, 2016

14

# 0.9 **TECH CITY PROFILES**

This warrants further exploration into the characteristics of tech cities across Europe. Through leveraging local property market and technology industry knowledge, the following section takes an in-depth look at a selection of markets from the top-twenty ranking.



#### LONDON

London has established itself as a world leader for creative and technology-based industries, by virtue of its location, language, political and legal structure, financial infrastructure and existing business clusters. London also offers a wide range of social and cultural attractions, in addition to a large number of world-renowned universities that generate large numbers of technically-skilled and highly-educated workers.

It is these fundamental characteristics that contribute to London's resilience, not only as the home to tech and creative companies, but also to its other constituent business sectors. For this reason, with the economic and political uncertainty brought about by Brexit, we look to these inherent fundamentals to serve as more robust indicators of London's continued strength as a major European, and global, tech hub.



The West End has long been viewed as the Central London market of choice by creative occupiers, due to its diverse occupier base, excellent transport links, supply of suitable office accommodation and range of social attractions. However, rising occupational costs and the growing shortage of suitable office stock has forced some occupiers to seek accommodation elsewhere.

This has resulted in a shift in demand towards the City, Midtown and Southbank, where some creative occupiers have acquired significant amounts of space in corporate buildings. This has fuelled the growth of new creative locations such as King's Cross and Farringdon, while Silicon Roundabout on the northern fringes of the city is now firmly established as a leading European market for tech start-ups and Small and Medium Enterprises (SMEs). Take-up by creative industries for the year to Q3 2016 has totalled 2m sq ft, making it the most active business group in Central London so far this year. Creative industries take-up has been strong across London for a number of years, with a combined 10.4m sq ft acquired between 2013 and 2015, 26% of all Central London take-up. By contrast, banking and finance take-up over the same period was 8.9m sq ft.

Creative occupiers are increasingly moving eastwards. City fringe markets such as Shoreditch and Clerkenwell as well as King's Cross have become attractive destinations for creative occupiers in recent years. In addition, there has been an increased propensity from certain occupiers to acquire space in more established core office locations such as Principal Place and Broadgate in the City. This demonstrates that certain tech occupiers, generally the larger more established companies, are less cost-sensitive and are willing to sacrifice value for location.



**Technology Company Distribution, 2015** 



The requirement structure in London is dominated by software and web services companies, which accounts for 64% of total active requirements from 2015-Q1 2016. Requirements from the web services sub-sector in London account for 19% of the regional total, with the next biggest share appearing in Dublin (9%).

Source: CBRE Research, 2016

16



### PARIS

Paris is a prominent technology hub in a European context and is seeing significant activity in the new technology sector. This is highlighted by the opening at the end of 2016 of the world's largest start-up incubator (1,000 start-ups over 30,000 sq m) in La Halle Freyssinet (Paris 13).

The technology sector has accounted for an average of almost 12% of office take-up in the Paris region over the past ten years although, at around 144,000 sq m, this dipped to around 7% in 2015. This decline was driven by a relative lack of large space transactions, and hides a much stronger dynamic for small and medium-sized units: take-up in units of less than 5,000 sq m ran at its highest level last year since at least 2000. One reason for this is that support from the municipality is supporting the growth of a strong startup ecosystem in central Paris.

Start-ups are particularly attracted to buildings in highamenity districts with an existing residential population, and close to public transport. Proximity to competitors is also considered an advantage by many, in order to attract and retain skills. Reflecting this combination

#### **Technology Company Density, 2015**

18

of factors and particularly the quality of its transport network, the semi-suburban Western Crescent area is one of the main technology destinations and has accounted for 36% of technology sector take-up over the past ten years. Within this area, the South Loop (Boulogne/Issy), Peri - Défense and Neuilly - Levallois areas are the main concentrations.

The Centre-West market (an area slightly larger than the CBD) has accounted for a further 21% of technology take-up over the past ten years, although the proportion rose above 30% last year, indicating that the advantages of city centre locations may be coming to play a greater role in tech companies' location decisions.

The active requirement structure for Paris is relatively balanced, with IT Services, Software, Technology Hardware and Web Services, taking an equal share of the total mix. This may go some way to explaining why Paris has by far the most active requirements in the region, to the extent that a variety of companies from varying sub-sectors each have considerable interest in city's growing tech ecosystem.



Paris Technology Sector Active Requirements, 2015 - 2016





Source: CBRE Research, 2016







#### BERLIN

Berlin illustrates the growth processes that are typical of the evolution of the tech sector within a city. In the early phases of the sector's evolution in 2010-11, most of the lettings were relatively small and occurred close to the city centre, whereas some of the more recent transactions have been both larger – as start-ups and existing majors alike have grown – and contributed to the emergence of separate ecosystems and distinctive campus-style concepts. The average tech lease through 2015 was around 3,100 sq m, and in Q1 2016 was slightly above 1,000 sq m. The two largest acquisitions were by Zalando with 7,000 sq m and 8,000 sq m. The latter was acquired in a prime location in the AAA Potsdamer Platz/ Leipziger Platz submarket.

Berlin has accounted for a growing proportion of Germany's technology sector in recent years, with a particular focus on new media/internet companies and e-commerce. In the past five years, and within the ten main tech zip codes in the city, the sector has accounted for around 22% of total office take-up and an estimated 49,000 sq m in Q1 2016. Current active requirement activity from tech companies is overwhelmingly biased in favour of Berlin, with Hamburg, Munich and Dusseldorf generating less than half as much interest. The software, media and web services sub-sectors make up most of these requirements, though interestingly technology hardware makes up for shortfalls in the media subsector in Munich and Dusseldorf.





Source: CBRE Research, 2016





It is notable that some of the ten zip codes are also among the most sought-after residential neighbourhoods in the city, such as Mitte, and Friedrichshain/Kreuzberg, including Mediaspree. Tech start-up companies tend not to commit to prelets because of their immediate need for space and their uncertain success in the early stages of their businesses. Providers of office space specially tailored for the needs of emerging start-ups fill this gap. Serviced office concepts – like Factory, WeWork and Mindspace – provide office space on the one hand and equally important a thriving scientific community for sharing ideas and solutions. Technology companies have a disproportionately high demand for highlyskilled employees, so start-ups have to create an attractive work environment in order to secure labour.

Berlin has been successful in attracting an international tech community and is thus Germany's start-up capital, also making it one of the top ranking destinations for private equity/venture capital investors.



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At the other end of the size spectrum, global players continue to set up or expand their European operations in Berlin. Additionally a growing number of German blue-chip companies are setting up labs in Berlin to drive innovation in their respective fields (finance, mobility, energy, media). The larger campus concepts that have emerged in the city may help facilitate procurement for a range of company types, and also appeal to landlords by bundling together the rental incomes of creative companies and growing entrepreneurs.

With the growing importance of the digital economy as a component of the German economy and robust macroeconomic fundamentals, Berlin will continue to grow as a global tech hub.

Cluster	Overview	Major Tenants
MITTE	Start-ups, mature companies, sought after residential market among young urban professionals	Microsoft, Mozilla, Rocket Internet, Twitter
MEDIASPREE / KREUZBERG	Start-ups, mature companies, sought after residential market among young urban professionals	Zalando, Rocket Internet, Universal, Vice Magazine, Wayfair
CITY-WEST	Start-ups and creative labs and mature players around the universities Technische Universität Berlin (TU) and Universität der Künste (UDK) with focus on IT and telecommunications	AVM, Strato
EUREF CAMPUS	Start-ups and mature companies with focus on Internet of Everything, Mobility/Industry 4.0, Sustainability, TU Campus	Cisco, Deutsche Bahn, Schneider Electric
ADLERSHOF	Start-ups and mature companies focusing on Industry 4.0 and Smart Cities	Atos IT Solutions, Corning Cable Systems

#### Technology Company Distribution, 2015







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### **BUCHAREST**

There has been a substantial increase over the last few years in the representation and size of outsourcing and tech companies. Indeed, in the last four years, the number of tech companies has almost tripled, while a majority of other outsourcing companies expanded their presence. In reality though these types of company have had a prominent market presence since as early as 1991, reflecting Bucharest's status as a favoured destination for outsourcing.

Outsourcing and tech companies represent a major driver of the office market, responsible for half of all pan-Romania office transactions. These companies account for some of the largest deals recorded in the market, some in excess of 20,000 sq m. Outsourcing companies alongside telecom and software companies, are a priority target for any developer considering office tenant mix, as demonstrated through the mix of active requirements for the city.

In 2015 more than 73,000 sq m of office space was acquired by technology companies, with IT services and technology software the main occupier groups. Two locations are of particular interest for such occupiers – Barbu Vacarescu / Pipera area and West, close to Polytechnic University. Tech companies generally occupy class A premises - a majority of the companies analysed have taken space in such buildings.

# **"OUTSOURCING COMPANIES ALONGSIDE TELECOM AND SOFTWARE COMPANIES, ARE A PRIORITY TARGET FOR ANY**



Bucharest Technology Sector Active Requirements, 2015 - 2016





#### Sub-Markets

North: Calea Floreasca/ Barbu Vacarescu Blvd., Piata Presei Libere and Baneasa – Otopeni
Pipera: Dimitire Pompei, Pipera – Tunari St.;
CBD: Victoriei Square and CDG Square;
Centre: Romana, Universitatii and Unirii Squares
West, East and South Areas.

Source: CBRE Research, 2016

28

The prominence of so many IT companies reflects two main factors.

- High number of graduates with programming / IT skills, in all major regional cities – over 20,000 people graduate with technical skills each year.
- The number and value of state incentives given by the Romanian Government to the IT industry. This includes 100% exemption on income tax for IT employees and public financing for development of IT innovation parks, plus various other incentives for the creation of new jobs.

The USA is the main origin of outsourcing companies in Romania. Around a guarter of companies come from the USA, linked to the fact that over 90% of the urban population speaks English. In addition, the economic and geo-political partnership between USA and Romania has contributed to the sizeable presence of American companies in the outsourcing sector. In terms of real estate, more than 50% of registered office sector transactions are done by companies in outsourcing, whether this is IT, business processes or human resources companies. Looking ahead it is clear that the sector will continue to play a prominent role in the office market. It is expected in the short-term that there will be demand in the range of 60,000 sq m with hardware technology to the forefront. Growth in the market's skills base is also making it more attractive to higher value-add functions as well as to cost-sensitive BPO activities.





### **TEL AVIV**

30

Israel is home to 250 multinational R&D centres, 87 NASDAQ companies, and an unusually high number of start-ups per capita. It was ranked 1st in the world for innovative capacity in 2014 according to the IMD Global Competitiveness Yearbook, and is attracting growing interest as a global high-tech start-up destination. There are over 1,500 start-ups in the Greater Tel Aviv area alone.

The general expansionary trend for the technology sector in Israel, and Tel Aviv in particular, has over 65,000 sq m being completed through 2015. The start-ups are scattered across incubators, independent co-working spaces secured off-market, and conventional commercial premises. While some spaces mimic traditional corporate working styles, many spaces give precedence to collaboration and informality which is often more desirable than traditional working environments.



Source: CBRE Research, 2016

Software
Technology Hardware
Web Services
Gaming
Digital Advertising / Marketing / Media
E-Commerce
IT Services
Telecom Services



The main concentration of early-stage tech companies is found along Rothschild Boulevard. The boulevard and its surrounds support hundreds of start-ups, accelerators and co-working spaces. It is attractive to young skilled workers, and therefore to mobile multinationals. Due to the small size of the area and limited availability of real estate around the boulevard, tech firms and local companies are moving concentrically outwards. Through 2015 hardware and software companies and cyber-security companies were the largest occupiers in Tel Aviv and Herzliya, a neighbouring area north of Tel Aviv.

Looking forward, typical take-up levels are expected to be around 50,000 sq m of mainly software and hardware technology companies. Active requirement trends over the last year seem to reflect this notion, suggesting that companies in the software and technology hardware sub-sectors make up 72% of demand in the city. The trend of company expansion in the sector is expected to continue, along with the ecosystem of support from venture capital firms to a service industry geared towards start-up generation. As start-ups succeed and attract capital many have expanded to New York, seeking top-tier services and investors. To date 264 Israeli start-ups have offices in Manhattan, an initial step towards the goal of NASDAQ listing.

### Israeli Startup Ecosystem



Source: mappedinisrael.com



### DUBLIN

Dublin is the preferred European HQ location place for a number of global tech companies reflecting, among other things, the low rate of corporate taxation which remains steady at 12.5%. The biggest internet technology companies first came to Dublin in 2002, and are now among some of the biggest employers in the city. Most of the tech companies are located in the city centre and Docklands areas.

Leading social media firms including LinkedIn and Twitter, e-commerce and software firms like AirBnB and Microsoft as well as international blue-chip manufacturers, are among the main occupiers in Greater Dublin. Local spin-offs such as the online user-intelligence platform Intercom and chip-maker Movidius, are also driving the market in Dublin.

The presence of international companies, coupled with local start-ups, is fuelling the growth of Dublin's digital hub and its status as a major European tech cluster. These international companies have also been a key driver behind the involvement of Irish startups in programmes like BlackBox Connect, which in turn facilitate the international development of small companies.

**"THE PRESENCE OF INTERNATIONAL** COMPANIES, COUPLED WITH LOCAL START-UPS, IS FUELLING THE **GROWTH OF DUBLIN'S DIGITAL** HUB AND ITS STATUS AS A MAJOR **EUROPEAN TECH CLUSTER."** 





In the first three quarters of 2016, tech take-up in the Dublin office market totalled nearly 50,000 sq m sector, representing nearly 30% of total take-up. The pre-letting of nearly 8,000 sq m to Twitter at Cumberland House, Dublin 2, illustrates the extent to which computing and IT tenants are expanding in the Irish market.

Web services and telecom companies have been the dominant market sectors. Their preferred locations are the South suburbs and Docklands area, near the Financial Centre. The International Financial Services Centre, after a period of turbulence during the crisis, is now evolving into a Fintech centre further underlining the growth of the sector in Dublin. This is evident with the acquisition by Hubspot of 2,500 sq. m of office space in One Dockland Central and the establishment of a technology incubation centre DogPatch Labs in the CHQ Building.

34



Looking forward, we anticipate short-term demand of over 60,000 sq. m per annum from a combination of new entrants and expanding companies. It only takes a glance at current active requirements in Dublin to understand the real attraction of the city's maturing digital cluster to companies from the software, web services and e-commerce sub-sectors, where an increasing proportion of web services interest may also lead to greater office take up.



#### Dublin Technology Sector Active Requirements, 2015 - 2016

3% 19% 26%

Source: CBRE Research, 2016

#### Understanding European Technology Clusters







### **AMSTERDAM**

The tech sector is one of the fastest growing sectors in the Dutch economy, both in terms of gross value added and employment, and Amsterdam is the principal focus for much of this activity, supported by strong underlying drivers such as accessibility, amenities and a large pool of highly-educated workers.

The sector has seen very strong take-up growth, more than doubling over the past five years. As a result, the sector's share of total take-up has increased from less than 9% in 2010 to an ample 20% by the end of 2015. Alongside a strong growth profile, the sector is also highly-susceptible to external shocks, making it unusually volatile. This "boom and bust" characteristic can cause significant fluctuations in space requirements within a short time period, and accentuates the need for flexibility in occupational terms.

Through 2015, activity was dominated by companies active in the field of web e-commerce, being responsible for more than half of the total take-up volume by the Technology & Media sector, against a share of 12% in 2010. Booking.com was responsible for the largest lease of 2015, acquiring 13,500 sq m at the Piet Hein Buildings at the IJ-river banks.

While the TV/Movie/Music and Technology Hardware sectors dominated the market in 2010 with a share of both around 28%, their share declined in 2015 to a share of 14% and 3% respectively. The tech industry as a whole maintains its interest in Amsterdam, with the technology hardware and software sub-sectors accounting for 63% of active requirements over 2015 and the first quarter of 2016.



### **"THE TECH INDUSTRY AS A WHOLE MAINTAINS ITS INTEREST IN** AMSTERDAM, WITH THE TECHNOLOGY HARDWARE AND SOFTWARE SUB-SECTORS ACCOUNTING FOR 63% OF ACTIVE REQUIREMENTS"





#### Amsterdam Technology Sector Active Requirements, 2015 - 2016



#### Amsterdam Technology Sector Lettings Transactions, 2015 - H1 2016



Legend Floorspace in sq m



Source: CBRE Research, 2016

38

Amsterdam has witnessed a strong decline in office vacancy in the city centre, down to 3% in the first half of 2016, and newly-available office space is eagerly targeted by tech firms, including Booking. com and TravelBird. This is most clearly visible in offices of 2,000 sq m and larger. There is currently little available stock in this size bracket, a fact which is expected to translate into demand in adjacent markets.

Regarding the first half 2016, the total take-up volume almost reached a level of 109,000 sq m. Technology Hardware and Web related companies dominated the market accounting for 54% of the share of take-up volume. IT service companies accounted for a 16% share, while 15% of the total take-up was taken up by Software Business companies. Web e-commerce and Digital Entertainment accounted for 10% and 6% respectively. Looking forward we expect IT services and E-commerce companies to be the dominant sources of demand in and around Amsterdam, though active requirement activity also suggest that the software and technology hardware sub-sectors will be areas of sustained interest.

#### Subsector

- Digital Entertainment
- IT Services
- Software
- Technology Hardware
- Telecom Services
- Web Services
- E-commerce



### **BUDAPEST**

40

Budapest has been successful in attracting technology companies in recent years, and the sector has become one of the most important drivers of new office demand. The European Institute of Innovation and Technology is located in Budapest, and is a key factor in the city's appeal to such companies.

Almost 80 companies signed a lease contract in 2014 and 55,500 sq m of new office space was leased and other 74,900 sq m was renegotiated. Of the new lease volume, 22,400 sq m was contributed to companies expanding in space-a ratio unseen across other industries.

In 2015, the average size of new leases signed by tech companies exceeded 1,500 sq m, with a total of 142,000 sq m. Two large pre-leases totalling 80,000 sq m boosted overall demand from IT companies. The sector is comparatively broad-based: the largest occupiers in Budapest are SAP, Systemax, Nav'n'Go, BME Infokom, Prezi and Nokia Networks.

Such companies demand high building quality standards, sometimes above location. Interestingly, some Hungarian companies, however, prefer to owneroccupy their own HQ building.

Geographical concentration is high - 72% of all office space acquired by the technology sector is in the three submarkets of South Buda, the Vaci corridor and, to a lesser extent, Central Pest. Of the three, South Buda is the most preferred accounting for 42% of IT and Telecom companies in the past few years. Ease of accessibility is a key locational factor; although proximity to the metro was not a pre-requisite in recent moves. The current demand profile is dominated by technology hardware and IT services although recent active requirement activity suggests that up to 26% of total tech sector requirements are from software companies.

#### **Budapest Technology Sector Active Requirements, 2015 - 2016**



Source: CBRE Research, 2016

#### **Budapest Technology Take-up Distribution**, 2015





#### **STOCKHOLM**

Stockholm is one of the fastest growing cities in Europe, having seen population growth of over 8% in the past five years, and is undoubtedly the main technology hub of the Nordics region. It has spawned some of the largest tech companies to have emerged in recent years, such as Skype and Spotify. Technology infrastructure in Stockholm is among the best in Europe, with full coverage of broadband for both fixed and mobile solutions. Furthermore, the fibre network is among the world's largest. Through 2015 more than 60,000 sq m of leases to the tech industry had been completed, the main sub-sectors being techhardware and computer gaming companies. Further growth, although perhaps at a lower level, is likely in 2016.

One notable cluster is Kista Science City, north of Stockholm city. Kista is one of the world's leading mobile technology clusters, displaying a very high concentration of expertise, innovation and business opportunity within the technology sector. The technology sector accounts for around a third of the number of businesses in Kista and about 30% of those employed in the area, according to Municipality of Stockholm. Estimates indicate that in 2013, the tech companies in Kista Science City had a combined turnover of 53 billion SEK. Kista Science City is a major driver in the Stockholm labour market: it is estimated that Kista generates two jobs for every one created in Stockholm.

Another hotspot for tech industry is around Medborgarplatsen on Södermalm, which is a part of inner city. Södermalm, Stockholm's equivalent of Shoreditch in London, has produced a large legacy of successful technology businesses that have gone on to expand internationally. Successful game development companies like EA/DICE, IDG, Avalanche Studios and Paradox Interactive originated here. The CBD area also attracts companies within the tech industry. Swedish-founded and world renowned game development company, King, are established in the CBD. Unconfirmed information says that the Spotify has signed a new lease for 20,000 sq m in prime premises in the Urban Escape, relocating from the fringe areas. Spotify is a Swedish music, podcast, and video streaming service that provides digital rights management–protected content from record labels and media companies. As of September 2016, Spotify has 40 million paying subscribers worldwide, up from 30 million paying subscribers in March 2016.

#### Stockholm Technology Companies







Source: CBRE Research, 2016

It is expected that the technology sector will continue to grow in the CBD area. There are several new startup hubs which may possibly work as an incubator function for new companies in the tech industry. Epicentre and SUP46 are just two examples of those kinds of companies. The current active requirement picture suggests that the demand from more conventional technology sub-sectors (Software and Digital Advertising/Marketing/Media) is higher than the requirements from emerging sub-sectors such as gaming and e-commerce.

- 1. Microsoft
- 2. Ericsson
- **3**. Lenovo
- 4. Lexmark
- 5. Fuijitsu
- 6. Keysight
- 7. Philips
- 9. Siemens
- **10.** King
- **11.** Spotify
- 12. lzettle
- 13. MAG Interactive
- 14. Avalance Studios
- 15. Paradox Interactive
- 16. IDG
- 17. EA/Dice



### MOSCOW

Moscow is one of the busiest and technologically developed cities in Russia. The IT industry is growing fast, and by the end of 2015 more than 67,000 technology companies were registered there. The number of IT companies in Moscow has been growing by 7% annually, and from 2011 to 2016 an extra 6,000 companies have established themselves in the area.



There is government support for the research and development of the IT industry in Russia, which among other things encompasses tax benefits and education schemes. For example, the Ministry of Telecom and Mass Communications of the Russian Federation plans to educate 350,000 IT specialists by 2018.

Skolkovo Innovation Center is developing just to the west of Moscow. The center aims to provide preferable economic conditions for start-ups working in new technology fields including IT and telecommunications, space research and biomedicine. The project development is planned to be completed in 2020 where it is hoped that about 50,000 people will live and work, with the key aim of promoting an entrepreneurial environment in order to help advance startup innovation within the technology sector as a whole.

45

IT and Telecom companies leased 57,000 sq m of office space in Moscow in 2015, which accounts for about 7% of the total take-up. Sberbank Tekhnologii leased 9,000 sg m in RTS BC located between the TTR and MKAD; Cisco Systems leased 5,000 sq m in Skolkovo (built-to-suit). In Q1 2016 IT and Telecom companies leased 13,000 sq m of office space or 8% of the total take-up. The predominance of technology hardware companies in Moscow is reflected in recent active requirement activity, accounting for almost 50% of the total. Telecom services are also well represented, but there also seems to be an increasing interest from e-commerce companies which represent 27% of the total from 2015-16.

IT companies in Moscow may be divided into four groups. Most companies from these four groups are Russian, apart from Technology Hardware where they are mostly international:

- Computer services
- Technology Hardware
- Internet Services
- Software

Computer services companies prefer to lease Class B offices in the area between the TTR and MKAD and between CBD and TTR in North-West and North-East directions. However, the two largest companies (CROC and RTI Systems) own their premises and they occupy 19% of the total computer services sub-sector.

All technology hardware firms in this sector lease their offices; Class A is a bit more popular than Class B (51% of the total) as it is chosen by large international corporations such as HP and IBM. The majority of offices are located in the area between the TTR and MKAD in West and North West districts.

Almost all internet companies in Moscow are Russian; they occupy 96% space in the sector. The two largest occupiers are Mail.ru (the country's biggest internet company) and Yandex (the country's biggest search engine) who occupy 53% of total space (Yandex owns their office while Mail.ru is leasing). The most popular locations are the area between the TTR and MKAD and CBD (due to Yandex being located there).

Two-thirds of software space is occupied by Russian companies. Class A offices are slightly more popular than Class B and companies within this sector tend to lease offices in the area between the TTR and MKAD towards the north.

#### **Moscow Technology Companies**



#### Moscow Technology Sector Active Requirements, 2015 - 2016



The three largest telecom companies (Rostelecom, VimpelCom and Transtelecom) lease half of all space occupied by the sector in the city, and most prefer to lease rather than own their property.



- 2. CROC
- **3.** Ericsson Corporation
- **4**. IBS
- **5**. Kaspersky Lab
- 6. Luxoft
- 7. Mail.ru Group
- 8. Microsoft Corporation
- 9. Rostelecom
- **10.** RTI Sistems
- 11. SAP AG
- **12.** Systematica
- 13. Transtelecom
- **14.** VimpelCom
- 15. Yandex



# 10.0 CONCLUSIONS

- What emerges from this analysis is a set of opportunities for landlords and investors to meet the continuing rapid growth of the technology industry; and some challenges for occupiers in both their locational decision-making and their choice of buildings.
- The markets that rank most highly are mostly established technology hubs. London and Paris in particular may be regarded as the premier European tech markets, and benefit from a strong demand structure across a wide range of occupier type and sizes.
- However, the variety of potentially attractive tech locations is wide, and is by no means restricted to gateway or first-tier cities. Warsaw, Hamburg and Sofia are increasingly important technology hubs; Turin, Utrecht and Cologne have high concentrations of employment in the sector; Sofia is displaying similar characteristics as the earlystage growth of the Bucharest hub, while Lyon and Zurich are expected to see stronger growth in tech employment than some larger markets. Individual location and investment decisions should take account of this changing landscape.
- One influence on future change will be how far, and in what ways, such cities provide the conditions that are favourable to technology activity, and in particular to new start-ups or growing companies. There is clearly opportunity for real estate investors and developers to respond to, indeed facilitate, the continued evolution of tech hubs across the region.



 Tech occupiers have a wide range of locations to choose from, each with particular attributes. Indeed the current demand pattern reflects the existence of sub-sector niches in some markets. The occupier mix in emerging cities will depend on their relative attraction for different activities, whether more traditional sectors such as technology hardware and software, or the group of faster-growing innovative sectors such as e-commerce or web services. This will be influenced not only by the agglomeration advantages of established hubs, but also by the adequacy, quality and quantity of office stock.



49

### Appendix: European Tech Ranking Table

All cities with over 40,000 people in ICT employment.

Overall City Rank	NUTS 3 or combinations	ICT Employment City 2015 (000s)	Rank	Location Quotient	Rank	Technology Employment Growth (%) 2010-15	Rank	Technology Employment Growth (%) 2016-20	Rank	Active Requirements Rank (2015)	ICT Patents (EPO, 2012))	Rank	Global Start- Up Ecosystem Ranking 2015 (out of 20)	Rank	QS Best student Cities ] (2016)	Rank	European Digital City Index 2015: Startup	Rank	Average Indicator Ranking
1	London	430.25	1	1.31	23	23.95%	5	7.01%	18	2	476	3	6	2	5	2	1	1	6.33
2	Paris	383.17	2	1.89	3	2.20%	31	8.60%	13	1	1010	1	11	4	1	1	6	8	7.11
3	Berlin	91.58	10	1.31	25	23.51%	6	8.75%	11	3	286	5	9	3	9	3	7	9	8.33
4	Munich	114.06	6	1.88	4	14.81%	15	4.18%	28	13	759	2		7	11	4	10	11	10.00
5	Madrid	216.41	3	1.80	5	2.16%	32	13.75%	4	11	135	13		7	22	7	12	12	10.44
6	Dublin	43.55	33	2.32	2	15.26%	14	19.69%	1	6		14		7	37	13	8	10	11.11
7	Budapest	91.46	11	1.37	18	32.55%	3	14.57%	3	8		14		7		21	22	18	11.44
8	Bucharest	74.24	14	1.52	12	28.21%	4	11.03%	7	4		14		7		21	30	22	11.67
9	Istanbul	113.53	7	1.60	9	45.95%	2	15.60%	2	23		14		7		21		25	12.22
10	Tel Aviv	84.77	13	1.00	33	22.70%	8	7.40%	16	5		14	5	1		21	1	1	12.44
11	Copenhagen	56.80	24	1.41	15	3.03%	29	13.11%	5	9	155	11		7	27	9	5	6	12.78
11	Stockholm	94.89	9	1.36	19	5.21%	24	6.52%	20	12	151	12		7	24	8	3	4	12.78
13	Amsterdam	52.36	28	1.32	22	5.81%	22	8.49%	14	7		14	19	6	27	9	2	3	13.89
14	Moscow	157.70	4	0.70	35	13.77%	16	6.59%	19	16		14	13	5	43	16	5	6	14.56
15	Barcelona	70.69	16	1.05	31	2.87%	30	10.24%	8	9	219	8		7	30	11	14	13	14.78
16	Vienna	56.96	22	1.46	14	15.66%	12	3.49%	31	19	164	10		7	16	6	15	14	15.00
17	Rome	118.92	5	1.49	13	3.41%	27	9.14%	9	22		14		7	61	19	28	21	15.22
18	Milan	106.47	8	1.55	11	-0.87%	34	6.12%	23	20	246	7		7	38	14	21	17	15.67
19	UK Thames Valley	72.99	15	2.51	1	20.36%	10	6.47%	21	28		14		7		21		25	15.78
20	Helsinki	59.55	21	1.33	21	9.42%	20	3.50%	30	18		14		7	34	12	4	5	16.44
21	Zurich	52.62	27	1.26	27	20.36%	9	8.69%	12	23		14		7	12	5		25	16.56
22	Prague	63.60	20	1.39	17	-0.62%	33	7.53%	15	17		14		7	39	15	19	16	17.11
23	Hamburg	66.48	18	1.39	16	12.57%	18	1.01%	34	13	453	4		7		21		25	17.33
24	Sofia	68.31	17	1.56	10	12.80%	17	5.00%	27	23		14		7		21	33	23	17.67
25	Turin	47.73	30	1.79	6	4.67%	26	8.84%	10	28	172	9		7		21		25	18.00
26	Lisbon	53.95	25	1.31	24	15.36%	13	3.04%	32	21		14		7	52	18	17	15	18.78
27	Lyon	41.79	34	1.26	28	16.71%	11	12.48%	6	28		14		7	46	17		25	18.89
28	Utrecht	45.75	31	1.68	7	5.14%	25	7.12%	17	23		14		7		21		25	18.89
29	Warsaw	89.44	12	1.20	29	9.23%	21	2.55%	33	15		14		7	63	20	24	20	19.00
30	Cologne	50.91	29	1.66	8	5.52%	23	0.30%	35	28	257	6		7		21	23	19	19.56
31	UK M25 North	41.12	35	1.17	30	49.75%	1	5.39%	25	28		14		7		21		25	20.67
32	Athens	56.96	23	1.34	20	-10.86%	35	5.60%	24	23		14		7		21	34	24	21.22
33	Manchester	45.18	32	0.80	34	22.92%	7	5.07%	26	28		14		7		21		25	21.56
34	St Petersburg	64.49	19	1.01	32	11.38%	19	3.56%	29	28		14		7		21		25	21.56
35	UK M3/M27 Axes	53.07	26	1.28	26	3.33%	28	6.46%	22	28		14		7		21		25	21.89



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