Metro-regions and their unique assets

An assessment of specialized clusters in Stockholm, Helsinki, and Copenhagen

Metropolitan Inc.

FORA IRISgroup

Foreword

Metropolitan Inc. is a consortium of three Nordic metro regions Stockholm, Helsinki and Copenhagen represented by Stockholm County Council, Uusimaa Regional Council (Helsinki) and The Capital Region of Denmark (Copenhagen Region).

The partners carries out joint analysis on the future challenges of metro regions and exchanges ideas and new knowledge about good practices within regional economic policy.

The idea is to pool analytical resources from each of the three metro regions and jointly build a solid fact base which the participating metro regions can drawn on in their regional strategy work.

The analytical activities are co-funded equally by the three Nordic metropolitan regions and the Danish Enterprise and Construction Authority.

The project has been led by a steering committee with representatives from the three metro regions (Stockholm County Council, Uusimaa Regional Council, Culminatum Innovation Oy, Capital Region of Denmark), while the analytical work has been carried out by FORA (The research unit of the Danish Enterprise and Construction Authority) and IRIS Group.

This paper is authored by Andreas Graversen, with valuable assistance from Jørgen Rosted, Markus Bjerre and Lasse Nielsen from FORA.

Metro regions - strategic sites in the global economy

Metro regions have become central nodes in the global economy. Even the most globalised industries and the largest multinational companies has a production process that is at least partly placed bound because of the combination of resources it requires (...) increasingly, metro regions become strategic sites where much of the work of globalization actually gets done.

Saskia Sassen
Professor, Columbia University

Executive summary

Copenhagen, Helsinki, and Stockholm are among the 10 richest metro-regions in Europe. They all contain world class clusters, and the share of employment in specialized strong clusters matches the richest and biggest metro-regions in Europe. The metro-regions' specialized clusters compete on knowledge and are key drivers of regional wealth.

Companies in metro-regions are important players in the global competition on innovation, and metro-regions are centers for the creation of new solutions to societal challenges and the exploration of new opportunities.

Strong clusters are drivers of wealth and the creation of new solutions to societal challenges. Clusters compete on knowledge and depend critically on access to high competencies, specialized research and strong entrepreneurship. Metro-regions with successful clusters attract talent from all over the world, and companies and universities from metro-regions are strong actors in emerging global innovation alliances.

Clusters are key elements in regional economic development, and world-class cluster-specific framework conditions are a precondition for success.

International comparison and benchmarking provide important input to fact-based regional development strategies. This study compares clusters and cluster-specific framework conditions, but it also points to areas where the three Nordic metro-regions could learn more from each other and from international benchmarking.

Suggestions for future action of the Metropolitan InC to develop the fact-base for cluster policy:

Initiate benchmarking with world-leading peer clusters

All three metro-regions hold very specialized and strong knowledge clusters, but it is not given that they exploit the potential of these unique assets fully.
Useful information could be obtained by identifying the regions that are hosts to the world's leading clusters and make peer reviews of cluster performance and cluster-specific framework conditions.

Map and benchmark emerging clusters

Global trends foster emerging clusters in greentech, health-tech and creative industries. All three Nordic metro-regions have a potential to host strong clusters in these areas in the future, but existing metrics for fact-based policies are weak.
Useful information could be obtained by using new techniques to map emerging clusters and make comparisons between the Nordic metro-regions and selected world-leading peer clusters.

Exchange policy experiences

There are many similarities across cluster policies in the three Nordic metro-regions, but policies are context-dependent and difficult to compare – even budgets and resources spent are difficult to compare.
Useful information could be obtained by an in-depth and unified description of policies, budgets and experiences.

Table of contents

Introduction

Metro-regions are important nodes in the global knowledge economy. They have a solid knowledge base and unique assets which give them competitive advantages. Identifying and building on these unique assets must be at the heart of a fact-based economic development strategy.

As nodal regions in the global economy, metro-regions often find themselves in direct competition with each other, for instance when it comes to the location of regional headquarters and R&D centers of global companies.

The most affluent cities in the world, such as San Francisco, Boston and London to name a few, are global hotspots for a number of innovative clusters that attract and grow the most innovative companies in the world. Such internationally significant clusters flourish partly because of the unique assets of these cities – and the clusters themselves then become unique asset of those cities.

Mapping a city's existing clusters, their strengths, their position in the increasingly globalizing value system of clusters, and potential synergies across clusters are key inputs for an economic development strategy. This analysis will provide part of such a mapping.

Analytical framework

This review of competitive clusters in Stockholm, Helsinki, and Copenhagen is part of a wider assessment of the innovation capacity of these three metro-regions carried out by the Metropolitan InC secretariat jointly with regional partners.

The assessment of the regions' innovation capacity is based on benchmarking among European metro-regions on four key drivers of innovation and regional wealth creation. The analytical framework is graphically depicted in figure 1.

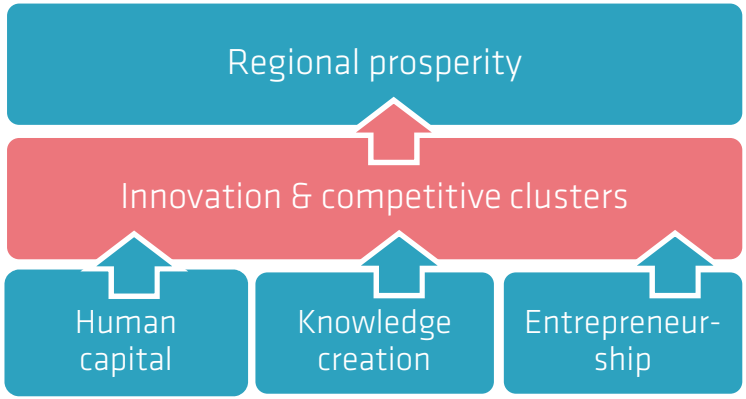
Human capital has to do with access to highly skilled workers in the region. And it has to do with companies' ability to manage and cultivate innovative organizations where the creativity of knowledge workers are utilized to its fullest extent.

Knowledge creation regards public and private investments in research and development. And it regards the quality of the educational system and public research.

Entrepreneurship is about the entrepreneurship activity and the extent of high growth entrepreneurs in the regions. And it is about the regions' efforts concerning entrepreneurship education and venture capital funding for high-growth entrepreneurs, which are important parts of the entire eco-system of entrepreneurship.

These framework conditions are crucial for the competitiveness of clusters and the prosperity of the regions. The most specialized and most competitive clusters drive the wealth and prosperity of their respective regions. Therefore, the benchmarking model explicitly focuses on these clusters.

Figure 1: The Metropolitan InC benchmarking model



Clusters are mapped on the basis of industry statistics in accordance with the methodology used by the European Cluster Observatory. The mapping of clusters is based on employment concentration within the region. Employment concentration is interpreted as a signal of competitive advantage. The clusters are treated as specialized when among the 10 clusters in European metro-regions with the highest employment concentration.

This study focuses on Stockholm's, Helsinki's and Copenhagen's specialized clusters, i.e. the clusters that have an employment concentration among the top 10 in European metro-regions.

Mapping competitive clusters

Mapping competitive clusters is a complex task. The most commonly used method for mapping clusters is based on industry statistics that show employment patterns across regions. This method is also employed in this study.

Companies that are co-located can simultaneously compete and collaborate with each other, and both activities can enhance their competitiveness.

It is competition in the market that form clusters, and because conditions that are important to companies differ from region to region, cluster formation and business specialization likewise differ from region to region.

The formation of clusters is an evolutionary and dynamic process. In a sense clusters are constantly eroding and cluster structures transforming. Globalization of cluster value chains is a strong force transforming cluster structures and dynamics in metro-regions.

The Nordic metro-regions are increasingly competing with other metro-regions aspiring to become global leaders in knowledge-intensive parts of global cluster value chains. Being among the wealthiest regions in Europe, the Nordic metro-regions cannot compete on low costs but compete on the basis of world-class research, innovation and the clusters' ability to manage commercialization.

Enterprises are the main actors of clusters, but far from the only actors. Many examples point to the importance of universities and specialized knowledge institutions for the competitiveness of clusters in metro-regions. Karolinska Institutet's importance for Stockholm's life sciences cluster is one; the Technical University of Denmark's importance for greentech in Copenhagen another; and the new Aalto University in Helsinki is expected to become an important player when it comes to future competition among companies designing new business solutions.

With available data from the European Cluster Observatory it has been possible to map out Stockholm's, Helsinki's and Copenhagen's existing clusters and compare these clusters with other metro-regions in Europe.

The competitive position of the specialized clusters in the three Nordic Metro-regions is assessed on the basis of selected cluster performance indicators, cf. page 8.

Key indicators of cluster performance and competitiveness

Employment specialization
Competitive clusters reap benefits of agglomeration economies in regions that offer a unique business environment for the cluster. Competitive clusters are large in terms of employment within their region relative to their competitors in other regions.

Employment specialization is calculated as the proportion of employment within a cluster in Stockholm, Helsinki or Copenhagen relative to the proportion of employment for that cluster in all European metro-regions. If the proportion is equal to the average proportion for all regions, the employment specialization or the localization quotient (LQ) is equal to 1.

Human capital
Knowledge is the key asset of competitive clusters in metro-regions. Clusters that wish to stay competitive need to invest heavily in new knowledge and innovation. Competitive clusters' demand for highly skilled employees is therefore high and rising.

Human capital is measured as the proportion of employees within a cluster with a tertiary education.

Advanced knowledge
Competitive clusters develop products and services with a very high knowledge content. To stay at the technological and entrepreneurial frontier clusters need to have access to and the capability to absorb the most advanced knowledge within their field.

Advanced knowledge in clusters is measured as the proportion of employees with a PhD degree (or similar).

Productivity
Competitive clusters are more productive than their competitors. They are able to pay higher wages and thereby contribute significantly to higher standards of living in their region.

Average personnel costs, which add up the total remuneration payable by an employer to an employee, are used as a proxy for cluster productivity.

Exports
Competitive clusters offer unique products and services which give them a strong standing on the global market. Competitive clusters have a high share of their world market.

Exports and world market shares are measured at the country level for each cluster.

Foreign Direct Investments
Competitive clusters make metro-regions attractive to foreign investors. As companies are increasingly sourcing knowledge from around the world, they look for ways to tap into the hidden knowledge of competitive clusters. Setting up operations within the regional cluster is one effective way of doing that.

FDI is measured by the number of foreign direct investments made in each region.

The metro-regional economies

The metro-regions of Stockholm, Helsinki, and Copenhagen are among the most affluent regions in Europe (OECD, 2009).

Stockholm and Copenhagen are roughly the same size with an employed workforce close to one million people. Helsinki is smaller and employment reaches about three quarters of a million, cf. table 1.

The metro-regional economies display the same overall composition in traded industries, local industries and public administration & services with roughly a third of employment in each sector.

Clusters only exist within traded industries that sell their products and services on a global market. When a cluster serves a global market, its size – as measured by employment and number of companies - can grow substantially within a region. Contrary to this, local industries are more constrained by the regional market that they serve.

Traded industries attract special attention as they are more productive than local industries, see higher growth, and because they lay the foundation for growth and employment in the region.

Helsinki has a higher share of employment in traded industries than Stockholm and Copenhagen, while the latter two have a relatively high share of employment in public services.

Table 1: Employment distribution in the metro-regions, 2006

	Stockholm	Helsinki	Copenhagen
Traded industries	338,000	275,000	295,000
Local industries	344,000	256,000	331,000
Public Service	305,000	205,000	299,000
Total	1,000,000	752,000	930,000
Traded industries	34%	37%	32%
Local industries	35%	35%	36%
Public Service	31%	28%	32%

Source: Register-based labor force statistics and own calculations

The share of employment in traded industries is, however, a very coarse measure of metro-regional advantages. A closer look at clustering in the traded industries provides a more comprehensive picture of regional specializations and advantages.

Metro-regional cluster portfolios

European Cluster Observatory identifies 38 cluster categories for each region, based on the geographical co-location of industries. This grouping of traded industries provides a very detailed picture of the regional economies.

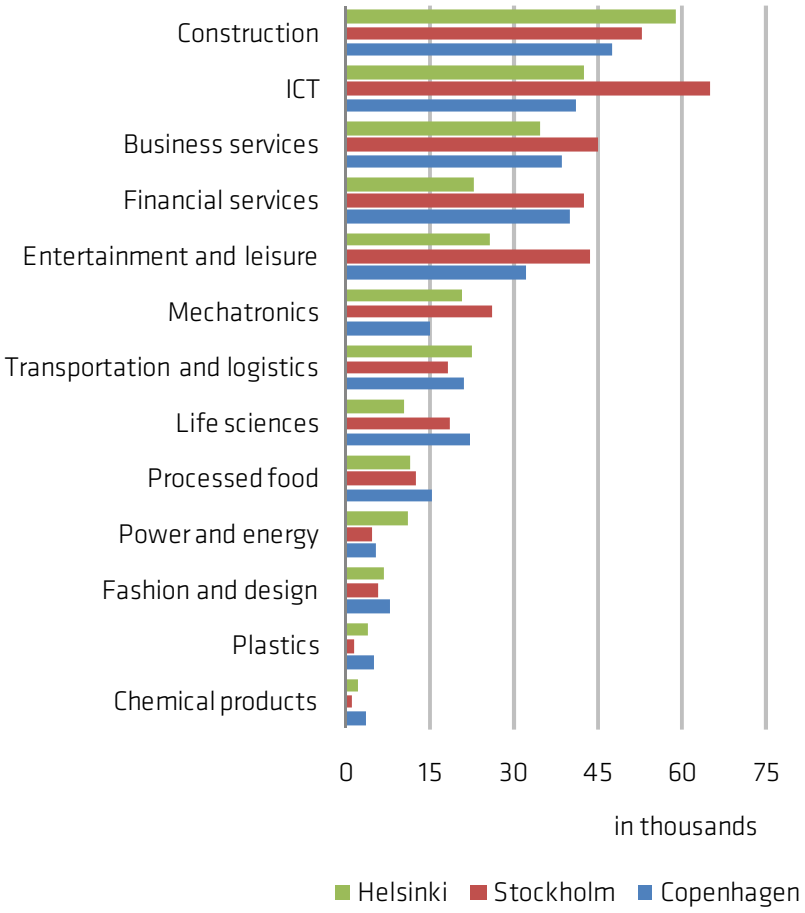
The 38 clusters are more or less related and may for illustrative purposes be grouped into families of clusters or what one might call mega-clusters.[1] IT clusters and communications clusters are, for instance, often strongly interlinked.

Construction, ICT, Business services, Financial services and Entertainment & leisure are the five largest mega-clusters in the three metro-regions. These five clusters account for more than two thirds of total cluster employment in Stockholm, Helsinki, and Copenhagen. The effect of employment and productivity trends within these mega-clusters on the entire economy of the metro-regions is therefore considerable.

Stockholm's cluster employment is the most concentrated within the five largest clusters, and ICT and Entertainment & leisure stand out as especially large compared with Helsinki and Copenhagen. The ICT cluster in Stockholm has 13,000 more employees than in Helsinki, and the Entertainment cluster has 11,000 more employees in Stockholm than in Copenhagen. The Financial services and Entertainment & leisure clusters are significantly smaller in Helsinki than in Stockholm and Copenhagen.

The cluster portfolio is, however, dynamic rather than static. Part of this dynamic can be observed through the employment changes of clusters over time.

Figure 2: Cluster employment, 2006



Source: Register-based labor force statistics and own calculations

Dynamics of metro-regional cluster portfolios

Since the turn of the millennium the cluster portfolios of Stockholm, Copenhagen and Helsinki have been affected similarly by two strong trends.

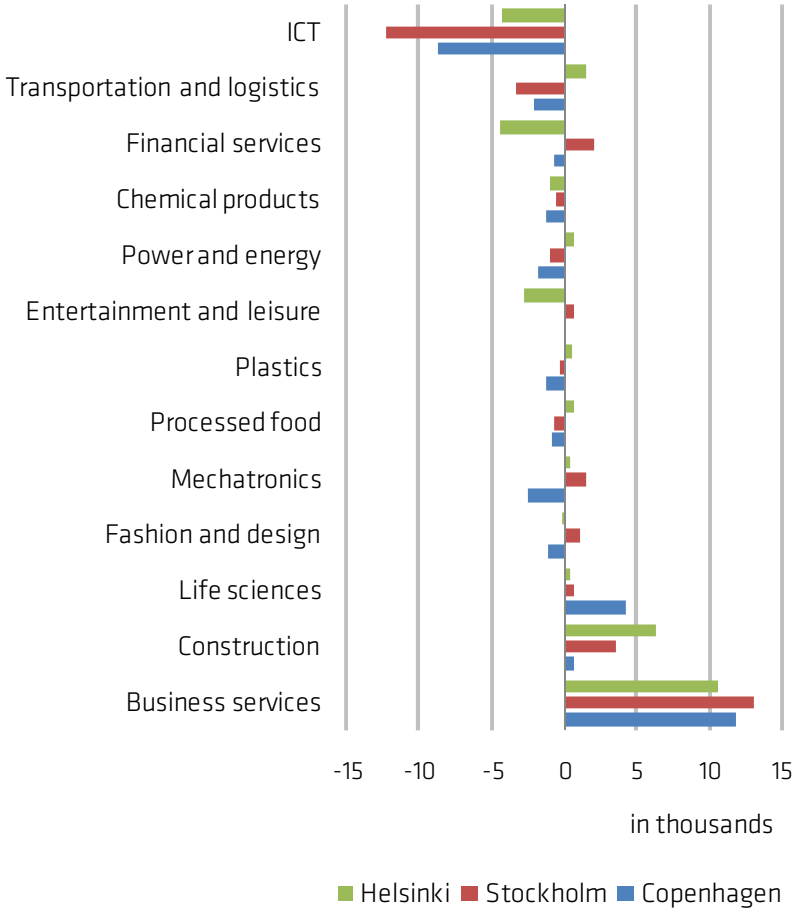
Following the burst of the IT-bubble in 2000 and an increased outsourcing of traditional IT activities, the regions' ICT clusters saw a steep decline in employment. In 2006 the ICT clusters employed 25,000 fewer people than they did in 2000. Employment has started to increase again in the most recent years. The ICT clusters have simultaneously seen a restructuring and a change of focus. Manufacturing of ICT equipment and publishing of software have been decreasing while ICT services and consultancy have been increasing. This restructuring has been most pronounced in Stockholm. Helsinki seems to have been far less affected by this trend.

The business services cluster has grown substantially in each region: more than 40 percent from 2000 to 2006. This development follows a strong international trend that sees companies outsourcing organizational functions such as database maintenance, facility services and recruitment. The trend in Stockholm, Helsinki, and Copenhagen does not necessarily reflect the emergence of a unique stronghold in these regions.

Aside from these two strong trends, the numbers show significant dynamism in other clusters as well. Since 2000 Stockholm has strengthened its position as the Nordic financial center. Within life sciences Copenhagen has – as the only metro-region – experienced strong employment growth. Helsinki has gained a stronger standing vis-a-vis Copenhagen and Stockholm in Construction, Transportation & logistics, and Power & energy.

The dynamics of the regions' cluster portfolios indicate both similar and distinct cluster evolutions in each region.

Figure 3: Changes in cluster employment, 2000-2006



Source: Register-based labor force statistics and own calculations

Specialized clusters – metro-regions' unique assets

The performance of the largest clusters in Stockholm, Helsinki, and Copenhagen is obviously very important for the wealth of the regions. But these clusters are not necessarily a unique asset for the region.

Construction, ICT, Financial services, Business services and Entertainment & leisure are usually large clusters in all metro-regions because the metro-regions have large home markets for them to serve. But even if a cluster is large, it is not necessarily a strong player in the global market. On the other hand, a relatively small cluster could be a strong player in the global market.

If a metro-region houses a cluster with a very high employment concentration (LQ) relative to other metro-regions, it signals high competencies and a strong competitive position, because traded clusters can only grow from successful competition in the global market. So the most specialized clusters - clusters with a higher employment concentration relative to others - must be located in regions with high competencies and a specialized knowledge for that specific cluster. In that sense, specialized clusters can be seen as unique assets for regions.

A comparison of cluster employment concentration in Stockholm, Helsinki, and Copenhagen relative to other European metro-regions makes it possible to see what is unique for each of the three regions.

Box 1: Identifying metro-regions and specialized clusters

Cluster data from the European Cluster Observatory form the basis of this study. The European Cluster Observatory arranges data according to Eurostat's definition of statistical European regions, so-called NUTS2-regions. These regions follow administrative boundaries and have between 800,000 and 3 million inhabitants. There are a total of 271 European NUTS2 regions.

In this study a NUTS2 region is called a metro-region if it contains a functional urban area of more than 1,000,000 inhabitants. Europe houses 60 metro-regions, among them Copenhagen, Helsinki and Stockholm.[2]

Employment concentration – also called specialization (see page 8) - is calculated for each of the 38 cluster categories in the European Cluster Observatory. The 10 clusters with the highest employment specialization in each of the 38 cluster categories are called specialized clusters – or simply 'top 10' clusters.

Specialized clusters in Copenhagen

Copenhagen hosts the most specialized Biopharmaceuticals cluster in Europe[3]. When including Medical devices, the Life sciences cluster in Copenhagen is the largest Life sciences cluster in the Nordic countries and among the largest in Europe.

Life sciences is not the largest specialized employer in Copenhagen. Both IT and Transportation & logistics are larger. Information technology is the fourth most specialized cluster in Europe, while transportation & logistics is number 10.

Transportation & logistics is one of the largest export markets in the world (Porter, 2010) and the Danish cluster contributes with more than a fifth of Danish exports. The strong presence in the global Transportation & logistics market is mainly attributable to Denmark's globally competitive shipping industry with Maersk as one of the biggest shipping companies in the world.

There is a great need for sustainable and energy-efficient transport and logistics solutions. If the Danish shipping industry and other strong Danish players within Transportation & logistics can meet this challenge of energy efficiency, Copenhagen might be in a unique position to become one of the leading spots in the world for international Transportation & logistics.

Table 4: Copenhagen's specialized clusters, 2005

	Employment	Specialization
Biopharmaceuticals	13,000	3.2
Medical devices	4,300	2.4
Information technology	22,200	2.1
Transportation & logistics	39,100	1.4

Note: Employment specialization expresses the excess of employment in a region within a cluster. The interpretation of a specialization of 3,2 in the Biopharmaceuticals cluster is that the share of employment in the cluster is 3.2 times higher in Copenhagen than the average for all European metro-regions.
Source: European Cluster Observatory and own calculations

The specialized and relatively big IT and Life science clusters in Copenhagen represent unique assets with a great global potential, but in order to master an increasing global competition on innovation and new solutions the clusters need to have world-class framework conditions.

The Copenhagen metro region also houses leading competencies in the emerging greentech industry and key players have recently established Copenhagen Cleantech Cluster.

Specialized clusters in Stockholm

Stockholm sees a strong specialization within five clusters. The most specialized clusters are Communications, Information technology, and Biopharmaceuticals. These clusters are well-known and recognized as internationally competitive. The clusters are dominated by two very large companies, Ericsson within ICT, and Astra Zeneca within biopharmaceuticals. The presence of these companies provides a unique opportunity for the clusters, but at the same time they induce a certain vulnerability as well. The performance of the clusters are strongly tied to the performance of these particular companies.

Stockholm has other strongholds as well. Stockholm is among the ten metro-regions in Europe with the most specialized clusters within Entertainment and Business services.

The Entertainment cluster - comprising arts, music and film production – is a core cluster in creative industries, which shows some of the highest growth rates in the global markets and is seen as a driver of wealth in cities like New York and London, which is why creative industries are currently receiving increasing political attention.

Stockholm seems to be in a unique position to benefit from growth incurred by Entertainment and creative industries. A newly published study indicates that except from London, Stockholm is the European metro-region most specialized in creative industries (Power & Nielsén, 2010). According to this study, creative industries employ 86,000 people in Stockholm.

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Table 2: Stockholm's specialized clusters, 2005

	Employment	Specialization
Communication equipment	11,500	3.2
Information technology	34,600	2.9
Biopharmaceuticals	10,300	2.2
Entertainment	20,500	1.7
Business services	41,000	1.6

Source: European Cluster Observatory and own calculations

Despite the fact that Stockholm is emerging as the financial center of the Nordic countries, the Financial services cluster does not appear specialized. Measured by employment specialization, financial services in Stockholm is ranked no. 25 among the 60 European metro-regions.

Stockholm is the only Nordic metro-region with a top 10 specialized Business service cluster, which indicates that Stockholm has an important asset in a fast growing industry.

Specialized clusters in Helsinki

According to the mapping of Communications clusters in the European Cluster Observatory, Helsinki hosts by far the most specialized Communications cluster in Europe, with Nokia as the spearhead of the cluster.

Helsinki also holds a leading European position within IT, even if not as strong as Stockholm and Copenhagen. IT is the largest specialized cluster in Helsinki, and considered jointly with communications, ICT remains very strong in Helsinki.

Besides these well-known cluster strengths in Helsinki, the benchmark shows that Helsinki has two smaller specialized clusters; Medical devices, and Power generation & transmission.

The Power generation & transmission cluster comprises industries that manufacture turbines and electric motors, especially for the production of electricity. These include technologies for clean energy production.

Cleantech is one of the strongest emerging markets, and a field where most countries and regions are striving to become winners. With massive public and private investments and intense global competition, regions that have existing strongholds to build on will have a competitive edge. The specialization in Power generation & transmission suggest that Helsinki hosts such a stronghold.[4]

Table 3: Helsinki's specialized clusters, 2005

	Employment	Specialization
Communication equipment	13,100	4.4
Information technology	18,900	1.9
Medical devices	3,200	1.9
Power generation & transmission	3,300	1.7

Source: European Cluster Observatory and own calculations

This is supported by a recent study by the WWF comparing sales of countries' clean technology products. The study shows that Finland is among top five in clean technology sales as a share of GDP, trailing only Denmark, Brazil, Germany and Spain. The study point at a Finnish strength in the market segment for insulation (WWF, 2009).

Clean and environmental technologies are not, however solely confined to a single cluster such as Power generation & transmission. Climate and environmental challenges are drivers of renewal and innovation across many clusters.

Specialized clusters in summary

When looking at the Nordic metro-regions' clusters, clear and distinct strongholds emerge.

Stockholm has 5 specialized clusters with an employment specialization among top 10 in Europe. Helsinki and Copenhagen have 4.

Stockholm is the leading European region within Information Technology, Helsinki the leading region within Communications, and Copenhagen the leading region within Biopharmaceuticals.

ICT stand out as an area where all three regions come out strong in the employment figures, even if Copenhagen is rather weak in Communications. The competition among regions and countries aiming to become global hotspots for this cluster is intense. A common Nordic effort to strengthen the regions' position in the global value chain of ICT seems plausible and might benefit each region in this competition.

Stockholm and Copenhagen is specialized within relatively large clusters. In Stockholm more than one in three employees in traded industries is employed in a specialized cluster, cf. table 5. In Copenhagen one in four employees in traded industries is employed in a specialized cluster. This is not the case in Helsinki.

Helsinki has a very low share of employment in specialized clusters compared to Stockholm and Copenhagen. In Helsinki less than one in seven employees in traded industries is employed in specialized clusters. It is hard, however, to draw any conclusion on the implication of this for Helsinki's growth prospects without further information.

Table 5: Total employment in specialized clusters, 2005

	Stockholm	Helsinki	Copenhagen
Employment in specialized clusters	117,900	38,500	78,600
Share of cluster employment in specialized clusters	34.4%	13.5%	26.2%

Source: European Cluster Observatory and own calculations

Business Services and Transportation & Logistics in Helsinki were only excluded from the list of specialized clusters by a small margin. Both clusters rank no. 11 among European metro-regions. These clusters employ more than 70,000 people. If they were to be included among the specialized clusters in Helsinki, Helsinki would stand out as the Nordic metro-region with the highest share of cluster employment in specialized clusters.

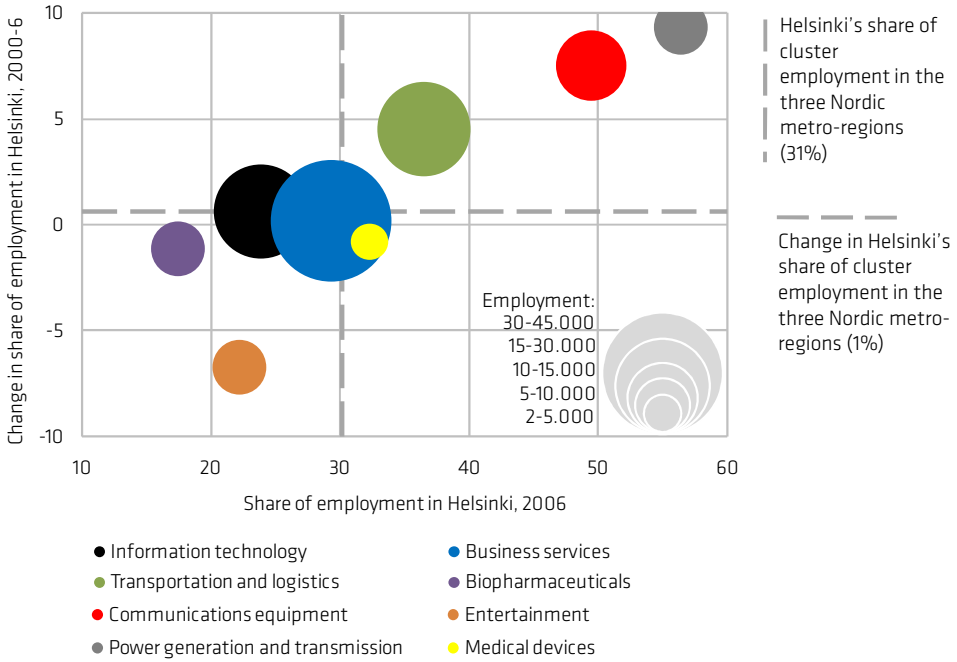
Employment specialization is an indicator of cluster strength. But are these specialized clusters really internationally competitive? More indicators are needed to conclude on this. When clusters are competitive one would expect them to gain employment relative to their competitors.

Employment gains of specialized clusters 2000-2006

The cluster portfolio of metro-regions is continually changing. Some clusters decline, while others grow. Some clusters grow simply because their market is growing. Others grow because they achieve higher market shares.

It has not been possible to collect data on employment gains in all 60 metro-regions in Europe. It is, however, possible to compare employment gains across Helsinki, Stockholm and Copenhagen.

Figure 4: Dynamics of cluster employment in Helsinki in relation to Stockholm and Copenhagen



Source: Register-based labor force statistics and own calculations

The Business services cluster has grown substantially in each of the three regions, reflecting the increase in the market for Business Services, cf. page 11. At the same time the IT cluster retracted substantially in each metro-region in the wake of the burst of the IT bubble in 2000 and the general outsourcing of certain IT activities.

The other specialized clusters show an interesting picture. The most specialized clusters have the best performance in each of the regions. This rather significant pattern illustrates the importance of specialized clusters in the emerging global competition on innovation.

Helsinki has manifested itself as the Nordic powerhouse within Communications, cf. figure 4. The Communications cluster has gained significant employment shares since year 2000. At the same time Helsinki's Power Generation & Transmission cluster has been growing in employment while its peers in Stockholm and Copenhagen have gotten smaller. Helsinki is the only Nordic metro-region that has seen clusters gain that many employment shares. Helsinki also gained employment shares within Transportation & Logistics; mainly over Stockholm.

Employment gains of specialized clusters 2000-2006

Stockholm has seen many of its clusters retract relative to their peers in Helsinki and Copenhagen. Entertainment is the exception where Stockholm experienced higher employment growth than Helsinki and Copenhagen, cf. figure 5. The employment specialization that Stockholm holds today within Entertainment has largely been established since 2000.

Copenhagen has experienced stronger employment growth in the Biopharmaceuticals and Medical Devices clusters than Stockholm and Helsinki, cf. figure 6. It seems that Copenhagen – and the entire Medicon Valley - is emerging as the most successful Nordic Life sciences cluster. Copenhagen also gained employment in Entertainment, but not as distinctly as Stockholm.

Figure 5: Dynamics of cluster employment in Stockholm in relation to Helsinki and Copenhagen

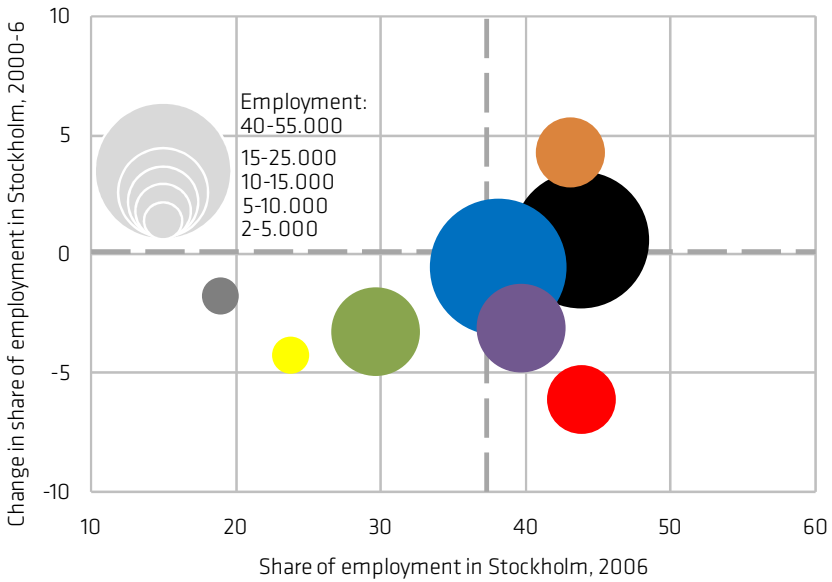
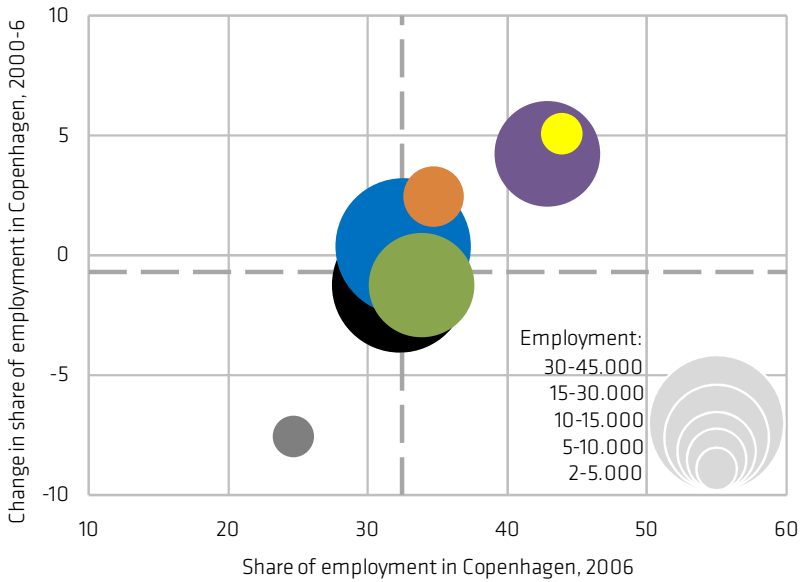


Figure 6: Dynamics of cluster employment in Copenhagen in relation to Helsinki and Stockholm



Note: The Communications cluster in Copenhagen is left out due to its small size. Its share of employment in 2006 was 7% and its change in share from 2000 to 2006 was -1,5%
Source: Register-based labor force statistics and own calculations

Skill level of clusters

Human capital

As they are located in some of the wealthiest regions in Europe, one of the main drivers of cluster competitiveness in Helsinki, Stockholm and Copenhagen must be human capital. To stay ahead in the global market place, clusters have to constantly upgrade their skill levels and commercialization of advanced knowledge.

Helsinki, Stockholm and Copenhagen have a highly skilled workforce. Close to a third of the employed are highly skilled, cf. table 6. The skill level does, however, vary substantially across sectors and industries. In the private sector specialized clusters are far more knowledge-intensive than the remaining part of the private sector.

In Helsinki more than 40% of the employed within specialized clusters are highly skilled. In Stockholm a little less than 40% of the employed are highly skilled. The knowledge intensity of the specialized clusters is less pronounced in Copenhagen where less than a third of the employed are highly skilled.

Advanced knowledge

The competitiveness of the specialized clusters is closely tied to creation and exploitation of knowledge. This drives up the clusters' demand for advanced knowledge. The share of PhD's is an indicator of clusters' exploitation of advanced knowledge.

Helsinki and Stockholm train many PhD's. There are 15,500 PhD's employed in Stockholm, 11,500 in Helsinki and 7,000 in Copenhagen. Most of the PhD's find a job at a university or at other public service institutions. The lion's share of PhD's that find a job in the private sector find it in a cluster. Clusters employ 3,800 PhD's in Stockholm, 2,000 in Helsinki and 2,400 in Copenhagen. The specialized clusters have by far the highest share of PhD's in the private sector.Stockholm is doing very well in terms of training PhD's. For Copenhagen there seems to be a challenge in training more PhD's. In Helsinki the challenge seems to be to train more PhD's in areas that are in demand in the industry: The stock is high, but the penetration rate into the private sector quite low.

Table 6: Share of highly skilled workers, 2006

	Stockholm	Copenhagen	Helsinki
Specialized clusters	37.2%	31.7%	42.8%
Non-specialized clusters	23.1%	26.9%	24.9%
Local industries	16.2%	14.9%	16.3%
Public Services	40.5%	47.7%	39.8%
Total	28.0%	29.9%	27.2%

Note: Highly skilled workers are defined as workers with an education classified as ISCED 5A or 6.[5] Generally this means that highly skilled workers has a post-secondary degree of at least three years.
Source: Register-based labor forces statistics and own calculations

Table 7: Share of PhD's, 2006

	Stockholm	Copenhagen	Helsinki
Specialized clusters	1.6%	1.4%	1.3%
Non-specialized clusters	0.8%	0.6%	0.6%
Local industries	0.3%	0.1%	0.3%
Public services	3.4%	1.5%	4.1%
Total	1.6%	0.8%	1.5%

Source: Register-based labor force statistics and own calculations

Highly skilled workers in specialized clusters

A recent study has shown that when companies increase the share of highly skilled employees with 1%, their productivity increases with 1% (Junge & Skaksen, 2010). This is a welcome reminder of the importance of highly skilled workers for the economic performance of clusters.

Stockholm, Helsinki, and Copenhagen are generally specialized in knowledge-intensive clusters. The share of highly skilled workers in ICT, Life sciences and Business services is high, cf. table 8.

With a few exceptions the specialized clusters have more highly skilled workers than their Nordic peers. This is particularly evident in the Communications cluster which is highly specialized and very knowledge-intensive in Helsinki and Stockholm: More than 50% of employees are highly skilled. In Copenhagen, which is not specialized in Communications, a mere 28% of employees are highly skilled.

This is a clear indication that the competitiveness of the regions' most specialized clusters is strongly tied to their augmentation of knowledge and competencies. This underscores the importance of the quality and relevance of the educational system for these clusters.

Two clusters deviate from the general pattern of the specialized clusters. Entertainment and Transportation & logistics have low shares of highly skilled workers. And the specialized clusters have lower shares of highly skilled workers than their Nordic peers.

Entertainment has been growing in Stockholm since the turn of the millennium, and among Stockholm's specialized clusters it is the cluster that has seen most growth relative to its peers in Copenhagen and Helsinki. The comparatively low skill level of Entertainment in

Table 8: Share of highly skilled workers in specialized clusters, 2006

	Stockholm	Copenhagen	Helsinki
Communications equipment	50,7%	27,7%	56,8%
Information technology	38,1%	36,9%	40,5%
Biopharmaceuticals	37,9%	42,8%	35,1%
Medical devices	28,9%	28,3%	32,4%
Business services	37,3%	37,1%	29,9%
Entertainment	16,8%	22,4%	22,5%
Transportation & logistics	14,4%	13,0%	17,3%
Power generation & transmission	31,2%	26,3%	32,6%

Source: Register-based labor force statistics and own calculations

Stockholm suggests that growth has been registered in less knowledge-intensive parts of the cluster, even if more detailed data is needed to conclude on this.

Transportation & logistics is among the most export-intensive clusters in Denmark, and it is somewhat surprising that the share of highly skilled workers is as low as 13%.

There is, however, a strong tradition within the Danish shipping industry of developing training programs for one's own employees, tailored to the company's needs. Companies' own training of employees is not accounted for, which is an obvious shortcoming in the estimation of the skill levels in these clusters. The substantial and specialized training of the Danish Transportation & logistics cluster does not show up in the statistics.

Advanced knowledge in specialized clusters

Advanced knowledge in clusters is measured as the share of employees with a PhD. PhD's only make up a small share of clusters' employees, but they are assumed to be critical to clusters' innovation and competitiveness. Especially in knowledge-intensive clusters such as ICT, Life sciences and Business services.

When it comes to PhD's, the same pattern emerges as with highly skilled workers across the three regions. A few clusters employ nearly all privately employed PhD's, and there is a tendency that specialized clusters employ more PhD's than their non-specialized peers, cf. table 9.

Copenhagen has significantly fewer PhD's than Stockholm and Helsinki, and there are indications that Copenhagen does not meet the demands of its specialized clusters, especially within Life sciences. A survey among life science companies in the three regions has shown that more companies in Copenhagen find that the universities educate too few candidates within their field than is the case in Helsinki and Stockholm (FORA, 2009).

Even though the Biopharmaceuticals cluster is larger in Copenhagen than in Stockholm, Biopharmaceuticals employ more PhD's in Stockholm than in Copenhagen. In 2006 Biopharmaceuticals employed 890 PhD's in Stockholm and 770 in Copenhagen.

Table 9: Share of PhD's in specialized clusters, 2006

	Stockholm	Copenhagen	Helsinki
Communications equipment	2.9%	0.9%	2.5%
Information technology	0.9%	0.8%	0.8%
Biopharmaceuticals	5.4%	4.5%	2.4%
Medical devices	1.6%	1.4%	1.9%
Business services	1.0%	0.6%	0.8%
Entertainment	0.2%	0.1%	0.3%
Transportation & logistics	0.1%	0.1%	0.1%
Power generation & transmission	1.2%	0.8%	0.7%

Source: Register-based labor force statistics and own calculations

In Helsinki a significantly lower share of PhD's find a job in the private sector than in Stockholm and Copenhagen, which suggests that even though the universities produce a significant amount of PhD's, the region does not meet the demand for advanced knowledge from its specialized clusters. In Power generation & transmission, the share of PhD's in Helsinki is 0,7%, which is nearly half the share of Stockholm. Helsinki is also trailing Stockholm within Communications.

Cluster productivity

Competitive clusters are important for the regional economy. They are typically more innovative and productive than their competitors and able to pay higher wages. Hence competitive clusters contribute extraordinarily to a region's standard of living.

It is not an easy task to measure cluster productivity. The most direct measure would be labor productivity, which is not available at cluster level. But if wages are relatively freely determined by market forces and factor input costs equal across countries and regions, average personnel costs will be a usable proxy of cluster productivity.

Comparable data of wages or average personnel costs are, however, difficult to collect because data collection differs between countries and a proper international harmonization has not taken place. On the other hand, it is the assessment that Nordic wage data are fairly comparable. Still: Results must be interpreted with caution.

Data on average personnel costs for clusters in the three Nordic metro-regions show that specialized clusters in Stockholm, Helsinki, and Copenhagen are more productive than the rest of their regional economy, cf. table 10.

The productivity differences are most pronounced in Helsinki, where specialized clusters pay a wage premium of nearly 30% more than non-specialized clusters. In comparison with local industries, the wage premium is 50%. In Stockholm the wage premiums are slightly lower, while the wage differences are significantly smaller in Copenhagen: About half the wage differences recorded in Helsinki.

Table 10: Average personnel costs, € 2006

	Stockholm	Copenhagen	Helsinki
Specialized clusters	68,000	62,500	60,500
Non-specialized clusters	54,500	54,000	47,000
Traded industries	61,500	57,000	50,000
Local industries	48,000	47,000	40,500
Total, all industries	54,500	51,500	45,500

Note: Personnel costs are made up of wages, salaries and employers' social security contributions. Wages and salaries amount to 68% of personnel costs in Sweden, 80% in Finland and 92% in Denmark. The statistics do not cover the public sector.
Source: Structural Business Statistics and own calculations

Wage levels in specialized clusters

One way of looking at the cluster productivity is their ability to pay wage premiums relative to other clusters within their region (OEM, 2007). This perspective shows that Communications pays a wage premium of 31% in Helsinki and 23% in Stockholm, but a negative wage premium of 4% in Copenhagen, cf. table 11. This is a clear indication that the specialized Communications clusters in Stockholm and Helsinki are more competitive than the cluster in Copenhagen.

Among Stockholm's specialized clusters, Biopharmaceuticals stand out as much more productive than its Nordic peers with a wage premium of 39%. IT and Communications are at a level with its peers. Business services and Entertainment are trailing Copenhagen, which is strong among its Nordic peers in these clusters.

Stockholm's Business services cluster has experienced a considerable increase in temporary employment agencies, which might have given rise to a lower wage level compared to Copenhagen. Stockholm's Entertainment cluster has a significantly lower share of highly skilled employees than Copenhagen, which might explain the lower wage level.

Copenhagen's specialized clusters do not pay higher wage premiums than their Nordic peers. In Life sciences the wage premium is even quite low compared to Stockholm. The existing data cannot provide a plausible explanation for this.

Helsinki's most specialized cluster – Communications – pays higher wage premiums than its Nordic peers. The same is true for Information technology, even if the difference is marginal. Medical devices and

Table 11: Average personnel costs in specialized clusters as a percentage of average personnel costs in all clusters, € 2000-2006

	Stockholm	Copenhagen	Helsinki
Communications equipment	123%	96%	131%
Information technology	117%	117%	120%
Biopharmaceuticals	139%	111%	109%
Medical devices	99%	91%	94%
Business services	93%	107%	91%
Entertainment	79%	99%	78%
Transportation & logistics	96%	99%	101%
Power generation & transmission	119%	104%	115%

Note: Data for Communications equipment in Stockholm are from 2004.
Source: Structural Business Statistics and own calculations

Power generation & transmission is above Copenhagen, but below Stockholm's level.

The data on cluster wages does not show a clear link between employment specialization and wages. Other studies with cluster data from more regions have, however, shown that specialized clusters tend to be more productive (FORA, 2009; Ketels, 2009). This means it must be worthwhile contemplating why some of the specialized clusters in Stockholm, Copenhagen and Helsinki are not more productive than their Nordic peers. The clusters might be specialized in small or slowly growing segments of their markets. Or their cluster-specific framework conditions might not be as favorable as they could be.

Cluster productivity growth

Clusters experienced quite different wage level growth trajectories in Stockholm, Helsinki, and Copenhagen between 2000 and 2006. Traded industries are driving wealth creation in Helsinki and Copenhagen while curbing it in Stockholm.

The cluster wages in Stockholm grew at an annual rate of 0.7% when measured in Euros, cf. table 12. This growth rate was far lower than the growth rates registered in Copenhagen and Helsinki. The clusters in Helsinki have been the Nordic growth champions with an annual growth rate in wages of 4.0%. Helsinki's specialized clusters registered even higher growth rates of 5.5%.

With a wage growth of 3.1% the specialized clusters in Copenhagen did not grow faster than the non-specialized clusters. In Stockholm the specialized clusters registered no growth at all while the non-specialized clusters registered annual growth in real wages of 1.7%.

Between 2000 and 2006 the Swedish Krona devalued by 1.4% per year, which provides part of the explanation for the weak growth rate in Stockholm. It is not, however, the main explanation. The devaluation of the Swedish Krona towards the Euro strengthens the competitiveness of Swedish firms in the short run, but in order to stay competitive in the longer run they have to constantly increase their productivity.

Table 12: Annual average growth in personnel costs, € 2000-2006

	Stockholm	Copenhagen	Helsinki
Specialized clusters	0.0%	3.1%	5.5%
Non-specialized clusters	1.7%	3.2%	3.7%
Traded industries	0.7%	3.2%	4.0%
Local industries	1.6%	2.8%	3.4%
Total, all industries	1.2%	3.0%	3.7%

Note: Data for Communications equipment and Automotive only for the time period 2000-2004 in Stockholm. The Swedish Krona devalued 8.6% between 2000 and 2006, equivalent to 1.4% per year.

Source: Structural Business Statistics and own calculations

The current data suggest that the productivity growth is low in Stockholm relative to Helsinki and Copenhagen. If this picture holds true, Stockholm will not be able to keep its position as the most productive of the three metro-regions. If Stockholm does not figure out how to speed up and unlock the productivity trap they seem to have got stuck in, the productivity level in Copenhagen and Helsinki will soon surpass the productivity level in Stockholm.[6]

The differences in wage growth are a clear indication of different dynamics in the three regions. Especially among the specialized clusters that show vastly different growth patterns. But how do the specialized clusters compare across the three regions?

Wage level growth in specialized clusters

Helsinki's high wage growth of 5.5% in specialized clusters is based on high growth rates in three of Helsinki's four specialized clusters. Communications, IT, and Power generation & transmission register significantly higher real wage growth rates than their Nordic peers, cf. table 13. Only medical devices – a small cluster in Helsinki - registers moderate growth rates of 2.7% compared to 4.1% in Copenhagen.

Copenhagen sees more moderate real wage growth rates in its specialized clusters compared with its Nordic peers. Medical devices has experienced strong growth compared with its Nordic peers, while Biopharmaceuticals has grown at a higher rate in Copenhagen than in Stockholm, and at the same rate as in Helsinki. IT and Transportation & logistics have higher growth rates in Copenhagen than in Stockholm, but lower than in Helsinki.

The specialized clusters in Stockholm have not had any real wage growth between 2000 and 2006. In real terms, growth has even been negative. Communications and Business services experienced real wage decreases over the period, while IT, Biopharmaceuticals, and Entertainment saw moderate to low real wage growth rates compared to Copenhagen and Helsinki. Stockholm's low real wage growth thus seems to be quite broadly based, even if driven by ICT and Business services.

The growth pattern for ICT in Stockholm is a clear indication that the cluster has been hard hit by the burst of the IT bubble in 2000 and that it has been restructuring in the years following the burst. The decrease in Business services might very well be related to this process as part of the activity within business services is related to IT management and consultancy. At the same time, the fastest growing segment in Business services in Stockholm has been temporary employment agencies where wages and salaries are comparatively low.

Table 13: Annual average growth in personnel costs in specialized clusters, € 2000-2006

	Stockholm	Copenhagen	Helsinki
Communications equipment	-1.5%	2.9%	6.2%
Information technology	0.7%	3.1%	4.6%
Biopharmaceuticals	2.4%	3.7%	3.7%
Medical devices	-0.4%	4.1%	2.7%
Business services	-2.3%	3.1%	2.6%
Entertainment	1.6%	3.2%	2.9%
Transportation & logistics	1.0%	2.9%	4.3%
Power generation & transmission	2.2%	4.3%	5.4%

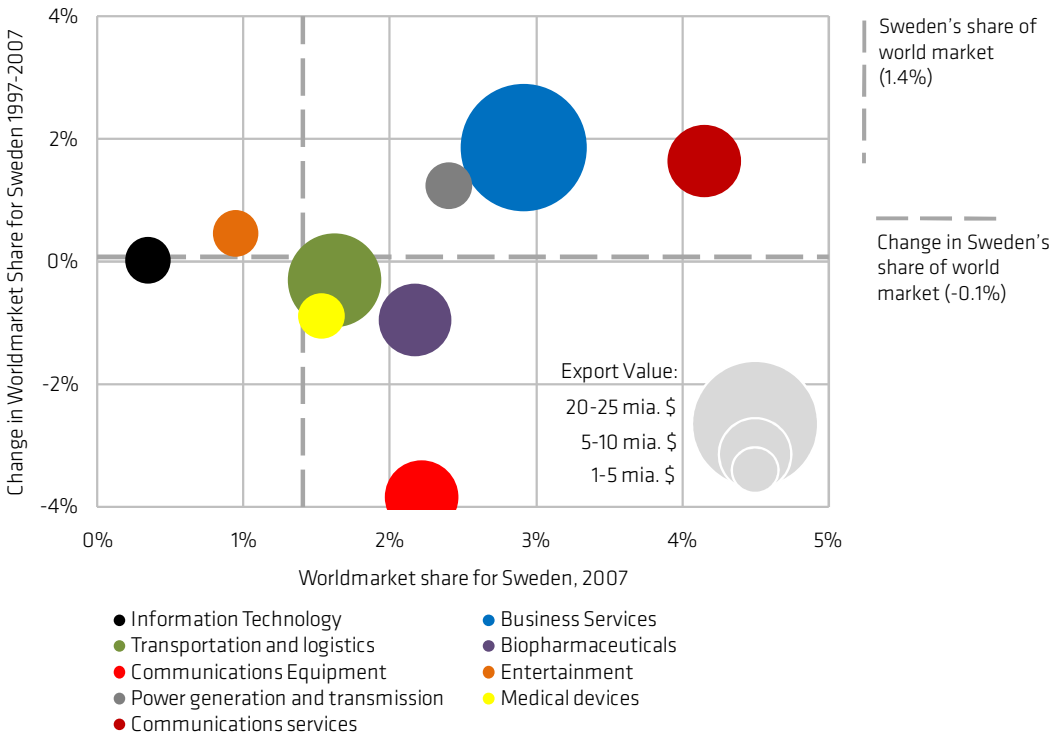
Note: Data for Communications equipment only for the time period 2000-2004 in Stockholm. The Swedish Krona devalued 8.6% between 2000 and 2006, equivalent to 1.4% per year.
Source: Structural Business Statistics and own calculations

Swedish cluster exports

Export data at regional cluster level do not exist. In this study national data at cluster level from Sweden and Finland are used to indicate the export performance of the different clusters.

Among the clusters that this study has been focusing on, the Swedish clusters that have the strongest standing on the global market are Communication services, Business services, and Power generation & transmission, cf. figure 7. These clusters gained considerable market shares over the last decade. Biopharmaceuticals, and especially Communications equipment are Swedish strongholds that have lost world market shares over the last decade. The market share for Communications equipment has dropped by a factor of three over the last decade.

Figure 7: Swedish cluster exports in selected clusters



Source: Prof. Michael E. Porter, International Cluster Competitiveness Project, Institute for Strategy and Competitiveness, Harvard Business School

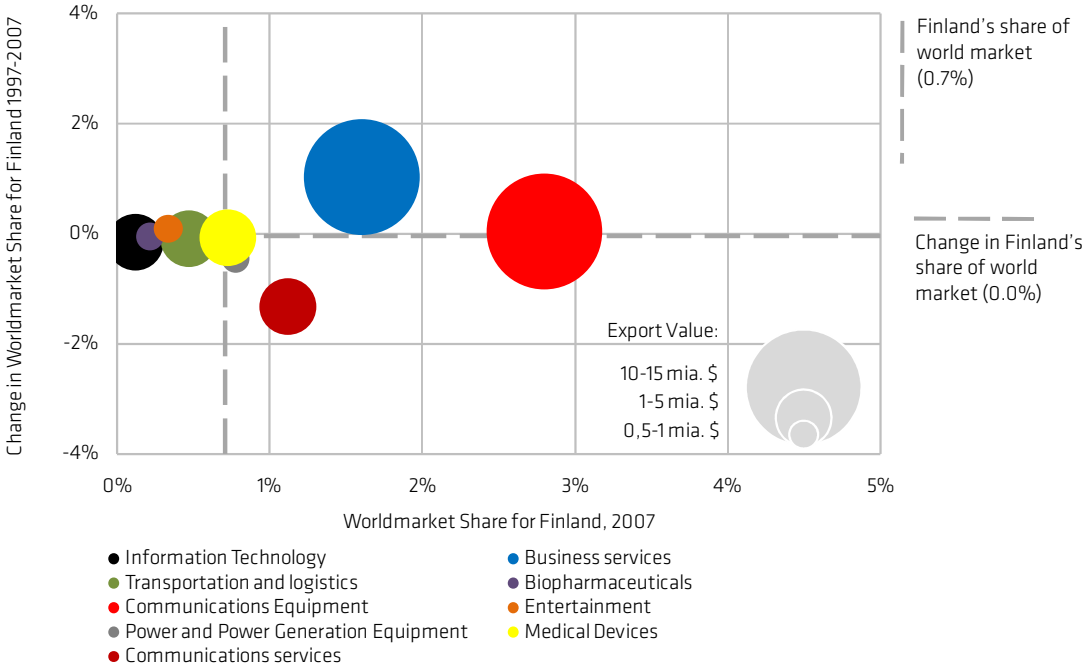
The change in exports show a striking restructuring in the Communications cluster from a focus on equipment manufacturing to a focus – and stronghold – in services. The exports data suggest that of Stockholm's five specialized clusters two – Business services and Communications services – have a strong standing on the global markets. The IT cluster has low exports, and Biopharmaceuticals has ost ground during the last decade. Entertainment does not show high exports, but has experienced an increase over the last decade.

Finnish cluster exports

The Finnish clusters do not show the same dynamism as the Swedish clusters. The global market position of most clusters have remained the same over the last decade. Only Business services has experienced increasing market shares, cf. figure 8.

The exports data suggest that of Helsinki's specialized clusters only Communications equipment has a strong standing in the global market.

Figure 8: Finnish cluster exports in selected clusters



Source: Prof. Michael E. Porter, International Cluster Competitiveness Project, Institute for Strategy and Competitiveness, Harvard Business School

Danish cluster exports

Harvard's database on cluster exports does not contain complete data for Danish cluster exports. However, the database provides some data on Danish cluster exports that are comparable with Sweden and Finland, and this facilitates a simple comparison between the Nordic countries.

In 2005 Swedish clusters exported goods and services at a value of USD 161 billion, while Finnish and Danish clusters exported goods and services at a value of USD 72 and USD 116 billion, respectively.

The exports data suggest that among Copenhagen's four specialized clusters Transportation & logistics has high world market shares in comparison with its Nordic peers, cf. table 14.

Transportation & logistics is by far the most export-intensive specialized cluster with an estimated world market share close to 5%. Due to the lack of data this estimate is rather uncertain, but it seems safe to conclude that this is the specialized cluster in the three Nordic metro-regions with the largest world market share.

The Danish world market shares within Biopharmaceuticals and Medical devices are estimated to be largely equivalent to the Swedish world market shares. This suggests that Life sciences in Copenhagen has a larger world market share than Life sciences in

Table 14: Export value for specialized clusters, million USD 2005

	Denmark	Sweden	Finland
Transportation & logistics	17,100	8,800	2,400
Biopharmaceuticals	6,600	7,400	800
Medical Devices	2,100	2,200	1.100
Information technology	1,600	2,100	1.000

Source: Prof. Michael E. Porter, International Cluster Competitiveness Project, Institute for Strategy and Competitiveness, Harvard Business School.

Stockholm. Denmark hosts one Life science cluster centered in Copenhagen, while Sweden hosts three. One in Stockholm-Uppsala, one in Malmö-Lund, and one in Gothenburg.

Foreign Direct Investments

Global companies make investments all over the world in order to gain access to the specialized tacit industry knowledge of competitive clusters, their research environments and creative talents. Metro regions with a well-run and knowledge-intensive business community, extensive knowledge-building and innovation capabilities, as well as an efficient infrastructure securing a high degree of mobility are, of course, interesting to foreign direct investors.

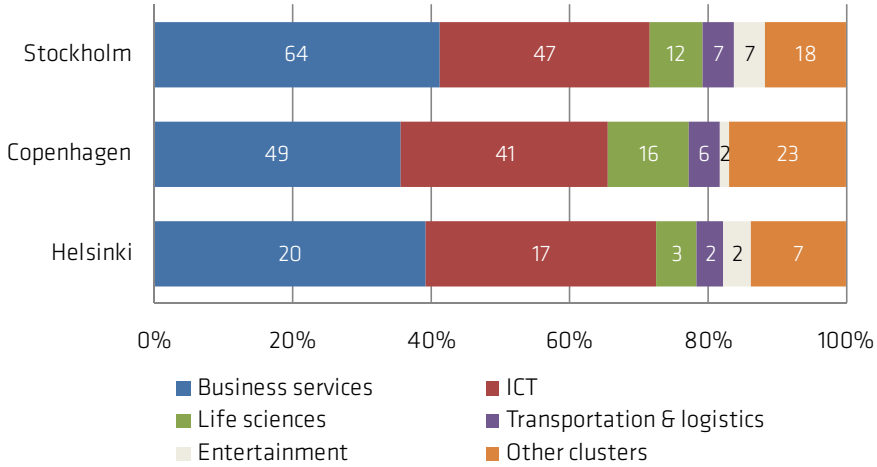
Stockholm and Copenhagen have been among the leading second-tier regions for FDI in Europe while Helsinki has seen only moderate incoming investments (FORA, 2007). Between 2006 and 2008 Stockholm registered 155 investments, Copenhagen 137, and Helsinki 51 investments. The leading European regions for FDI are London, Paris, and Barcelona.

The Nordic metro-regions are mainly attracting sales and marketing departments of foreign companies, which indicates that they are attractive markets for foreign companies. The regions are, however, also attracting R&D departments of foreign companies. Stockholm and Copenhagen are among the top 10 regions in Europe when it comes to attracting R&D investments (FORA, 2007).

Foreign Direct Investments give only weak indications about the competitiveness of the specialized clusters. Life sciences and Entertainment, specialized clusters of, respectively, Copenhagen and Stockholm, seem to be more attractive than their Nordic peers. This pattern is not found in Business services and ICT.

Among the specialized clusters in Stockholm, Helsinki, and Copenhagen, Business services and ICT attract the largest share of investments. Between 2006 and 2008 Business services attracted roughly 40% of investments and ICT another 30%, cf. figure 9.

Figure 9: Incoming foreign direct investments, 2006-2008



Source: Copenhagen Capacity on the basis of Ernst & Young's European Investment Monitor

Copenhagen has been the primary Nordic location for Life sciences investments with 16 investments and a share of 12%. The metro-regions have registered only a few investments within Transportation & logistics and Entertainment. Interestingly, 7 out of 11 registered investments within Entertainment have been located in Stockholm where the Entertainment cluster is specialized.

Regional cluster initiatives

The setup of regional cluster initiatives are different in Helsinki, Stockholm, and Copenhagen.

Finland and Sweden have national cluster policies that support regionally developed cluster initiatives. Denmark has only regional cluster initiatives.

Helsinki

The Helsinki region's cluster initiatives are concentrated around the implementation of the national Finnish Centers of Expertise cluster program, which co-finances nine cluster initiatives in Helsinki managed by Culminatum Innovation Oy Ltd. The Centers of Expertise program co-finances cluster initiatives in all Finnish regions. The aim of the program is to provide leverage for regional strongholds with a focus on renewal and emerging markets. The main activities of the initiatives are network and project development aiming to facilitate knowledge transfer from academia to SME's. In Helsinki, the nine Centers of Expertise have a total annual budget of € 2,2 million.

Helsinki's cluster initiatives focus on the commercialization of new technologies with expected high future growth potential, such as ubiquitous computing and biotechnology.

Even if Helsinki's cluster initiatives focus on the development of emerging business sectors, their focus reflects the city's existing specializations – most notably the stronghold within ICT. ICT is seen as a catalyst for innovation within emerging experience, construction, transportation, and health clusters.

The regions' cleantech cluster initiative also draws significantly on the stronghold within ICT with a focus on energy efficiency solutions. The initiative might, however, pay too little attention to the fact that Helsinki is specialized in power generation & transmission.

The specialization within power generation & transmission - encompassing the manufacturing of electric motors, generators, and transformers - has seen an increase in employment of 20% relative to Stockholm and Copenhagen. And it is a knowledge-intensive cluster that has seen a significant increase in wage levels.

The data suggest that the Power generation & transmission cluster is thriving. The cluster does not, however, have a stronger standing in the world market than the Finnish industries have on average. And exports data show that the cluster's share of the world market has been declining over the last decade.

If the trend in exports could be turned around now that the market for cleaner technologies is expanding rapidly, Helsinki could benefit from this new market opportunity.

Regional cluster initiatives

Stockholm

Sweden's national cluster policy is implemented by the national innovation funding agency VINNOVA. The Swedish regions (Län) are not formally involved in the implementation of the national cluster policy in the same way as in Finland.

VINNOVA's main cluster program, VINNVÄXT, finances cluster initiatives on the basis of competitive tenders. Recently the program has been restructured to focus on fewer and bigger cluster initiatives. Cluster initiatives can obtain funding of € 10.3 million (100 million SEK) over a ten year period. Stockholm has not been awarded funding for a cluster initiative from VINNVÄXT.

Probably the two most notable cluster initiatives in Stockholm are focusing on the region's two most specialized clusters: ICT and Life sciences. The two initiatives combine physical and soft infrastructure via the establishment of entire city districts.

The ICT cluster initiative Kista Science City is home to Ericsson and more than 500 other ICT companies, 1100 public researchers, and 5000 students. The Life science cluster initiative Stockholm Science City is not yet established. It involves investments of SEK 50 billion over the next 15 years and aims at developing an entire city district for Life sciences including university research, hospitals, companies, and auxiliary support activities.

The infrastructure for Stockholm's two other specialized clusters – Business services and Entertainment - are not quite as developed.

There are no cluster initiatives explicitly targeting Business services nor Entertainment as such. Filmregion Stockholm-Mälardalen and Creative Business Region Stockholm are targeting the Film industry, which is part of the Entertainment cluster. In comparison with the initiatives supporting ICT and Life sciences they are quite small.

Business services and Entertainment are clusters that are becoming more important for the regional economy. Between 2000 and 2006 employment in Business services increased with more than 12,000. Employment increased in Entertainment with more than 1,000, while decreasing in Copenhagen and Helsinki.

The clusters are not, however, performing well in terms of value creation. The data indicates that the real wage level of the clusters is lower than in Copenhagen, and the real wage growth is lower than in both Copenhagen and Helsinki.

Regional cluster initiatives

Copenhagen

In Denmark, the regions have become the prime movers of cluster initiatives. The national Danish innovation and entrepreneurship policy has a horizontal focus, but greentech, welfare technology, and food are given priority.

The current five Danish regions were established in 2007 and chartered with the responsibility of drawing up and implementing regional economic development strategies. These economic development strategies put cluster initiatives and triple helix thinking high on the agenda. The yearly budget for regional development is between €30 to €60 million depending on the size of the region.

Since its inauguration the Capital Regions of Denmark has provided funding for a range of cluster initiatives covering a broad range of clusters. It has become a growing concern, however, whether these initiatives obtain sufficient critical mass. Therefore, fewer but substantially bigger cluster initiatives are now being formed.

In 2009 the cluster initiative Copenhagen Cleantech Cluster received €22 million in funding for a five year period. The initiative brings together leading Danish research institutes and universities, leading Danish companies, local authorities as well as science parks and incubators. With all the key actors in the regional innovation system for cleantech engaged in the initiative, the idea is for the initiative to kick off a leapfrog movement in the framework conditions for Danish cleantech; examples include new degrees at the universities, tailored to the needs of the cluster, and new investments in better test and demonstration facilities. By 2013 the initiative intends to bring the cleantech cluster into the European top 3.

The Copenhagen Cleantech Cluster is by far the most comprehensive cluster initiative in Copenhagen, but others are forming with a comparable organization and strategy.

The review of Copenhagen's specialized clusters did not indicate that Copenhagen sees a specialization within cleantech. Instead Helsinki came out as the most specialized Nordic capital in Power generation & transmission, which might be considered part of cleantech. The largest Nordic Power generation & transmission cluster is, however, situated in the western part of Denmark. The main research institutes for the cluster and part of the research departments of the largest companies are, however, situated in Region Copenhagen.

Regional cluster initiatives targeting Copenhagen's specialized clusters – IT, Biopharmaceuticals, Medical devices, and Transportation & logistics – are more fragmented and smaller when compared to the Copenhagen Cleantech Cluster initiative. Overall, the regional spending for Life sciences and ICT is, however, larger than for cleantech.

When compared to Stockholm's massive investments in Life sciences and both Helsinki's and Stockholm's focus on ICT, the regional initiatives towards these clusters in Copenhagen might even seem inadequate.

Copenhagen's unique specialization within Transportation & logistics among the Nordic regions could be a platform for future growth. The data have shown, however, that the general skill level of the cluster is fairly low. This is an issue that needs to be addressed if the cluster is to deliver more sophisticated logistics solutions for the world market in the future.

World class cluster-specific framework conditions

A region's wealth and competitiveness may be significantly influenced by cluster-specific regional framework conditions.

In today's globalizing knowledge society, companies compete on innovation and new business solutions. FORA has built a benchmark model with five main drivers of cluster innovative capacity: Human capital formation, knowledge creation, entrepreneurship infrastructure, and social capital.

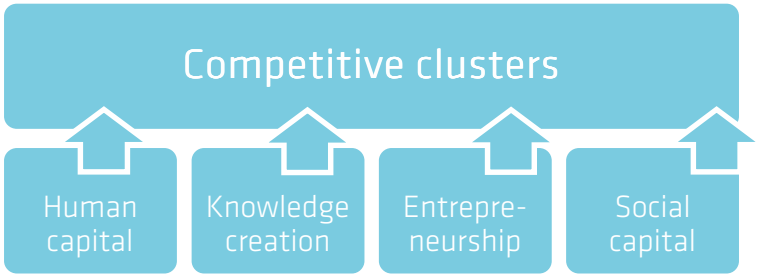
Human capital has to do with access to world class knowledge workers from regional universities or good chances of attracting workers from abroad. And it has to do with companies' ability to manage and cultivate innovative organizations where the creativity of knowledge workers is used to the full.

Knowledge creation concerns the cluster's access to leading academic and industry knowledge. Is public research, for instance, sufficiently tailored to the needs of companies?

Entrepreneurship infrastructure is about the terms for setting up new companies, and access to specialized consulting services and to venture capital. And it is about establishing an entire eco-system for high-growth entrepreneurs.

Social capital formation covers initiatives that aim to boost cluster trust and collaboration in order to maximize the benefit of having a large concentration of related players and skills in the region.

Figure 10: FORA's analytical framework for competitive clusters



Note: See FORA, 2009, for further details about methods contained in this analytical framework.

When companies in a regional cluster compete as well as collaborate, they boost innovation. Collaboration on innovation, or open innovation, is, however, increasingly borderless, and regional initiatives that aim to strengthen the international outreach of clusters are becoming more important.

In addition to these four drivers it is becoming evident that innovative public demand and smart regulation spur innovation and dynamism in clusters (FORA, 2009b).

Whether the three Nordic metro-regions have world class cluster-specific framework conditions is an open question. A benchmarking of the regions' specialized clusters against leading European, North American and Asian peers would provide new and useful inputs for future efforts to upgrade cluster-specific framework conditions.

Emerging clusters

The purpose of this study has been to provide a fact-based input for the design of future economic strategies and cluster policies.

It is obvious, however, that there are issues that this study does not address properly. Even very important and pressing issues that cluster-based economic strategies need to address.

One important issue concerns the dynamics and transformation of clusters and the emergence of new clusters. In order to stay competitive clusters need to be highly responsive to changing needs in global markets.

Cluster mapping based on employment concentration will necessarily describe existing clusters. This underscores the importance of supplementing such cluster analyses with other sources of fact when designing cluster-based economic strategies.

There is a need for timely assessments of global market trends and their impact on the regions' existing clusters.

There does not seem to be much doubt that global challenges such as climate changes will have a significant impact on the innovation activities of many companies. The same is true for societal challenges related to welfare provision such as health and security. A third global trend affecting companies' innovation activities is the growing global market for unique individual experiences and new technological opportunities for fulfilling individual needs at historically low costs.

These strong global trends will most likely be the source of new cluster formations, transforming existing and hitherto separate clusters into innovative clusters within cleantech, health-tech, and creative industries.

When addressing such emerging clusters in economic development strategies, the most important policy areas will most likely be entrepreneurship, commercialization of research, and the involvement of users in innovation processes.

The fact that existing cluster mapping delineate emerging clusters such as cleantech only poorly makes it difficult for regional policymakers to assess the performance of these clusters. There is a general tendency in both Stockholm, Helsinki, and Copenhagen to think that the regions are strong in cleantech. The metrics on which this notion is based are, however, quite different among the regions. Without internationally comparable indicators of cluster performance it is hard to determine whether the notion is justified – and whether the implemented policies are adequate and proper.

The same can be said for welfare economics and creative industries.

There are, however, techniques for mapping and benchmarking emerging clusters, thereby obtaining a fact-based input for design strategies for emerging clusters (FORA, 2009c; FORA, 2010b).

End notes

1.

Mega-cluster	Cluster
Construction	Building fixtures, equipment and services
	construction materials
	Forest products
	Heavy construction services
ICT	Communications equipment
	Information technology
Business services	Business services
Financial services	Financial services
Entertainment and leisure	Entertainment
	Hospitality and tourism
	Publishing and printing
	Sporting, recreational and children's goods
Mechatronics	Aerospace
	Analytical Instruments
	Automotive
	Heavy Machinery
	Metal Manufacturing
	Production technology
Transportation & logistics	Transportation & logistics
Life sciences	Biopharmaceuticals
	Medical devices
Processed food	Agricultural products
	Fishing and fishing products
	Processed food
	Tobacco
Power and energy	Oil and gas products and services
	Power generation & transmission
Fashion and design	Apparel
	Footwear
	Furniture
	Jewelry and precious metals
	Leather products
	Lightning and electrical equipment
	Textiles
Plastics	Plastics
Chemical products	Chemical products

2.

European metro-regions (Larger Urban Zones) with more than 1,000,000 inhabitants, according to Urban Audit Statistics, Eurostat:

Amsterdam Ankara Antalya Athens Barcelona Berlin Bielefeld Birmingham Bremen Bristol Brussels Bucuresti Budapest Bursa Dublin Düsseldorf Frankfurt am Main Gaziantep Gdansk Glasgow Hamburg Hannover Helsinki København Istanbul Izmir Kraków Köln Lille Lisboa Liverpool Lodz London Lyon Madrid Manchester Milan München Naples Nürnberg Oslo Ostrava Paris Porto Poznan Praha Riga Rome Rotterdam Sevilla Sheffield Stockholm Stuttgart Toulouse Turin Valencia Warszawa Wien Wroclaw Zürich

See www.urbanaudit.org for further details.

End notes

3.
This conclusion might be biased in favor of Copenhagen's rank within biopharmaceuticals as data are missing for Switzerland and UK which are well-known for their Life science locations.

4.
Research conducted by ETLA seems to support this finding (Rouvinen, 1996).

5.
According to the OECD, this provides the best comparison of highly skilled workers in the Nordic countries (OECD, 2006). The definition resembles the more widely used classification 'tertiary education', which also includes educations classified as ISCED 5B. The practices of classifying educations in this category is, however, slightly different in Sweden, Finland, and Denmark. Comparison of workforce skills based on 'tertiary education' generally underestimates the skill level of the Swedish workforce.

6.
Data from the OECD support the picture that productivity growth has been slower in Stockholm than in Helsinki and Copenhagen. Between 1995 and 2005 Stockholm experienced an annual growth in GDP per worker of 0.9% in constant 2000 USD (PPP), while Copenhagen and Helsinki experienced a growth of 1.3% and 1.7%, respectively (OECD, 2009).

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