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Description	一般論文

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1. Introduction

New and groundbreaking medical genetic and biological engineering achievements seems to occur almost daily. The promises of biotechnology, both in terms of technical advancements and new applications as well as future revenues are rapidly changing the environment we live in.

Regions around the world are trying to benefit from these advances in order to create a competitive bio-industry and thereby generate economic growth, employment opportunities and investments. For these bio-regions to be successful, a number of critical factors that often are referred to have to be realized¹:

- A strong science base
- An entrepreneurial culture
- Skilled workforce
- Availability of finance
- Premises and infrastructure
- Business support and large companies
- Effective networks
- Supportive policy environment

It is only by joint efforts from the different regional actors that one can create the cluster environment conducive to enhance these factors. The benefits of clustering are numerous, incl. enhanced innovation through cross disciplinary and cross-organisational interaction. Critical mass is paramount to share R&D facilities, support and skills, and stimulate commercialization. A clear focus is necessary to attract investors and world-class researchers.²

This paper gives an overview of the major bio-business regions in Sweden, how they compare to the rest of Europe and the actions needed to remain in the forefront of biotechnology competition, particularly bringing up the initiative ScanBalt. Sweden has built up excellence in networking with the other countries and regions in Scandinavia promoting regional growth. With the formation of the ScanBalt bio-cluster with Sweden as one of the major centers, this trend could grow even stronger.

2. Swedish Bio-Business Clusters

A startling fact is that Sweden with only 2.5% of the EU population account for 10.3 percent of the number of European biotechnology companies and 7 percent of the products in various stages of development. Actually the whole Scandinavian cluster stands out with 7 percent of the EU population being home to 19 percent of the European biotechnology companies and 23 percent of the products in pre-clinical or clinical development.³ During 1997-2001 the number of biotechnology companies increased by 36 percent⁴ and numerous factors are behind Sweden's success in the formation of new biotechnology companies.

Unlike in most other countries, the university researcher who makes a discovery owns the rights to it. This so-called Teacher's Exemption Rule has influenced the rapid growth in the number of patent applications and created a natural entrepreneurial spirit among researchers resulting in a great many biotech start-ups coming out of universities.

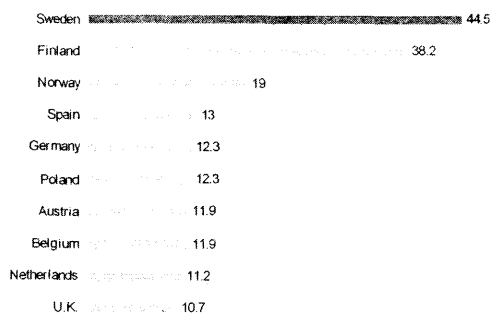


Figure 1: Share of European firms with co-operation arrangements with universities or government research institutions 1994-6, percent

Source: OECD, Science, Technology, and Industry Scoreboard, 2001

Given the complexity and pace of change, success requires collaboration across multidisciplinary research groups and between corporate and academic research. A study by the OECD, covering business and academic research

³ The European Biotechnology Report 2003, p4 and p38

⁴ Swedish Biotechnology, p108

⁵ A comparison of the dynamics of industrial clustering in computing and biotechnology. pp. 1139-1157

¹ BioCluster and BioIncubators, slide 6

² BioCluster and BioIncubators, slide 7

between corporate and academic research. A study by the OECD, covering business and academic research collaboration across a range of industry sectors, shows this is more common in Sweden than anywhere else: 45 percent of all firms with more than 50 employees actively participate in joint R&D and innovation projects with other organizations, Figure 1.

The issue why biotech companies select various locations has many possible explanations. According to a study by Swann and Prevezer⁷, in biotechnology, the main attractive force was the presence of a strong research base, and to some extent, industrial employment in key sectors. This has led to that biotechnology companies usually locate near research centers and larger cities and that is also the case for Sweden.

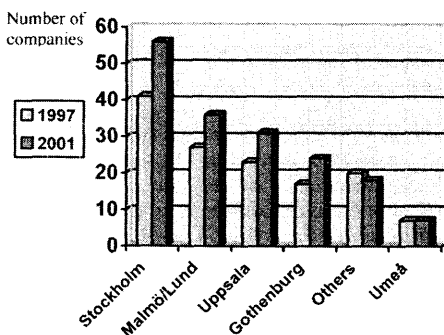


Figure 2: Number of companies in 1997 and 2001 per city
Source: Swedish Biotechnology, p108

According to Figure 2, most Swedish biotech companies are primarily located in four metropolitan areas with large universities, i.e. Stockholm, Uppsala, Gothenburg and Malmö/Lund. From 1997 to 2001 the growth of the industry to these four cities ranged from 33 to 41 percent, while outside these four cities the number of companies did not increase. Following, the main characteristics of the three major Swedish clusters, Stockholm/Uppsala Bioregion, Medicon Valley and MedCoast will be examined.⁹

2.1 Stockholm/Uppsala Bio-region

With 2.1 million inhabitants the region is comparable to San Diego in size. The region hosts one of Europe's largest medical universities, the Karolinska Institutet (KI). KI conduct roughly 45 per cent of the entire nation's state funded medical research. Combined with the Royal Inst. of Technology and Stockholm Univ. as well as Uppsala Univ. and the Swedish University of Agricultural Sciences (SLU) in Uppsala, the breadth of research activities in the region provides a fertile ground for innovative research and new inventions.

In Figure 4 it is clearly shown that the amount of research being conducted is linked to the number of biotech

⁶ Swedish Biotechnology, pp 73-74

companies in the region. Therefore, a strong research base is paramount to generating a large number of companies. Home to the Nobel Prize, Stockholm will always attract the most prestigious researchers' attention and thereby improve the networking with the world's scientific community.

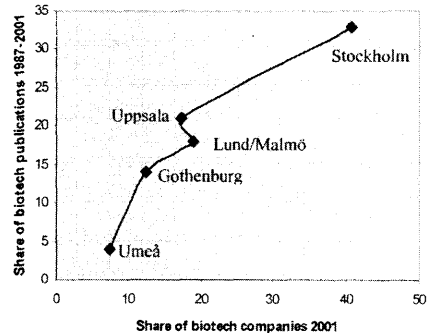


Figure 3: Correlation between share of biotech companies and research output among universities
Source: Swedish Biotechnology, p108, 112-113

With about 440 life science companies and strong presence of AstraZeneca, Pfizer and the biotech tools and supply sector in Uppsala, Stockholm/Uppsala Bioregion is poised to be an attractive city for commercialization of research. Uppsala has been especially good at building up networks between companies and supporting organisations, largely based on personal contacts between former Pharmacia scientists and managers who have been freed-up to channel their expertise and talents into start-up companies and projects.

2.2 Medicon Valley

Since its establishment in 1997 Medicon Valley has made its name worldwide known through active marketing. With the launch of the Öresund bridge in 2000 the region has received strong support from the EU as an example of cross-border collaboration. Joining the county of Scania (Skåne) in Southern Sweden and the greater Copenhagen area in Denmark, the Swedish side can now access Copenhagen international airport in 20 minutes.

The region employs around 34,000 people in the life science industry and is home to about 450 life science companies. The infrastructure and scientific base is especially strong with 5 science parks, 20,000 scientists, 12 universities, 140,000 students and 26 hospitals. The major center for research is Lund University and the Ideon Science Park has been hosting some 400 companies (incl. IT and other sectors) since its start in 1983.

Contributing to the networking is the Medicon Valley Academy. Its 250 members consists of industry, university and hospital representatives.

Four fully integrated pharmaceutical companies; Novo Nordisk, Lundbeck, AstraZeneca and Leo Pharma are attracting skilled personal and contribute to the industry-

academia exchange and cross-fertilisation in the region. With about 10 new companies per year being established the major worry today is the bottleneck of attracting enough scientists for the growing industry.

2.3 MedCoast

In response to the advances of Stockholm/Uppsala and the Medicon Valley, Gothenburg and Västra Götaland has linked up with the greater Oslo area forming a 3 million people cluster. Apart from encouraging networking one of the main tasks is to harmonize efforts between Norway's FUGE and Sweden's SWEGENE functional genomics programs to further strengthen the scientific infrastructure. SWEGENE combines facilities at Gothenburg University, Chalmers Institute of Technology and Lund University. Eventually, MedCoast hopes to collaborate with the Danish's BRIC thereby forming a seamless research infrastructure from Oslo in the north to Copenhagen in the south.

3. Comparison with other European clusters

Stockholm/Uppsala Bioregion and Medicon Valley are both competing on a global arena to attract new companies and competencies. The two most important aspects determining industry growth and which regions that will be the leaders of tomorrow are: strong research capability and the ability to convert research into successful commercial activity.¹⁰ Here we will look at how these two regions are doing compared to other U.S. and European biotech clusters.

In overall research performance, Stockholm/Uppsala and Medicon Valley are well-positioned among European biotech clusters. Figure 4 shows the combined number of publications and Figure 5 the combined impact (average number of citations per paper) for the entire Medicon Valley region, comparing these figures to those of other strong biotech regions in the world.

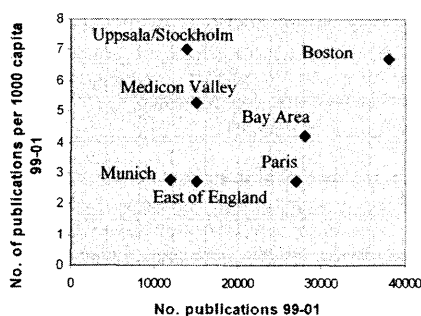


Figure 4: Volume of biomedical publications/capita
Source: Commercial attractiveness of biomedical R&D in Medicon Valley, p16

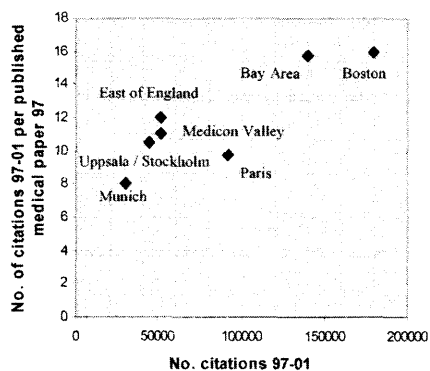


Figure 5: Research impact for selected biotechnology clusters 1997-2001
Source: Commercial attractiveness of biomedical R&D in Medicon Valley

In Figure 6 the average size of companies and the number of companies are compared. Stockholm/Uppsala and Medicon Valley position themselves among the top regions in continental Europe but is outperformed by East of England. Here again the Bay Area and Boston plays in an altogether different league.

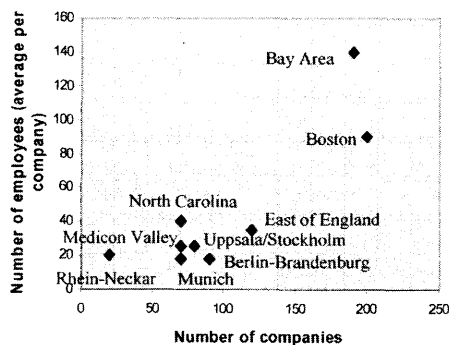


Figure 6: Comparison of US and EU bio clusters
Source: Swedish Brain Power, p43; Positionierung Deutscher Biotechnologie-Cluster im Internationalen Vergleich; Medicon Valley Academy homepage

4. ScanBalt - a European Macro-region

With biotech clusters in Europe now in the hundreds there is a risk that public resources for research will be spread out and that regions are out-competing each other rather than developing healthy relationships, thereby worsening the environment for European biotech companies in relation to the U.S.

The EU has aimed to restore European leadership in life sciences and biotechnology research. The 6th Community Framework Programme (2002-2006) proposes this area as the first priority in constructing a European Research Area.

⁷ Signs of Life, p3

The program encourages cross-border networking also between developed and less-developed regions. Another initiative by the European Commission is the framework entitled "Life Science and Biotechnology – A Strategy for Europe" in which they propose three main pillars for action: the resource base, networks and a pro-active role for public authorities.¹¹

With comparatively small populations and long distance between the cities, the Nordic countries have had a tradition of networking and building strong links with neighboring cities and countries. The countries are now starting to share infrastructure. However, the need for skilled people is even greater which the countries on the other side of the Baltic Sea could provide.

Country	Inhab. (Mil. inhab)	GDP per capita (US\$)	Univ. (Bio / Life Sc.)	Biotech comp.	Bio-valleys
Denmark	5,33	25.500	6	~100	~4
Estonia	1,42	10.000	2	~20	-
Finland	5,17	22.900	10	~125	~5
Germany (North)	5,25	23.400	6	~100	~4
Iceland	0,28	24.800	1	~20	?
Latvia	2,39	7.200	2	~15	?
Lithuania	3,61	7.300	3	~5	?
Norway	4,48	27.700	6	~60	~3
Poland	38,63	8.500	15	3	-
Russia (West)	7,90	?	14	?	-
Sweden	8,86	22.000	12	~170	~8
Total	~85		67	>700	>>20

Table 1: Biotech/Life Sciences in the Baltic region
Source: ScanBalt homepage

To cater to this need and capitalize on the EU initiatives the organisation ScanBalt was formed in 2002. Promoting itself as "The Network of Networks" they represent 11 countries, 85 million people, 63 universities and >700 Biotech/Life Sciences companies, see Table 1. ScanBalt could prove valuable to many different stakeholders in the region such as the ScanBalt network itself, the bioregions, foreign and domestic investors, universities and for Europe as is explained below.

Through the ScanBalt network one get direct access to available, experienced and highly educated manpower. The Bioregions can enhance critical mass and catalyse collaboration between SME's, By bundling forces and building up common information and project platform, the regions can enhance visibility and attract private and public investors. The possibility of using a West-East platform in industry and science that adheres to the highest standards in science, education, clinical practices, production and service in combination with the growth perspectives of one the most dynamic region in Europe, constitute a most attractive offer to a potential investor. For the universities the region is a sizeable, functional and attractive platform for exchange, recruitment, spreading of new ideas and complementing

research and education. ScanBalt could become a model region for Europe since the initiative is very much in line with EU ambitions to promote interregional/international collaboration in order to harmonise funding and regulations, and create units with larger critical mass.

ScanBalt is now taking several measures to facilitate networking in the region. Worth mentioning are projects to build up a common IP infrastructure, establish a ScanBalt university, promote harmonization of biobanks and ethics laws, encourage educational mobility and networking of research activities such as Bio-Nanotechnology, Stem Cell research and Marine biotechnology.

Just as the Stockholm/Uppsala, Medicon Valley, MedCoast and other relatively sparsely populated biobusiness clusters have been successful in creating relatively many new biotech companies and have drugs in the pipeline by building links with each other, the cross-border networking in ScanBalt inter-zone will most probably drive growth even further by complementary exchange of expertise and experience.

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⁸ Life sciences and biotechnology, p10