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Ict Clusters In European Cities: The Cases Of Helsinki, Manchester And The Hague

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ICT clusters in European cities: The cases of Helsinki, Manchester and The Hague

Paper for the 40th congress of the European Regional Science Association

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Abstract

The ICT (information and communication technology) sector is at the centre of interest to cities, that see the sector as new source of wealth and employment. This paper describes and analyses ICT clusters and cluster policies in three European cities: Manchester, The Hague and Helsinki. The clusters show a very diverse development pattern, mainly due to differences in the spatial-economic structure of the cities and their position in their national urban systems. It is concluded that development chances depend on the initial size and quality of the cluster, the degree to which local knowledge-resources are exploited, the structure and quality of the local demand for ICT products and services, and very importantly, the quality of the urban living environment.

1. Introduction

The ICT (information and communication technology) sector is at the centre of interest to cities. Many of them invest heavily in developing and attracting this promising sector, and develop policy tools to boost them. Also in academic circles, the development of ICT business in its urban/regional context attracts much attention. Researchers from many backgrounds (economists, sociologists, urban planners), are occupied by the question why developers of distance shrinking technologies often tend to cluster together. Many are inspired by the buoyant success of Silicon valley as concentration of ICT activity. The subject of this paper is the development the ICT sector in three rather “old” cities: Manchester, The Hague, and Helsinki. We assess the cluster’s development, describe the policies cities pursue to strengthen their local ICT clusters, and finally attempt to identify important differences in ICT cluster development in different cities.

What does this paper add to the existing busloads on ICT cluster research? To begin with, comparative urban studies in this field are very scarce. Second, the problem with many existing studies is that they are very general in their assessment of ICT clusters, i.e. they do not discriminate between ICT developments in different types of cities. In this way, large differences between cluster developments in different types of cities remain unrevealed. By taking three very different European cities and comparing, we hope to contribute to the understanding this diversity. At the other extreme, there are a number of studies focussed on very special cities, notably on world cities such as New York, London and Tokyo, but also on well-known high-tech cities such as Cambridge (UK), Boston and Seattle. Less “visible” cities such as our cases are greatly underrepresented in ICT cluster research. Finally, the approaches of many geographers focus on large regions, such as Silicon Valley and Route 128 (Saxenian 1990, 1994; Scott, 1995), which implies that the typical urban dimension is under-emphasized.

The paper is organised as follows: section 2 reviews the relevant literature on (ICT) clustering and urban development, and elaborates on the methodology used; section 3 contains a brief description of the ICT cluster in the cities of Manchester, The Hague, and Helsinki; section 4 describes urban policies that the case cities pursue to strengthen their ICT clusters. In section 5, the clusters are compared along several relevant dimensions that are derived from the literature. Finally, section 6 draws conclusions and identifies issues for further research.

2. ICT sector growth in urban regions: some notions from theory

Due to technological and economic developments, the ICT sector is booming. In Europe, growth figures of the sector are impressive. Total value of the European market amounts to EURO 365 billion, 5% of the European GDP, and this percentage is rising rapidly. (EITO, 1998). The cities in our study have the clear ambition to benefit from the growth of the ICT sector and become a strong ICT centre. What can be learned from the literature about cities' chances and possibilities in this respect? A number of studies have appeared on the location behaviour of innovative industries such as the ICT sector, but also on the opportunities and constraints for cities to develop these industries.

Several authors observe a strong spatial clustering of innovative industries. To explain this, some stress the importance of inter-firm co-operation and regional knowledge transfer (among many others Boekholt, 1994; Malmberg et al. 1996; Lazonick, 1992; Cooke, 1995). The argument is that in fast changing business environments, interfirm knowledge and information exchange greatly benefits the development of the sector, because it stimulates and speeds up innovation processes, and facilitates specialisation. Knowledge can be transferred via people changing jobs within the region, or via supplier relationships, or via joint product developments. Spatial proximity greatly enhances all these types of transfer. Some also point at other factors stimulating regional knowledge transfer, such as cultural proximity and trust, needed to share valuable information. (Aydalot and Keeble, 1988; Putnam, 1993).

Others have pointed at the importance of universities for the development of ICT clusters. An outstanding example is the role of Stanford University in the development of Silicon Valley (Malone, 1985). Van den Berg, Braun and van Winden (1999) discern several roles of universities: as source of spin-out companies (founded by students or staff), as supplier of new employees for the cluster, or as partner for the local industry in research projects.

A very relevant issue is the role of large, transnational companies (TNC's). They play a pivotal role in the way local innovative networks relate to global networks. Malmberg et al.(1996), and Van den Berg, Braun and van Winden (1999) stress that if a TNC is rooted and integrated ("fledged") in the region and engaging in regional networks, it can act as an important disseminator of new knowledge, information and innovation from abroad into the region. This is particularly relevant for research and development

activities: knowledge flows are facilitated by personal relationships, and mobility of employees or spin-outs from the large firm.

Hall (1998) stresses the special advantage of (some) urban regions for ICT activity. He points at the fruitful marriages between ICT and typically urban sectors such as cultural and entertainment industries. Cities with particularly good prospects are those with a thriving cultural life, a rich history, and high quality of life. Mitchell(1999) sees a bright future for cities with a rich cultural life, a nice urban scene, and a good climate, as these places will be able to attract the (increasingly mobile) most talented professionals.

In his study on industry clusters, Porter (1998) stresses the importance of large and critical local demand as condition for cluster development and trigger for innovations. This demand may be important for ICT clusters as well: there is some evidence that ICT-firms tend locate near their main customers, in regions with high concentrations of financial and business services (Roost, 1998).

Approach

In this paper, we study ICT clusters in Manchester, Helsinki, and the Hague¹. These cities have in common that they explicitly strive to develop their ICT cluster. At the same time, the cities are very different in their economic structure and their position in their national urban systems, which makes comparison more interesting. The analysis leans on the findings of the literature summarised above, from which the following relevant questions are derived:

- What is the role of (local) demand in the urban cluster's development?
- What is the role of large firms in urban ICT cluster development
- What is the role of the research and education infrastructure in ICT cluster development?
- What is the role of the quality of life in urban regioes as determinant of ICT development?

For each case-city we thoroughly reviewed the available reports and studies on the cluster involved. On that basis, we were able to identify key (public and private) actors in the cluster. After this, we executed in-depth interviews with key representatives. In

¹ and gathered additional information on the cluster of Amsterdam.

our analysis we encountered severe data problems, seriously hampering a comparative analysis on the basis of data only. To start with, each city uses its own definition of what its ICT cluster consists of. Also, the regional scale to which the data apply differs: For Manchester for instance, only ICT employment data for the North-West region were available. Also, it proved hard to figure out and compare the numbers of ICT students in the various cities, as each university has its own definitions. We encountered similar problems in assessing the quality and quantity of ICT (and related) research in the universities. Fortunately, interviews with key people yielded invaluable information. In open interviews, the interviewees were asked to express their view on the local cluster development, the relation between the ICT sector and the local economy, the role of the research infrastructure and the electronic infrastructure, as well as local ambitions and policies with regard to the ICT sector.

3. The clusters in Manchester, The Hague and Helsinki

This section contains a brief description of the ICT clusters in the three case studies, to introduce the cases and sketch a picture of their ICT clusters.

Manchester

The city of Manchester is the capital of England's North West region. It counts 440,000 residents and forms the heart of the Greater Manchester area with a population of 2,578,000. Manchester, the cradle of the industrial revolution, has to cope with severe economic restructuring as the manufacturing sector started to decline from the late 1960s onwards. The city has experienced severe problems, in common with many other major industrial cities in Europe and the US. Between 1975 and 1990, Manchester lost over 100,000 manufacturing jobs and approximately one-third of its population. In the same period the service sector created many new jobs, but the problem was that most of these new jobs did not go to the people displaced by the job losses in manufacturing. For years, the economic performance of the greater Manchester area has been below the UK European averages in terms of Gross Regional Product and unemployment. From this perspective, the Manchester City Council views the ICT sector as new and desperately needed source of urban wealth and employment. (Carter, 1997).

The city of Manchester is the principal centre of ICT activity in the North West region of England. (BT, 1999). The cluster is diverse, and contains electronic components and

networks systems hardware manufacturers, software developers, internet service providers, internet developers, ICT consultancy business. There is no clear specialisation. Most firms predominantly operate for the regional market, but in some respects, the cluster has a function that supersedes the regional dimension. For instance, the region hosts some of leading ICT firms' European headquarters (see box). The size distribution shows that there are several very large firms, as well as around 1,000 of smaller ICT firms active in software development, internet and telecom firms; their number has been rising sharply in the last years, as is reflected in the development of the Manchester Business Park². In the region of North West, 30,000 people are employed in the ICT (MIDAS, 2000), a substantial part of them in Manchester. A major asset of Manchester are its universities. The region counts 4 universities, with a total students population of 77,316. In 1997, collectively, the four universities produced some 1,000 graduates in computer science and IT; another 2,300 graduate in engineering and technology related disciplines (Higher Education Statistical Agency, 1998).

Types of ICT business in Manchester

European headquarters: ICL/Fujitsu (1,500 staff), Siemens (energy and automation Division) 500 staff, Brother international Europe (350 staff), Sharp (UK) 400 staff

Main regional operation: IBM, Cap Gemini, Sun, Bull, Logica, ICL, Oracle, Sema, Andersen Consulting, HP

Fast growing software companies: Infogames, CMG, Admiral, S1

Fast growing Manchester Internet Companies: Powernet (Internet Infrastructure), TeleCity (Internet services), Kewill (E-commerce), XHTML (Internet Infrastructure), Harbinger (E-commerce Solutions), Burns Open Systems (e-commerce)

The Hague

With 445,000 inhabitants, The Hague is the third largest city of the Netherlands and is the seat of the Dutch national government. It hosts virtually all the national ministries, as well as foreign embassies and other diplomatic functions. The cities' ambition is to

² Started in 1984 with one building, the Park currently consists of six buildings accommodating 45 technology-based companies, with around 550 employees. Construction has commenced on a second site on the City-International Airport parkway, which can potentially double its size (<http://www.mspl.co.uk/>)

become a strong ICT/telecom city, which forms part of its general strategy to develop more (international) private business (City of The Hague, 1999).

The Hague counts several headquarters of telephone service providers, among which the headquarters of Dutch market leader –and former state monopolist- KPN, which has the Hague as a home for many years. It is only since the second half of the 1990s that the cities' ICT sector began to grow. The fastest growth was realised in the last years, with the arrival of the mobile communications service providers Ben (320 staff) and Dutchtone (550 staff), which are new entrants (since 1998) in the liberalised Dutch telecom market. They are owned by foreign companies (City of The Hague, 1999). For these firms, The Hague was also attractive because of the nearness political decision makers relevant for the telecom sector (several ministries, and the telecom regulation body, the OPTA).

In the slipstream of these telecom providers, The Hague attracted technical equipment firms such as Alcatel, Siemens and Nokia, mainly functioning as sales outlets and customer services centers, not R&D facilities. Other well-known players are amazon.com, the American e-bookstore, that has recently opened its European headquarters in the centre of The Hague (staff: around 400), serving as European call-centre and logistics control centre for the European market. Another North American internet-firm in the Hague is Mapquest, a leader in interactive geographic information systems. These companies wanted to locate in The Netherlands anyway, but choose the city of The Hague for its international atmosphere and the availability of (ICT) staff. ICT educational facilities in the region are the Haagse Hogeschool (2,600 students in the field of ICT), and the Delft Technical University (1,850 students) nearby (<http://www.its.tudelft.nl/>).

It's not only large players in The Hague: Along the highway, branches of ICT consultancy companies are located (such as CMG); also the cluster counts some small and young firms active in software development, all kind of internet business, e-commerce companies and so on. The adjacent cities of Delft and Zoetermeer also host a lot of ICT activity. A certain specialisation of ICT activities can be observed: in The Hague, headquarter functions of telecom firms dominate the scene, although (new) media firms and small ICT firms are also present thanks to the "urban atmosphere" and the presence of so many clients. Zoetermeer is particularly strong in software and IT-consultancy companies: its relatively good accessibility makes it a good location for these firms, that frequently interact with clients all over the country. Delft, home of the

large Technical University, has a "natural" attraction as R&D centre in the field of ICT: it hosts a rich variety of small and medium sized ICT firms, some of them concentrated in commercial business-centres.

Helsinki

With a population of 532,000 Helsinki is by far the largest city in Finland. The region's economy is strongly dominated by services; some 80% of employment fall into that category. Manufacturing is much less important, in particular compared to Finland's average. Finland is a very advanced country when it comes to the production and application of state-of-the-art telecommunication services and new media services. It has the highest penetration rate of mobile telephones in the world, exceeding 50% in 1998, and internet and new media services are also relatively widespread. A basic reason for the high penetration rates of new communication devices, the low prices and the success of Finnish telecom service and equipment producers can be traced back to the early liberalisation of the Finnish telecom market. Helsinki is the principal ICT cluster in Finland. One player is very dominant: Nokia. This firm is famous for its development and production of mobile telephones. With a global market share of 21%, it is a true world leader in the field. Nokia has grown tremendously during the last few years³. The firm employs 7,000 people in Helsinki, 22,000 in Finland, and 42,000 world-wide. (Nokia, 1998). There are very many smaller firms in the Helsinki region active in ICT. Many of them have some links to Nokia, as suppliers of parts, components, software or other services. Other customers of these firms are buying new media services mainly for the purpose of corporate communication, internal communication and advertising (Media Studio, 1997). Besides, foreign equipment manufacturers have establishments in Helsinki. An example is Eriksson, the Swedish competitor of Nokia, which employs over 1,000 people in the Helsinki region. Another important category of players in the cluster are the providers of telecom services, such as telephone companies of different kind and size, internet providers and others. The largest among them are Sonera and Finnet Group (Finnet Group, 1996). The research and education infrastructure is well developed, with a technical university, a university of art and design a general university and several polytechnics.

4. Urban ICT-policies

All our case cities seek to be (or become) a principal centre of ICT, as can be read in the official strategy documents. Evidently, a number of relevant variables that determine the development of a cluster cannot be influenced directly by urban policymakers but are rather national or European competencies. Examples are telecom market regulation, competition policy, tax policies, and research and education policies. Still, a number of instruments are left to urban managers. We discerned four types of cluster-specific policies: Starters policies, infrastructure policies, ICT adoption policies, inward investment policies, and finally, the development of business locations for new-economy activities. We have deliberately left out the internal ICT policies of the cities (such as introducing local e-government, e-democracy and service provision), as the impact of these policies on the development of the urban ICT business clusters is only very limited.

Starters policies

Starters policies are popular with urban managers: they realise that start-ups in the ICT sector may grow fast and contribute to the future urban economic development. New firms create dynamics, they offer employment, create value added, and may act as useful suppliers for existing firms in a cluster. In the cities, we found several types of starters support policy, ranging from low-key information provision to the offering of substantial aid programmes, and from very general approaches to ICT-firm specific programmes. The most integrative approach was found in the starters facility in Helsinki, that offers not only office space and all kinds of legal and administrative support but also offers starters access to networks of established firms in the region. Also the incubation initiatives in Manchester are not restricted to seed capital provision, but also offer substantial administrative and business support. The university incubator company, Campus Ventures, usually takes a share in the start-ups, and has thus a direct interest in its success. In all cities, the municipality financially supports start-up support in any way, but the actual exploitation of the support policies is left to a specialised organisation: in Manchester and Helsinki, support is given by public-private companies (Culminatum in Helsinki and Campus Ventures in Manchester). In The Hague, the

³ In the period from 1993 to 1997, net sales more than doubled, from FM 22,000 million to FM 52,000 million (Nokia, 1998).

chamber of Commerce offers "starters packages" with general information, and the Polytechnic helps its own students with ICT-start-ups.

Infrastructure

Traditional telecom infrastructure provision used to be a task of state-owned telecom monopolists, that owned and maintained the networks and also provided services. They provided national access without much regional discrimination. Additionally, local-government owned cable networks that transmitted television and radio programmes in the cities. In the last 10 years, in Europe the situation has changed (and is still changing) drastically. Most old telecom monopolists in Europe are privatised, have to compete with new carriers and allow service providers on their networks. New infrastructure-providers are developing electronic infrastructure (glass fibre networks), some European wide (KPN Quest), some national, some global (MCI-Worldcom). These firms do tend to be spatially discriminating: generally, they follow demand, which means that big "telecom spending" agglomerations end up to be much better connected and served. Additionally, many of the local cable companies are "eaten up" owned by large telecom-providers. The former cable company of The Hague, Casema, for instance, is now owned by France Telecom. As a result, cities have lost control over their cable-networks.

So, what are urban managers doing to influence the electronic infrastructure in their cities? In Helsinki, the problem is not urgent. As national capital, it is excellently "cabled and wired". The City of The Hague is in a different position: this city is not a hub on the carriers networks. To change this, the city has chosen an innovative approach: it tries to convince carriers to extend their backbones to the city of Hague. To that end, it has commissioned a study into the telecom-demand potential. It proved that The Hague has potential comparable to Rotterdam but is not connected.

ICT adoption

All the three cities run programmes to enhance ICT adoption by firms in their city. In this way, they not only seek to improve the competitiveness of "old economy" firms (mostly SME's), but also indirectly stimulate the ICT sector by growing its client base. Manchester and The Hague run projects to help SME's make the shift to the information economy, by offering them free advice in the form of consultancy days (The Hague), or cheap advice (Manchester). Manchester uses ERDF money to fund

these policies, and leaves the technical support to a university-based organisation; In the Hague, the project is carried out by Syntens, a regionally active organisation of the National Ministry of Economic Affairs. It is unclear what the impacts of these programmes is on the development of the ICT clusters in the respective cities, although we feel that the effects should not be overestimated.

Creation of ICT-intensive areas

Some European cities explore the possibilities of the future by building futuristic urban quarters "loaded" with the latest technology. In this way, they seek to make their city attractive as seedbed for new technological and infrastructure development, and seek to increase the number and quality of interactive services that are offered. Helsinki's Arabianranta area is an outstanding example, located at six km from the centre of Helsinki. This large site (about 85 hectares) is intended to become a so called "Art and Design City" within the city of Helsinki. The scheme's aim is to turn Arabianranta into one of the leading ICT-areas in Europe, where the functions of living, working, studying and recreation are mixed. The project is planned to be completed by 2014. The area hosts already 4,000 residents and 3,000 jobs; these numbers are intended to increase to 12,000 jobs and 8,000 residents respectively. An integral development strategy has been adopted, in which there is space for such complementary activities as research, business, education and housing and shopping. Already, 50 to 60 firms are present on the site, employing some 300 people. The number is growing as the site is very popular. Many of the small firms work for larger firms in the region, such as Ericson, Nokia, Siemens and Sonera. The university of Art and Design is also located on the site, already since 1985. Also, new high quality housing and shopping facilities are being constructed. A concert hall with a capacity of 300 places is planned. The electronic infrastructure of the Art and Design city will be very sophisticated. A region-wide broadband fibre network will be implemented, with open access for all residents, schools and businesses. The intranet offers opportunities for teleworking, -shopping and -banking, tele-health and library services. The site proves attractive for large firms such as Sonera telephone corporation, and Nokia. For one thing, these firms can benefit from the superior quality of the electronic infrastructure by using the area as a test-site for new products, or as a showcase to display what is possible in the future.

Inward investment

The three cities seek to expand their local ICT sector with marketing efforts directed towards foreign ICT companies. In Manchester, the inward investment agency has designated ICT as spearhead sector. It offers US and Canada based firms general info on the region, and supports them to find a good location, and staff and tax reduction and subsidy possibilities. The organisation works on a regional basis: it is owned by not only the City of Manchester, but also by the neighbouring cities of Salford, Trafford, and Tameside. It uses “Manchester” as brand name to sell the region. In the Hague Region, on the contrary, co-operation is not so smooth: the neighbouring cities of The Hague, Delft and Zoetermeer, all have their own inward investment policies and strategies. The lack of co-ordination leads to unfruitful and inefficient inter-municipal competition. Distrust among the regional policy makers is the main reason. Despite this, The Hague managed to attract Amazon.com and Mapquest’s European headquarters, as well as new telecom providers. Helsinki Metropolitan Development Corporation Oy HMDC is a company which promotes international business in the Helsinki Region. HMDC is a joint-stock company owned 52 % by the City of Helsinki. Other shareholders are the municipalities around Helsinki, The Uusimaa Regional Council and the Chambers of Commerce in Helsinki and Espoo. It markets the area as a suitable location for international business and co-operation and promotes the it as a major business center of the "new northern Europe". IT is one of its target sectors. Also, it helps small and medium-sized enterprises in the region expand their business abroad.

5. Different cities, different clusters.

All the three cities benefit of the rapid general growth of the ICT sector, and actively seek to expand it with various policies. Section 3 shows that the cities' ICT clusters differ considerably, in respect to their size, market orientation, and specialisation. In this section we will further highlight the differences between them, along the question raised in section 2; we look at 1) the role of local demand, 2) of large firms, 3) of research and education facilities and 4) the quality of the urban living environment in the development of the ICT clusters in our case studies.

Different role of large firms

The presence in the urban area of a dominant strong ICT firm may have a strong positive effect on the cluster's development in a number of respects. First, it may give

the hosting city an internationally known "ICT-image". Second, it provides for a pool of qualified labour, which makes the city attractive for competitors that may "buy" staff; third, especially if the firm has an open culture, it serves as important client for other ICT-related firms (suppliers); As they are active in international partnerships, they have access to global source of knowledge and technology, some of which is transferred in the local economy. Also, often a large firm spinn-offs in terms of new companies that are started up by its staff.

In Helsinki's cluster, Nokia plays all these roles. Nokia has developed as market leader in mobile telephones, and is the largest European company in terms of market capitalisation. The firm has put Helsinki on the map as international ICT centre; indirectly, it generates a lot of employment in Helsinki as it leans heavily on local ICT suppliers (software developers, internet companies). This bears risks as well. In Helsinki, many firms are strongly dependent on assignments of Nokia. A possible downturn of such a dominant firm may have detrimental impact.

In the Hague, albeit to a much lesser extent, KPN (the former Dutch telephone monopolist), plays a pivotal role in the cities' cluster development. The impact mainly runs via the labour market: the presence of a pool of specialised telecom-staff at KPN was an important reason for the new entrants Ben and Dutchtone to locate in The Hague. Many former KPN staff members are now employed in these companies. Manchester doesn't have a "local-grown" ICT-leader within its territories, although it has managed to attract big international ICT companies. More research is needed to answer the question whether a local grown flagship firm adds more value to an ICT cluster than an "imported" company, but it can be assumed that the last type of firms are less tied and integrated to a region.

Different Demand Conditions

In line with Porter's argument in his work on clusters and competitive advantage (Porter 1990, 1998), we found indications that the development direction of an ICT cluster is strongly related to the economic structure in the urban region. The most "heavy" users of ICT are corporate headquarters, financial institutions and the media industry. (Saxenian, 1994; Hall, 1999). Particularly the rapid development of on-line banking and new media (online publishing, web-TV and radio) and entertainment services provide a mixing of the ICT sector and the banking and media sectors.

In Amsterdam, the demand side is particularly favourable for ICT business. The strong financial sector is an important driver behind its ICT cluster growth (KPMG, 1999), but also the presence of many publishers, advertisement agencies and other segments of the media industry –Amsterdam is the Dutch media capital- provide it with a rich and demanding client base. To a lesser extent, this holds for Manchester. Although London is England's undisputed financial capital, Manchester is an important regional financial center for the countries Northern parts. Also the media-industry, another big ICT spender, is overrepresented in Manchester, with locations of BBC and Granada TV. From a recent survey in the ICT sector, a number of companies judge the presence of the clients base as important location factor (Midas, 2000). In The Hague, the strongly represented public administration functions and its publishing houses exert a high demand for ICT products and service. On the other hand, in The Netherlands' Randstad Area, the distances between the four large cities The Hague, Amsterdam, Rotterdam and Utrecht are in fact so small that it is questionable whether the local demand plays a role in the location decisions of ICT companies.

The case of Helsinki demonstrates the importance of *critical* demand for a cluster's development: thanks to early market liberalisation, the local telephone companies had to compete already in the 1980s to gain or retain their customers, and therefore needed innovative networks and equipment. In that way, they gave local producers of telecom equipment -Nokia is the best example- an important incentive to innovate, and laid a basis for the current success of the cluster.

A critical question in this discussion is how important is distance to its clients for an ICT company? Our interviews suggest that much depends on the complexity and "repeatedness" of the transactions. There are indications that only for advanced ICT services, proximity between principal and client is necessary. This is the case in complicated innovation and reorganisation processes –for instance when a company introduces e-commerce-, or with the development of new business concepts. It should however be noted that for many other information services, physical proximity with clients is not important. This holds for, instance for standardised processing of data in back-offices or call-centers. Also, there are many examples where more or less

standardised programming jobs are outsourced to remote parts of the planet, enabled by telecommunications⁴.

Different role of the research and education infrastructure

The public research and education (R&E) infrastructure, here defined as universities and polytechnics, is an important part of any ICT cluster, in several respects: as source for staff for the urban ICT industry; as generator of new knowledge (although this role should not be overestimated); and as source of new start-up firms. All the cities in this investigation stress the quality (and quantity) of their universities in their promotion activities to attract foreign ICT firms. From many surveys, ICT companies attach heavy weight to their infrastructure in their location decisions.

An important issue is the degree of co-operation between universities and the local ICT industry. More co-operation and interaction is better for the cluster development: Companies can benefit from the resources of the local universities such staff, trainees, but also research results. For the university, co-operation generates financial resources, helps to focus research activities on matters that are relevant for business or society, and thus entail a more efficient spending of (public) money. It may also increase the quality of the research, since the demands of the market are generally high. In all cities in this study, we found co-operation projects, ranging from contract research (Helsinki) to specific education for ICT entrepreneurs and ICT adoption for SME's (Manchester). However, incentives often work in the opposite way: for universities, what counts most is the volume and level of publications; applied research for the industry is esteemed much lower. A striking example in Manchester is the transformation of its Polytechnic into a University, in the 1980s. The former polytechnic used to have many links with industry and executed a lot of applied research. During the last decade, the focus has shifted to theoretical research as attempts to score higher in scientific rankings.

Particularly in Manchester and The Hague, a major problem hampering fruitful university-business interaction proved to be the cultural difference between the business sector and universities in terms of objective-orientation and time span of activities. Although university-related policies are in most cases on a national level, there might be a role for urban government to break these barriers: the potential economic spin-offs of

⁴ Bangalore, India is a place where many relatively cheap but well-educated programmers work on

university-industry co-operation for the region can be high. In Helsinki and The Hague, ICT companies have some influence of the education programmes.

Starters initiatives -to help student or staff start an ICT company- are launched in all the cities concerned, although the degrees differ. In Manchester, a private company is active in the stimulation of start-ups from the university. It offers space, legal/financial and administrative support, and provides access to university facilities such as labs and high capacity networks and computers. Start-ups pay royalties to the company, as certain % of their turnover. In the last 5 years, 50 start-ups were guided, offering a total of 200 jobs. In Helsinki and The Hague, the universities are less involved in starters policies.

Different quality of life, metropolitan ambience

Labour shortage and rapid business expansion make that there is a great and increasing global competition for ICT talent. From this perspective, the quality of life in the urban region –availability of comfortable housing, metropolitan ambience, cultural conditions, green spaces, but also climate etc.- is an important condition to attract (or retain) staff to the city and thus for developing a cluster. Mitchell's (1999) point that in the end, the "pleasant places" on earth will be the main ICT centres might be somewhat extreme, but there is much truth in it. In the Netherlands, the explosive growth of Amsterdam's ICT cluster can be partly explained by its young, dynamic and cultural image. Its vivid urban life makes it -of course among many other factors- an attractive place for young ICT entrepreneurs.

Helsinki's cluster is booming for several years now, but the limits to expansion are in sight. Up till now, the cities' "knowledge base" expanded thanks the immigration of young professionals from other villages and cities in the country. However, it is not easy to attract foreigners to the remote city, with its cold and dark winters. The strategy of many rapidly expanding ICT companies is now to attract workers from the Baltic. Manchester has also problems in attracting –and retaining- its talent. Although the city is known for its nightlife and has a large (and expanding) cultural scene, it faces heavy competition for talent with London. The capital acts as a magnet for talented people in any sector, also ICT. Many students that are educated a one of Manchester's universities leave the town for a job in London. In The Hague, which is part of the Randstad, the situation is a bit different. The cities' ICT companies indicate no special problems in

attracting ICT staff. This is not only due to quality of the cities' environment, but also to the large labour market that is within reach: The Hague forms part of the Randstad area (with Amsterdam, Rotterdam and Utrecht), with 5 million inhabitants. A high percentage of the staff of The Hague based ICT companies don't live in the Hague or even its region.

Most cities' policymakers realise the importance of quality of life as general condition for knowledge-intensive activities such as the ICT sector. Helsinki invests heavily in new cultural facilities (the new museum of contemporary art is an example), and upgrades the inner city area. The Hague is also upgrading and restyling its inner city, offering high quality housing and office space. Manchester has a similar strategy: Manchester seeks to improve the quality of its urban environment by restructuring the inner city and building expensive housing facilities, also in the city centre.

5. Conclusions

The ICT sector's growth is high, but the way how different types of cities benefit differs widely. The clusters in our three case cities differ in character in many respects. Manchester's cluster is diversified, with a varied mix of ICT business. With some exceptions, most firms in the cluster serve the regional market, as service provider or sale outlet. with a small proportion also linked to infrastructure provisions. Helsinki's cluster is more internationally oriented, dominated by the global player Nokia, but also telecom service providers (such as Sonera) and small firms are increasingly international. Many firms are active in R&D. The Hague cluster has a very different nature: it lacks a strong R&D base, but mainly consists of administrative headquarters of telecom operators that are active in the Dutch market. Thus, is it relatively specialised. Different trajectories of ICT sector development in cities may be traced back to national circumstances and chance factors. In Helsinki, for instance, early market liberalisation was an important trigger for the development of its cluster. The same can be said of Nokia's lucky shift towards mobile communications in the 1980s. In The Hague, the location of KPN, the former telecom monopolist, proved to be the engine of the cluster development in the late 1990s.

It may also be concluded that for the future, a high quality of the urban living environment will be more than ever a precondition for cluster development: because of the increased mobility (and scarcity) of ICT professionals cities need to be attractive to

attract and retain talent, the basic resource of the ICT sector. This means that investments in, for example, the environment and cultural provisions, may have a high return on the long haul.

Lessons for cities?

What more can cities do to strengthen their ICT cluster? A first thing could be to exploit local knowledge resources embedded in universities by stimulating industry-university co-operation. Furthermore, rather than attracting just any type of ICT-companies cities should make well-considered efforts to attract ICT-companies that fit their economic structure. Another frequent mistake is to focus one-sidedly on the construction of ICT-infrastructure and facilities, in the belief that once the infrastructure is there, economic activities will follow as a matter of course. There is a risk that optimistic growth expectations lead to ill-considered policies. Salomon (1998) saw many regions make mistaken efforts to become another Silicon Valley by attracting high-tech industry without understanding the ingredients of real success. An example from the 1980s and early 1990s is the investment by many cities in teleports, on the assumption that in the 21st century teleports will have economic relevancy on a level with airports and seaports. However, the one-sided emphasis on infrastructure and technology and the lack of integration and economic judgement have caused many a teleport project to fall through. A more promising strategy is the co-ordinated investment in infrastructure, technology and human capital. That is the strategy pursued by Singapore (Warf, 1995; Corey, 1991). That city-state has, in close co-operation with the private sector, invested on a massive scale in ICT-infrastructure as well as in people and training courses. The efforts were directed not only to stimulating ICT as an independent growth sector, but also, explicitly and consistently, to making capital of ICT's potential for enhancing the existing strong points of the economy: the trade function, the port and the financial sector. Integrality is yet another strong point: much money is invested not only in infrastructure but also in education, on the assumption that the presence of human capital can tip the scales in investment decisions.

To conduct an oriented ICT-policy towards starting entrepreneurs is another way for towns to strengthen the local ICT-sector. The local government can act as provider of generic support, such as (cheap) accommodation and venture capital, but also as

purchaser of the products of new companies, or as broker and connecting factor between starters and both the existing private sector and the knowledge institutions.

It can be concluded that public-private co-operation is a prerequisite to develop effective and efficient cluster-policies. "Interactive policymaking" is needed in the marketing of the cluster, in attracting new firms, in helping start-ups and in all other aspects of cluster policies, to make optimum use of the knowledge and resources of the existing actors in the cluster. This also implies that civil servants involved in cluster policies need to be well educated and have sufficient "feeling" with the cluster.

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