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BRAIN CIRCULATION AND FLEXIBLE ADJUSTMENT:  
LABOUR MOBILITY AS A CLUSTER ADVANTAGE

by

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ABSTRACT. This article explores the role of labour mobility as a potential cluster advantage. We review the theoretical arguments as for how and why labour mobility could enhance the dynamism and performance of clusters of similar and related firms. A combination of quantitative and qualitative data from two information and communication technology (ICT) clusters is used to answer two research questions: (1) What is the role of mobility enhancing (or restricting) institutions in clusters? (2) In what ways does labour mobility contribute to knowledge transfer within clusters? The two ICT clusters studied in the article generally seem to have higher levels of mobility, compared to the labour market at large. Although it is regarded as beneficial in theory, most cluster firms try to restrict mobility of workers since they fear the risk and costs of losing staff. Labour mobility is also rarely viewed as a viable way to increase the knowledge bases or contact networks of firms. However, when firms need to recruit the clustered labour markets seem to benefit them by facilitating the use of informal recruitment processes. By way of conclusion it is suggested that cluster firms might be under-investing in mobility and that innovative institutional solutions could help realize clusters' mobility potential.

*Keywords:* economic geography, cluster, labour market, labour mobility, knowledge transfer

## **Introduction**

This article aims to explore the role of labour skills and labour mobility in clusters. Does a labour market for specialized skills function better if spatially localized and could it be that this – rather than various other forms of inter-firm interaction – constitutes a major cluster advantage?

We analyse the mobility of labour over time in order to show how people move within, into and from two information and communications technology (ICT) clusters in Sweden. The clusters of Kista in the Stockholm region and Mjärdevi in Linköping, in south east Sweden are chosen as case study areas. The following questions will guide our analysis:

- What is the role of mobility enhancing (or restricting) institutions in clusters?
- In what ways does labour mobility contribute to knowledge transfer within clusters?

The rest of the article is structured in five main sections. The next two sections give the theoretical background to the analysis, and discuss issues related to data and methods, respectively. The following section contextualizes the empirical analysis by introducing the two cases in point, the Swedish ICT clusters in Kista and Mjärdevi. The empirical findings are presented and analysed in a major section, followed by a brief summary of the main findings and a concluding discussion of whether labour mobility can indeed be seen as a major cluster advantage.

## **Theoretical background and research context**

Taking its starting point in the ambiguity of the cluster concept, this section gives the theoretical background to the study by arguing the case for why cluster theory needs a labour-centred approach, and by presenting some theoretical approaches to the role of labour mobility in processes of localized learning and innovation.

### *The ambiguous notion of cluster advantages and the case for a labour-centred approach*

Since the early 1990s, the cluster concept has been central to theoretical as well as empirical and policy discussions in economic geography and related fields (see Martin and Sunley 2003). Local clusters of similar and related firms have been viewed as drivers of competitive advantage and economic development. But why do similar and related firms agglomerate in space to form specialized clusters, and what are the benefits following from such spatial clustering?

In brief, the dominating contemporary model of thought in answering these questions consists of three arguments. The first says that learning and innovation are key factors behind long-term competitiveness in an increasingly knowledge-based economy (Porter 1990; Lundvall 1992; Nelson 1993). The second says that innovation, as well as knowledge creation generally, is mainly the outcome of inter-relations and interactions between firms and other actors in their surroundings (von Hippel 1988, Håkansson 1989). The third says that geographical proximity plays a key role in such interactions (Malmberg and Maskell 2002). In particular, knowledge spillovers are held to be more prominent in a localized agglomeration of firms than in a spatially more dispersed system of firms (Maskell and Malmberg 1999; Porter 2000a, 2000b; Malmberg and Maskell 2006; Storper and Venables 2004), especially in cases where the knowledge involved includes tacit elements (Gertler 1995, 2003).

The dominating line of thinking on clusters and competitiveness thus seems to imply that clusters exist and thrive because spatial proximity between similar and related firms makes easier the types of inter-firm interactions that lead to processes of learning and innovation. A supplementing argument is that rivalry between co-located firms doing similar business will increase the innovative efforts in the cluster (Porter 1990, Malmberg and Maskell 2002). This model has faced problems, however, when tested against real-world cases of localized clusters of similar and related firms. The emphasis on the importance of localized inter-firm interactions has lost some of its appeal as it has become evident that most firms in clusters do only limited or even negligible business with neighbouring firms. In contrast, the typical case is that cluster firms will source inputs, machinery and technology worldwide, in order to eventually address the global market with their final products (for a review of empirical studies, see Malmberg and Power 2005). It is thus important to note that the activities of internationally competitive clusters are normally not confined to their immediate surroundings. Especially the central actors of clusters will most typically rely on distant markets, and have important links to customers and suppliers outside the cluster region (cf. Bathelt *et al.* 2004). The same applies to the rivalry argument. While the local rivalry idea is intuitively appealing, it seems that most firms in clusters tend to report that their primary rivals, if they do indeed report that such exist, are not located nearby (Waxell and Malmberg 2007).

As long as we focus on inter-firm relations and interactions, it seems increasingly difficult to maintain that processes of knowledge exchange and acquisition are to any decisive extent internal to the cluster. This is something of a predicament for the research on spatial clustering. Some of the most cherished hypotheses have not stood the test of empirical validation well. The cluster advantage must lie somewhere else.

Against this background some researchers have proposed that clusters may form the basis for well-functioning local labour markets for specialized skills and thereby contribute both to efficiency and knowledge transfer. Thus, it can theoretically be argued that local labour markets function better, both from the point of view of firms and employees, if there are several similar and related firms around. Well-functioning markets for specialized labour skills should thus be added to the list of possible explanations to why clusters exist and offer advantages to firms located there. There are several reasons why the labour issue should be brought to the fore in cluster analysis.

In a globalizing world economy, where less expensive and more effective transportation and communication technologies have made production factors like capital, goods and information, considerably more mobile, people are still relatively geographically immobile (Hammar *et al.* 1997; Geddes 2003). Even though travelling has become easier, we may not expect dramatic increases in human mobility and migration in the future due to factors such as location-specific insider advantages (Fischer and Malmberg 2001). As a consequence, most people will move only a limited number of times during their lifetime, and spend much of their working life in a few locations. This means that geographically concentrated clusters for the most part will continue to be tied to their regions via the local or regional labour market.

In the following, two basic lines of arguments are put forward, related to brain circulation and flexible adjustment, respectively. The arguments are similar in the sense that they both point to advantages of being located within a specialized labour market, but different in the sense that they emphasize separate mechanisms by which labour markets processes are beneficial, to the clustered firms and the individuals working in these.

*Theoretical points of departure: clusters, labour and job mobility*

What exactly are then the mechanisms that could be assumed to make labour mobility a major cluster advantage? Already in 1890, Alfred Marshall indicated the existence of at least two labour-related advantages linked to spatial clustering of similar and related firms. The first is hinted at in the quote below where Marshall writes about the advantages that co-located firms with a similar demand for labour will benefit from when sharing the same labour market.

Again, in all but the earliest stages of economic development a localized industry gains a great advantage from the fact that it offers a constant market for skill.

Employers are apt to resort to any place where they are likely to find a good choice of workers with the special skill which they require; while men seeking employment naturally go to places where there are many employers who need such skill as theirs and where therefore it is likely to find a good market.

(Marshall 1890 [1920], p. 271)

The first and most basic idea is that the aggregated demand for labour can be balanced by co-located firms with overlapping competence profiles; a high demand for labour in some of the firms may coincide in time with a low demand in others, thus facilitating the matching process on the labour market for both firms and workers (cf. Krugman 1991). Basically, expanding firms will find it easier to employ skilled labour, and laid-off workers will have a better access to new job opportunities. This smoother *matching process* at the level of the local labour market will help to keep unemployment at a lower rate than elsewhere. The geographical proximity between workers and firms will also reduce transaction costs on the labour market, not least since workers will be able to find a new job without paying the social and economic costs of moving, but also by keeping the search costs down for both parties. Proximity thus helps in processes of structural transformation and adjustment within a cluster, securing that labour resources are continuously reorganized in an efficient way.

A second, and more recently developed, argument is based on the idea that *knowledge flows* between clustered firms, and other relevant organizations (like universities, R&D units, etc.), is likely to increase through the flow of labour between local economic agents. Labour mobility is thus believed to be one of the mechanisms through which the process of knowledge dissemination between firms and organizations in a cluster is enhanced, thereby stimulating innovativeness as well as learning, upgrading and the spread of best practices (Saxenian 1990, 1994; Feldman 1999; Pinch and Henry 1999; Malmberg 2003; Power and Lundmark 2004). Of particular importance in this case is tacit knowledge that is not codified or standardized, and thus not easily transferable between actors in the form of written documents or other types of media. It can further be argued that this form of knowledge transfer will be of particular importance in the case of specialist workers (management, researchers, technicians, engineers, programmers, etc.) moving between firms and workplaces in the cluster (Song *et al.* 2003). This is of course not to say that labour mobility is the only way that knowledge flows between firms and organizations; other potentially important mechanisms include regular business relations, inter-firm collaboration, use of consultants, multiple affiliations, spin-offs, and so forth. But, being

employed obviously represents a deeper commitment, compared to some of the more temporary collaborative projects exemplified above.

A related effect of knowledge transfer through labour churning is the creation of new combinations of knowledge and competences, at the level of the firm, but potentially also at the aggregate level of the cluster itself (Basant 2002; Boschma *et al.* 2009). A continuous inflow of new ideas and competences may induce intended or unintended synergetic effects in the learning process, stimulating innovations and unexpected solutions. Furthermore, labour mobility may contribute to the formation of networks between firms and other actors within a localized cluster. When people, or in some cases even groups of people, move from one firm to another, more or less developed relations between the two firms are likely to be established. In this sense interpersonal links between organizations will function as a form of cluster glue. Moreover, movers often bring with them business contacts (with former colleagues, customers, clients, suppliers, etc.) into the new firm, thereby expanding and reshaping its overall business network. This should, in theory, translate to a positive effect on firm performance following from labour mobility. Wictorin (2007) showed that the level of staff turnover was positively correlated with workplace productivity up to a certain point. However, this effect could only be observed in the ICT sector, not in the two other more traditional manufacturing sectors that were studied: machinery and rubber products. Another comprehensive study of Swedish industrial clusters (Eriksson and Lindgren 2009) showed that although labour turnover has a short-term negative effect on firm performance it generates a positive effect in the long run (i.e. two to three years).

Still mobility is also associated with considerable efforts and costs, even when job changes occur within a limited geographical area. For employers, large inflow of new workers may result in high costs for the recruitment process, on-the-job training, lower initial productivity, and in many cases costs related to interruptions in the work process of the firm (Carnoy *et al.* 1997; Abbasi and Hollman 2000). In this sense excessive levels of labour turnover are harmful to most firms. Moreover, in cases when individuals moving from one employer to another bring along exclusive business relations, customers and strategic business information to the new employer, mobility may lead to the loss of these relations for the firm left behind and can thus threaten the business networks of involved firms (Breschi and Lissoni 2001a). Labour mobility can therefore be viewed as a balancing act. On the one hand, it allows firms to adjust the composition of the workforce to market conditions and possibly contributes to the spread of competences and contacts. On the other hand, it implies various costs and can lead to the loss of skilled persons or even loss of control over firm specific know-how (Tomlinson and Miles 1999; Tomlinson 2002; Madsen *et al.* 2003). To workers, changing from one workplace to another is also often related to

considerable efforts to invest in new work tasks and routines, to build up new social relations and so on. Nonetheless, career moves are normally rewarding to the individual, in terms of higher salary and/or more challenging work tasks.

Labour mobility within the cluster may thus lead to brain drain as well as brain gain for individual workplaces. The most important point in this context, however, is that it implies a brain circulation that might be beneficial for the cluster as a whole.

Summarizing the discussion so far, we have argued that there is good reason to pay more attention to labour markets when trying to understand the nature and workings of localized clusters of similar and related firms and industries. We have identified two different mechanisms whereby labour mobility might be beneficial to both firms and workers. The first relates to external economies of scale when sharing a common labour pool of skilled workers; we may label this cluster advantage *flexible adjustment mobility*. The second concerns the effects on local transfer of specialized knowledge and business contacts generated through individuals changing from one employer to another, in particular within a geographically concentrated cluster. This mechanism may be labelled *brain circulation mobility*.

## **Methods and data**

Empirical research on labour mobility in clusters is typically based on either statistical data (e.g. Almeida and Kogut 1999; Dahl 2002; Power and Lundmark 2004; Victorin 2007; Andersson and Thulin 2008; Eriksson *et al.* 2008; Lundmark and Power 2008; Eriksson and Lindgren 2009) or on in-depth interview studies in particular areas (Saxenian 1994; Pinch and Henry 1999; Benner 2003; Gray and James 2007). We argue, however, that a combination of qualitative and quantitative data and analysis is particularly suitable when trying to assess, within the same space-time context, both overall patterns of labour mobility, and individual motives and attitudes of central actors towards mobility (cf. Granovetter 1974). Therefore the empirical analysis presented in this article is based on two sources of information; statistical data at the level of the individual workers employed in the ICT sector, and interviews with firm representatives in the two different study areas. Another feature of the empirical research in this article is the comparative approach. By comparing two clusters of ICT firms located to, and embedded in, quite different local labour market regions we can get additional insights into the mechanisms of labour mobility.

The qualitative data is based on 30 in-depth interviews with firm representatives in Kista and Mjärdevi, carried out in 2005 and 2006. The firms approached in the interview study were selected randomly within nine categories based on the size and main type of business of the firm

(see Appendix 1 for a full list of studied firms). The interviewees generally had the position of CEOs for the smaller firms in the sample and human resource (HR) managers for the larger firms or workplaces. The interviews were semi-structured, guided by a set of questions covering five broad topics (see Appendix 2). Each interview lasted for 30-60 minutes and was recorded and later transcribed.

Quantitative register data for this study encompasses all individuals employed in the two studied clusters between the years 1997 and 2002. This information has been retrieved from the so called PLACE database.<sup>1</sup> It is widely acknowledged that a large portion of all perceived job changes on the labour market is most likely caused by reorganizations, mergers, acquisitions and other such events (Graversen *et al.* 2002). In many cases, these events have negligible effects on the workplaces themselves, that is, their daily routines, ways of doing business and learning processes. This implies that a considerable share of labour mobility observed in register data could be labelled ostensible. This would imply that the “true” mobility of workers between workplaces is often over-rated, especially in sectors characterized by a fast pace of reorganization, like the ICT industry. When dealing with register data there is currently no established method for distinguishing between true and ostensible mobility, which means that quantitative methods are largely insensitive to fundamental differences in types of labour mobility. The dataset used here makes it possible to define job change quite rigorously, as a change in both an individual’s assigned workplace and employing organization between two separate years. Applying these double criteria makes the results more valid and specific. By applying our rigorous definition a large portion of the ostensible mobility has been excluded from the analysis (e.g., job changes caused by changes in ownership of workplaces).

### **Two cases: labour mobility in Kista and Mjärdevi**

In the following section the two case study clusters are presented and a general background to the labour mobility in these clusters is provided. The case study areas are two Swedish ICT clusters; the internationally renowned Kista Science City, on the northern outskirts of Stockholm, and Mjärdevi Science Park in Linköping, a regional centre in south-east Sweden. Both clusters are

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<sup>1</sup>The PLACE database, kept by the Department of Social and Economic Geography at Uppsala University, is based on official taxation and civil registration records held at Statistics Sweden. It contains anonymized information on all individuals and their attachment to workplaces and firms in the study areas. The detail of the individual records and the complete nature of the dataset offer possibilities to examine the flows of individual workers on the labour market and in the studied clusters.

characterized by high concentrations of ICT firms and have distinctive identities that are maintained by local development organizations. Firms with a strong presence in Kista include Ericsson, Oracle, Microsoft, Sun Microsystems, as well as the Swedish telecom operator Tele2. Leading firms in Mjärdevi are Ericsson, Sectra, IFS Industrial and Financial Systems, Motorola and Autoliv Electronics. Both clusters also harbour many consultancies and other smaller ICT firms. For the purpose of this article, the spatial boundaries of Kista and Mjärdevi are delimited by selected Small Areas for Market Statistics created by Statistics Sweden, in turn based on municipalities' sub-divisions and on electoral districts. The areas are quite narrowly defined. The Kista cluster stretches over some 4 km<sup>2</sup>, the Mjärdevi cluster 1 km<sup>2</sup>.

The selection of these two clusters is based on the simultaneous presence of interesting similarities and differences between the two cases. Both Kista and Mjärdevi are populated by firms active in the information and communication technology sector and the Swedish telecom giant Ericsson is heavily involved in both areas. The clusters function within the same national legislative framework and have the support of local authorities as well as universities (KTH Royal Institute of Technology and Stockholm University in the case of Kista, and Linköping University in the case of Mjärdevi).

Kista and Mjärdevi differ considerably in both size and diversity of the cluster as well as character and size of the surrounding labour market regions. Mjärdevi also has a somewhat younger workforce than Kista, partly related to the fact that Mjärdevi as an ICT cluster is around ten years younger than Kista as Mjärdevi Science Park was originally developed during the mid-1980s (Klofsten *et al.* 1999).

Regarding cluster size, firms located in the Kista ICT cluster had some 18,000 employees in 2002, whereas the Mjärdevi ICT firms employed a workforce of just over 3,000 persons. Kista also displays a more diverse cluster labour market than Mjärdevi, with a larger total number of firms in a wider array of sub-industries. Concerning the surrounding region, Kista is located in the capital city of Sweden and is thus a part of a large and varied regional labour market which also includes many ICT firms. Mjärdevi, albeit located in the fifth largest city in Sweden, is part of a much smaller regional labour market that is considerably less varied than that of Stockholm. From this follows that Mjärdevi also has a larger proportion of ICT employment in its region than does Kista, see Figure 1. The differences in size and regional context between the two cases allow for an analysis of how these factors relate to the levels of mobility, as well as to the outcomes of job change.

[INSERT FIGURE 1 ABOUT HERE]

### *Levels of mobility in the studied clusters*

Labour markets that are associated with clusters are often characterized by high concentrations of qualified and specialized workers with similar and complementary skills, as well as high levels of mobility between workplaces (Saxenian 1994; Porter 1998; Feldman 1999; Pinch and Henry 1999; Breschi and Lissoni 2001b; Boschma *et al.* 2009). It is fairly uncomplicated to demonstrate that there is a concentration of a specialized work force in a cluster. As mentioned already, it is more challenging to assess the level of labour mobility. Besides the complexity of job-to-job mobility another challenge is related to the difficulty to find an appropriate base level of mobility with which one could compare the levels found in clusters. Labour markets are often thought of as being segmented into small units, each with their own characteristics (Kerr 1950, 1954). Consequently, there is no single national labour market with a certain level of mobility against which cluster mobility can be justly compared.

At this stage it is also important to recognize that the level of mobility on a local labour market is conditioned by a number of macro factors and both structural and institutional circumstances. For instance, mobility tends to be lower during times of recession (Lundmark and Power 2008; Andersson and Tegsjö 2006a, 2006b). Furthermore, mobility is directly related to the intensity of the restructuring process itself in the local economy, i.e. the number of start-ups and closings of firms and workplaces, as well as the growth or downsizing of existing firms. Mobility has also been shown to be higher in large labour markets that are both specialized and comprised of many firms, while labour markets dominated by only a few large firms tend to reduce labour mobility due to the access to internal career opportunities (Eriksson *et al.* 2008). The level of mobility is also conditioned by regulations on the labour market and by both formal and informal agreements between firms, as well as by norms and general attitudes among firms and workers towards mobility.

Finally, mobility is highly dependent on individual characteristics of the workers, like age, sex, education, family situation and the like. For instance, in the case of the ICT sector, and not least in the two clusters studied in this article, there is considerable evidence that the labour force has a younger age profile compared to the labour market in general (Power & Lundmark 2004, Bienkowska & Hedberg 2006, Bienkowska 2007). A cluster populated by younger workers is likely to produce more job changes than average.

Thus, analysing and comparing the intensity of flows of labour within and between local labour markets requires sensitivity to the frameworks made up by a multitude of conditional circumstances. The national average for mobility in Sweden is used as a reference in the article, but it cannot be used to strictly claim a higher or lower level of mobility in clusters regardless of other factors.

Notwithstanding these methodological issues, several studies have nevertheless examined the mobility of workers between firms in clusters in various ways and found higher levels of mobility there than elsewhere on the labour market (Henry and Pinch 2000; Waxell and Malmberg 2007; Lundmark and Power 2008). However, some studies suggest that a cluster location alone does not automatically lead to higher mobility; other conditions also have to be in place, such as a favourable legal framework (Gilson 1999), specific industry features (Fallick *et al.* 2006) or a mobility-enhancing composition of firms in the cluster (Lawton Smith and Waters 2005).

Both clusters studied in this article certainly harbour large numbers of skilled and experienced IT professionals in workplaces within walking distance from each other. They also seem to display higher levels of mobility than the total labour market in Sweden (see Fig. 2). Results presented in figure 2 suggest that labour mobility was higher than the national average in both ICT clusters during each year covered by the analysis. Still, the gap between the clusters and the national average was considerably lower in 2002 than in previous years. This is likely to be a temporary effect of the particularly severe recession that hit the ICT industry in the early 2000s. Furthermore, for the year 1999 an exceptionally high level of mobility is noted in Mjärdevi, 35 per cent of the ICT workforce employed in Mjärdevi seems to have changed jobs during that year. The observation reflects the fact that the largest firm in the cluster changed its identity number in the database during this year due to a major reorganization, thus creating an extreme case of ostensible mobility which was discussed previously.

[INSERT FIGURE 2 ABOUT HERE]

Overall it can also be noted that labour mobility in the ICT clusters seems to follow the business cycle quite closely, with high levels of growth coinciding with high levels of mobility and vice versa. Sweden experienced high growth in real GDP during 1998-1999, and considerably lower growth during 2000-2002 (SCB 2008). Additionally, the rise and subsequent burst of the “dot-com” stock market bubble in 2000–2001 was especially severely experienced by the ICT industry. This result is in concordance with previous findings, for example Osberg’s (1991) study

of the Canadian labour market. Other studies have in addition previously shown that regional mobility is related to phases in the regional business cycle (Jackman and Savouri 1992; McCormick 1997). In a similar vein, it has also been shown that job-search strategies of individuals tend to vary across the business cycle (Osberg 1993). When studying levels of mobility it is thus imperative to either study it over an extended time period or pay close attention to the business cycle during which a certain job-change rate is observed.

The level of labour mobility should furthermore be understood in the context of the national institutional set-up, such as the legal framework. Swedish labour market regulations allow only a narrow definition of fair dismissal and call for high compensation for unfair dismissal thus making firing of workers difficult and costly for firms (OECD 2004). Furthermore, seniority rules concerning dismissal enforced by the last-in, first-out principle make it more beneficial for employees to remain with the same employer over time as it automatically leads to greater job security (Lindbeck 1994). The industry structure also makes mobility less probable since one large firm (Ericsson) dominates the Swedish ICT industry. The career opportunities present within large firms, in combination with the relative security that such employers can offer, will have a negative effect on workers' motivation to move to other employers (Granovetter 1985; Carroll and Mayer 1986). This points to the conclusion that labour mobility in the two ICT clusters in Sweden is hampered by the legal framework as well as industry structure, thus pushing mobility to a lower level compared to similar clusters in countries or regions with more mobility-enhancing institutional and structural settings.

The strictly internal mobility within the two clusters – that is, persons staying in the area for the whole studied period, but switching from one employer to another – is fairly substantial. After controlling for the effects of some larger reorganizations<sup>2</sup> it can be estimated that some 16–17 per cent of the “internal” workforce more or less voluntarily moved at least once to another workplace between 1998 and 2002 in both areas. The effect of the somewhat younger workforce in Mjärdevi is likely to have been compensated for in the Kista case by its larger number of work opportunities and more differentiated mix of firms.

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<sup>2</sup> The job changes which were part of flows of more than 100 workers between two specific organizations were excluded from this particular analysis as the size of these flows indicated that they were created by reorganizations.

### *Recruitment of employees to the cluster firms*

In order to assess the importance of local labour mobility for the firms in the studied clusters the sources of recruitment of new employees in the cluster firms have been analysed. This enables us to see whether the cluster labour market is an important asset with regards to the fulfilment of firms' recruitment needs. Tables 1 and 2 show that other cluster firms constitute important sources of newly recruited workers, being the second most common source of employees for both Kista and Mjärdevi firms. The results also show that labour mobility in the two clusters is conditioned by their embeddedness in two different regional contexts. Kista Science City is situated in a much larger (more than 1 million employees) and more differentiated regional labour market than Mjärdevi. Also, the region surrounding Kista hosts a fairly large number of ICT firm and jobs, whereas the Mjärdevi Science Park dominates the supply of ICT jobs in the Linköping local labour market. As shown in Table 1, Kista cluster firms recruit many of their workers from ICT firms elsewhere in Stockholm, in addition to recruiting internally in the cluster.

Still, there is a quite strong tendency to recruit people with ICT sector experience from within the cluster in both cases. This can be seen if the data displayed in Tables 1 and 2 are compared with those in Figure 1 above. While Kista hosts some 10 per cent of all ICT employees in the wider Stockholm region (i.e. the Stockholm Municipality and Stockholm County in Fig. 1) some 40 per cent of the recruits coming from the ICT sector in the Stockholm region come from the Kista cluster itself. This means that the likelihood that an ICT sector employee in the Stockholm region will be recruited by a Kista firm is four times higher if his/her original employer is located in Kista rather than elsewhere in the region. The corresponding increased likelihood is 2.7 in the case of Mjärdevi (cf. Fig. 1 and Table 2).

[INSERT TABLES 1 AND 2 ABOUT HERE]

In the Mjärdevi case it should also be noted that a large proportion of new recruits in the cluster come from non-ICT firms in the municipality of Linköping, as well as ICT industry in other regions. This does not necessarily have to be interpreted as a disadvantage to the Mjärdevi cluster; from a knowledge transfer perspective more distant influences and competences may function as fresh injection to the knowledge formation in the Mjärdevi firms. On the other hand, and especially in times of general expansion in the ICT sector, the Mjärdevi cluster may face problems finding the suitable labour at short notice (for further elaboration on this subject, see Bienkowska 2007).

## **Empirical findings and analysis**

In this section results from the study of mobility in the two Swedish ICT clusters are presented and discussed. The structure of this section follows the questions posed in the introduction, starting out with a presentation of the results concerning mobility-enhancing institutions in the studied clusters, followed by an analysis of the relations between mobility of workers and knowledge transfer. In this paper, institutions are understood as formal or informal “rules of the game” (cf North 1994). Following Scott (2008), we understand such rules to be comprised of regulative, normative and cultural-cognitive elements. The regulative elements consist of laws, regulations and formal agreements, the normative elements refer to values, standards and norms of proper behaviour, while the cognitive-cultural elements can best be understood as common mind-sets or shared logics of action (Scott 2008). Together with associated activities and resources, institutions such defined give stability and meaning to social life in general, and provide an important structuring framework for cluster labour mobility in our specific case.

### *Mobility enhancing – or restricting – institutions and firm strategies*

The two ICT clusters studied seem to be associated with a higher level of job change. Does this mean that firms in clusters are actively promoting mobility or do they on the contrary regard mobility as a problem? What local labour market institutions, formal or informal, are being developed to handle mobility? It is possible that both mobility enhancing and mobility restricting firm-level institutions can exist simultaneously in clusters, since job change can potentially be beneficial but also costly for organizations.

Most of the firms in the Kista and Mjärdevi ICT clusters interviewed for this study expressed relatively negative attitudes regarding labour mobility. While some firms considered mobility as beneficial in general terms, the majority of firm representatives stated that employee retention rather than mobility is their main focus. Thus, most employers seemed mainly preoccupied with assuring to offer their workforce such attractive employment terms and working conditions that they should not consider other job opportunities.

We try to keep the employees we have. We do not want to lose them. We have fantastic employees here. ... So we try in every possible way to keep them. Even though it has been difficult to provide competitive enough salaries.

(CEO of a small service business in Mjärdevi)

Most firms were consequently taking action in order to keep as many of their employees as possible, something that makes sense from a business perspective since it is often the case that a firm's most valuable employees are the ones that are most likely to find other jobs.

Many firms were reluctant to state that their location in an ICT cluster represented an advantage in terms of supply of skilled labour. At the same time, it was often obvious that the local university and/or other local firms were indeed key sources for labour recruitment. Some firms for example employ students as extra personnel on a part time basis and have them doing their master thesis projects within the firm before eventually hiring them. A vital aspect of the recruitment strategy was for most firms the usage of personal contacts also suggesting a certain preference for local workers.

Some firms were unable to see that they predominantly recruit locally, even though this was obviously the case. One interview illustrated this in a particularly clear way:

*Have you been recruiting people from Kista?*

At the moment we have never once needed to advertise, people have come to us because they know us.

*And from where?*

Everywhere!

*OK ... so not particularly from here?*

Well ... not just from Kista... but having said that, I would say 70 per cent actually of the people that are working for us – I'm just talking research consulting, not the programmers – I never thought in those terms, but now that I'm thinking of it every single one have Kista involved in it.

*Oh really?*

And when I picked them up they actually came from Kista. Four were consultants working for other companies but left the other company when the other companies went bankrupt or laid off people, and came to join us. When I think about it there is only one of us that hasn't got a Kista background. ... Interesting exercise.<sup>3</sup>

(CEO of a small service business in Kista)

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<sup>3</sup> This interview was carried out in English. All other interview quotes have been translated from Swedish by the authors.

Agreements between firms to restrict labour mobility, as reported by for example Lissoni (2001), can be seen as another potentially important institution connected to cluster job mobility. A few of the interviewed firms did indeed state that they have formed informal agreements with other cluster firms in order to reduce poaching of labour by employers.

There exists an informal policy that dictates against poaching employees from each other. One should be decent and diplomatic here. That means that I usually ask those applying for a job at this firm if their current employer knows about that. Then I call their present employer and say that I have this guy here applying for a job. And I expect others to do the same for me.

(HR Manager of a manufacturing business in Mjärdevi)

In the Kista cluster though these informal agreements were described as being industry-wide rather than local and specific to the cluster. It is for example considered risky to try and recruit labour from client firms, regardless of their location, as that could lead to a deterioration of the business relation.

If we would go out and recruit people from our customers, for example if we know about some brilliant engineer somewhere, it would not be very good for our reputation. It would be considered as stealing staff from the customer and that is something we cannot do. It is all about being tactful because it can hurt the business relation if there is a misfortune.

(Personnel Officer of a small service business in Kista)

An additional mobility restricting institution found in both ICT clusters was the widespread use of covenants that potentially discourage employees from changing jobs. These were for example non-compete agreements and non-disclosure agreements.

Sure we have a non-compete agreement that states that the employee cannot pursue competing activities during the time he or she is employed by us. And of course all our employees sign a non-disclosure agreement where they assure that they will not pass on any

information that they gain during their employment here and which can damage the firm. That covenant is valid even after they have left the firm.

(Personnel Officer of a small service business in Kista)

In order to effectively enforce the covenants, “garden leave” was sometimes applied by a few of the interviewed firms. That means that an employee remains on the payroll of a firm for a certain length of time, even after quitting or losing their job. During that time he or she can be obliged to stay at home and not show up at the workplace, while at the same time not being allowed to engage in any business activities with other firms.

The results of the interview study suggest that cluster firms are trying to cope with mobility of staff by focusing on employee retention and in some cases outright restricting job changes, for example out of fear of damaging business relations with other firms. It seems as though firms are trying to counteract the churning of labour occurring in the cluster. Therefore it can be argued that mobility in practice is considered as more of a problem than a positive force on firm level, although a lot of interviewees stated that job changes in general terms are positive. It is possible that that it is rather at the level of the individual worker that one would find attempts to enhance mobility through, for example, activities in occupational networks and communities (see e.g. Benner 2003).

However, it could also be argued that firms are under-investing in labour mobility by not supporting it enough. As a result, firms are partially missing out on the positive effects of job change that can be observed in the long run, as showed by Eriksson and Lindgren (2009). Furthermore, the very fact that many firms seem to be preoccupied with restricting or regulating labour mobility indicates that there is indeed a latent mobility potential in the cluster. Thus, the lack of enthusiasm displayed by the interviewed firms regarding the options for higher labour mobility should not necessarily be taken as an argument against the idea that local labour mobility, whether realized or just potential, could make up a factor contributing to the general potential for development in a cluster.

#### *Job change: brain circulation and flexible adjustment*

One aspect of mobility that is highlighted in several studies is its function as a mechanism for transferring knowledge between organizations (see for example Hyde 1998; Almeida and Kogut 1999; Feldman 1999; Pinch and Henry 1999; Dahl 2002; Breschi and Lissoni 2003; Oettl and

Agrawal 2008; Maliranta *et al.* 2009). However, this role of mobility as brain circulation is often treated as a black box or as a given assumption in studies of job change. In this section we study firm representatives' views on knowledge transfer through mobility of employees, both in instances of hiring and quitting or dismissal of workers.

Theoretically, hiring of staff is generally treated as a brain gain of embodied knowledge for the recruiting organization (Breschi and Lissoni 2003). Yet, the firms interviewed for this study often suggested that most new recruits provide merely additional manpower while the firm itself possesses and provides the business-critical knowledge. The extreme case in other words meant that newly employed individuals were perceived as having everything to learn and nothing to teach the organization. A lot of firms expected a rise in the level of energy at the workplace rather than knowledge inflow to be the main effect of bringing in new staff.

If we have been successful with the hiring the new recruits bring in a sense of joy of working. They are energized and eager to show their best side and I believe it affects the whole workplace in a positive way.

(Services Manager of a small service business in Kista)

Still, the firms also stated that sometimes they do recruit in order to fill particular knowledge gaps in the organization, for example with regard to market knowledge, specific skills or industry-specific knowledge from customer industries. Only in these cases was knowledge gain the primary goal of hiring. Many firms viewed recruitment of new personnel as a fast but expensive way of expanding the firm's competence base and contact network. In most cases internal promotion was preferred to external recruitment, and training of employees was preferred to filling perceived knowledge gaps with new staff.

It has already been mentioned that several characteristics of a cluster labour market can affect the level of labour mobility taking place there. In a similar way, it is probable that these characteristics can affect the quality of the labour mobility, that is, its impact on knowledge transfer and contact gains. In order to assess this statement we use workers' income levels as an indicator of the value of their knowledge and contact network to the employer. A simple quantitative analysis of the correlation between number of job changes made by every worker in the Kista and Mjärdevi clusters and their income points in the direction that job mobility is not always beneficial for income level and therefore also knowledge transfer, see Figures 3 and 4.

[FIGURES 3 AND 4 ABOUT HERE]

Job change inside the Kista cluster was associated with higher income than job stability during the study period, while in Mjärdevi the relation was the opposite. The difference in outcomes can be explained by two main factors, cluster size and diversity of workplaces on the cluster labour market. While Kista had almost 20,000 ICT workers in 2002, Mjärdevi only had approximately 3,500 workers. Kista also contains a wider array of ICT activities and hence provides more opportunities for profitable job changes. These results can also be viewed in light of the two types of mobility discussed in the article. Job change in Kista seems to a larger extent to have been of the brain circulation type, where the positive effect of job change on income can be viewed as a premium for relevant specialized knowledge or possibly business contacts. In Mjärdevi it can be assumed that flexible adjustment mobility has been more prevalent, probably decreasing the occurrence of unemployment among cluster workers, but with less beneficiary effects on individuals' incomes and firms' development.

The other aspect of mobility, namely the brain drain or knowledge loss that occurs when employees quit or are dismissed, is often overlooked in studies of mobility although it deserves as much attention as the brain gain. As mentioned previously, the interviewed firms focused their HR management efforts on employee retention, thus signalling that brain drain is potentially a disturbing factor.

It takes a lot of time to train our employees; therefore we lose a considerable investment every time someone quits, particularly those who have been here for a while.

(Country Manager of a small service business in Kista)

Most interviewees considered prevention of knowledge losses when employees leave the firm difficult. Although many firms stated that it is not easy to keep knowledge inside the firm when employees quit, the issue was not considered a very problematic one. This can be partially explained by the Swedish institutional set-up, which keeps a check on mobility as was mentioned earlier in the article.

Besides working actively with the retention of staff, various methods were used in order to incorporate individual employees' knowledge into the organizations. These methods include

knowledge sharing as an integral part of teamwork, creating extensive documentation and the usage of knowledge management software.

This is the most difficult aspect of running a service business. ... There is a lot of knowledge and history stored inside a person's head. But through our routines and processes for documenting everything – in different ways, either on paper or in data bases or report systems – we can ensure that it at least is there to be found.

(CEO of a small service business in Kista)

Since manufacturing and trade firms in the ICT sector also are highly knowledge-intensive and engaged to a high degree in service activities their representatives have similar views on prevention of knowledge losses when employees leave the firm.

It is difficult to protect the firm [when employees quit] since a lot of the knowledge is situated in employees' brains so to speak. You cannot extract their knowledge and say "now you have to forget everything you have done here"

(HR Manager of a manufacturing business in Mjärdevi)

There is a difference between information and knowledge. The firm does not own the knowledge, it is owned by the individual. We cannot prevent the individuals from taking it with them. It is different with our internal information.

(CEO of a trade business in Mjärdevi)

On the whole however, knowledge management seemed a somewhat neglected aspect of the daily business routines, where the focus is on retaining staff rather than getting the workplace ready for workers leaving. Perhaps it can be viewed as a strategy where efforts are put into keeping embodied, more or less tacit, knowledge inside the firm at all costs.

Besides studying firms' perspective on transfer of knowledge through labour mobility, we suggest that it is important to analyse the effects of mobility on firms' contact networks separately. This is partly motivated by the connective rather than exclusive property of contacts which means that new contacts can be established both when employees are hired and when they

quit or are dismissed. Here it was emphasized among other things that a friendly closure between an employee and the firm is important in order to gain contacts in spite of a brain drain.

It is great to have people that know us and what we stand for out there at our client firms that can contribute to an increase in our business there. So mobility is positive even though we do not want too much of it at the same time because we do not want to replace employees all the time.

(CEO of a small service business in Mjärdevi)

Some interviewed firms expressed that contact gains after dismissals or employees quitting are tricky to manage in an active way and rather expected them to grow naturally where it is most suitable. Concerning contact gains through recruitments, most often it was stated that if new employees could provide new network links these were considered a valuable and useful bonus, but were seldom an important aspect of the selection and hiring process.

[The person we recruit] could be somebody who brings in a lot of new contacts, for example if they come from some firm we do business with and maybe we do not have a network of contacts there – then this person brings it into our company. Perhaps you learn to know the right people a little easier and know whom to approach. The contact network is knowledge in its own right.

(HR Officer of a small manufacturing business in Kista)

However, some smaller firms stated that contacts are intertwined with the kind of industry experience and knowledge they require for most positions, thus making them a natural priority when recruiting.

Summing up our results concerning transfer of knowledge and contacts through labour mobility, we have shown here that although knowledge and contact gains are sometimes achieved through new recruitments, these effects are rarely in focus during the hiring process. Employers do not always value and put to use the knowledge that new recruits bring along, especially when they consider themselves being technologically or in other ways superior to other firms.

## **Labour mobility as a cluster advantage – discussion and conclusion**

This article has attempted to make two contributions to the burgeoning cluster literature. The first is to make an argument as to why labour mobility is likely to be an important, yet in the literature often neglected, cluster advantage. Second, by combining quantitative and qualitative analyses, we have been able to show that location within a dynamic and flexible labour market may be favourable both to firms and workers, as well as the cluster as a whole, due to two separate mechanisms. These are referred to as flexible adjustment mobility and brain circulation mobility. The first mechanism relates to the cluster as a location where a more efficient matching process between supply and demand for labour can take place. The second mechanism refers to the enhanced transfer of specialized knowledge and contacts between firms and organizations, resulting from a churning of skilled labour within the cluster. Defining these two types of mobility makes it possible to combine two common perspectives currently existing in separate strands of literature. By specifying two mechanisms we suggest that mobility can be beneficial even with negligible knowledge transfer, due to the processes of labour market matching and flexible adjustment. Knowledge transfer can therefore be viewed as an additional favourable effect of mobility, in those cases where it indeed can be observed.

These basic ideas are empirically illustrated in a comparative analysis of two distinct and successful ICT clusters in Sweden: Kista in the Stockholm metropolitan area and Mjärdevi in Linköping. We have used a combination of interviews and statistical data in order to analyse both overall patterns of mobility in the areas, and the norms and attitudes towards labour mobility expressed by firms located in the two clusters. Generally speaking, the two ICT clusters display relatively high levels of mobility. Moreover, the cluster labour markets constitute an important source of new personnel for cluster firms and can therefore be considered a valuable local asset. It can be claimed that this asset could not have been as readily accessed had the firms not been located in close proximity to each other. There are, however, important differences between the two studied clusters, not least in terms of their regional contexts. The Kista cluster benefits from the larger Stockholm labour market for new recruitments with a background in ICT, whereas the Mjärdevi cluster is more reliant on inflows of labour from distant locations and other sectors.

Two questions were formulated to guide the empirical analysis: (1) What is the role of mobility enhancing (or restricting) institutions in clusters? (2) In what ways does labour mobility contribute to knowledge transfer within clusters? In the following we summarize our main findings.

Regarding the first question, most firms in both Kista and Mjärdevi fear the risk of losing key personnel, and mobility restricting institutions are quite common while mobility enhancing institutions are less obvious. The interview study indicates that firms were paying more attention to labour retention than to mobility enhancing measures. The actions taken to mitigate (too) high levels of mobility range from the creation of good working conditions, to both formal and informal agreements between firms, and between firms and employees, to refrain from poaching labour from one another, and to reduce the risk of leakage of sensitive business information. The interpretation of this finding could be twisted one step further however. The fact that interviewed firms were preoccupied with taking measures against losing labour to other firms, could be seen as an indication of a strong underlying mobility potential in the clusters under study. Also, the clustered labour markets seemed to benefit firms by facilitating the use of informal recruitment processes. A concentrated specialized labour market offers better possibilities for informal recruitment, since it is easily monitored and there are plenty of various types of relationships between different actors.

Regarding the second question, labour mobility might lead to knowledge transfer that enhances the overall performance of the cluster, but we have not been able to show that this potential benefit is acknowledged at the firm level in either cluster. Most firms interviewed did not regard the recruitment of new staff as a way to increase the knowledge of the firm. A more common view was that hiring of new employees is primarily about expanding the general capacity of the firm, and that an expansion of the firm's knowledge base and contact networks through internal processes was preferred. Only on rare occasions was the active recruitment of specialists and experts viewed as a viable strategy to widen the knowledge base or the networks of the firm.

How do we interpret these findings? The results from the interviews may seem discouraging to the ideas about the positive relationship between, on the one hand labour mobility, and knowledge transfer on the other. The statements made in the interviews may also seem to be at odds with a growing number of studies confirming a positive correlation between high levels of labour mobility and an increase in labour productivity (see e.g. Wictorin 2007; Andersson and Thulin 2008; Eriksson and Lindgren 2009).

One possible explanation to this mismatch could be that the advantages of labour mobility are difficult to recognize at the level of the firm, and that they become more apparent at the cluster level or at the level of the individual worker. If this is the case, it suggests that previous research has given too little attention to these levels of analysis. It also gives us reason to suggest a methodological conclusion from this study. Further research on labour mobility and knowledge transfer needs to focus on more detailed empirical studies at the level of the individual worker

moving from one job to another. In particular, it would seem important to study in detail the mobility of “key knowledge workers”, for instance, by following cohorts of engineers through their working life.

Another conclusion, already hinted at above, is that firms may actually be under-investing in labour mobility. There is of course always a limit to how much labour turnover a business operation can cope with, but if there is in fact an unused potential for knowledge creation and transfer through a more active human resource management, especially at the level of the cluster as a whole, there is perhaps space for new and innovative organizational solutions, in terms of, for example, labour market intermediaries and recruitment consultants. Overall it can be claimed that mobility benefits both workplaces and workers, when certain conditions are in place. Since job change is likely to be more common within clusters, mobility can be argued to be at least a potential advantage that benefits cluster firms, although the firms themselves might not be fully aware of it.

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## Appendix 1: List of firms and workplaces interviewed for the study

Table A. *Interviewed Kista workplaces, main type of business and size.*

	Micro and small workplaces (1–99 employees)	Medium workplaces (100–499 employees)	Large workplaces (500 or more employees)
Manufacturing	Ericsson Network Technologies Bluewave Microsystems	Lorentzen and Wettre	Ericsson (Kista)
Trade	Adobe Systems Nordic Analog Devices	Arrow Nordic AxCom	
Services	Technia Symantec Sweden UGS Hansa World Scoop Publishware Cardium Serafim O M Infocom Global Travel Management	Oracle Atea/Martinsson Unisys Proact	

Table B. *Interviewed Mjärdevi workplaces, main type of business and size.*

	Micro and small workplaces (1–99 employees)	Medium workplaces (100–499 employees)	Large workplaces (500 or more employees)
Manufacturing	AppliedSensor	Flextronics	Ericsson (Mjärdevi)
Trade	SICK IVP UCS	Sectra Imtec	
Services	Enea Epact Ibitec Zenterio Nira Dynamics		

## Appendix 2: Interview questions

### General background questions

Describe the business idea and the main activities of the firm/workplace.  
Describe the organization and ownership structure of the firm/workplace.  
How many employees does the firm/workplace currently have?  
What is the age, gender and educational composition of the employees?  
How well is the firm/workplace currently doing?  
Describe the HR-situation in the firm/workplace during the recent years.  
Has the firm been downsizing or expanding?  
How large is the staff turnover?

### Local and historical context

When and how was the firm founded?  
Why is the firm/workplace located in Kista/Mjärdevi?  
How does the location affect the firm/workplace?  
Does the firm collaborate with other firms in Kista/Mjärdevi? If yes, describe.  
Does the firm participate in activities organized by the local development organizations? If yes, how does it affect your firm?  
From an HR-perspective, can it be considered as an advantage or a drawback to be located in Kista/Mjärdevi?  
Is there a general view on recruitment from other firms in Kista/Mjärdevi? Describe.

### Recruitment

Describe the recruitment process of the firm/workplace.  
How free is the firm/workplace regarding recruitment (in relation to laws and regulations, owners, financiers, etc.)?  
Describe the occupational background of recently recruited employees.  
Do the previous contacts of new employees strengthen the network of your firm/workplace?  
Is it important for your firm that job candidates have previous work experience in the field?  
Has the firm been recruiting new college or university graduates?  
Has the firm been recruiting staff from other firms in Kista/Mjärdevi?  
Are there any specific obstacles to recruiting from Kista/Mjärdevi firms?  
What are the advantages and drawbacks of recruiting from other firms in Kista/Mjärdevi?  
Does recruitment from Kista/Mjärdevi firms strengthen local collaboration in the cluster?  
Is there any difference in the firm's current recruitment process compared to recruitment during the ICT boom in late 1990-ies?

### Layoffs and quits

Describe the process when an employee is laid off or quits the firm/workplace?  
Do you use covenants not to compete (CNCs) or other restrictions on former employees?  
How many of your former employees still work at other firms in Kista/Mjärdevi?  
Is there a heightened risk of losing staff to Kista/Mjärdevi firms compared to firms elsewhere?  
Does your firm limit or stimulate employee mobility to other firms? What kinds of methods are used?

### Knowledge development

How important is it for the firm to keep up to date with the knowledge development within your field?  
How do you access and bring in new knowledge to the firm/workplace?  
Have new employees been bringing in new knowledge to the firm? If yes, what kind of knowledge and how?  
Have new employees contributed to and promoted changes in the firm/workplace?  
How does the firm protect knowledge accumulated in the firm when an employee is laid off or quits?

Table 1. Accumulated number of workers recruited by Kista cluster firms during 1998–2002, by location and sector of previous employment.<sup>4</sup>

	ICT industry		All other industries	
	No. of recruited	%	No. of recruited	%
Kista local area	5 334	23.9	352	1.6
Rest of Stockholm Municipality	5 416	24.2	2 944	13.2
Rest of Stockholm County	2 693	12.0	2 189	9.8
Rest of Sweden	1 493	6.7%	1 918	8.6
<b>Total</b>	<b>14 936</b>	<b>66.8</b>	<b>7 403</b>	<b>33.2</b>

*Source:* PLACE database.

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<sup>4</sup> Workers not on the labour market during the year prior to being employed in Kista were excluded from the analysis.

Table 2. Accumulated number of workers recruited by Mjärdevi cluster firms during 1998–2002, by location and sector of previous employment.<sup>5</sup>

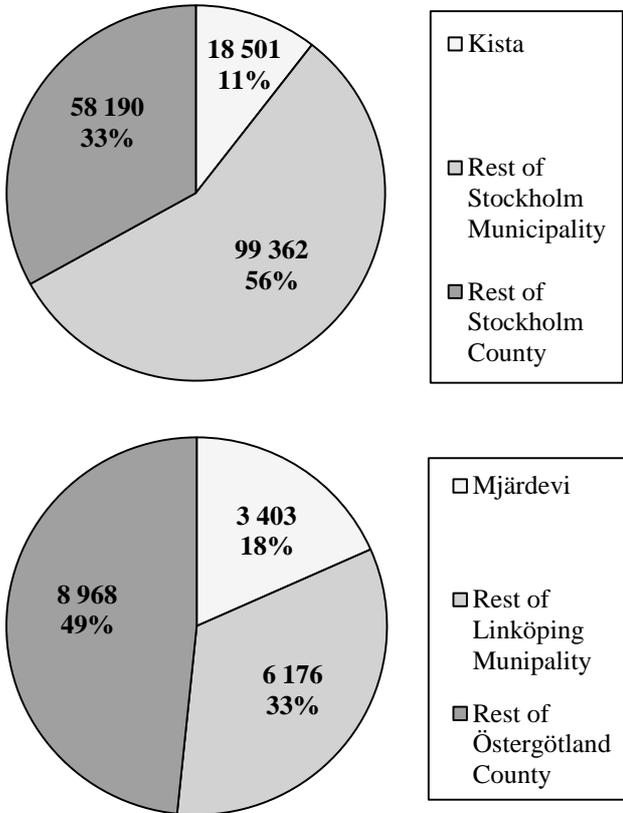
	ICT industry		All other industries	
	No. of recruited	%	No. of recruited	%
Mjärdevi local area	860	18.1	104	2.2
Rest of Linköping Municipality	490	10.3	1 078	22.8
Rest of Linköping County	340	7.2	463	9.8
Rest of Sweden	801	16.9	600	12.7
<b>Total</b>	<b>2 491</b>	<b>52.5</b>	<b>2 245</b>	<b>47.5</b>

*Source:* PLACE database.

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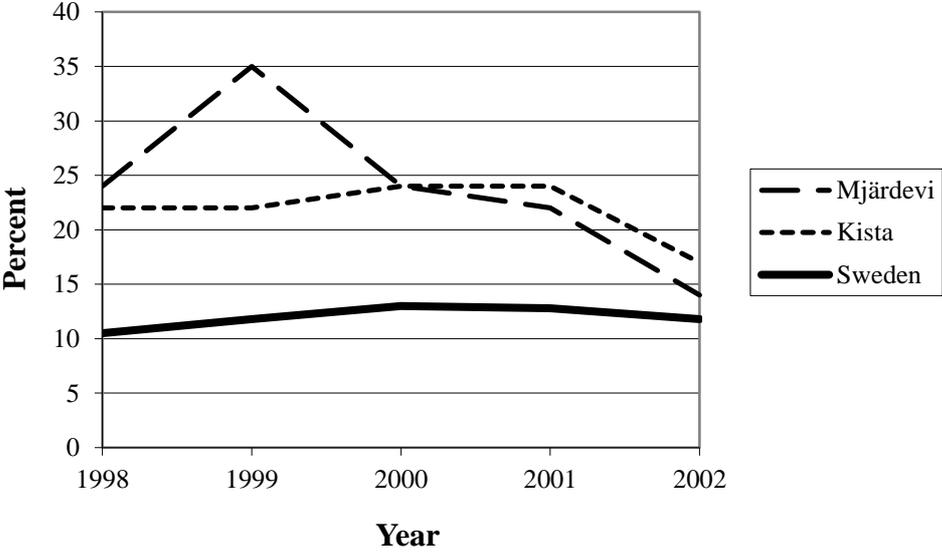
<sup>5</sup> Workers not on the labour market during the year prior to being employed in Mjärdevi were excluded from the analysis.

Figure 1. Number of ICT employees in Kista and Mjärdevi 2002, in relation to total ICT employment in the municipality and county.



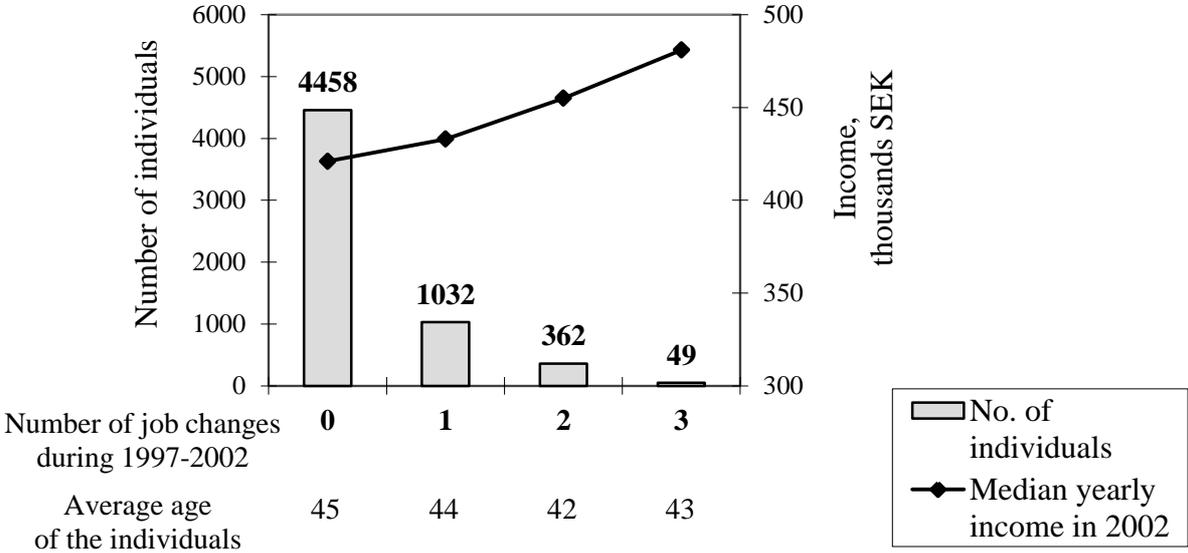
Source: PLACE database.

Figure 2. Job-to-job mobility of ICT workers in Mjärdevi and Kista clusters compared with total mobility on the Swedish labour market.



Sources: PLACE database and Andersson and Tegsjö (2006a).

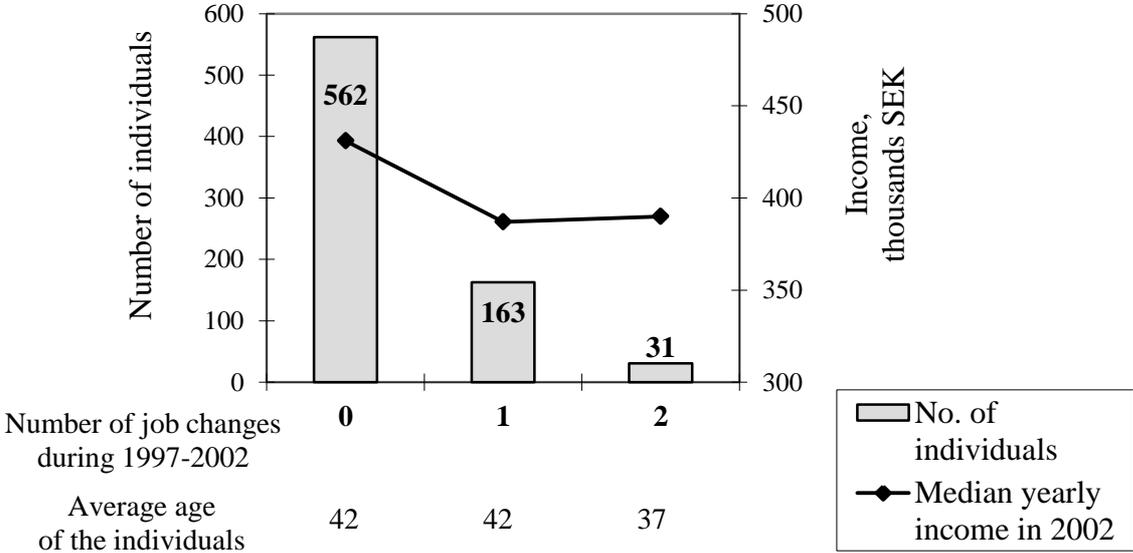
Figure 3. Median income and number of individuals in the Kista cluster per number of job changes made during 1997–2002.<sup>6</sup>



Source: PLACE database.

<sup>6</sup> Individuals employed in the Kista cluster all years between 1997 and 2002 are shown in the figure. Individuals with more than 3 job changes during 1997-2002 are not shown in the figure as there were fewer than ten observations.

Figure 4. Median income and number of individuals in the Mjärdevi cluster per number of job changes made during 1997–2002.<sup>7</sup>



Source: PLACE database.

<sup>7</sup> Individuals employed in the Mjärdevi cluster all years between 1997 and 2002 are shown in the figure. Individuals with more than 2 job changes during 1997-2002 are not shown in the figure as there were fewer than ten observations.