

The Intra-Metropolitan Competition for Attracting High-Tech Firms

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ABSTRACT

The study examines the considerations of high-tech firms when choosing a location within a metropolitan region. Since metropolitan regions function as a preferable location for high-tech firms, the competition among different places for attracting such firms is associated mainly with the quality and surroundings of the production milieu (i.e., a metropolitan region's local milieu). This study adopts the principles of the Regional Competitiveness Model developed by Kitson et al. (2004), which pointed to the competitive advantages created by the metropolitan region's capital assets. These spatial capitals were measured, and their effect on the probability of attracting high-tech firms was examined through discrete choice modeling. The empirical study examined competition among intra-metropolitan locations for attracting high-tech firms in the Tel-Aviv metropolitan region. Four industrial parks in different parts of the metropolis were selected for the analysis, and 117 managers of high-tech firms located in these industrial parks were interviewed.

Keywords: High-tech firms, Location-choice model, Metropolitan region, Spatial capital.

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This Working Paper summarizes the main results of research project conducted in the EU Sixth Framework Programme - RICAPE 2 – "Regional Comparative Advantage and Knowledge-Based Entrepreneurship"

Non-Technical Summary

The study examines the considerations of high-tech firms when choosing a location within a metropolitan region. Entrepreneurship development of technological innovation depends mainly on a production milieu that encourages a high level of local innovation and the synergy of different factors to create regional competitive advantages. An innovative production milieu reduces the uncertainty and risk that a firm might face in the process of innovating. The existence of entrepreneurship capital is one way to define a region's ability to create and attract new firms. This ability necessitates the existence of entrepreneurs and firms that are willing to take risks and to invest. Together with an encouraging milieu, entrepreneur activity is promoted through conditions appropriate for technological innovativeness, the existence of supporting formal and informal networks, and financial support like venture capital.

Since metropolitan regions function as a preferable location for high-tech firms, the competition among different places for attracting such firms is associated mainly with the quality and surroundings of the production milieu (i.e., a metropolitan region's local milieu). The high-tech industry has specific needs that differentiate it from other economic sectors. These needs result from the type of activities that take place in such firms, and they are expressed in a firm's location in the region. With respect to location, the metropolitan milieu of today, a polycentric metropolis plays a significant role in the creation of an agglomeration of high-tech firms within the region.

We study examined competition among intra- metropolitan locations for attracting high-tech firms in the Tel-Aviv metropolitan region. Four industrial parks in different parts of the metropolis were selected for the analysis, and 117 managers of high-tech firms located in these industrial parks were interviewed.

The findings show that in intra-metropolitan competition, different zones that seemingly enjoy the same opportunities desired by high-tech firms do, in fact, display

local differences. Such differences are associated to a large extent with the nearby milieu's spatial capital assets. They help to create an innovative milieu, thereby increasing a zone's attractiveness to high-tech firms. In contrast, only few significant differences were found among the structural features of high-tech plants located in the Tel Aviv metropolis. Small plants that invest high proportions of their revenue in R&D tend to locate in more central zones or in a supportive milieu that supplies a high standard of services. In comparison, large plants, usually found in more advanced stages of their life cycle and more involved in production activities, will compromise the level of service they receive in favor of considerations regarding direct costs. Their more organized business system and greater economic flexibility allow them to provide their own needs. Thus, our findings suggest that differences between zones are associated, not with their distance from the metropolis's core, but with advantages found in the local and metropolitan milieus. The results point at a milieu's attractiveness as being of greatest importance to small firms that rely on a skilled labor force and on R&D activities. This finding is important, since small firms are usually less established and more sensitive to costs. Nevertheless, we found that the relatively high costs resulting from local taxes do not necessarily harm the attractiveness of employment zones. Small plants tending to engage in R&D prefer, in fact, to locate in more expensive regions in the Tel Aviv metropolis; this means in Ramat Hahayal-Atidim and in Qiryat Etgarim. It seems that their metropolitan milieus supply supportive infrastructure, including a high-level human capital pool, supporting networks, and technological innovativeness as manifested in a high concentration of start-up firms and intensive venture-capital investments in the region.

Local development and investments to develop supportive human and social capital may increase a zone's competitive ability to attract high-tech firms. Human capital includes not only qualitative personnel but also a large pool of potential high-tech labor. The existence of this labor pool will enhance high-tech firms' confidence in their location and reduce the risk of their investment. A milieu encouraging innovation will create an

appropriate atmosphere and draw capital investments that will strengthen a region's image in the eyes of the high-tech industry.

The practical conclusion for decision-makers is that local authorities should emphasize the enhancement and growth of human capital through education, the creation of appropriate infrastructures, and the provision of social support networks--assets that can raise a region's attractiveness to high-tech firms.

1. Introduction

Entrepreneurship development of technological innovation depends mainly on a production milieu that encourages a high level of local innovation and the synergy of different factors to create regional competitive advantages (Mukkala and Ritsila, 2004). An innovative production milieu reduces the uncertainty and risk that a firm might face in the process of innovating (Camagni, 1995). The existence of entrepreneurship capital is one way to define a region's ability to create and attract new firms. This ability necessitates the existence of entrepreneurs and firms that are willing to take risks and to invest. Together with an encouraging milieu, entrepreneur activity is promoted through conditions appropriate for technological innovativeness, the existence of supporting formal and informal networks, and financial support like venture capital (Audretsch and Keilbach, 2004).

In intra-metropolitan competition, prominent differences are associated with the local production milieu and the adjoining metropolitan milieu, which combine to create advantages manifested in types of spatial capital. A local production milieu becomes attractive when companies agglomerate within it, creating economies of scale (Davelaar, 1991; Audretsch and Feldman, 1996; Porter, 1998; McCann and Shefer, 2004). The high-tech industry has specific needs that differentiate it from other economic sectors. These needs result from the type of activities that take place in such firms, and they are expressed in a firm's location in the region. With respect to location, the metropolitan milieu of today, a polycentric metropolis plays a significant role in the creation of an agglomeration of high-tech firms within the region.

The competition between cities and regions is based on absolute advantage rather than on relative advantage (Camagni, 2002). A region's absolute advantage is manifested in its technology level, developed infrastructures, social advantages (manpower, etc.), and institutional infrastructure, all of which are at higher levels than those of other regions. Even though these elements are assets exterior to the firm, they create advantages through their contribution to the firm's productiveness, thus suggest two key questions. First what are the revealed locational preferences of high-tech firms within a metropolitan region? Secondly, how different local milieus create competitive advantages that help to attract high-tech firms?

2. Objectives and Hypothesis

The main purpose of this study was to identify the considerations prioritized by high-tech firms in the process of choosing a location within a metropolitan region for establishing or relocating their business. We assume that location considerations are affected by intra-metropolitan diversity. In general, the location choice of high-tech firms depends on the utility they obtain from the combination of factors connected to the production milieu, the stage in their lifecycle, and their technological level (Frenkel, 2001; Ng and Tuan, 2003). In this study, we argue that the combination of the metropolitan region's specific local milieu, the local production milieu, and the firm's structural variables compose a firm's utility function for location choice, and this is what will determine its location within a metropolitan region.

Metropolitan regions supply high-tech firms with basic needs and, therefore, function as the preferable location for high-tech firms. Accordingly, we hypothesize that there is little difference in the structural attributes of such firms located within the metropolis in comparison to the differences that were found between central and peripheral regions (Davelaar, 1991; Dijk and Pellenbarg, 2000; Frenkel 2001). We then argue that the competition to attract high-tech firm within the metropolitan region is associated mainly with intra-metropolitan differences. Such differences occur during the evolution of the metropolis's polycentric pattern (Parr, 2004) by fostering production milieus (employment zones) and local milieus with different relative advantages. Accordingly, we expect to find that the advantageous offered by different milieus will have a greater effect in attracting high-tech firms than those emanating from the structural attributes of the firms themselves.

3. Background

Entrepreneurship, Agglomeration, and Regional Economic Growth

High-tech industry has become one of the greatest engines fostering economic growth in the global economy. This is due to these firms' innovativeness, which results from a combination of technological developments and market needs. This process is composed of a sequence of activities that begins with an idea and ends with the development and manufacturing of a product (Ficher, 1995). Knowledge and technology by themselves, however, are insufficient for economic growth creation. A major element in building new markets, invigorating business sectors, and economic

growth in general is entrepreneurship (Acs and Armington, 2004; Audretsch and Keillbach, 2004; Fritch and Muller, 2004). Regions that traditionally encourage entrepreneurship and innovative activities have a higher probability of growth. An absence of entrepreneurship will lead to insufficient resource utilization, which may lead to the economic stagnation of firms, cities, and regions (Acs and Storey, 2004).

R&D is a crucial component in the activities of high-tech firms and the extent of investment in it is usually high (Davelaar, 1991; Stokey, 1995; Griliches, 1995; Bayoumi et al., 1999; Hall, 1996; Hall and Reenen, 1999/2000; Danell and Persson, 2003). The ability to engage in R&D activity depends first and foremost on the availability of quality human resources, which is necessary for the development of innovation. Innovation is necessary to maintain different market niches, especially in cases in which products are exposed to rapid technological changes (Suarez-Villa and Walrod, 1997; Mariani, 2002).

Another element that contributes to the economic growth of regions is the agglomeration of firms and industries. Agglomeration creates competitive advantages for firms; hence it has much influence on their growth (Porter, 1990; McCann, 2001). Concentration or "clusters," of firms, is usually organized in a suitable business milieu characterized by the existence of scientific knowledge, especially in universities and research institutes (Porter, 1998). These concentrations are also served by institutional commerce and support organizations, helping to strengthen relationships among the different actors in order to create competitive advantages. The concept of "industrial clusters" has recently been added to regional models as part of the common debate regarding the potential advantages of industrial clusters for entrepreneurship, investments, and risk reduction. (McCann and Arita, 2002).

Agglomeration also has a positive effect on a firm's activity. Geographical proximity between high-tech firms engaging in R&D creates positive externalities that lower development costs. Knowledge spillover between firms contributes most significantly to their R&D process. A concentration of firms at a location makes it possible for them to achieve technological advantages and a competitive ability that combine to raise profitability and improve performance in spite of the intensive competition (Satterthwaite, 1992; Gersbach and Schmutzler, 2000; Suars-Villa, 2003). The stability of firms and the continued development of high-tech agglomeration require

the development of infrastructure that is appropriate for the needs of high-tech firms and strengthen a region's competitive advantages (Saxenian, 1994). Infrastructure development promotes a high level of accessibility that may enlarge the exposure of companies and products. It reduces the costs of production supply, enhance access for workers and clients, and consequently increase the demand for both employment and products (McCann and Shefer, 2004).

The Metropolitan Milieu

High-tech firms in metropolitan regions are in general characterized by technological innovativeness. Most high-tech firms in the metropolitan region are located in organized science and industrial parks. The location of industrial and science parks is affected by the evolution of a polycentric metropolis pattern that has occurred in the past few decades. The spatial structure that characterizes the polycentric metropolis contains a main C.B.D. in addition to several centers. This structure allows it to enjoy the advantages of a large urban center and, in parallel, to reduce its disadvantages, such as high land costs, traffic congestion, and air pollution (Parr, 2004). Inner-metropolitan zones in the new polycentric pattern began to take advantage of the utilities that an urban-metropolitan environment offers and to compete in attracting firms (Suarez-Villa and Walrod, 1997; Wu, 1999; Parr, 2004).

The polycentric milieu provides available skilled workers living in the area, proximity to venture capital resources, and business services that support the firms' activities. The well-developed infrastructure promotes knowledge transformation through advanced means of communication, and it supplies access to centers of employment. In addition, the prestigious image of metropolitan areas has contributed to their ability to attract high-tech firms (Danell and Persson, 2003). The polycentric pattern of today's metropolis supplies a scope of choices among different location options. A firm's location in a particular area in the metropolis might allow it to be more competitive through a reduction in transaction and R&D costs (Suarez-Villa and Rama, 1996). Proximity to an airport and to a highway, and the distance from the metropolitan CBD are also important to high-tech firms (Shuka and Waddel, 1991; Wu, 1999).

Finally, in order to develop a region that can attract high-tech firms, it needs to create advantages in the characteristics that enable firm's high level of production (Turok,

2004). Still other variable that influence a firm's location choice are the quality of residential areas and infrastructure in the nearby region. In this respect, the proximity to qualitative residential areas, and to cultural and educational activities, will increase the attraction of the region (Gottlieb, 1995).

4. Methodology

The Model

Previous studies have highlighted a number of factors that may influence the utility function underlying a firm's choice of location (see, for example, Felsenstein, 1996; Love and Roper, 1999; Suarez-Villa and Rama, 1996; Frenkel, 2001; Nachum and Wymbs, 2002; Almazan et al, 2007). The models most preferred in these studies are discrete choice models, which basically serve as decision-making models implementing concepts derived from micro-economic utility theory.

With regard to the specific issue of intra-metropolitan competition in attracting high-tech firms, we considered three groups of "conditioning" variables that might influence the probability that firm i would choose employment zone j within a metropolitan region P_{ij} . This suggests a model of the form:

$$(1) \quad P_{ij} = f(A_{ix}, L_{jy}, M_{jz})$$

Where:

P_{ij} = the probability that firm i will choose employment zone j as its preferred location, where it will achieve its maximal utility ($j=1\dots n$).

A_{ix} = attribute x of firm i (for example, size, investments in R&D, percentage of skilled employees, etc.) ($x=1\dots m$).

L_{jy} = characteristic y of employment zone j ; the variables represent the local production milieu (for example, the extent of management and maintenance services, land rent, municipal tax, distance from the metropolis's CBD. etc.). ($y=1\dots s$).

M_{jz} = characteristic z of the metropolitan local milieu where employment zone j is located; these variables represent the capital assets of the metropolitan's milieu ($z=1\dots r$) (see, in detail, below).

The Logit discrete choice model was employed for the empirical analysis. The model assumes that rational considerations dictate individual behavior; that is, a decision is

based on the desire to maximize one's utility level (Ben-Akiva and Lerman, 1985; Pindyck and Rubinfeld, 1981). Accordingly, discrete choice theory assumes that from a given set of alternatives, the one chosen will be the alternative that yields the maximum utility level. The model fits the case in which the dependent variable is a dichotomy or categorical variable that refers to a qualitative choice from among several alternatives (for example, see Wu, 1999; Mariani, 2002).

The choice model within a set of alternatives in the present study assumes n mutually exclusive alternatives of locations (employment zones) and is given by the following expression:

$$(2) \quad P_{ij} = \frac{\ell^{V_{ij}}}{\sum_{k=1}^n \ell^{V_{ik}}}$$

Where:

V_i = a utility function of the explanatory variables related to location j where firm i chooses to locate in the model as follows:

$$(3) \quad V_{ij} = \beta_0 + \sum_{x=1}^m \beta_x A_{ix} + \sum_{y=1}^s \beta_{m+1} L_{jy} + \sum_{z=1}^r \beta_{m+s+1} M_{jz} + \varepsilon_i$$

Where:

$\beta_0, \dots, \beta_{m+s+1}$ = parameters to be estimated.
 ε_i = error term, so that $E(\varepsilon) = 0$.

The utility function in the model is composed of the variables that presented the actual location chosen by the firms, the alternative features (such as the employment zone's attributes and the metropolitan local milieu characteristics), and the decision-makers' features (the firm's attributes). More specifically, we hypothesize that the particular features of the employment zones, especially their nearest surroundings (e.g. local milieu), have a significant effect on the ability to attract high-tech firms to certain places in the metropolitan region. These features may contribute to a firm's competitive advantage in a situation in which similar competition conditions exist as in the case of a metropolitan region.

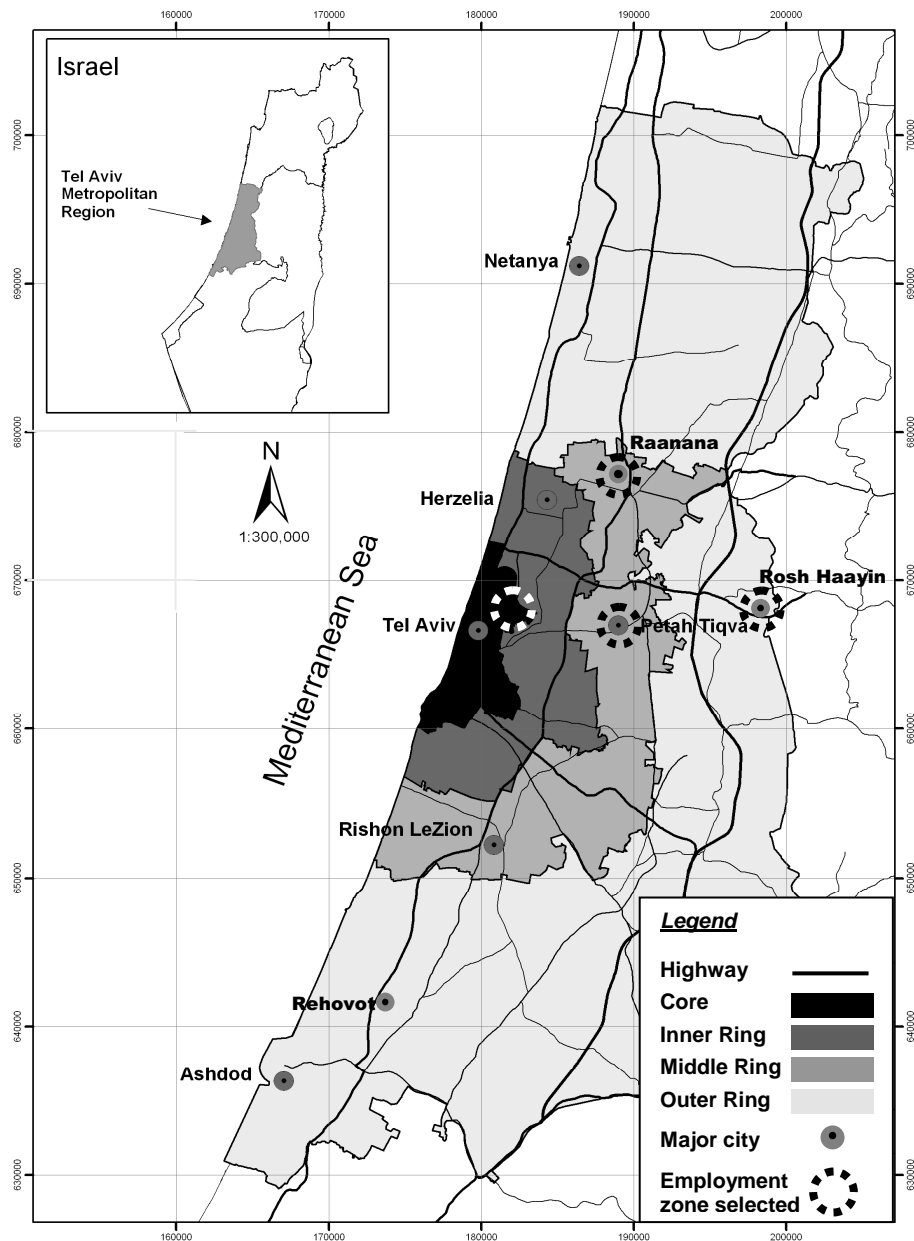
The characteristics of the metropolitan local milieu (the third group of variables in the model) were examined by employing the Regional Competitiveness Model developed by Kitson et al. 2004. The idea behind this model is that regional competitive advantage benefits from certain and softer dimensions of the regional or urban socio-

economy in addition to the region's productivity. These dimensions include six "capital" assets that contribute to a region's competitive ability: Human capital - quality and skill of labor force; Social/institutional capital - the extent, depth, and orientation of social networks and institutional forms; Cultural capital - the range and quality of cultural facilities and assets; Knowledge/creative capital - the presence of an innovative, creative class; and Infrastructural capital - the scale and quality of public infrastructure. All these assets support the creation of an efficient productive basis for the regional economy (productive capital). They act as key assets or externalities that benefit firms and businesses, and hence they are major components of regional competitive advantage.

Data Source

The Tel-Aviv metropolitan region was selected for the empirical study (Map1). A total of 3.04 million people, constituting 43.5% of the total Israeli population, resided there in 2006. The city of Tel-Aviv, the metropolitan core, included 384,000 inhabitants (12.4% of the metropolis population). The metropolitan region has a developed R&D infrastructure, a liberal policy regarding the support of technological activities, and both a small local and regional market as well (Felsenstein and Ergas, 2002).

The Tel Aviv metropolis presents a polycentric pattern, in which a number of employment centers benefit from the advantages of a metropolitan location. Most of the employment centres are relatively accessible to a large pool of highly skilled workers and to highly developed communications infrastructures. These centers are located near business and financial services and other positive externalities. Being part of the same metropolitan region, they compete with one another to attract high-tech firms although they seemingly operate in similar conditions emanating from their location in the central Israeli metropolis. Therefore, the Tel Aviv metropolis offers a suitable case for examining the differences between these centres and their impact on a firm's location preferences.



Map 1: Tel-Aviv metropolitan region

In order to examine our hypotheses, sub-centers (including large employment zones) in the Tel Aviv metropolitan region were identified by employing several criteria for the division of a polycentric metropolis, based on the Growth Pole Model developed by Par (2004). In all, 11 metropolitan poles (each functioning as a metropolitan local milieu) and their employment zones were identified. Seven of them specialized in high-tech industries, each with an agglomeration of such firms, thus having relevance to our study. Four employment zones were selected for the analysis according to differences in their characteristics: population size, distance from the metropolitan CBD., type of management, number of firms, and specialization (see Map 1).

The biggest of the four employment zones selected in terms of number of employees and firms is Ramat Hahayal-Atidim, which is located in the north-eastern part of the city of Tel-Aviv (the metropolitan core area). Next is Qiryat Arie, an industrial zone located in a large-medium-size city, Petach Tikva, in the middle ring of the Tel Aviv metropolitan region. The third employment zone is Qiryat Etgarim, a high-tech park located in Raanana, a medium-size city in the middle ring, and the last zone is Afeq Park, a high-tech park located in a small town, Rosh Haayin, in the outer ring of the Tel Aviv metropolitan region.

A field survey was conducted in each of the four employment zones selected. Senior managers from 117 high-tech plants located in the four zones were interviewed through a well-constructed internet questionnaire, which provided sufficient data on their firms' attributes, as well as their location considerations. The sample constitutes 23.5% of the 498 high-tech plants located in the four zones. The sample plants employ 8,250 workers, who comprise 18% of all high-tech employees in these four employment zones. The distribution regarding the four zones is presented in Table 1.

Table 1: Distribution of Sample Plants, by Employment Zone

Center pole/Employment zone	Total High-Tech Plants		Sample Plants		% of sample of total
	Number	Percentage	Number	Percentage	
Tel Aviv - Ramat Hahayal-Atidim	164	32.9	30	25.6	18.3
Petach Tikva - Qiryat Arie	118	23.6	29	24.8	24.6
Raanana - Qiryat Etgarim	121	24.3	27	23.1	22.3
Rosh Haayin - Afeq Park	95	19.1	31	26.5	32.6
Total	498	100.0	117	100.0	23.5

Most of the high-tech firms sampled are small and medium size insofar as number of employees (under 50). The most prominent fields of both the sampled plants and the total (almost 90% of each) are electronics, software, and communications equipment. Slight differences were found in regard to annual revenue and plants size, with less representation of plants in the sample that had annual revenues above \$10 million and a labor force of more than 100 employees. However, this group of plants is not prominent, and hence the sample well represents the total high-tech plants located in the four industrial zones.

5. The Employment Zones Selected and the High-Tech Plants Within The Employment Zones

The four employment zones differ geographically and, as manifested in their size and type of management (Table 2). Two of the zones—Ramat Hahayal-Atidim and Qiryat Arie—are larger in terms of number of plants and employees. These two larger zones are older and located closer to the center of the metropolitan region. They contain a large number of services and complementary business facilities. Of the four zones, Ramat Hahayal-Atidim is the most pronounced high-tech center, having the fewest traditional firms, the largest number of high-tech workers, and many supporting services.

Property taxes decrease with distance from the metropolitan center, but this does not hold true for rents (Table 2). Thus the factors that affect costs are not necessarily connected to distance from the core of the metropolis, but rather to other attributes of the production milieu and the metropolitan local milieu.

Another difference among the four zones is the mix of firms and companies within each. Ramat Hahayal-Atidim is characterized by a large number of service and food businesses, whereas Afeq Park has a relatively small amount of such businesses. Qiryat Arie is more characterized by a mix of traditional industries and workshops, even though high-tech firms are dominant there. Qiryat Etgarim is prominent in the number of foreign companies located in this zone. These differences indicate that a single employment zone may stand out in a particular domain because of a production environment that differs from other zones.

High-Tech Plants – A Comparative Analysis

As for most of these plants' attributes, no statistically significant differences in size, age, number of years at the site, and annual revenue were found to exist among the four employment zones (Table 3). Hence these characteristics were not found to be associated with the choice of location within the metropolitan region as expected.

Table 2: Major Features of the Four Employment Zones

Feature	Ramat Hahayal - Atidim	Qiryat Arie	Qiryat Etgarim	Afeq Park
Location in the metropolis	Core city	Large- medium- size city in the middle ring	Medium-size city in the middle ring	Small town, in the outer ring
Years in existence	32	50	8	14
Type of management	Private management company and municipality	Municipality economic corporation	Engineering administration of the municipality	Municipality economic corporation
Site size (hectare)	65	250	80	90
Distance from metropolitan CBD (km)	6.8	7	18.5	19.5
Time travel from metropolitan CBD (minutes)	16	18	32	40
Built-up floor area (square meter)	500,000	700,000	350,000	300,000
Number of firms and companies at site ¹	500	345	325	280
Number of high-tech plants	165	110	115	90
Number of traditional industrial plants	12	39	9	29
Percentage of high-tech plants	33%	32%	35%	32%
Rent of buildings (\$ per square meter)	15	8	12	12
Municipal tax for high-tech firms (\$ per square meter per year) ²	29	28	25	23
Overall number of employees	23,500	14,500	11,100	11,000
Number of employees in high-tech plants	18,700	12,000	9,500	4,600
Percentage of employees in high-tech plants	80%	83%	86%	42%
Percentage of originally Israeli firms	97%	88%	89%	89%

Source: Data were collected through interviews that were held at the local authorities and with response bodies of the industrial zones selected. Additional information was collected from surveys conducted among the firms in the different zones.

1. All kinds of firms: productive firms (including high-tech), commerce and retail, food, finance, services, and so on.
2. Property taxes were based on the municipalities' property taxes for 2006.

Table 3: Distribution of Attributes of Sample Plants, by Employment Zone

Variable	Ramat Hahayal (N=30)		Qiryat Arie (N=29)		Qiryat Etgarim (N=27)		Afeq Park (N=31)		Overall Sample (N=117)		ANOVA test
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	F -value
Plant size (number of employees)	67.2	138.1	31.8	29.4	43.7	132.0	41.9	43.3	46.1	97.2	0.68
Age (years)	11.8	7.1	16	11.9	9.6	6.2	16.3	18.7	13.5	12.4	2.08
Years of existence at site	7.4	4.5	7.5	4.7	6.3	3.4	8	5.3	7.4	4.5	0.67
Annual income (\$000), 2005	25,945	81,055	10,604	19,326	16,044	61,564	6,212	8,846	14,532	51,223	1.62
% academic employees	79.1	22.1	56.8	30.6	75.6	28.7	60.8	25.6	67.9	28.2	4.83*

* Statistically significant at 99%.

The exception is the percentage of academic employees, which is significantly higher in Ramat Hahayal-Atidim and Qiryat Etgarim than in Qiryat Arie and Afeq Park. The first two employment zones benefit from a highly supportive milieu (see Section 6), thus attracting plants that are based mainly on a highly skilled labor force (but was found unrelated to plant size). Accordingly, Qiryat Etgarim is more appealing than Qiryat Arie, which is located closer to the metropolis's center, or Afeq Park, which is located at the same distance from the center. Apparently, the proximity to a relatively high level of human capital is the reason for Qiryat Etgarim's attractiveness.

In regard to their life-cycle stage, most plants in the sample (62.4%) are at their established stage (Table 4), meaning they have a mature product and growing sales in the market. Hence, the findings do not support the assumption that the metropolitan region, and even the metropolitan core, attracts more plants during their early stages. We hypothesize that this finding is due to the great involvement of high-tech plants in R&D activities in the metropolitan region, even in their mature stage (see below).

Statistically significant differences were found among the four employment zones in regard to their stage in the life cycle: Ramat Hahayal-Atidim and Qiryat Etgarim relatively tend to attract more plants that are at their early stage (28.6% and 20% respectively), while Qiryat Arie and Afeq Park seem more suited for more established plants (64.5% and 85.7% respectively). Thus, plants at their initial stage do not necessarily prefer to locate in the metropolitan inner ring, while plants at their established stage do not necessarily prefer to locate in the metropolitan fringes. We

assume that this pattern is the result of the polycentric evolution of the Tel Aviv metropolitan region.

Table 4: Distribution of Plants According to Life-Cycle Stage (%)

Stage	Ramat Hahayal-Atidim	Qiryat Arie	Qiryat Etgarim	Afeq Park	Total
Seed stage	14.3	3.2	3.3	0.0	5.1
Start-up	14.3	9.7	16.7	3.6	11.1
Early growth	17.9	22.6	33.3	10.7	21.4
Establishment	53.6	64.5	46.7	85.7	62.4
Total	100.0	100.0	100.0	100.0	100.0
N	30	29	31	27	117

Source: Plants Field Survey, 2007

$\chi^2=16.68$; $df=9$; $sig=0.054$

With respect to actual location choice, most plants transferred to their current site from other sites (66 of the 117 plants), particularly in Qiryat Arie (Table 5). Most also (71% on average) transferred from sites nearest their present locations. In addition, managers indicated that during the location-choice process, most plants considered locating to the surroundings nearest the site eventually chosen (in the same metropolitan ring or to the nearest ring). These results imply a tendency to remain in a familiar milieu or in a milieu that provides similar conditions. It shows that a relatively narrow ribbon of mobility exists in the metropolitan region, a situation that amplifies regional competition within the metropolitan region.

Table 5: Plant Location Preference, by Employment Zone

Variable	Ramat Hahayal (N=30)	Qiryat Arie (N=29)	Qiryat Etgarim (N=27)	Afeq Park (N=31)	Total (N=117)
% of plants initially not established at site	53.0	66.0	55.6	51.6	56.4
Initial location in the nearby milieu ¹	62.5	84.2	53.3	81.2	71.2
% of plants serving customers at same location	20.0	20.7	7.4	25.8	18.8

¹ Percentage calculated from the overall number of plants that were not established at the site.

Source: Plants Field Survey, 2007

High-tech industry is mainly involved in R&D activity carried out by plants. The existence of R&D, its location, and extent can indicate the demand for skilled labor and require a great amount of investment. Most of the high-tech plants in all four employment zones carry out R&D activity to some extent at the same site where they are located, and usually inside the plant as a part of its ongoing activities; otherwise, at a separate division located elsewhere in the metropolitan region.

Most of the high-tech plants that engage in R&D in the four employment zones (75%) invest 30%-60% of their expenditures in R&D. However, statistically significant differences were found among the four employment zones (Table 6). The lowest R&D percentage was found at Qiryat Arie and Afeq Park. More than 50% of the plants in these two employment zones invested up to 30%, compared to 39% of all sampled plants, and about 5% of them invested over 60% compared to the 20% average of all plants. On the other hand, more than one third of the plants in Ramat Hahayal-Atidim and Qiryat Etgarim invest more than 60% of their expenditure in R&D.

Table 6: Percentage of Plant Investments in R&D of Total Expenditures

% expenditures in R&D investment	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park	Total
Up to 30%	30.8	57.9	16.7	50.0	39.1
30%-60%	34.6	36.8	44.4	45.8	40.2
Over 60%	34.6	5.3	38.9	4.2	20.7
Total	100.0	100.0	100.0	100.0	100.0
N	26	19	19	24	87

Source: Plants Field Survey, 2007

$\chi^2 = 16.4$ df = 6; sig. = 0.012

6. Intra-Metropolitan Local Milieus

In defining metropolitan local milieus, we refer to the nearby surroundings of each of the employment zones under examination. This includes the city to which the employment zone belongs and its hinterland. Several indices (variables) were ascribed to each of the seven capital assets defined through the Regional Competitiveness Model developed by Kitson et al. 2004 (see methodology section). The level of spatial capital in each of the metropolitan local milieus was measured with these variables.

Benchmark analysis was employed to indicate the performance of each of the capital assets defined in the local milieus. The variables were ranked on an ordinal scale of 1-10 (1 = lowest score; 10 = highest score), and an average score was computed for every metropolitan local milieu. The benchmark analysis indicates the capital assets that create advantages for the metropolitan local milieu that encompasses each employment zone selected. The level of capital assets in the four metropolitan local milieus will now be presented.

Spatial Capitals

Productive Capital

Productive capital offers a supportive infrastructure for the high-tech industry. The existence and level of this capital asset were measured by the extent of the floor area devoted to supportive activities (industries, businesses, commerce, and banking) in the city area adjacent to the employment zone, normalized by the number of high-tech firms in each of the zones examined. In addition, the percentage of employees in supporting businesses in the metropolitan milieu described was measured. A high value indicates a potentially large supply of supporting services in the region (Table 7).

Table 7: Productive Capital Variables, by Metropolitan Local Milieu

Variable	Metropolitan Milieus Ascribed to Employment Zones			
	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Industry and workshops floor area (square meter) per high-tech plant	8,254	9,134	2,416	3,001
Businesses floor area (square meter) per high-tech plant ¹	26,627	3,878	2,072	4,689
Percentage of employees in business services	25.7	18.1	16.2	10.7
Banking floor area (square meter) per high-tech plant	2,442	131	64	42
Commerce floor area (square meter) per high-tech plant	13,709	6,664	652	311
Benchmark analysis average score	9.8	4.8	2.1	1.9

¹ These include accounting offices, lawyer's offices, business advisory, real estate, banking, and financial advisory.

Source: Israel Central Bureau of Statistic, local authorities; data sets, 2005, CBS local authorities' website.

The results obtained from the benchmark analysis indicate that Ramat Hahayal-Atidim gains the most potential from its nearby milieu. The advantage (found in all measures tested) of this zone is especially manifested in supporting businesses and services, particularly in the financial sector. Qiryat Arie also benefits from its nearby milieu in most of the variables in comparison with Qiryat Etgarim and Afeq Park, and hence its productive capital is greater than theirs. Qiryat Etgarim and Afeq Park are relatively similar in their productive capital.

Human Capital

Human capital represents the value that is embodied in high levels of education and in the occupational skills of individuals and groups. Human capital is essential to rapid economic growth and contributes to the ability of firms to develop innovative products and continue being competitive in the international market. The extent and level of human capital in a region can be evaluated through measurements indicating a population's socio-economic level, educational level, and occupational skills of workers living in the metropolitan milieu near the employment zone (Table 8). Human capital also has an influence on a region's image.

Table 8: Human Capital Variables, by Metropolitan Local Milieu

Variable	Metropolitan Milieus Ascribed to Employment Zones			
	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Socio-economic ranking (weighted average of localities) ¹	7.8	6.4	8.0	7.1
Percentage of students of the group aged 20-29 living in the region	21	18	23	18
Percentage employed in knowledge-based occupations	10	13	11	14
Percentage of academicians living in the region ²	23	22	27	26
Benchmark analysis average score	8.6	8.3	9.5	9.1

Source: Israeli Central Bureau of Statistic's datasets.

¹ This measure is based on the Israel Central Bureau of Statistic's socio-economic ranking.

² Percentage of the population that lives in the near metropolitan milieu and holds a bachelor's or higher academic degree.

The data analysis shows that the metropolitan local milieu that is most prominent of the four in regard to the level of human capital is that of Qiryat Etgarim. However, the local milieu of Ramat Hahayal-Atidim has the largest reservoir of skilled and qualified knowledge-based occupations. The weakest milieu in these matters is Qiryat Arie, since the socio-economic status of the Petach Tikva population is lower than the others.

Social Capitals

Social capital results from relationships and mutual trust among people in the society. It is based on the quality of social relationships, people's manner of behavior, and the region's social construction (World Bank, 1998; Lin, 2001; Jaeger and Holm, 2007). The variables (Table 9) present two categories of social networks, based on Putnam's work (Putnam, 2000): Supportive social networks - characterized by strong

preliminary relationships (family, neighbors, and friends) and the willingness to receive help and assistance from others, thus providing the individual with a physical and spiritual security network; Bridging social networks - characterized by weaker relationships between people of different backgrounds but with similar economic status and political orientation. These networks provide access to diverse resources and contribute to decision-making that helps in crisis situations.

Table 9: Social Capital Variables, by Metropolitan Local Milieu

Category	Variable	Metropolitan Milieus Ascribed to Employment Zones			
		Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Supportive social networks	% of inhabitants who report having supportive social networks	90.3	84.6	90.5	92.5
	% of inhabitants who feel lonely – ‘once in a while’ to ‘often’	30.5	29.5	27.4	26.4
Bridging social networks	% of residents who looked for work through relatives and friends	40.7	33.3	38.2	35.6
	% of residents who volunteered in the community in the past year	14.9	11.7	18.4	23.2
Benchmark analysis average score		9.0	8.0	9.0	9.4

Source: Israel Central Bureau of Statistics, Social Survey 2006.

The findings indicate relatively small differences in the level of social capital among the four metropolitan local milieus. Afeq Park’s surroundings lead in this variable as a result of the presence of supportive and bridging networks in this region, which consists of small towns and a large rural area with small community settlements.

Institutional Capitals

Public and educational institutions are among the basic services provided by authorities, and therefore they indicate the institutional capital of a region and the level of services provided to the inhabitants. In addition, a balanced budget indicates a local authority’s high level of management, whereas reliance on governmental budget support indicates low management ability and dependence on exterior budgets.

Over all, the level of educational services was similar in all regions (Table 10). This finding is probably linked to the municipality’s legal obligation to provide educational services according to identical standards. In contrast, significant differences were found in the public services, possibly due to the fact that some of the services are provided on an informal basis. In matters of budgetary balance, the municipality of Petach Tikva (which includes Qiryat Arie's metropolitan milieu) is the only one of those under examination that is in deficit, whereas the city of Tel Aviv has the most

positive balance, followed by Raanana and Rosh Haayin. In matters of income received from governmental allocations, the cities of Petach Tikva and Rosh Haayin in particular, are much more dependent than Tel Aviv or Raanana-Kfar Saba. These findings indicate that the metropolitan milieus ascribed to Ramat Hahayal-Atidim have a high level of institutional capital, above the other local milieus, in particular Afeq Park and Qiryat Arie.

Table 10: Institutional Capital Variables, by Metropolitan Local Milieu

Variable	Metropolitan Milieus Ascribed to Employment Zones			
	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Education floor area (square meter) per 1,000 inhabitants	4,592	4,789	4,975	4,884
Public services floor area (square meter) per 1,000 inhabitants	5,854	4,203	1,980	2,713
% governmental participation in a local authority's regular budget	12	20	17	31
Budget balance in US\$ per 1,000 inhabitants	7,700	-20,200	4,800	1,140
Benchmark analysis average score	9.8	6.7	7.2	5.9

Source: Israel Central Bureau of Statistics, local authority data sets 2005, and localities' budget reports, 2005.

Cultural Capital

The cultural environment is crucial for the individual and the society, no less than for the natural environment. In the current era, status ascription is not based upon human capital or material capital alone, but upon cultural capital as well. Cultural capital, which is the product of different life styles, is reflected in the character of different environments: the family, the neighborhood, the town, and the country. Culture capital measurements allow an assessment of the quality of the components of the culture infrastructure that are available in the region.

The findings indicate that the metropolitan local milieus of Qiryat Etgarim and Ramat Hahayal-Atidim are richer in culture capital in comparison to the two other zones (Table 11). The two local milieus are ranked highest in most measurements. Ramat Hahayal-Atidim metropolitan milieu, especially the city of Tel-Aviv, predominates in the number of cultural infrastructures and institutions.

Table 11: Culture Capital Variables, by Metropolitan Local Milieu

Variable	Metropolitan Milieus Ascribed to Employment Zones			
	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Culture, leisure, recreation, and sport institutions – floor area (square meter) per 1,000 inhabitants	2,301	725	2,378	733
Local authority's expenditure on culture – US\$ per 1,000 inhabitants (2005)	27	154	72	118
Monthly average wage of hired workers during 2005 (US\$)	1,365	2,295	1,460	1,750
Open public space – square meter per 1,000 inhabitants	15,189	2,759	5,702	5,128
High frequency activities ¹ – institutions per 1,000 inhabitants	0.24	0.23	0.62	0.27
Low frequency activities ² – institutions per 1,000 inhabitants	0.1	0.06	0.08	0.08
Household monthly consumption expenditure money on culture, sports, and leisure, by net income per standard person (US\$)	62	71	62	71
% of residents participating in leisure activities in the past 12 months (2005 data)	30	27	40	24
Benchmark analysis average score	8.3	5.3	9.0	5.3

Sources: Israel Central Bureau of Statistics, social survey 2005, authorities' data sets 2005, CBS local authorities web sites.

¹ Community centers, movie theaters, sport facilities, and libraries.

² Low frequency institutions include galleries, museums, and theatres.

Infrastructure Capital

Infrastructure capital is expressed by the existence of public infrastructures meant to support the inhabitants, workers, and economic activities of a region. This type of capital reflects the physical environment and its level of development, as well as the dwelling opportunities that a metropolitan milieu provides (Table 12).

Table 12: Infrastructure Capital Variables, by Metropolitan Local Milieu

Variable	Metropolitan Milieus Ascribed to Employment Zones			
	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Construction completed, 2004-2006 (thousand square meters per 1,000 residents)	5.8	4.3	3.4	3.2
Construction, widening, and repair of roads, 2004-2006 (meter per 1,000 residents)	90	38	16	215
Distance of employment zone from main highway (km)	3.2	0.5	1	1
Distance of employment zone from rail station (km)	2	6	5.5	3
Dwelling opportunities (variety of settlement types)	1	2	3	3
Benchmark analysis average score	5.8	5.8	5.0	7.4

Source: Israel Central Bureau of Statistic, local authorities' data sets 2005, CBS local authorities web sites.

Tel-Aviv, which serves as the local milieu of Ramat-Hahayal-Atidim, leads in the construction index as a result of high demand for both residential and, in particular, business areas in the core city. In contrast, the milieu in which the largest extent of infrastructure development has taken place is Rosh Haayin (Afeq Park).

The proximity to developed transportation infrastructures, such as main highways and railway stations, indicates a high level of accessibility and the direct connection of a zone to the rest of the metropolis and to the country as a whole. In this respect, Ramat Hahayal-Atidim enjoys high proximity to a rail station while Qiryat Arie benefits from main highways.

Although the four employment zones are located in urbanized areas, their surroundings differ in the variety of living forms. Two of the zones, Ramat Hahayal-Atidim and Qiryat Arie, are each located in a big city, marked by high density and a relatively narrow variety of dwelling styles. Qiryat Etgarim and Afeq Park are situated in a region that is more varied in matters of dwelling opportunities and is surrounded by rural settlements.

Knowledge and Creativity Capitals

Knowledge and creativity capitals are associated with a region's innovativeness and entrepreneurship potential and with its ability to draw and create new and innovative firms. Entrepreneurship ability necessitates the existence of investors, along with an environment that encourages entrepreneurship by supplying appropriate conditions for such activity. The variables in Table 13 are based on a computation of location quotients in regard to innovation activities in the various local milieus.

Table 13: Enterprenership and Creative Capital Variables, by Metropolitan Local Milieu

Variable	Metropolitan Milieus Ascribed to Employment Zones			
	Ramat Hahayal	Qiryat Arie	Qiryat Etgarim	Afeq Park
Spcialization in employment in start-ups in the region ¹	1.22	1.53	2.57	1.53
Spcialization in investments in start-ups in the region ²	1.14	1.60	3.17	1.60
Benchmark analysis average score	4.2	5.5	10.0	5.5

Source: Schwartz and Bar-El (2007).

¹ Location quotient of employees in start-ups in the region in relation to employment in high-tech activities in the same region.

² Location quotient of investments in start-ups in the region in relation to employment in high-tech activities in the same region.

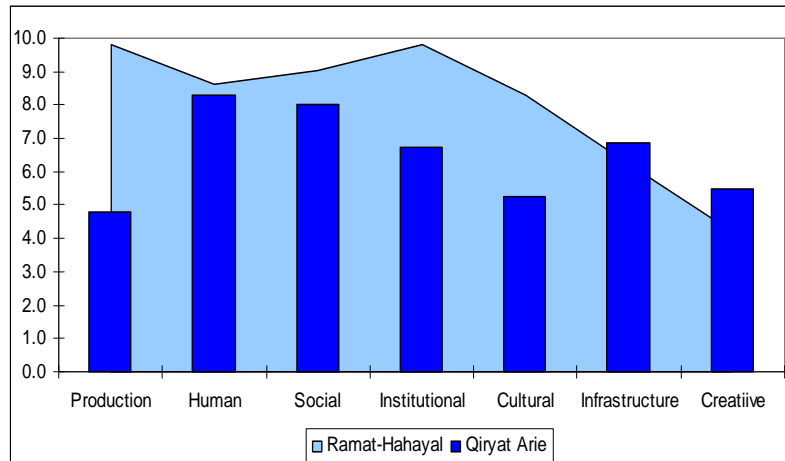
All four regions specialize in start-up firms and receive a high share of the investment of venture capital, since all their location quotients are above 1.0. However, in regard to the level of specialization, the local milieu where Qiryat Etgarim is located shows a high specialization grade that differs greatly from the three other local milieus. These results indicate that the local milieu located outside the core area, especially the milieu in the northern section of the middle ring of the Tel Aviv metropolitan region, benefits from a larger concentration of knowledge and creativity capital; this makes the milieu more attractive to start-up firms and to venture capital investment.

Comparative Analysis

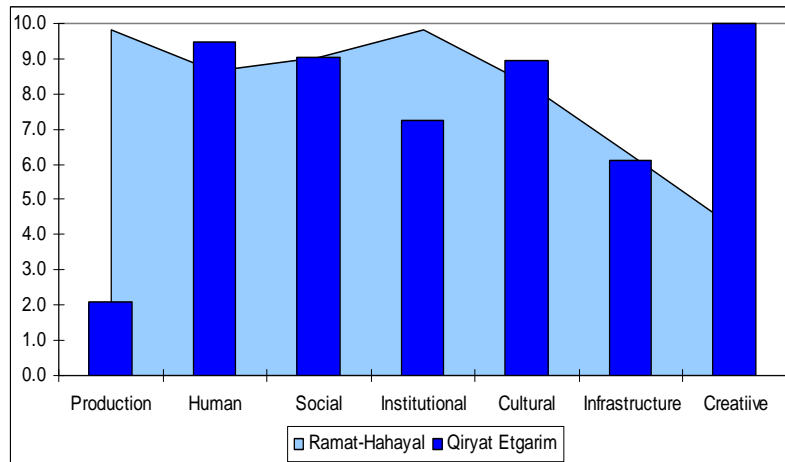
The benchmark analysis indicates, through the level of different capital assets, the high-tech attraction ability of the four metropolitan local milieus examined. Figures 1-3 below present the differences among the four local milieus encompassing each of the employment zones selected. In the Figures, the local milieus of Qiryat Arie, Qiryat Etgarim, and Afeq Park are compared to Ramat Hahayal-Atidim's local milieu. This last milieu which received the highest average score for all the capital assets examined, served as the benchmark.

It is clear from Figures 1-3 that although a comparison of the capitals of the Ramat Hahayal-Atidim and the Qiryat Etgarim local milieus shows an almost balanced picture, the gaps revealed in a comparison to Qiryat Arie and Afeq Park exhibit a clear advantage to Ramat Hahayal-Atidim. The four regions divide into two major groups that are distinct from each other insofar as their spatial capital level. The first group, comprising the local milieus of Ramat Hahayal-Atidim and Qiryat Etgarim, offers the most supportive milieu for most of the assets examined. The gap between these regions and the local milieus of the Qiryat Arie and Afeq Park employment zones is significant. This finding is interesting, pointing as it does to the fact that the proximity to the center of the metropolitan region does not necessarily assure a supportive milieu. Even places within the middle ring of the metropolitan region succeed in receiving a high level of spatial capital that could assist employment zones and attract high-tech firms.

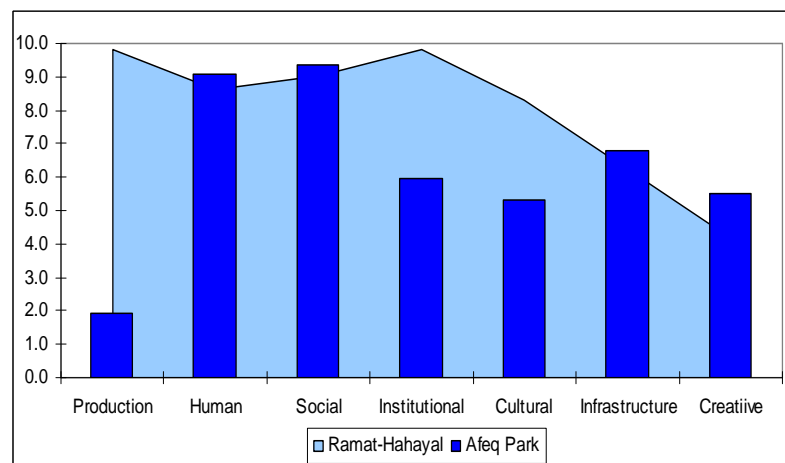
**Figure 1: Benchmark Analysis – Spatial Capital Profile:
Qiryat Arie vs. Ramat Hahayal-Atidim local milieus**



**Figure 2: Benchmark Analysis – Spatial Capital Profile:
Qiryat Etgarim vs. Ramat Hahayal-Atidim local milieus**



**Figure 3: Benchmark Analysis – Spatial Capital Profile:
Afeq Park vs. Ramat Hahayal-Atidim local milieus**



7. Location-Choice Model

The influence of the different variables on location choice was examined by employing the Logit model, a disaggregate model of discrete choice, on the empirical data. Because of constraints deriving from the sample size (117 firms), a Binary Logit model was employed, which allowed an examination of the probability of choosing a specific location from two alternatives. We assembled the four employment zones into two groups according to the similarity in different features between pairs of zones as obtained from the analyses. The first group, consisting of Ramat Hahayal-Atidim in the city of Tel Aviv and Qiryat Etgarim in the city of Raanana, is labeled 1 in the model; the alternative group, Qiryat Arie in Petach Tikva and Afeq Park in Rosh Haayin, is labeled 0. The two groups reflect employment zones whose characteristics differed, at least insofar as the features of their firms and their metropolitan local milieus.

The basic model included variables that belong to the first two groups of explanatory variables. Because of multi-collinearity between the size of the employment zone and, variables that described the metropolitan local milieu, the latter were not included in the basic model but were added later. Table 14 presents the results of the basic model.

Table 14: Basic Logit Model Results for Location-Choice Model Analysis

Variables		Estimated Parameter B	Standard Error	Significant
Plant's Structural Attributes	% investment in R&D (of total expenditures)	0.018	0.009	0.051
	% academic-educated employees	0.021	0.009	0.025
	Plant size (0≤50 employees; 1>50 employees)	-1.962	0.766	0.010
Production Milieu's Characteristics	Annual municipal tax	0.069	0.039	0.078
	Site size (total employees)	0.243	0.061	0.000
Constant		-3.496	1.144	0.002

N= 117; -2 Log likelihood = 111.78; Nagelkerke R square = 0.466.

In regard to the plants' attributes, high percentages of R&D investment and high percentages of personnel with academic education were found to have a statistically significant positive influence on the probability of choosing a location in the Ramat Hahayal-Atidim and Qiryat Etgarim employment zones.

The third variable in this group, a dummy variable referring to firm size, has a negative influence (at a high significance level - 99%) on the probability of choosing a location in Ramat-Hahayal-Atidim and Qiryat Etgarim. These two employment zones seem to be more attractive to small firms, whereas large firms tend to choose industrial zones in Petach Tikva and Rosh Haayin.

In regard to explanatory variables of the employment zones' characteristics, the rise in local taxes increased the probability that high-tech firms would choose to locate in the Ramat Hahayal-Atidim and Qiryat Etgarim employment zones in spite of the municipality's higher tax burden (this finding will be discussed below). Furthermore, a zone's total number of employees has a positive influence on the probability of location choice, indicating the positive effect of agglomeration economies.

Table 15 presents three complementary models. In these models, variables of the third group (the metropolitan local milieu) were inserted into the basic model (by omitting the employment zone's size variable). The multi-collinearity of the different capital assets did not allow their inclusion together in one model, and therefore each variable was tested separately. In the models, the variables that represent the metropolitan local milieus are the average scores of the each of the local milieus according to the benchmark analysis (see section 6).

The models obtained did not improve the overall level of explanation of the basic model (Table 14). Moreover, some explanatory variables included originally in the basic model actually diminished the level of statistical significance. Still, the importance of using these models lies in the possible implications of their results for metropolitan development policy. A proper policy can create helpful and encouraging conditions for attracting high-tech firms.

Three capital assets (human capital, social capital, and creative capital) were found to have a statistically significant positive influence on the probability of choosing the Ramat Hahayal-Atidim and Qiryat Etgarim employment zones. A high level of these spatial capitals constitutes an attraction factor for high-tech firms. Integrating these capitals into the basic model has proven their contribution to attracting small firms that intensively engage in R&D activity. These capitals supply a pool of high-level human capital, a supporting milieu through social networks, a high level of

technological innovativeness, and a milieu that attracts venture capital. These characteristics amplify the probability of choosing the Tel Aviv and Raanana employment zones, which are more abundant in such spatial capitals.

Table 15: Results of Three Logit Models for Location-Choice Model Analysis (S.E. in parentheses)

Variables		Model 1	Model 2	Model 3
Plant's Structural Attributes	% investment in R&D (of total expenditures)	0.019 (0.009)**	0.017 (0.008)**	0.021 (0.009)**
	% academic employees in plant	0.023 (0.009)*	0.023 (0.009)*	0.024 (0.009)*
	Plant size (0<50 employees; 1>50 employees)	-1.133 (0.640)***	-1.308 (0.669)**	-1.194 (0.696)***
Production Milieu's Characteristics	Annual municipal tax	0.066 (0.042)	0.061 (0.037)***	0.077 (0.050)
Metropolitan Local Milieu Characteristics	Human capital level	1.721 (0.533)*	-	-
	Social capital level	-	0.906 (0.435)**	-
	Creative/technological capital level	-	-	0.424 (0.124)*
Constant		-16.442 (4.991)*	-8.894 (4.021)**	-3.818 (1.287)*

N= 117

* Significant at $p < 0.01$ level.

** Significant at $p < 0.05$ level.

*** Significant at $p < 0.10$ level.

Model 1: -2 Log likelihood = 123.32; Nagelkerke R square = 0.376

Model 2: -2 Log likelihood = 130.49; Nagelkerke R square = 0.316

Model 3: -2 Log likelihood = 120.55; Nagelkerke R square = 0.399

Of the three capital assets, human capital makes the highest contribution to the location-choice probability. This is recognized through the human capital's B coefficient, which is four times that of the creative coefficient and twice the social coefficient.

8. Discussion and Conclusions

The findings of this study show that in intra-metropolitan competition, different zones that seemingly enjoy the same opportunities desired by high-tech firms do, in fact, display local differences. Such differences are associated to a large extent with the nearby milieu's spatial capital assets. They help to create an innovative milieu, thereby increasing a zone's attractiveness to high-tech firms. In contrast, only few significant differences were found among the structural features of high-tech plants located in the Tel Aviv metropolis. Small plants that invest high proportions of their

revenue in R&D tend to locate in more central zones or in a supportive milieu that supplies a high standard of services. In comparison, large plants, usually found in more advanced stages of their life cycle and more involved in production activities, will compromise the level of service they receive in favor of considerations regarding direct costs. Their more organized business system and greater economic flexibility allow them to provide their own needs. Thus, our findings suggest that differences between zones are associated, not with their distance from the metropolis's core, but with advantages found in the local and metropolitan milieus.

The results point at a milieu's attractiveness as being of greatest importance to small firms that rely on a skilled labor force and on R&D activities. This finding is important, since small firms are usually less established and more sensitive to costs. Nevertheless, we found that the relatively high costs resulting from local taxes do not necessarily harm the attractiveness of employment zones. Small plants tending to engage in R&D prefer, in fact, to locate in more expensive regions in the Tel Aviv metropolis; this means in Ramat Hahayal-Atidim and in Qiryat Etgarim. It seems that their metropolitan milieus supply supportive infrastructure, including a high-level human capital pool, supporting networks, and technological innovativeness as manifested in a high concentration of start-up firms and intensive venture-capital investments in the region. The explanation for this result seems to derive from the plants' relatively small size: for one thing, they require less space; for another, even though in many cases they are at the early stage of their life cycle, they are willing to pay more (in taxes) in order to benefit from the location advantages that the particular metropolitan local milieu provides.

The current study found that the Tel Aviv and Raanana metropolitan local milieus supplied a higher level of spatial capital than did their competitive milieus – Petach Tikva and Rosh Haayin. Therefore, the attractiveness of the former to small R&D-oriented firms, which employ high percentages of academic personnel, is higher. The importance of spatial capitals in these areas lies in their contribution to an innovative milieu supporting high-tech firms and creating the added value that attracts such firms in spite of relatively high municipal tax costs. Of all the assets ascribed to the metropolitan local milieu, human capital was found to be the most significant, although social capital has a relatively strong influence, too.

Our findings are compatible with the basic idea behind the Kitson et al. (2004) model, which claimed that a region's competitive advantages are composed of a combination of economic, social, cultural, and infrastructural factors. By providing an efficient productive basis and a supportive milieu, this combination of factors creates externalities conducive to attracting high-tech companies and their workers. Accordingly, a zone wishing to attract firms, particularly R&D-oriented ones, requires these types of externalities in order to compete with an advantage over other zones.

As has been mentioned in other studies (McCann and Shefer, 2004; Porter, 1998; Audretsch and Feldman, 1996; Davelaar, 1991), the findings of the present study also point to the fact that the agglomeration economies is of great significance to high-tech firms, especially small firms that engage intensively in R&D.

We examined the hypothesis reported in other studies (Shuka and Waddel, 1991; Wu, 1999) that high-tech firms find employment zones adjacent to the metropolitan center to be attractive. The proximity to the metropolitan core allows access to the metropolitan CBD, where many managements, financial institutions, business services, and skilled labor concentrate. This concentration of spatial capital causes the nearby zones, as well, to be attractive despite their relatively high land costs. Contrary to our hypothesis, we found no particular preference for locating near to the metropolitan CBD.

An employment zone located in a metropolitan fringe that provides business services, a qualified labor force, and a good image compensates for the distance from the metropolitan core. The spread of metropolitan sub-regions containing a variety of services is a frequent phenomenon of the polycentric structure characterizing the present metropolis. Two of the four employment zones in our investigation that were found to be more attractive have different locations in the metropolitan region. One (Ramat Hahayal-Atidim) is near the metropolitan core, but the other (Qiryat Etgarim) is relatively far from the metropolitan CBD. Thus, a zone's extent of attractiveness is determined by the nearby milieu's quality, and not necessarily by its location relative to the metropolitan center.

Local development and investments to develop supportive human and social capital may increase a zone's competitive ability to attract high-tech firms. Human capital

includes not only qualitative personnel but also a large pool of potential high-tech labor. The existence of this labor pool will enhance high-tech firms' confidence in their location and reduce the risk of their investment. A milieu encouraging innovation will create an appropriate atmosphere and draw capital investments that will strengthen a region's image in the eyes of the high-tech industry. Therefore, the practical conclusion for decision-makers is that local authorities should emphasize the enhancement and growth of human capital through education, the creation of appropriate infrastructures, and the provision of social support networks--assets that can raise a region's attractiveness to high-tech firms.

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