SERIE RESEARCH MEMORANDA

TECHNOLOGY AND REGIONAL DEVELOPMENT:

SOME THOUGHTS ON POLICY

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Researchmemorandum 1987-57 december 1987

VRIJE UNIVERSITEIT

FACULTEIT DER ECONOMISCHE WETENSCHAPPEN

EN ECONOMETRIE

A M S T E R D A M

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1 Agglomeration tendencies

Despite numerous policy efforts to disperse new technology and innovative economic activities, it displays a persistent tendency toward agglomeration and concentration (Malecki, 1984). Given our current understanding of nonroutine economic activities, there appear to be sound reasons for this agglomeration. The information-intensive nature of technological activities and the resultant need for face-to-face communication favor those places that offer (1) high levels of competence; (2) many fields of academic and cultural activity; (3) excellent possibilities for internal external communications; (4) widely shared perceptions of unsatisfied needs; and (5) a general situation of structural instability facilitating a synergistic development (Andersson, 1985). These conditions for "regional creativity" can be translated into more conventional policy variables, but in general, they focus on three main elements: (1) the presence of professional and technical labor (competence); (2) urban agglomeration, or a threshold size of place, where cultural activity and communication will be heightened; and (3) conditions that promote synergy or instability. Oakey (1985) places even greater stress on agglomeration economies as a necessary condition for regional high technology development; Rogers and Larsen (1984) concur.

It is clear that the location factors which predominate in "high tech" industries and in the majority of innovation-oriented regional polices are broader than those common in previous generations of regional policies. The importance of information and instability in the process of technological change itself brings this about (Molle, 1983). However, the recent attempts to bring about more widespread growth are perhaps not very different from earlier growth pole and growth center policies (Oakey, 1984). The most ambitious example of deliberate high technology development is the Technopolis Concept in Japan, a plan to build a network of 19 regional high tech cities linked to Tokyo by bullet trains (Tatsuno, 1986). Tsukuba Science City, planned during the 1960s and now the home of two universities and 50 national research institutes, is somewhat a prototype for the scheme. The criteria used by MITI (the Ministry of Trade and Industry) to select the locations include: proximity to a "mother city" of at least 150,000 to provide urban services, proximity to an airport or bullet train station, an integrated complex of industrial, academic, and residential areas, and a pleasant living environment.

Much emphasis is also placed on high levels of local amenities for the attraction and retention of mobile technical workers (Keeble and Kelly, 1986). Labor was traditionally undifferentiated in regional economic research except perhaps by cost, whereas now it is recognized that quite a distinct labor market operates for professional and technical workers from that for production employees. The availability of technical and professional workers is related to technological agglomeration in a complex way (Malecki, *forthcoming*). The mobility of these workers and their access to information about employment in a large number of possible locations make it

particularly difficult to foresee any reduction in their tendency to agglomerate in space. For the workers themselves, large urban regions maximize their alternative employment opportunities within the range of daily commuting distance. In order to maximize the likelihood of obtaining a sufficient number of professional workers, firms in turn locate in large cities.

A consequence of the agglomeration tendencies noted above is that new firm formation also tends to be higher in areas where professional workers are concentrated. These may be large urban regions (and nearly always suburban or fringe areas of such regions), or they may be small towns in attractive settings, but they tend to be within reach of major airports and other essential urban amenties (Keeble and Wever, 1986). This reflects not only their attraction for employers, but also their ability to identify sources of funding (venture capital, etc.) for the establishment of new firms. The "spin-off" process, frequently identified as a consequence of R&D in a regional context, is a subset of the general entrepreneurial process which takes place in facilitating (usually urban) environments. New firms in high technology sectors are even more dependent on agglomeration of technical workers and of city size generally (Armington et al., 1984).

The implication of the situation as described above is that there may be relatively little that policies as typically viewed can do to alter the situation (Goddard and Thwaites, 1986). Some possibility exists that a small region can become a technological complex, or that a declining city can revitalize itself around new technologies. More often, the choice must be among large, already rather prosperous urban regions (Pottier, 1985). The promotion of entrepreneurship on a regional basis, as has been tried notably in F.R. Germany, is too recent to be considered a long-term success.

Incrrasingly, entrepreneurship and the locational preferences of mobile professional workers enter into discussions of viable regional and technological policies.

2 Innovativeness and entrepreneurship

A great deal of reliance in regional technology policies is placed on small, innovative firms, largely based on the long-standing observation that innovation, especially more radical, "leap-frog" innovation, is more likely to originate in small firms where older products and technologies are less entrenched than in large organizations (Rothwell and Zegveld, 1982; Sweeny, 1985).

New firms are not equally likely to arise in all industries. Instead, they are likely to respond to the relative barriers to entry across sectors, and to the general level of opportunities presented in various technologies and markets (Nelson, 1986). From a regional perspective, the sectoral variation shows itself through the industrial mix and the propensity for new firms to arise in sectors already found in the area (Johnson and Cathcart, 1979; Sweeny, 1985; Wever, 1986). This is cited as particularly important in technology-based sectors (Bollinger et al., 1983; Garvin, 1983; Malecki, 1985). However, industry mix alone does not account for the observed geographical variations in new firm formation; the relative size of establishments may play a greater role (Beesley and Hamilton, 1986).

As mentioned above, it is often asserted that small firms are more innovative than large firms, and this is used to justify policies to cultivate and assist small firms. However, innovation is even more difficult to monitor than is new firm formation, since new firms are usually registered in

some way; innovations are not. A concern for regional innovative capability became a focal point in regional research a few years ago, but it was concerned almost equally with large and small firms: the overall technological level of the region was the focus (Ewers and Wettmann, 1980; Thwaites, 1982). However, the predominant empirical finding about small firms in peripheral areas is their relatively low level of innovativeness, compared to those located on the fringe of major urban regions in the Netherlands (Pellenbarg and Kok, 1985), and in more densely populated regions containing urban agglomerations in West Germany (Meyer-Krahmer, 1985). The concentration of R&D in the UK is even more biased against peripheral regions (Goddard and Thwaites, 1986).

3 Entrepreneurship and regional development: a brief review

Coffey and Polèse (1984; 1985) have placed entrepreneurship at the center of the process of local economic development. They clearly were reacting to the well-documented consequences of "external control" (Sweeny, 1985, p. 97; Watts, 1981). Coffey and Polèse propose four stages of local development: (1) the emergence of local entrepreneurship; (2) the growth and expansion of local enterprises; (3) the maintenance of local enterprises under local control; and (4) the attainment of an autonomous local control structure and of a local business service sector.

Their view of entrepreneurship appears at first to be an operationalization of a cumulative causation model. It is not clear, however, whether innovation or technology plays any role at all. Wever (1986) points out that most new entrepreneurs are in nonbasic activities (shops, cafes, pubs, repair shops), where they most often simply replace fellow entrepreneurs. In

addition, closure rates of new firms are quite high--50% of new firms in Wever's study closed within 5 years. In the Coffey-Polèse model, local entrepreneurs function mainly to counter the economic divergence brought about by external control (Brugger, 1986; Stöhr, 1986).

Martin (1986) strongly disputes the likelihood for backward regions to spawn innovative entrepreneurs. Martin believes that only rather densely populated regions, in the vicinity of large urban centers, will produce sufficient entrepreneurship. In the context of small, peripheral regions, innovative development, it is "too good to be true" (Martin, 1986, p. 17). The human capital of such regions is too limited and too mobile: i.e. many of the talented people will simply leave. Unless a local economy meets some fairly large threshold size, its base of potential entrepreneurs--and the likelihood that they as a group will be able to come up with successive rounds of innovations as the product cycle progresses--will be inadequate to compete with other regions.

Social characteristics are also at work in entrepreneurship. For example, Wever (1986) found, in the Netherlands, that new firm formation rates (per 10000 population) were lowest in rural areas, and that regions with high NFF rates also had many 'good' entrepreneurs and large numbers of in-migrants with high educations and salaries. The tendency for some regions to have a greater proportion of successful, more rapidly growing small firms may be even more important than geographical differences in new firm formation. Again, social and occupational influences appear to be most significant in reinforcing existing spatial contrasts (Keeble and Wever, 1986; Mason, 1985). How do such regional variations come about? Successful entrepreneurs may simply be more prepared for starting a business: they may have more starting

capital, be more oriented to markets outside the local region, and have a larger number of clients (Wever, 1986). Overall, there is a strong tendency for entrepreneurship to be strongest precisely in those regions which need it least, suggesting that to rely on new and small firms will not eliminate regional economic differentials (Keeble and Kelly, 1986).

There is no shortage of "ingredients" or regional conditions which foster high rates of entrepreneurship. Bruno and Tyebjee (1982) cite twelve factors as "essential" for "the environment for entrepreneurship" in previous research. These are, in apparently ranked order:

venture capital availability
presence of experienced entrepreneurs
technically skilled labor force
accessibility of suppliers
accessibility of customers or new markets
favorable governmental policies
proximity of universities
availability of land or facilities
accessibility to transportation
receptive population
availability of supporting services
attractive living conditions

It is evident from this list that several of the factors are simply conditions common to most, if not all, large urban regions. For example, availability of land and facilities, accessibility to transportation, suppliers and customers, and attractive living conditions tend to be attributes found in virtually any major metropolitan region. It is the other factors that appear to vary most among regions.

Shapero (1984) stressed such urban characteristics in attempting to account for "the entrepreneurial event." He has suggested a dynamic process in which local investment propensities and an industrial base of small businesses together lead to a local economic environment that exhibits a readiness to lend or invest in new and different companies. In terms of

possible public policies, Shapero (1984) focused on economic development programs that could focus on providing incentives and facilities to encourage the founding and growth of small firms. He specifically cited incentives for commuter airline services and other transportation and communication facilities, which are often inferior outside the largest urban regions. He thus lends implicit support for the appearance of air accessibility in most recent surveys on location factors for nonroutine business activity.

4 Venture capital

The issue of venture capital is one of the most difficult to deal with. It appears in virtually every inventory of "necessary" conditions for innovative entrepreneurship, and is a high priority for policy initiatives in Western countries (Houttuin, 1985; OECD, 1985). It must be stressed that venture capital is not the same as loan funds. Venture capital involves equity investments, and profit through capital gains after stock is sold publicly. This equity may be lost entirely if the firm fails; usually, some assets remain. Thus, there is a real distinction from public-sector capital programs, which usually lend money and expect a full and regular payback. The contrast between them is so great that public sector capital programs are looked on with disdain by the American venture capital industry (Wilson, 1985).

Data are scarce, but indicate that flows of risk capital have enormous variation from region to region, and that many regions in the USA are virtually without venture capital (Premus, 1985). Shapero long emphasized the significance of the local financial community on the potential for local entrepreneurship (Shapero, 1971). The appearance of the first, "almost

random" company formations in an area are the most difficult to account for, and may not always precipitate any follow-up of further entrepreneurship. He found substantial differences among localities in the degree to which local banks were willing to lend for new, untried ventures. If an area attained a level of sustained entrepreneurship, it was typically associated with the growth of a financial, legal and service community to support it.

The source of initial capital and of the "almost random" appearance of the first entrepreneurs is perhaps related simply to the availability of start-up financing. Financing for start-up firms can come from many sources, including personal funds, family and friends, local bankers, and outside lenders, but spatial variations result most from informal (noninstitutional) sources that operate almost entirely via a network of personal, and local contacts who are willing to back new, unproven entrepreneurs and their start-up firms (Wetzel, 1986). Local bankers or public officials are unlikely to lend in such a risky situation--unless they have previously had successful experiences with firms of this type. Once an area becomes known for its spin-off activity--in part a result of the willingness of local lenders--venture capital from other regions may enter in order to profit from entrepreneurs in the area. This is certainly the experience of the Silicon Valley area (Wilson, 1985). The "entrepreneurial climate" of a region, which may be a particularly critical variable influencing entrepreneurship, relies almost entirely on a well-connected network of informal and formal investors, previous entrepreneurs, and an aura of nonroutine, innovative activity (Gruenstein, 1984; Miller and Coté, 1985; Shapero, 1984; Sweeny, 1985).

Rural areas tend to be at a severe disadvantage in terms of venture capital (Ewers and Wettmann, 1980). In a study of new small businesses in

Wisconsin, Shaffer and Pulver (1985) found that firms in the peripheral northern region and those in rural locations reported an inability to find capital within thirty miles; they also were classified as more likely to be experiencing "capital stress," any of a variety of conditions of insufficient capital.

5 Incubators and spin-offs

The "incubator" hypothesis suggests that some locations, especially cities, serve to "incubate" new firms, which may subsequently move to other locations in the urban region. Davelaar and Nijkamp (1986) have reviewed the available literature and conclude that previous work is fairly ambiguous with respect to the hypothesis. It is also clear that the interpretation of most previous work refers only to a single urban area, rendering the findings inappropriate at the wider regional scale. For example, Rees (1979) has suggested that the accumulation of a critical mass of production in an industry serves as an incubator for new firm generation.

Spin-offs are most common in large urban areas. It is in such places that a sufficient number of potential entrepreneurs are present, as well as the other "environmental" factors that encourage entrepreneurship. Shapero (1971) studied technical company formation in relatively small American counties over a 28-year period. The variables most highly correlated with firm formation tended to be those related to city size and agglomeration, such as manufacturing employment, educational expenditures, and income.

Universities have not been prominent sources of spin-offs, despite the examples of MIT and Stanford so frequently cited (Rogers and Larsen, 1984; Rogers, 1986). Instead, universities provide a necessary resource to an

area--technical personnel--as well as a pool of well-educated, potential entrepreneurs (Keeble and Kelly, 1986; Segal, 1986). Cooper (1973, 1985, 1986) has continued to make the case that firms, not universities or government facilities, tend to be the "incubator organizations" of entrepreneurs. Such firms are typically small (< 100 employees), but a significant number of founders do come from large firms (Cooper et al., 1985). It is through the location of branch plants that quality of life may operate, according to Cooper, by attracting operations that employ large numbers of technical workers. In some of these branch plant locations, then, entrepreneurship begins, and few, if any, entrepreneurs change location. It must be stressed that not all R&D generates new spin-off firms. The state of the local industry's technology must be sufficiently unstandardized, preferably with multiple market niches, and the barriers to entry by new firms must be low (Bollinger et al., 1983; Garvin, 1983). Even so, it would seem that the European experience with branch plants and with public sector R&D in peripheral regions has led to very low levels of entrepreneurship (Cooke, 1984).

6 Regional technology policies in the USA

We distinguish initially between policies that address technology-based firms already in existence, and then policies which directly address the formation and support of new firms.

6.1 Industrial recruitment

Most regional programs for 'high-technology development' in the USA are considered as extensions of existing state-level economic development strategies, usually by 'targeting' industrial recruitment and incentives offerred

toward high-tech industries. The designation of variously-named 'high-tech regions' with catchy names is a popular way to add high tech to conventional industrial recruitment, and to inspire perceptions similar to those elicited by Silicon Valley, Route 128, and the Research Triangle. Some of them are so large in area that any uniqueness of location is lost. North Carolina's Research Triangle is such a planned technological region. The Research Triangle Park got its start in 1959 and, although it now competes with other regions for major R&D facilities (Whittington, 1985), it can still be identified as a region in which venture capital is scarce. Consequently, very few spin-offs have occurred despite the area's attraction for the operations and R&D of large firms.

6.2 University support

Boosting funding levels at state-supported universities is a relatively easy way to visibly improve the high-tech status of the region; less frequently is any comparison made to universities or regions elsewhere. High-tech spin-offs take place in some locales--around the best institutions--without any university-industry connections being present (Segal, 1986). The Stanford and MIT examples have probably distorted the perceived role of universities, although they do serve as models for other regions (Stankiewicz, 1985). Researchcan be procured from a distance, as the many research support agreements in biotechnology recently have shown.

However, the prominent success of Texas in rising to the top ranks of university research has shown that determined investment can have discernible effects. One must not expect too much from policies to boost university support. Unless there are suitable job opportunities within the region,

graduates will go elsewhere; their return migration could be encouraged by desirable employment, but this requires a more diverse and long-term set of high-tech policies. In addition, university research must be prominent in both quantity and quality to attract a cluster of R&D facilities. It is neither easy nor cheap to create and to maintain the status of a top-notch university (Vaughan and Pollard, 1986).

Other states in the USA, perhaps recognizing this, have instituted more focused programs, concentrating funding and promotion on selected high-tech fields. These include the microelectronics research units established at Arizona State University and at North Carolina, and biotechnology and medical research in Baltimore, MD, which were set up in order to appeal to a single sector of high tech industry. A somewhat broader approach is that of New York, New Jersey, and Ohio, all of which have established advanced technology centers, each concentrating on a given field of technology, at universities within the state. A similar approach has been taken in Texas, as part of the deal that brought the Microelectronics and Computer Technology Corporation (MCC), an industry R&D consortium, to Austin. The state agreed to set up a new endowment that would benefit departments at the University of Texas at Austin of interest to MCC, such as physics, chemistry, engineering and computer science.

It is important to emphasize once again the role of agglomeration. Regions which have several top-ranked universities, especially when they are located in or near major metropolitan areas, can attract both government and industrial R&D. The significance of agglomeration contrasts with the experience and potential of regions in which the major universities are in isolated small towns and rural locales.

6.3 Policies to promote new firms

Wever (1986) notes that, from a policy viewpoint, it is easier to prevent a firm from failing than to persuade someone to start a new firm. Despite such common-sense advice, there have been a number of attempts recently to create or generate innovativeness in peripheral areas or regions (Farrell, 1983; Hall and Markusen, 1985). In each case, success has seemed to elude peripheral regions for reasons that, in light of the arguments made earlier in the paper, are somewhat easily identified. The principal shortcoming of peripheral regions in Britain, for example, seems to have been the relative scarcity of R&D carried out there, in contrast to the South East (Goddard and Thwaites, 1986).

In spite of challenging competition from other regions, several types of policies have been implemented by states or by local governments in recent years in an attempt to promote new, usually high tech, firms, often in conjunction with a local university. The most common vehicles include: venture capital, in recognition of the geographic disparities in such investments, science parks, and business incubators, which try to keep firms from failing.

6.3.1 Venture capital funds

At least 20 states in the USA have created venture capital funds, in response to the overwhelming geographical concentration of investments by the private venture capital industry, and the perception that venture capital has indeed been a major reason for the growth of some regions (Premus, 1985). The objective of state venture funds is to favor firms within the state,

because these firms might be unable to secure funding in the private sector. However, few of these public funds as yet have any track record. They may or may not exactly qualify as *venture* (i.e. high risk) capital, but small business loan programs are based on a growing awareness of the capital needs of small business.

Venture capitalists argue that government forays into venture investments are done by people with little knowledge or experience in venture capital. In response to this opinion, state venture capital funds in Michigan and Illinois are managed by private professional venture capitalists. Many state employee pension funds, such as in Ohio, Michigan and Washington, now invest a small (1-5%) portion of their funds in risky investments, often with or, as in Illinois, exclusively through private venture capital firms. In other cases, states match privately-raised capital. Tax credits for a portion of individual investments in state venture capital pools also are intended to create larger pools of private funds. It is too early to know if these attempts to alter the availability of venture capital will affect the patterns of new firms, but it is clear that they are addressing directly a major geographic inequality in the USA.

6.3.2 Science parks

Given the clean office and research atmosphere of R&D activities, many of them have settled into the office and industrial parks that are now the commonplace location for economic activity in metropolitan areas. Whether called science parks, research parks, or technology parks, they cater to the preference of high-tech firms for a campus-like setting with low density, dispersed building sites. Occupancy in existing American parks tends to be

highest in places where high tech has been successful for other reasons, such as at around Stanford, Princeton, and Yale Universities. Segal (1986) considers this to be typical. Britain's Cambridge Science Park--set up after the Cambridge Phenomenon was well along--had nothing to do with the attraction of the Cambridge area for high-tech firms, although it now probably enhances it. In the USA, state participation in science parks is now quite common, particularly centered around or coordinated with state universities. Joint ventures between universities and private developers are increasingly seen.

Science parks are an attractive policy, but they do not tend to increase the propensity for new firms to form (Britton and Gertler, 1986). Metropolitan regions and their bundle of amenities and infrastructure are the primary potential locations for new firm formation. Much the same has been concluded by Goddard, Thwaites, and Gibbs (1986) and by Draheim (1972) over a decade ago. It is not surprising, then, that so few science parks in the U.S. have been successful, nor that the most successful are in large urban areas (Cox, 1985; Danilov, 1972; Miller and Coté, 1985). Among the complex of factors associated with urban size, face-to-face communication, pools of workers or the potential to attract and keep them outweigh the largely aesthetic attributes of a science park. Of course, they can serve as prestigious addresses for appropriate units of large corporations, but those firms would almost certainly have located in the area without a science park.

6.3.3 Incubator facilities for new firms

Incubator facilities, as their name implies, address the specific problems faced by new firms. Since new firm spin-offs are an expected and desired

outcome of high technology, incubators also have been used in connection with high tech policies. Incubators range from inner-city buildings to communal facilities in new science parks (Smilor and Gill, 1986). They typically offer shared services, advice, financing, and other help to emerging companies. Most incubators are a product of local, rather than state, policy, and many are available to virtually any small firm, rather than only high tech firms. Those intended exclusively for high tech firms are often called innovation centers.

Incubator facilities feature shared-tenant services, such as word-processing, a copy center, and personal computer rental. The range of services and facilities can be quite extensive. A recent study of incubator facilities in Pennsylvania by Allen and Levine (1986) found that at least half of the twelve incubators studied provided in-house consulting services and management assistance on government regulation and procurement processes, preparation of business plans, and relocation planning. Nearly all them furnished conference rooms, receptionist, clerical and word-processing service, copiers, and mailing, shipping and receiving services.

The attraction of such shared facilities to new firms is that they can significantly reduce the initial capital needed. The drain on a young firm's finances can thereby be significantly reduced, whether by subsidized rent or by the landlord (often a major university) taking an equity stake (30% is common) in new companies in lieu of rent or fees (Andrews, 1986). This is now the case in several American cities, including Minneapolis, Milwaukee, Salt Lake City, and Atlanta. The goal of incubators is to "nurture" firms and allow them to expand in size and employment so that they can outgrow the incubator and relocate elsewhere in the local area. A board, comprised of

local entrepreneurs and business representatives, may periodically review each firm to identify problems and to determine when each will be able to leave the center. It is simply too soon to tell whether this is likely to happen in all cases.

6.3.4 Combined efforts

Pennsylvania's Ben Franklin Partnership represents an attempt to combine conventional strengthening of the state's public-sector universities with advanced technology centers that would link with private firms. The goals of the program are explicitly 'high-tech' and entrepreneurial:

> --to maintain and create jobs in new advanced technology enterprises
> --to improve productivity, particularly among Pennsylvania's existing industries, and
> --to diversify the state's economy, with special emphasis on increasing Pennsylvania's share of advanced technology firms.

Unlike the programs of some states, the Ben Franklin Partnership was able to build from an already strong base of university research and industry R&D. It is focused around (at present) four Advanced Technology Centers, distributed throughout the state, each of which is centered on one or more local universities, and must involve at least equal financial participation by non-state sources. The first $28 million in state funds was matched by $84 million from private and other sources (Robertson and Allen, 1986). The visibility and potential raised by these centers has helped to make venture capital availability an issue, especially in the Pittsburgh and Philadelphia areas, much of which has backed firms connected with the Advanced Technology Centers. In addition, business incubator facilities and R&D grants to small firms are a prominent part of each Center's operations. Largely because there was a healthy base on which to build, Pennsylvania has been able to

construct a program that addresses several elements of high-tech economic development at once, and to attract a rather high level of private sector support and financial backing.

7. Prospects for policy

At the outset, we must not ignore the advantages provided by existing concentrations of entrepreneurs and high technology: it will be difficult for new areas to supplant the established regions. At the same time, it is clear from past experiences of high tech regions that "success breeds success" by forming into a critical mass of workers, researchers, investors, and other supporting businesses and services. We should also recognize that there can be considerable gain even if regional policies fail. The comparative advantage of many places will improve from having upgraded local conditions, such as education and university research (Malecki, 1984).

Regional policies cannot create entrepreneurs Sweeney

Entrepreneurship is largely a product of the local industrial firm and plant mix and the socioeconomic environment created by the local population, so it can, over time, respond to the results of industrial recruitment efforts. Incubators and venture capital pools can encourage entrepreneurs to stay in the area rather than to seek more favorable local conditions. Networks of entrepreneurs and investors will not emerge from policy initiatives alone. In fact, they are a uniquely personal and capitalistic phenomenon (Wetzel, 1986). This critical element of a place's entrepreneurial environment is perhaps the least amenable to any public policy. Policies have also shown little ability to speed up the process of technology-based

regional development. It can take 20 or 30 years for a high-tech region to generate new firms (e.g. Silicon Glen in Scotland; Research Triangle in North Carolina).

Policies are unable to substitute for a critical mass

Small high-tech regions have a harder time attracting professional workers than do large urban areas. It is this labor market for professional workers and the constraint they impose on firm location that is inadequately understood and on which high tech policies very critically depend. The synergy found in large urban regions cannot really be substituted for in smaller regions (Andersson, 1985; Martin, 1986; Miller and Coté, 1985).

Regional policies can have indirect effects

In the North American context, policies to improve local universities can also have the side-effect of improving the "intellectual climate" of the area, in addition to improving research itself. There is a substantial "fuzzy" component to quality of life that relates to the "ambiance" and the "image" or reputation of a place as high tech (Galbraith, 1985; Oakey, 1983). In addition, the variety of university facilities and programs may well be combined in the perceptions of professionals into an intangible image of an "intellectual atmosphere" that is different from the more rigorous examination of university research capabilities conducted by companies. Cultural activities are a standard component of quality of life, but they depend, especially in North America, to a large extent on public and private sector support and enthusiasm. Small cities with large universities compete culturally to a certain extent with much larger cities because of the events

and facilities available on campuses.

The recent boom in high tech policies provides a focus for regional advantages not unlike the growth pole policies of a decade or two ago. The creation and evolution of North Carolina's Research Triangle as a focal point for high technology shows that, with some effort and a cognizance of the varying potential of places within a state. Unfortunately, political considerations can dilute scarce funding by designating too large a number of foci, or by selecting some that are inappropriate for high technology given the demands of firms and their workers.

It is less clear that policies can facilitate the entrepreneurial climate in a significant way, although recent American research suggests that this has been the pattern, especially in the two most prominent high tech regions, California and Massachusetts.

The recent focus on high tech and entrepreneurship has had some positive effects on state and local policy. It has prompted a more long-term perspective about economic development; it has demonstrated the connection between universities and the economy; and it has shown the significant advantages to be gained from investments in human capital, especially through education. Even if done only partially and half-heartedly, such policies can have these effects.

Kirby (1985) reminds us that economic change is not the same, and policies will not be equally appropriate, in all places. Locally specific attributes, shortcomings, and histories all play a part in defining the future potential of a regional economy. Finally, much of the variation found in entrepreneurship is a direct product of labor market processes. To a large extent, the professional labor market for high technology workers, for example, deter-

mines that only some places will be R&D or high tech locations. And there is much we do not yet know about technological change in the context of employment and regional development (Fischer and Nijkamp, 1986).

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