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THE ROLE OF SCIENCE PARKS IN INITIATIVES FOR ECONOMIC DEVELOPMENT

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THE ROLE OF SCIENCE PARKS IN INITIATIVES FOR ECONOMIC DEVELOPMENT

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INTRODUCTION

A successful science park is the culmination of the efforts of a large number of actors, public and private. Although there is no denying the success and prestige of California's Silcon Valley or Boston's Rt. #128, efforts to duplicate those parks have met with mixed success. Science parks should be considered as only one possible means of orchestrating the individual resources of government, universities, and industry for the purpose of stimulating regional or national economic growth. They are not the panacea for economic recovery that many planners believe them to be.

This paper will examine the roles of science parks and models for their establishment, starting with an overview of the objectives for their creation, followed by an analysis of issues in their establishment and management, a description of the essential components of successful science parks, a description of several successful developments, and several recommendations for planning science parks in developing countries.

The authors argue that the usefulness of any "science park model" is limited, since a park must fit the peculiarities of the region it is intended to serve. Science parks are seldom successfully copied, and several examples illustrate mistakes which have been made by overlooking the particulars of a region's geographical and cultural infrastructure in new science park start-ups. Using a biological metaphor, regardless of the complexity of an organism, it must, for its own sake and for its host's survival, share a symbiotic relationship with its environment.

In developed or developing countries, or in underdeveloped parts of developed countries, development efforts must share a symbiotic relationship with -- not be parasitic on -- the hosting region. In particular, developing countries should take care to match a science park (or other development project) to the country's (and region's) overall development plans. Planners might best follow only one axiom: the key to economic growth is not always high technology; it is not always a science park.

OBJECTIVES OF SCIENCE PARKS

The stagnation of traditional heavy industries, including automobile and ship building industries and steel production, is a problem for many developed countries (Botkin et al.). Among economists, a debate continues to rage over the optimal proportion of resources invested into these industries as opposed to emerging high-technology industries. Although high-tech initiatives are viewed as being more important to future econmic power and social well-being, the problem of maintaining and expanding market share in an international economy is not solved by a simple parity of support between older "sunset" and newer high-tech "sunrise" industries.

The Promise of Economic Development

Many regions of the U.S. and many other nations have copied aspects of the Silcon Valley and Rt. #128, in hopes of reaping similar economic benefits. The complexity of these developments, however, renders them difficult to copy. High-tech in the U.S. has developed, to a large extent, through ad hoc policy making, through a complex of social, educational and political factors. Having emmerged from the last world war essentially unscathed and being the only player in the technology development game for several years following the war, the ability to manufacture and market technology products developed easily. Recently, however, the same social history that helped create the Silicon Valley has also led to the U.S. problem of sunset industry, which needs more than high-tech to "correct" the problem.

ISSUES IN DEVELOPMENT OF SCIENCE PARKS

Industry - University Interaction

In the developed countries there is presently a growing call for increased interaction between local and national government, industry, and universities to facilitate high-tech economic competitiveness. Universities, believed to be the major source of high-tech knowledge, are responding to the pressure by moving closer to, and cooperating more with, industry.

The U.S. has had a long tradition of univeristy-industry co-mingling, through institutional policies permitting university researchers to divide their time between academic and business interests, a situation envied by many European and Japanese university researchers. Though there is debate over the wisdom of increasing this cooperation (see Galbraith, Krieger), economic competitiveness is seen as becoming more and more dependent on advantages brought through high-tech research and new knowledge which is smoothly transferred from its primary source -- universities -- to the agency of application and exploitation -- industry.

It is argued in the U.S., sometimes with alarmist fervor, that without increased university-industry interaction and higher priority being given to the science and engineering departments of universities, the country will face a nearly certain economic crisis. Academic and industrial leaders agree that cooperation between universities and industry will accelerate progress, increase the growth potential of the economy, and revitalize competitiveness. There is a concommitant concern among public, industrial and academic officials that universities declining to cooperate with industry lack a sense of public responsibility and will loose their technological currency.

University faculty cannot be made to cooperate, however. Some university environments, though comfortable for researchers, will stimulate little entrpreneruial development. When planners build a science park development adjacent to such a university, entrepreneurial interest sufficient to trigger self-sustaining growth is unlikely. Tsukuba is illustrative of this problem. The project, though designed thoughtfully from the beginning, has yet to result in the productivity which was forecasted. The city and its university may be too isolated from the rest of the Japanese business world.

This problem suggests that the model used in planning may have been faulty. Planners often assume that the development process moves obediently and in a linear fashion from research findings through development activity to the marketplace.

RESEARCH → DEVELOPMENT → MARKETPLACE

This presumed uni-directional relationship is a gross simplification. A more realistic model must include an interactive element, in which research, development and the marketplace each influence each other.

RESEARCH ↔ DEVELOPMENT ↔ MARKETPLACE (with RESEARCH ↔ MARKETPLACE)

Researchers must be in touch with the marketplace and vice versa for high-tech enterprises to crystalize.

Attracting Large or Small Companies

Several years ago Birch's study of Rt. #128 maintained that small businesses accounted for the majority of new jobs and economic growth (Miller). Recently, however, further analysis of that data and new studies indicate that new businesses account for only a small portion of new jobs and that most of the growth in employment occurs with the expansion of larger companies. Whether large or small businesses are the priority targets for science parks is still debated.

Attracting a branch of a large, established coporation to an area might give a development initiative the appearance of success. The costs of doing so -- in terms of economic benefits such as generous tax-loans, etc. -- must be weighed against the benefits. Included in such a consideration should be the loss of the "incubator" function of a branch plant of a large corporation.

A branch plant produces a known product; few, if any, changes can occur when the upper management of the larger company is centralized especially if the company's main location is in another city or region. Branch plants are generally too self-contained to be useful in promoting an active business cluster and will allow few commitments to a local community, since it is primarily responsible to the corporation rather than to the location of the branch. (It is interesting to note that in the U.S., United Technologies recently abandoned New Haven, CT, as its location because of a dispute between local officials over the company's commitment to the city of New Haven [Miller]). Even when branch plants need labor in considerable numbers, the risk that corporate headquarters will decide to relocate in a low-wage region prevails (Dekker in Braun).

In general, small manufacturing and service-oriented businesses are favored for activity in small firms feasible again, more entrepreneurial start-ups will be likely, and the distinction between manufacturing and business services will tend to disappear, making soft-starts in manufacturing even more feasible.

Local Investments

Investments need to be available locally. Bringing in outside investment is both difficult -- since a region must compete with other regions for the resources -- and generally occurs at substantial costs the region.

Though entrepreneurs usually contribute their own funds in the initial stages, some form of outside funding must be sought as the company hardens. The main financial constraint of this first round of outside financing is not that it involves a large amount of money, but that it is a very high risk investment. Banks seldom fund businesses at this precarious stage.

In some cases, notably Cambridge Science Park, financing was a relatively small problem, since soft-starts predominated. In other parks, hard-starts have been more common, requiring outside financing, a sometimes lengthy and usually costly process. Any region which is planning a science park must identify interested, informed individual and institutional investors.

Although some regions are experiencing a growing number of venture and seed capital sources, most find that the amount of capital is still inadequate. However, capital itself is not the most significant shortage. The fledgling high-tech entrepreneur is most in need of business advice, and this need grows proportionately with the growth of his or her company. A local venture capitalist, in addition to providing access to capital, can also be of primary importance as a source of information in deciding which businesses are likely to succeed and in providing business advice and strategic recommendations on how to make those successes happen.

Local venture capitalists play an essential role in start-ups. Venture capitalists make possible the confirmation of "formal" information available from traditional sources.

Information gathering techniques used by large organizations, such as government and large corporations, are usually inadequate for making venture decisions, which require informal sources and information networks developed through participation in technical meetings and conferences. The key here is actual connection to, and interaction with, the various players, including universities, businesses and government technical experts and officials. This role as informants is essential at early stages of the development of science parks.

Industrial Levereage

By means of research grants, contracts and cooperating agreements, industry can gain considerable access to and influence over university research agendas. Quite commonly, company representatives sit on the management boards of university-industry consortia. In addition to the immediate research results that a company pays for, the company also gains the almost priceless infrastructure of the university without cost.

This infrastructure provides access to new talent, to research sponsored by federal research agencies, and to pre-published research results. While the outside influence of industry facilitates project-focused research at the universitities, it can also lead to decreased rather than increased research success. Some are concerned that with recent pressure to increase university-industry interaction, the distinction between academic and corporate technology spheres will pale still further. Because of fewer resources, university research would be hard pressed to compete with industry -- should research agendas become sufficiently similar that competition would result.

Not all universities are eager to embrace industrial cooperation. With increased university-industry interaction (often through science park initiatives), it has been noted that there is a tendency for industry, when unable to solve a problem on its own, to contact the university as a means of "last resort" without realizing that there may be no immediate solution to the problem (Runser). Within universities and among their cooperators, a balance must exist between scientific, knowledge-driven research and applied, market-driven research.

Ironically, the universities that have most succesesfully abetted the growth of high technology have been those with both a tradition of faculty independence and a governing structure that has insulated researchers from political pressures and outside influences (Holt). However, insulation of the university from the real world is precisely why so much university "pure" research is often of little commercial value. The most useful applied research and development activities are market oriented. Applied research that takes place in nonprofit organizations like universities and government laboratories is usually not market driven and therefore seldom gets translated into products or ideas that lead to the formation of new enterprises (Miller and Cote).

Plans for a science park which involves a university must consider the rules and attitudes of the relevant science and engineering departments and faculty. Universities produce knowledge, but without an orientation toward application, this knowledge will tend to "transfer" to the scholarly journals, rather than to the marketplace. Some universities prefer to continue in this tradition.

In spite of objections, however, industry-university interaction is proving to be a very productive part of the development of new technology and an essential ingredient in the development of science parks. Economic advantages associated with these high-tech interactions please and attract more than just the industry, government and universities institutions. The potential for profit and prestige also attracts university scientists, and they, in turn, attract outstanding students.

Reciprocity

In most cases, science park projects have encouraged further expansion of university-industry research cooperation which already existed. The concept of the two-way "window" on university research is argued to be an important asset for both industry and universities since now, more than ever before, knowledge of the findings from either industry or university sources will be of value to both. This transfer of information can take place in less time than if each were isolated in their research activities.

However, the "window" is not actually two-way. While university scientists exchange information with their academic and industrial colleagues fairly freely, giving seminars and publishing research results in journals, industry researchers often must treat their findings as "trade secrets". For example, some computer-aided design tools and experimental processes, even though developed jointly, are held as company proprietary knowledge.

Though perhaps not reciprocal, university-industry "window" is important. It provides to universities a view of current industry research and engineering concerns, allowing universities to keep their science and engineering curricula up to date with marketplace needs for scientific and engineering personnel and for technical applications. To industry, the "window" provides access to the university infrastructure, early access to research findings, and access to a pool of highly educated and talented new scientists and engineers.

Brain Drain

The time of faculty is one of the most important resources in universities. Though given more leeway than university researchers in most other countries, some U.S. university researchers have chosen to more directly share the fortunes which entrepreneurs and venture capitalists have developed from commercial exploitation of their research findings. As a result, universities are finding that some of their top researchers either exceed their officially approved "extracurricular" activities or simply leave their university positions to join new company start-ups. A mutually beneficial industry-university partnership allows industry scientists to spend time teaching and interacting with university faculty and students, allows university scientists the flexibility of consulting and periodic leaves of absence to work with industry and then return to the university, and provides a steady flow of new scientific personnel from the university to industry.

ESSENTIAL COMPONENTS OF SCIENCE PARKS

The concept of a "science park model" is a simplification of the complex set of relationships which foster economic development and job growth related to high technology. In truth, several approaches to business development, as well as several approaches to planning, have been used. More often than not, research cooperations, incubators and business centers are aspects of the same regional development efforts. They share the objective of economic develoment, but they differ in several respects.

Research Consortia

Most research consortia are aimed at increasing the interaction between university researchers and their industrial counterparts. Some are located on campus as university research centers which are sponsored by industry. Some are located off campus but in the proximal area. These may serve as a bridge between university and industry researchers by offering services to both.

In spite of some university objections (in the name of academic freedom) to increased cooperation with industrial researchers, the infusion of industrial research funds into university research programs has been, in most cases, necessary and welcomed. These funds have enabled program expansion and the development of university strengths to better serve industrial partners. In some cases, industrial support of university research has also stimulated the development of services to facilitate the interaction of university and industrial scientists. Increased university-industry interaction commodifies research findings, allowing industry to gain not only influence in research agenda setting, but also control of technology through advanced knowledge of it. And advanced knowledge of new technologies can be valuable even if the company has no intention of using the technology. It allows a company to develop related technologies which are supportive or defensive and which prevent another company from making use of it. Additionally, the information advantage can be economically beneficial through licensing agreements with other firms.

Incubators

Incubators are a means of launching new small businesses. Incubator efforts range from those provided by university-industry consortia or established organizations to new co-operative developments. In many cases they offer below market-rate rents, on-site assistance, financing, and other services and training. All of these approaches tend to improve the entrepreneur's chances for success. The cooperative development is extremely useful in helping small businesses avoid the dual threat of insufficient capital and undeveloped management skills.

Incubation organizations are frequently established for local development and are largely publically funded. Businesses applying to these organizations can be high-tech or traditional, but all are expected to become independent, to grow and "leave the nest". Among local development initiatives, incubators are a growing means of launching new small businesses and are particularly useful for promoting community business development, though they are not restricted to this use.

Business Centers

Business centers also target community business development but unlike reserch consortia, provide management and business assistance to entrpreneurs starting new companies. They are particularly helpful in improving the odds that new entrepreneurs will succeed in their first ventures. Both public and private organizations have been involved in developing business centers with encouraging results. From its various training programs, data services, advisory and business connections, Control Data -- for example -- has developed a number of services for the entrepreneur and claims that only 14% of the firms -- as opposed to the usual expectation of 70-80% -- have gone out of business after three years (Fusfeld).

Essential Components

Studies of technology-based business developments have shown a number of elements to be essential for the development of science parks. Some characterize a receptive environment according to four factors (Engstrom):

1. A strong, scientifically oriented university
2. The establishment of a technology center close to residential, commercial and manufacturing areas
3. Venture capital
4. Conducive physical and cultural climate

Others (Braun) describe the ingredients essential to a science park a complex a constellation of:

1. Technological capability -- frequently the result of a major technological university or industrial or government research laboratory.

2. Positive interaction, formal or informal, between a technology-based institution and the technical business community. In the case of a university, the key is the

attitude of the faculty toward direct involvement in business.

3. Successful technical entrepreneurs -- the role models that say it can be done and encourage others to try.

4. Financing for soft and hard start-ups and contract research.

5. Consultants, including venture capitalists and other management assistance and training needed by the technical entrepreneur.

6. Supportive local infrastructure, including the positive attitude of the local community and ethnographic considerations which encourage risk-taking.

High technology development depends on a steady infusion of both new research findings and new researchers. Though corporate labs can supply the former, often with a more practical, applied orientation, the latter must come from universities. A country or region that does not produce its own high-tech personnel must, by default, depend on outside assistance. Imported talent is sometimes unavailable, sometimes overly expensive, sometimes transient, and sometimes not in tune with local and regional needs. Just as university research programs develop according to the talent of the faculty and students, science parks are constrained by the talent which is indigenous or which can be imported.

Universities serve another vital double function, as well. As universities become proactive agents in the development of research consortia, their involvement not only helps create the science parks, but also gives the parks credibility, validating them in the public mind. A reciprocal benefit acrues to universities from business success.

University researchers and technological entrepreneurs do not always share the same goals. Merely establishing an university-industry cooperation will not automaticaly cause techno-economic miracles to happen. At least some university scientists must share the entrepreneurial spirit of science park companies and vice versa.

Physical proximity influences the rate of new knowledge transfer and positive interaction between university researchers and associated companies. As previously mentioned, one means of transfer occurs through academic consultancy work, as part of the university-industry "window", but a very important mechanism for transfer continues informally as company and university researchers interact socially.

Ties to the business community are essential, and care must be taken to avoid isolating the park from marketplace realities. Once established, these agglomerations of companies, if secure under a university umbrella, can ossify into respectable research islands, artificially maintained at public expense. For example, Sophia-Antipolis in France and Tsukuba Science City in Japan are both heavily subsidized, highly planned and wonderful intellectual environments in which to live and work. But because of their existing financial security, they are unlikely to reach self-sufficiency through entrepreneurial activity.

For start-up companies to continue residing in a science park after initial start-up, the park must prove itself marketably fertile. Enough entrepreneurial activity must exist in regions proximal to the park that markets for the new high-tech products can be found or created.

Science parks showing measurable success have no lack of start-ups. The problem common to many parks, even the successful ones, is the high rate of failure, due mostly to undercapitalization and lack of business expertise. Many technology entrpreneurs are, though technically expert, quite naive about business. Along with technical ideas, a fledgling entrepreneur must convince an investor or lending institution that he or she has a sound idea about when and how repayment of investments will be made. This hard business reality applies whether the "loan" is seed caiptal, venture capital, or a private loan.

The entrepreneur must learn the game-plan of each type of lender. Venture capitalists often have millions to lend but invest only in companies promising rapid growth, having little interest in a small company with little promise of measurable intention of growth. Seed capital, though usually a much smaller initial amount, is useful for feasibility assessments, with more funds available if commercial success seems likely. There is no clear line between venture and seed capital lenders, since some smaller venture firms having smaller capitalization are looking at the seed capital level of investments. If the company promises success, a larger venture capital firm will likely become interested.

Another type of support is contract research. Often funded by government, contract research has led to the development of a number of important products and companies. For example, MIT, Harvard and the University of Pennsylvania, funded largely by such contracts, developed the first minicomputers. Digital Equipment Corporation was developed to market the PDP minicomputer, which was a spin-off of MIT's TX-O minicomputer project. Contract research can also be funded, in part or totally, by private corporations. Such projects often involve corporate and university staff from a number of different areas, requiring coordinated, interdisciplinary work toward a common goal.

Venture capitalists form an essential link between the marketplace and aspiring entrepreneurs. Like other businesses, high-tech businesses must survive their first year, and often owe a good deal of their success to advice from their venture capitalists. Venture capital itself is secondary in importance to this information and advising function. The planners and entrepreneurs of a region who are interested in developing a science park, then, must identify local venture capitalists and assess their interests and previous involvements. Areas which are well-supplied with generous government grants or government-supplied venture capital pools may be less likely to have located and identified these critically importan participants in the development of synergy in science parks. Alternative sources of information access can be identified, but they tend to lack the motivating drive engendered by venture capitalists.

Along with this advice from venture capitalists, a growing company needs a multitude of legal, accounting, planning and marketing assistance. As basic as these tasks are, their importance comes as a shock to many new high-tech entrepreneurs. In successful park developments, service and support companies, as well as in-house support organizations, can be found. Support organizations assist park companies directly and indirectly, and often conduct training seminars.

Support services are also growing at a number of universities that now offer specialized management and business courses for technical entrepreneurs. These courses may seem less important to soft, small consultancy companies, but are actually vital for all new entrepreneurs, though beginners often resist "business" involvement. It has been found that technical entrepreneurs have a disproportionate tendency to adopt a behavioral pattern which does not lend to business successes (Commission). Other studies have established a clearer profile of the characteristics more or less likely to lead to entrepreneurial success, making it possible to identify design criteria for more successful enterprise training programs in the future. Entrepreneurs, both academic and non-academic, must be primarily high-tech users not pure researchers.

The continuous start-ups and business failures occuring at most science parks can seem chaotic to local communities not used to constant change. High-tech workers are necessarily accustomed to change. Because the talent pool is much more mobile, executives and workers routinely deal with job shifts and changes. The propensity of the lcoal community to this type of influence and its ability to respond (Cognos) are essential to the longevity of a park. Suppliers and vendors deal regularly with major plant reorganizations. With the local impact of all this change, planners and developers must both evaluate the likelihood of a region being able to adjust to a high-tech environment and seek local support. Support must be sustained by local leaders. Social-political support will lead to public expenditures promoting the park and to the selection of park businesses for local high-tech projects. This local support should include local non-park businesses, which must eventually develop a sort of "social contract" with the fledgling park companies. Once local support is evident, other entrepreneurs wil be attracted to the area.

A close look at Silicon Valley or Cambridge reveals that an area with a tradition emphasizing individualism will likely prove more successful for a science park development than will an area with a long labor union history, with its emphasis on group consciousness. Silicon Valley, though largely unplanned, was greatly supported by a positive local climate for the young high-tech entrepreneur, a support that is lacking in many other areas.

Areas targeted for economic development initiatives should be selected to include this cultural characteristic, because social sanctions for failure by risk-takers can handicap innovation initiatives. A cultural attitude toward forgiveness for business failure, a "try, try again" tenacity, and a spirit of adventure are important ethnographic considerations.

OVERVIEW AND RECOMMENDATIONS

Are science parks the key to economic development or recovery in every region? In a word, NO.

Science parks can and have failed to reach critical-mass even when every detail is planned. There is no sufficient set of prerequisities for park development that will assure success. Though care must be taken if any of the elements discussed above are conspicuously missing, economic reality ultimately changes the question of development from, "Is a science park recommended for area X?", to, "What type of development activity is feasible for area X?". It is difficult to overstate the importance of a proposed project's being appropriate for its environment. A development initiative will not likely succeed unless it fits in perfectly with local and regional circumstances (Eekels in Commission).

Just as development initiatives must fit their communities, university strengths must also fit the marketplace. In addition to their academic responsibilities, universities should focus on information transfer for small and medium-sized firms, using advanced library and data base services, using geographical location near government offices, using international relationships and contacts with other universities, and using decision support, innovation and strategic planning resources to assist in the creation of new entrepreneurial activities.

For all the interest in science parks, it must be remembered that they have not yet proven themselves to be major generators of net employment increases. Even where parks are most successful, they supply only a small number of jobs. Along Rt. #128 in Massachusetts, renowned for its high-tech industries, high-tech companies accounted for only 12% of total employment (Miller). Likewise, Cambridge Science Park, with its large number of soft companies, has employed a relatively small number persons, though when and if these companies harden, more employees will be needed.

There is no denying the success of Silicon Valley, Rt. #128 or Cambridge Science Park. But just as evident as their success are their differences. This is to say, that had the development of either the Boston or Cambridge parks been dependent upon duplicating Silicon Valley -- on their becoming "Sili-clones", they would have had little success because of their widely differing circumstances. Successful development efforts should be studied and their characteristics articulated. These models, however, cannot be used as recipes. It may be that the real contributions of a successful "science park model" are, first, the inspiration it generates in surrounding and neighboring areas and, second, the lasting impact of the synergistic partnerships created.

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Addendum to Russell + Moss, "The Role of Science Parks in Initiatives for Economic Development"

SCIENCE PARKS FOR DEVELOPING COUNTRIES?

Science parks are not panaceas, as stated earlier, but they have promoted economic growth in some notable situations. Under what conditions, it can be asked, can science park initiatives be successful in developing countries?

The desire for change can be stimulated out of vision, out of desperation, or out of compromise. A region (and the more localized this region the greater are the chances for success) in which a science park will be initiated must be receptive, if not eager, for change. This willingness to change must be accompanied by an entrepreneurial spirit - the ability to perceive opportunity combined with the courage and commitment to try something new, to risk the possibility of failure for the chance of success.

Governments, public organizations and established groups take relatively few risks. They tend to make safe decisions which require the consensus of influential groups and which are protected by organizational resources and/or stability. By their nature a proportionately greater amount of time is needed to make those decisions, and once made they tend to be safe and difficult to reverse.

In contrast to this conservative approach, successful science parks have been characterized by the fast response to opportunity with an appropriate solution, the flexibility to adapt products and services to satisfy the market and the ability to structure innovative partnerships. These have been possible because the risks have been taken by individuals whose investment capital is personal or by local venture capitalists. In either case, there is an absence of conservative, time consuming bureaucracy.

When this delegation of control and responsibility, willingness to risk and spirit of entrepreneurial opportunity are present in developing countries, and when the technical talent, the business acumen and the managerial and marketing know-how either exist or can be obtained, the synergistic initiatives and partnerships of science parks are possible. To facilitate such development, intervention must be based on information access and unsuccessful start-ups must be encouraged to redirect their activities, guided in trying different alternatives, allowed to fail, and encouraged to try again.

As a precursor to assembling in developing countries the essential components for successful science parks, development activities which promote the establishment of indigenous technical know-what, know-who and know-how are all positive steps toward technology development. The identification of investment resources, business and management experience and marketing capability also can be accomplished as a preliminary stage to making these necessary resources available.

INTERNATIONAL INTERVENTION IN TECHNOLOGY INITIATIVES

It is true that financial, technological, personnel and information resources are limited in developing countries. Because of the constraints of resources within one country, opportunities to establish synergistic partnerships may require the combined resources of more than one region, of even more than one country. What opportunities exist, then, for international initiatives, involvements or intervention in promoting technological synergy and cooperative development?

A successful partnership or cooperation requires a complementarity of needs and resources and a parity between costs and rewards. The reality of industrial development today is that the economy is global, technological changes are occurring in many areas and at a very rapid pace, the marketplace is becoming more individualized with custom and semi-custom production, and vertical information control and authority is yielding to horizontal information networks and access complexity.

In this era of dynamic change, the leadership perspective must be global, and the advancement of any one participant (country, company, agency or individual) must be based on using existing strengths as leverage to build further capabilities. The recognition of strength itself requires a knowledge of the global environment. In this first essential steop, the identification of strengths, the international perspectives of UNIDO provide a vast resource from which developing countries can identify their strengths and initiate national or regional programs to fortify those strengths in order to generate indigenous capability which can be developed and marketed so as to build international technology alliances and cooperations.

To enter into an exchange, a participant must have something to offer. UNIDO assistance can be targetted toward aiding developing countries in the identification and development of the strengths and resources on which their bargaining for cooperation can be based.

Technological alliances among developing countries, once developed, can generate the development of collective or mutual capabilities strong enough to attract the interest of developed countries. Again, the international perspectives and information channels of UNIDO can be strategically employed to promote those collective strengths and to facilitate the mutual awareness and reciprocal benefits in alliances and partnerships between a group of developing countries and a developed country.

Building and bridging are the intervention opportunities for UNIDO in establishing technology initiatives in developing countries. Information access and exchange are the tools. Now is the time.