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Developing High-Technology Communities:
SAN DIEGO

EXECUTIVE SUMMARY

**Office of Advocacy
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DEVELOPING HIGH-TECHNOLOGY COMMUNITIES:
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EXECUTIVE SUMMARY
and
LESSONS FOR COMMUNITIES

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EXECUTIVE SUMMARY

Developing High-Technology Communities: San Diego was written by Innovation Associates to assist business leaders, university heads, economic developers, and other key community players to better understand some of the processes involved in developing a supportive environment to grow small, high-technology businesses. San Diego is one of several cities in the U.S. that have exhibited resiliency in the face of economic downturns. San Diego in the late 1980's and early 1990's was hard hit by defense cutbacks that caused severe economic dislocations of defense workers, particularly in aerospace and supplier industries. But less than one decade later, all of the lost jobs were replaced, mainly by new jobs in business services, high-technology clusters, and tourism. Small firms almost exclusively created these jobs as small, service and high-technology firms grew at unprecedented rates during the 1990's.

From 1990 to 1998, high-technology clusters added over 46,000 new jobs to the region. Some of this growth has mirrored rapid national expansion in high-technology clusters. But growth in some clusters such as biotechnology and pharmaceuticals, and communications, have exceeded the national average employment growth. Jobs in biotechnology and pharmaceuticals doubled adding almost 12,000 new jobs to the San Diego region. These jobs were almost exclusively in small firms, averaging fewer than 50 employees. Employment in software and computer services, also doubled, and communications grew by over one-half, together adding 16,000 new jobs. QUALCOMM, Inc., which started in San Diego in 1985, became a dominant force in the region's communications cluster. But most communication employees still work for small firms, and firms in software and computer services averaged fewer than 15 employees. Wages in most of the clusters are below national averages. However, wages in biotechnology and pharmaceuticals are increasing at a much faster pace than the national average and the wage gap in other clusters is narrowing. In addition to biotechnology and pharmaceuticals, communications, and software and computer services, other promising high-technology clusters in the San Diego region are recreational goods, environmental technology, and biomedical products. All of the growing technology clusters are small firms, and except for a few major companies, technology firms and small firms in the San Diego region are synonymous.

The San Diego region has developed new high-technology jobs, despite a major economic disruption from defense downsizing, and one of the highest costs of living in the country. The success of the San Diego region's ability to create and expand high-technology businesses is due to multiple factors. These factors include a rich research and development base, active university promotion of science and technology to local businesses, availability of a skilled workforce, an involved business community, and improving public support. In addition, CEO's say that the physical environment continues to attract their firms and workers to the region.

San Diego's technology growth was not the result of a master strategic plan, and the region's business, academic, and public sectors were not always in sync. In the 1980's San Diego mounted unsuccessful bids for major national R&D centers, particularly the Microelectronics and Computer Corporation and Sematech, which were awarded to another city. The loss of these centers to a city in which key players banded together, taught San Diego about the importance of community cohesiveness. The San Diego Regional Economic Development Corporation (EDC) took the lead in promoting greater community participation by private sector leaders and involvement of the academic community to reduce the region's economic dependence on defense. At a time of impending economic distress, the EDC's efforts resulted in better networking among business leaders, a closer working relationship between the University of California at San Diego (UCSD) and the business community, and improved communication between the public, academic, and private sectors. Although the intent of early community efforts was to attract diversified businesses and R&D centers to the

region, the efforts that rallied business leaders and brought together key players, ultimately resulted in strengthening the region's environment for technology development. These early initiatives included the Financial Forum, the San Diego chapter of the Massachusetts Institute of Technology Enterprise Forum, and UCSD's CONNECT program. Some of these efforts also attracted federal funding from the U.S. Economic Development Administration that seeded entrepreneurial initiatives at San Diego State University, and small business incubation at the Center for Applied Competitive Technology, San Diego City College.

San Diego's defense industries provided the base for spin-offs in fields such as wireless communications, and computer and software services. Two of the largest homegrown technology firms -- Science Applications International Corporation (SAIC) and QUALCOMM Inc. -- started by serving the defense industry in the San Diego region. Although SAIC's defense work increased with the rapid expansion of its business in the late 1990's, the company diversified, and the majority of its business is now devoted to commercial sectors. QUALCOMM Inc. also started its business based on its predecessor's defense communications work. The firm used its expertise in defense communication technology to develop commercial products in cellular technology, making it the second largest producer of cellular telephone technology in the world. Although San Diego suffered from major losses in aerospace and related industries in the early 1990's, the rich R&D base left behind by the defense industry provided fertile ground for new technology growth aimed at meeting the demands of emerging commercial markets. San Diego's world renown research institutions -- Scripps Research Institute (formerly the Scripps Clinic and Research Foundation) and Salk Institute for Biological Studies -- also provided fertile ground for growth in medical services, biotechnology, and medical device industries.

The development and growing prestige of UCSD was particularly important in promoting the development of high-technology firms in the region. UCSD not only trained many of the engineers and scientists who would later take positions with new and growing high-technology firms, but also provided a valuable science and technology base for these firms. One of QUALCOMM's founders was a member of UCSD's faculty, and other firms, such as Hybritech Inc., which is credited with starting the biotechnology industry in the San Diego region, traces its roots to UCSD. According to UCSD, most of the high-technology firms in the San Diego region were based on technology developed at the University or founded by its faculty or graduates.

UCSD's Chancellor from 1980 to 1995, Richard Atkinson, now President of the University of California system, played a vital role in building UCSD's science and engineering disciplines and in placing the University at the center of the region's high-technology development. He established a school of engineering and enhanced the University's national credibility and prestige by attracting academic "stars" in science and engineering. He convinced local firms to endow chairs and fund the University's major expansions. He also expanded the depth and breadth of the campus' basic research capacity, especially through the creation of interdisciplinary research centers, established in cooperation with technology companies. Under Dr. Atkinson's leadership, the University successfully bid for one of the national Supercomputer Centers and was one of the top five university recipients of federal research funding. Dr. Atkinson worked externally, with community organizations, and internally, with the University's department heads, to forge a relationship between the University, the community, and the private sector. He believed that it was part of the University's mission to create a more favorable environment for attracting and developing technology-based industries around the University and in the community.

Local organizations also added a key element in developing a supportive environment for high-technology industries. The San Diego chapter of the Massachuset's Institute of Technology Enterprise Forum, started in

the early 1980's, has provided advice and education services to the region's growing companies. UCSD's CONNECT program, which started a few months after the Forum, has helped technology start-ups and small companies through business assistance, venture capital fora, networking, awards, and public advocacy. BIOCOM has represented the region's biotechnology and medical device industries, and the Software and Internet Council serves as an important networking organization for the region's computer and software industries. The San Diego Regional Technology Alliance has implemented programs aimed at promoting science and technology in schools and disseminating technological know-how. One ingredient of the region's success has been the inclusive cooperative spirit of these industry organizations.

San Diego's future as a technology community looks promising. Only a few years ago, reductions in defense spending caused severe disruptions to the economy. Today, rapidly growing technology industries have driven the unemployment rate below the national average, and have set the stage for future growth. Although defense spending is still strong in the San Diego region, diversification of the economy should make the region more resistant to future economic downturns than in the recent past. Moreover, the legacy of UCSD's former Chancellor, Richard Atkinson, who created a nationally recognized research university, and the commitment of the region's business leaders to build a technology region, should continue to provide a healthy environment for new technology growth. Technology clusters that have developed in the region, particularly communications, and biotechnology and pharmaceuticals, are well positioned in rapidly growing markets. In addition, firms in these clusters have developed strong supplier relationships in the region, and this should further stimulate growth in clusters such as business services, and computer and software services. High costs of living, transportation and other issues may somewhat slow growth. Moreover, improvements in K-12 education, particularly for a growing minority population, are essential to supply future skilled workers for technology industries, to insure continuing wage increases, and to lessen the widening wage gap. But, in the near future, San Diego's economy shows every sign of remaining healthy and growing, as it continues to diversify and as technology clusters in emerging markets continue to expand.

LESSONS FOR OTHER COMMUNITIES

Although most communities cannot recreate the beauty and climate of the San Diego region, there are some elements that have contributed to the region's economic turnaround, which communities can learn from and apply to their own environments. Some of these lessons are:

➢ **A research university provides a valuable resource for technology firms, but does so only if the university is open to and actively facilitates linkages with the private sector**. Technology transfer offices and industry relations offices can provide help in patenting and licensing university technologies, organizing industrial sponsored or collaborative research, and identifying professors and students for consulting. Organizations such as UCSD's CONNECT, which operates as part of the University, can provide additional entrepreneurial assistance, venture capital match-making, information dissemination, networking, and advocacy. In other cities, these activities often are provided by independent, non-profit organizations supported by state technology programs, and located at major research universities. There are advantages and disadvantages to both types of models. A university program may have greater credibility in the community, but less flexibility, than an independent program located at or near a research university.

➢ **Leadership within the university, from the top, sets the tone and direction for cooperation with industry.** In the case of UCSD, former Chancellor Richard Atkinson viewed the research university as a platform for technology-based economic development. He set into motion technology transfer policies and university-industry programs that helped create the foundation for a growing technology community.

➢ **Universities, as well as technology firms, benefit from university-industry collaboration.** Industries benefit from having a window on emerging technologies and access to faculty and students. Universities benefit from increased funding of R&D, financial support for faculty and students, and having a window on "real world" industry needs.

➢ **Research universities not only are an important source of R&D, but perhaps more importantly, are a source of future skilled labor for growing technology firms.** The university provides a valuable source of skilled labor from which technology firms can draw, as well as a source of future entrepreneurs. Industry support of research universities helps insure a continuing labor supply of skilled labor.

➢ **The supply of technicians and technical support is equally important as the availability of engineers and scientists to support growing technology firms.** In San Diego, San Diego State University and San Diego City College provide a valuable source of highly skilled technical labor. Moreover, entrepreneurs who start service firms that support technology industries often come from technical backgrounds.

➢ **Industry organizations can provide an important forum for technology industries to exchange ideas, keep abreast of developments in their field, and advocate for issues that affect their industries.** In San Diego, organizations such as BIOCOM, Software and Internet Council, and MIT Enterprise Forum are important sources of information, networking, and advocacy for the region's technology firms.

➢ **University and industry organizations can provide valuable services for small technology firms.** Small firms, unlike larger firms, often do not have access to capital sources, and may not be able to afford business planning, market research, and other services needed for start-up and growth. University and industry organizations can be a valuable resource for these small firms. UCSD's CONNECT program and the MIT Enterprise Forum, in San Diego, provide small firms the opportunity for introductions to the investment community, licensing and partnering, business planning, and help with other critical services.

➢ **Current and in-depth analysis of cluster data is essential for economic development planning. A local or regional organization can provide this information service.** The San Diego Association of Governments (SANDAG) provides information services to the region by collecting and analyzing data, not only on traditional industrial categories, but also on high-technology and other clusters. In addition to conducting economic analysis of traditional indicators, SANDAG assesses demand and supply relationships among clusters, collects data on firm size, and provides other data inputs upon which to base regional economic planning and decision-making.

➢ **Economic data provided by federal agencies is lagging behind the information needs of communities and regions.** In a rapidly changing economic environment, once useful industrial classifications and data collection, no longer provide adequate information for local economic development needs.

➢ **Local and state governments can make a difference by creating a "business friendly" environment for technology firms.** In San Diego, Mayor Golding cut numerous regulations and streamlined permit processing. The Mayor let it be known that the City was willing and able to work with technology industries. In addition, the state government supported a technology environment by increasing tax credits on business investments in university research, and providing other direct incentives for technology industries.

➢ **Cooperative leadership from all sectors -- academic, government, and private -- is an indispensable element in creating a technology environment.** In San Diego, leadership came from several sources: the Director of the Economic Development Corporation, the UCSD Chancellor and Dean of University Extension, the Mayor, CEO's of corporations, heads of local foundations, and service providers.

➢ **A severe economic event can unite leaders, but it takes a common vision of the future and a local plan of action to sustain the momentum.** In San Diego, the loss of defense contracts brought the community together temporarily to seek other government funding. But it was not until the leaders got together to develop a strategic plan aimed at building a technology base on local resources, that real cohesiveness was achieved.

➤ **The technology firms that survived defense cutbacks were those that remained flexible enough to diversify.** Some of San Diego's defense industries survived the up's and down's of defense budgets by quickly diversifying their technologies to meet new government priorities and commercial market demands. QUALCOMM, Inc., for example, originally developed and supplied defense communications, but quickly applied this technology to the commercial market for wireless communications.

➤ **As firms in certain technology clusters developed, they spawned other firms in that cluster.** New firms resulted when employees of technology firms spun off other firms in niche areas, often becoming suppliers to the original firm, or providing secondary or tertiary products, processes and services. In San Diego, this clustering of firms appeared most prominent in communications, biotechnology and pharmaceuticals, and biomedical devices.

➤ **Networking of technology firms appeared to help develop and maintain small, technology suppliers in the region.** Technology luncheons, award events, and other opportunities for firms to interact, helped provide an opportunity for service providers and suppliers to learn about the needs of growing technology firms and develop relationships with those firms.

➤ **Small firms, in business services and technology, were the driving forces of San Diego's economic turnaround.** Almost all of the new jobs created by San Diego firms in the 1990's were created by small firms. Entrepreneurs, primarily from UCSD and defense industries, led the way in creating technology firms to meet the demands of evolving defense and commercial markets.

As San Diego enters the year 2000, its economy is much stronger than just one decade earlier. The region's economic landscape is being reshaped by a committed and cohesive private sector, a rich research base that involves university-industry collaboration, and an active community leadership. Although tourism and defense industries still are major sectors of the region's economy, technology industries have become a major economic force, and have set new directions for San Diego's economic future. Small technology firms have led the way. As these technology firms continue to grow and spawn other technology firms, they increasingly will change San Diego's image from a town known for Sea World to a town known for technology.

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