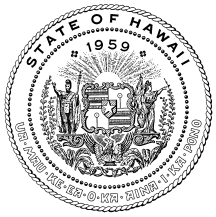
A New Millennium Growth Strategy For Hawaii's Economy



Department of Business, Economic Development & Tourism
State of Hawaii

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Preface

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The *New Millennium Growth Strategy* presents the Governor's vision for Hawaii's economic development into the New 21st Century Economy, tempered by a realistic appreciation of Hawaii's assets and its liabilities. In addition, the document advances broad economic development themes, policies and principles that will be used to guide Hawaii's development toward achieving this vision. Highlights of the Strategy with policy directions for key sectors are presented in the Executive Summary, along with brief supporting rationales as appropriate.

While emphasizing the State's role in economic development, the Strategy focuses on: (1) advancing existing and emerging economic activities that will most likely serve as the driving forces behind Hawaii's future economic growth; (2) increasing the supply of factors that are needed to realize Hawaii's economic potential (e.g., skilled workers, investment capital, etc.); and (3) encouraging Hawaii's enterprise to seize every opportunity for beneficial engagement in the New Global Economy.

While some components of the Strategy are new, many have been in force for years if not decades. These older components are included in the document in order to present a more complete and comprehensive picture of the Strategy in a single, concise treatise.

Furthermore, the Strategy is evolving and will continue to evolve over time in response to changing circumstances and opportunities—particularly advances in new technology, shifts in the U.S. and world economies, the opening up of new opportunities for Hawaii, additional contributions by those involved with economic development, new insights, changes in community values, etc.

Purpose

The purpose of this Strategy is to provide information to help (1) guide and coordinate decisions that affect Hawaii's economic development, particularly decisions by government; and (2) help those parties affected by the Strategy make decisions that will allow them to adapt to government economic policies and to anticipated development. Although many major decisions will be made within the next few years, their consequences may endure for decades.

Intended Audience

This Strategy is intended for legislators, government agencies at all levels, existing and potential businesses, investors, managers and employees, unions, educators, students, and other interested parties. The large audience reflects the fact that—within the context of Hawaii's partially regulated market economy, the multi-layered democratic republic, and the many government agencies—economic decisions are dispersed among a great many parties.

Methodology

The Strategy was drafted by DBEDT based on an accumulation and synthesis of knowledge gained over the years from: numerous discussions and meetings that have addressed economic development problems and opportunities, economic studies of Hawaii's existing and promising economic activities, and experiences of other communities and lessons learned about successful economic development strategies.

Implementation

Any strategy can only be as good as its implementation. For a particular policy, this may require a number of specific actions, and each action will require the designation of a responsible party or parties (a State agency, a County agency, the university, industry organizations, etc.), possible supporting legislation, an estimate of costs and a source of funding, a schedule to carry out needed tasks.

Although details on how to implement policies are omitted from the Executive Summary in order to enhance its readability, general requirements for implementing many policies are clear from the context. The actual details are covered in the body of the report or in related reports, or will be covered in future documents. As a guide to the reader, the principal goals and policies in each section have been placed in bold italics form.

Foreword

Moving Toward a Knowledge-based Economy

As we enter the new millennium, it is clear that fundamental changes are taking place not only in our economy, but also in our daily lives – in how we think, how we communicate, how we deal in workplace and markets, far and near. Changes are occurring at lightning speed, driven by the rapid and accelerating technological advances of the last decade and a half. Personal computers are attaining more and more power and adaptability at less and less cost; telecommunications not only provides faster but more versatile transmission of information; and uses of the Internet are just beginning to surge.

If we reflect a bit on where we've been and what many of us have gotten used to, we are today indeed in a New Economy. What does this mean for Hawaii? Are we really "in" the New Economy? If not, what does it take to catch up or secure more of its benefits?

The New Economy puts a premium on intellectual capacity and adaptive efficiency, the ability of institutions and individuals, whether they be government, industry, or our educational system, to innovate, continuously learn, and productively change. In the old economy, fixed assets, financing, and labor cost were principal sources of comparative advantage for firms. But now, as markets fragment, technology accelerates, and competition comes from unexpected places, learning, creativity, and adaptation are the principal sources of competitive advantage in many industries and must also become the driving forces behind public policy in the New Economy.

In this New Economy environment, I am convinced that states can play the leading role in stimulating and advancing economic progress. States are closer to the places where research breakthroughs occur. State governments are generally flexible enough so that innovative adaptations can be encouraged and widely disseminated. States will be the first to recognize and take action to overcome deficiencies and build on competitive advantages which enable growth in an increasingly global marketplace.

My conviction that states can lead the way in grasping the benefits of the New Economy has been reaffirmed by my fellow Governors of the Western Governors Association, of whom I have the honor of serving as Chairman. At our most recent meeting, we selected "Growth on the Cutting Edge" as our theme for economic strategies to address the New Millennium.

This theme represents quite a turnaround from traditional state strategies. Instead of touting the comparative advantages of lower taxes which reduce state revenues or lower labor costs which constrain wages, our new theme focuses on <u>competitive</u> advantage. For Hawaii, this means shifting our focus from comparative advantage based primarily

on geography and natural assets to competitive advantage based on productivity in key areas.

We intend to compete, but our competition will be based first on meeting the high standards and goals we will set for ourselves. Our challenges will be to build up our knowledge infrastructure. This means states must invest in and enhance world class education, training, research and development. This means workers must upgrade workforce skills, and companies must provide both labor and management with productive cutting edge tools that will enable them to succeed with the growth of the Internet and the digital economy.

I firmly believe this is a competition that Hawaii can win. For a long time, I have been convinced that here in Hawaii we have all the ingredients for scientific and technological advance – unparalleled natural resources, strategic location, and an intelligent people. I have therefore set the development of our technological capabilities and our knowledge facilities as prime goals for the reinvigoration of our economy. In 1997, I convened the State's first biotechnology conference, and in 1998, a gathering of leaders in academic research, technology enterprise, and venture finance in information technology.

We have met these challenges before. Our sugar and pineapple industries have been worldwide leaders in the introduction and use of technological advances. Our tourism sector has prospered through innovative application of integrated resort development.

My vision is that working together – government, business, and academia – we will create a knowledge and idea-based economy where as before the keys to job creation and higher standards of living are innovative insights and adaptive technology embedded in both services and products; an economy where risk, uncertainty, and constant change are the rule, rather than the exception.

In striving for competitive advantage, we must of course be alert as to what other states are doing. Maryland for example, has a vision to become the state, which centers around Internet commerce. They intend to do this by making sure everyone in the state has access to the Internet, by supporting technology education both at early levels and through life-long learning, and by collaborating with the private sector and universities on technology transfer and commercialization.

Maryland and others would like to become the nation's E-commerce states. Here in Hawaii, we have also progressed in these areas, and there's no reason we can't meet this competition. However, there's also much we can learn from the successes or missteps of others. For this is the essence of New Economy competition – a competition for excellence. And in Hawaii's case, we do have a comparative advantage. With our cultural ties, economic relationships at both business and official levels, and our wide-band wireless networks, we can focus on technological developments in Asia-Pacific markets and their potential for trade, industry, and commercialization. Why not Hawaii as the E-Knowledge state or the E-Entrepôt state – America's entrepôt to E-commerce in

the Asia –Pacific. At any rate we have a unique opportunity in the New Millennium and I intend to fully investigate its possibilities.

I have asked Dr. Naya and his colleagues to develop a strategy and outline some of the means by which my vision for Hawaii in the New Economy can be attained – a plan for action if you will. This report will also delve into other aspects of our economy in what I hope will be a community-wide learning-by-doing process. Where necessary, I will submit for legislative consideration some measures to help further our economic growth. At all times, I will welcome the input of our broad citizenry on every island into this learning and doing process.

---Benjamin J. Cayetano
Governor of Hawaii

Introduction

Why Hawaii Must Pursue Technology Development

As this report will show, Hawaii's economic future may be determined in large measure by how well we can use science and technology to increase our productivity and become a center for technological innovation in the Pacific. As tourism settles into an era of more modest growth, an expanded technology sector could become Hawaii's new growth engine. This would generate new export products, raise Hawaii's profile in the worldwide technology community, and help attract interest and investment in Hawaii as a site for serious scientific and technology activity. Moreover, an expanding technology sector can help support the spread of new technology into all of Hawaii's industries, which is critical for ensuring a competitive economy in the 21st century. Because of their importance and promise, the development of Hawaii's technology capabilities and enhancement of our knowledge base have become Governor Cayetano's top economic policy goals.

Hawaii's Economic Transition

The last eight years has been a period of change and restructuring in our economy. As most of us know, Hawaii's post-statehood boom era, based on high tourism growth, large inflows of foreign capital and high labor immigration, came to an end in the early 1990s. The State met this challenge with an aggressive program to reinvigorate economic growth, including government streamlining, reduce regulation in the economy, and nurture new economic activity that can take advantage of our unique resources and assets. The private sector has made significant progress in improving productivity, raising the competitiveness of the economy, and refocusing on areas where Hawaii companies have a competitive edge.

With a turnaround in the economies of the Far East, we can be genuinely optimistic about the near-term future of our economy. Most economic indicators have turned or are beginning to turn positive, and 1999 will likely show solid gains. It is, therefore, an appropriate time to focus on the future, particularly on the kinds of economic activity and policies that will define Hawaii's economy in the 21st century.

Technology's Role in the Economy

Certain industries like tourism, the military, and agriculture will continue to be vitally important activities and their contribution will remain substantial to the extent they are able to embrace and utilize improved technology. In this new millennium, technology and the industries that it spawns or boosts will be key to bolstering the State's productivity and competitiveness in the New Economy of the future. Let me explain why.

Research over the past several decades has shown that the impact technology has on productivity is a major factor in how fast economies grow and how well they can compete in national and international markets. Technology's impact on the national economy has been tremendous. It is estimated that as much as half of all economic growth in the U.S. in recent decades has been due to the application of technology.

On the other hand, our research shows that Hawaii's post-statehood economic boom was fueled mainly through large inflows of overseas investment and inputs of labor, but not very much from the application of new technology. During this boom period, Hawaii's economy grew faster than the nation's but did not reflect the productivity increases that technology contributed at the national level. Moreover, when the post-statehood boom ended in the early 1990s, the small contribution being made by new technology was not able to overcome other inefficiencies in the economy that were causing overall productivity to fall, even though labor and the capital stock were increasing.

The improvement in the economic contribution of technology for the 1995-98 period reflects the sustained effort to improve efficiency by both the private and public sectors. The private sector increased its efficiency by embracing newer technology and focusing on areas where it could be more competitive. The State's program of budget constraint, regulatory reform and business stimulation instituted by Governor Cayetano in 1995, has been an important factor in improved public productivity. This improvement illustrates the potential boost that technology can provide to the economy, permitting it to expand, even when capital and labor growth are modest.

We Have the Foundation for Technology Development

It is important to note that Hawaii already has an established base of technology-related activity to build on. In fact, with little fanfare, that base has grown in recent years, even hoping to cushion an otherwise flat or declining job count in other industries. For instance, from 1990 to 1997, the number of jobs in business computer services nearly doubled in the state. This stimulated job growth in the broader business services industry by an estimated 85 percent for the same period. Another example is Hawaii's technology-intensive, health care industry. This sector has increased its job count by 20 percent since the beginning of the decade, and now provides nearly as many jobs as the entire hotel industry in the state, and more than hotels when public sector health care is included.

The islands have a number of important advantages and nice opportunities which can help us be more competitive in technology development. Conditions are unparalleled in Hawaii for research and technology related to biotechnology, astronomy, oceanography, energy, and vulcanology, to name a few. Hawaii's mid-Pacific location and first-class research University attract scholars and research projects from around the Pacific Rim. The physical and social environment for doing research and technology could not be better.

This has been reflected in some significant accomplishments in scientific research and technological innovation. Most notable has been the development of the "Honolulu" genetic cloning technique by researchers at the University of Hawaii. Further, our technology industry base has been boosted by the attraction of such international firms as Uniden and Square USA (which now employs 300 people in Hawaii) and the establishment of Call Centers to meet the needs of international clientele.

Government's Role in Technology Development

Clearly, technology is important to economic growth, and Hawaii now has a sound base to build upon. Government at both Federal and State levels has played vital roles in this development. Government intervention has generally been rationalized on externality grounds.

We recognize that an amplified and enlightened knowledge base is a necessary condition for technological innovation and the more that people invest in their education, the better off society will be. However, people tend to invest in only enough education to satisfy their own goals, not the community's goals. But by subsidizing basic and advanced education, government is able to encourage more investment in education, resulting in future benefits to the community that more than make up for the subsidy.

Technology investment is similar to education investment in that the potential benefits to the community go far beyond the sales value of technology products. However, the expenses and risks involved in technology development are much greater than in education. Consequently, the private economy will tend to underinvest, and government subsidy has become widely prevalent.

The Federal government has, for decades, invested public resources to encourage scientific research and development. What the taxpayer has received for this support in return is the most technically advanced society on the planet, with arguably the highest standard of living. In Hawaii, the Federal government has been the prime source of research funding through such agencies as the National Science Foundation and National Institutes of Health and through Defense appropriation mandates for commercial extension of technical projects.

The State in turn has been very active in encouraging and supporting the further development of Hawaii’s technological resources. Governor Cayetano’s direct participation and leadership through scores of face-to-face visits with the CEOs of fast-growing technology firms on the Mainland and Asia has been pivotal in this effort.

To sustain this effort, cooperative partnerships among the private sector, the University, and agencies of the State are being encouraged to pursue technology development, as well as develop the physical and human resource infrastructure support. A particularly effective approach has been the promotion of the products and professional services of Hawaii’s technology sector- particularly energy and environmental technologies- through

joint economic missions to Asia as well as inspection visits to such Mainland bases as Silicon Valley and the Microsoft campuses.

To further support these efforts, the Administration secured the passage of a comprehensive technology enhancement measure during the 1999 Legislative session. This act inserted a number of tax incentives, largely in conformity with Internal Revenue Code credits for a variety of firms engaged in technology research or investment. In conformance with legislation enacted in other states, it prohibits discriminatory income, excise, or use taxes on electronic commerce or Internet access.

It established and funded a Millennium Workforce Development Initiative, designed to help develop technical skills needed by both technology companies and companies who must adopt new technologies in order to stay competitive. The act also provides for the establishment of virtual, site-based schools in the Department of Education and authorizes a special advisor to the Governor to facilitate statewide technology development, as a first step in a process to streamline the agencies dealing with technology development.

Final Thoughts

It is important for the community to understand that the State's determination to develop the technology sector is neither a pipe dream, political rhetoric, nor simply following a fad. With comprehensive legislative enactment, authority now exists to pursue a growth strategy to move Hawaii's economy briskly forward in the New Millennium. However, although technology development is an area in which government must exercise leadership to ensure optimal progress, the effort must be in cooperative partnership with the private sector. In addition to the rewards of a healthy economy, the common thread that unites the partners is the knowledge that the future of our children and their children in these islands may depend upon how well our partnership succeeds.

---Seiji F. Naya
Director
Department of Business,
Economic Development & Tourism
State of Hawaii

I. New Millennium Growth Strategy: The Vision for Hawaii's Economic Future*

Executive Summary

Introduction

On the brink of the new millennium, Hawaii's residents continue to seek a high standard of living and higher quality of life. A strong and vibrant economy is a necessary, if not sufficient, condition to achieve this goal. A strong economy can provide the incomes and jobs necessary to reach our goals both as individuals, as residents of an island community, and as participants in a new global era, -- an era which has attained widespread appellation as the New Economy.

Major Trends and Opportunities for Hawaii's Economy

Hawaii, as the rest of the world, faces a number of major trends that present both challenges and opportunities for improving our residents' standard of living. In some respects, Hawaii has already begun to deal with these trends, but ultimate success will require flexibility and openness to new ideas and challenges. This document discusses some of these trends and then offers a set of goals and policies designed to further our quest for higher living standards and an improved quality of life.

a. Information Technology

Advances in information technology (computers and telecommunications) have spawned revolutionary changes in the U.S. and world economies. These changes include: increases in productivity, lower production costs, faster and cheaper delivery of goods, improved products and capabilities, new products and services, electronic commerce (e-commerce), and the nearly instant exchange of information (text, drawings, photographs, audio, and video) on demand and without regard to place and distance. In magnitude these economic changes may prove similar to those caused by the industrial revolution, mass production, the generation and distribution of electrical energy, the telegraph and telephone, and advances in transportation (powered ships, railroads, cars and trucks, and airplanes).

The improvements in information technology have greatly reduced Hawaii's isolation and greatly expanded opportunities for Hawaii to serve overseas markets. They have also made it possible for overseas suppliers to serve Hawaii more easily and at lower cost.

**Contributions to this report by Bruce Plasch (Decision Analysts Hawaii, Inc.), Mary Lou Kobayashi, Chris Grandy, Jim Crisafulli, and other members of the DBEDT staff under editorial direction of Shelley M. Mark are hereby acknowledged.*

b. Biotechnology

Advances in biotechnology—molecular biology, biochemistry, genetic manipulation, bioengineering, and so on—will transform thinking and knowledge on the sources of life and survival itself and thus important sectors of U.S. and world science and industry..

For Hawaii the greatest opportunities will most likely come in biotechnological applications of agriculture, aquaculture, marine sciences, medicine and environmental remediation, although the opportunity for breakthrough from integration of biological and computer sciences in a new field of bio-informatics remains provocatively open.

c. The Global Economy

The continuing globalization of economic activity (advanced by the changes in information technology discussed above) provides new opportunities for Hawaii businesses to serve overseas markets. Over the long term, the opening of China, and other emerging economies to increased trade will greatly expand export opportunities for Hawaii. Globalization also presents new competitive challenges within Hawaii that promise to raise productivity and lower the cost of goods and services for residents.

d. Global Warming

Global warming concerns may generate a number of changes in Hawaii's economy. The demand for technologies that use less energy or that generate energy with lower emissions of greenhouse gases, will rise. Hawaii can play a role in developing and distributing such technologies. Global warming concerns may also alter existing Hawaii industries, including tourism and agriculture.

e. Ethnic Tensions

Across the globe, nations have divided themselves violently along ethnic lines. To some, Hawaii is a refreshing counterexample. But this reputation hides real tensions and issues here. Efforts to resolve these issues are on-going. Their outcome will determine whether Hawaii continues to export its ideal of mutual respect and tolerance, or whether it will join others in social and economic division and dislocation.

f. Individuality

In practice, Hawaii's multi-ethnic tolerance exists because of respect for the individual. Respect for the individual undermines prejudice on another basis. The concept of the individual’s importance is expanding across the globe. With it spreads incentives for self-improvement, risk-taking, and hope for the relevance of hard work and merit. Hawaii's many ethnic groups give us a role in encouraging the spread of

individual rights to areas where it is only beginning. Fulfilling that role will bring benefits in the form of new ideas and markets.

Overview of Economic Development Goals

In order to improve our quality of life while facing the challenges and opportunities described above, we must develop some consensus on certain economic goals and policies. In traditional delineation, these include views on the rate of economic growth, economic diversification, our role in the global economy, issues of equity, and environmentally sustainable economic development.

It will be seen that some goals will be self – reinforcing; others in conflict (e.g., growth vs. diversification; diversification vs. equity; growth vs. environment). Similarly for policies, although properly formulated and implemented policy can help attain multiple goals. Achieving consensus stands as a formidable, but not unattainable challenge to future citizenry and polity.

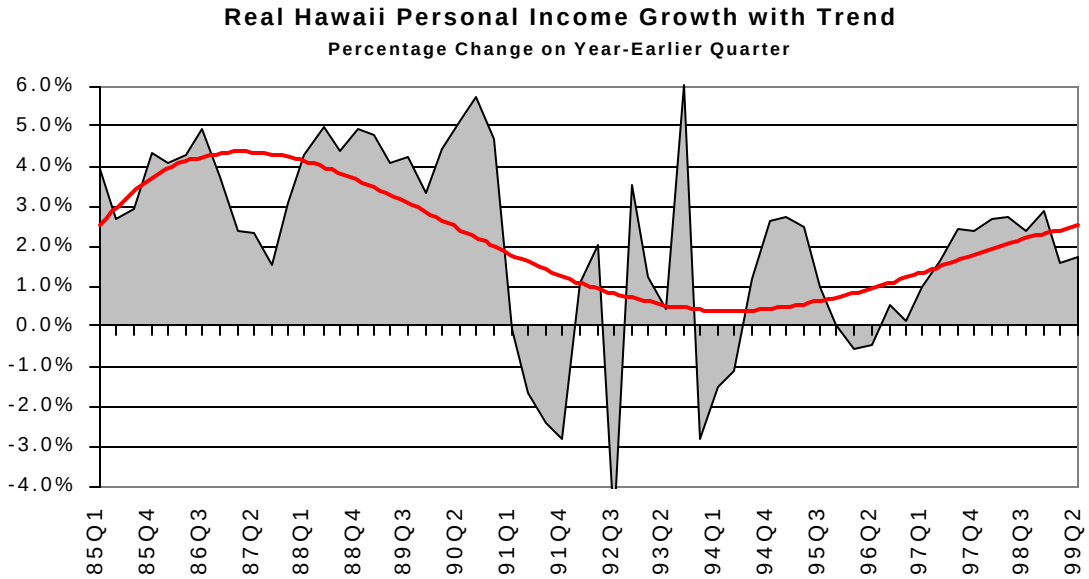
In a somewhat more untraditional vein, but critical to the growth strategy being proposed in this report and indeed to the attainment of the other enumerated goals, we have included a sixth goal; getting Hawaii on board with the New Economy.

This discussion begins in the knowledge that many factors affecting Hawaii's economy are beyond our control or persuasion. These include: the strength of the U.S. and Japanese economies, exchange rates fluctuations, trade restrictions, airline and shipping rates, overseas competition, Federal Government priorities, interest rates, inflation rates, oil prices, war, hurricanes in Hawaii, earthquakes in California and Japan, and so on. Further, entrepreneurial activities and business expansions often occur in spurts in response to changing conditions and new opportunities and are usually not predictable in advance.

Still, we can act to improve our quality of life and standard of living. We can also act—or fail to act—in ways that will lower our quality of life. Which we choose requires developing an understanding of, and agreement on, some basic goals, and in particular, how we choose to enter the New Economy. The following are put forth:

1. **Attain a steady, sustainable rate of economic and employment growth that continues to raise our standard of living. (i.e., economic growth)**

   Growth should be sufficiently rapid to provide good jobs and rising incomes for Hawaii's residents. At the same time, growth should not be pushed so fast that it creates a "bubble" that will eventually burst. Steady, sustainable growth is preferred over growth characterized by booms and busts.



Hawaii's growth in the late 1980s may have been unsustainably high – more recent growth rates should be sustainable.

2. **Achieve an economy supported by a number or variety of economic activities that reduce the size or impact of business cycle swings. (i.e., diversification)**

The issue of economic diversification arises from a heavy reliance on certain primary economic activities that "drive" Hawaii's economy and generate most of our income from overseas (currently tourism; in the past, military expenditures, sugar, pineapple). A strategy aimed at securing a greater variety of technology-based industries represents an attempt to attain greater diversification.

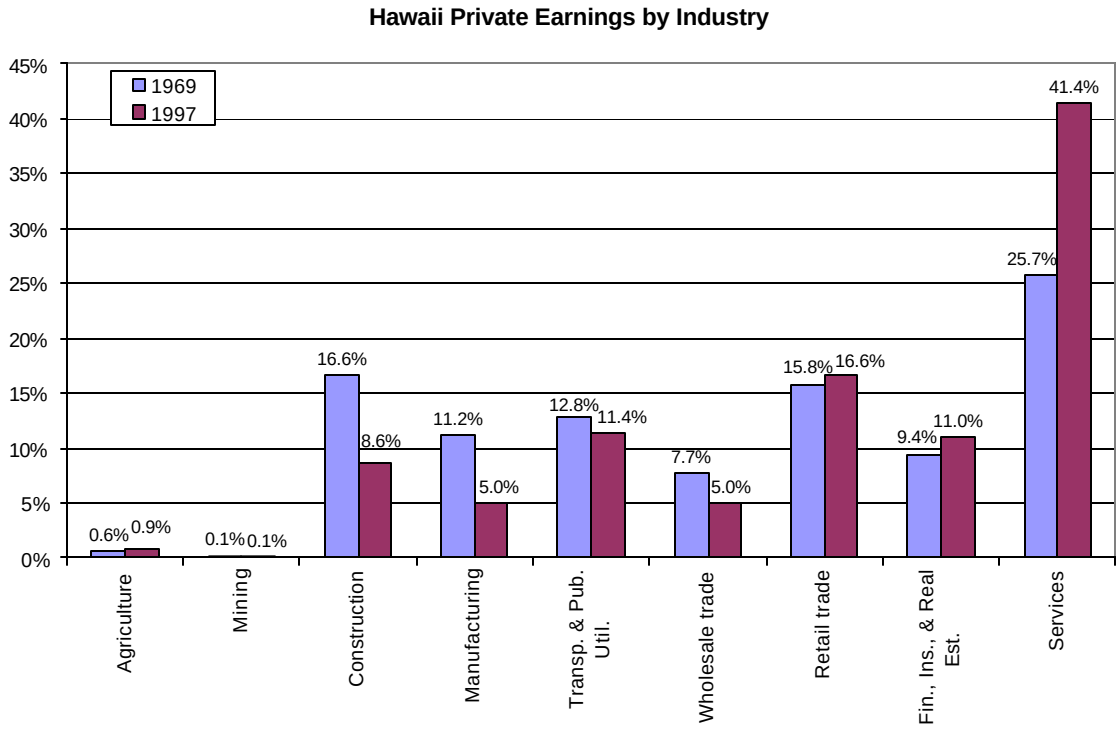
A diversified economy provides a wider selection of employment opportunities. More importantly, a diversified economy is less vulnerable to fluctuations in economic activity.

Diversification can take place both in markets served by the industry sector and in the products offered by a sector. For example, in tourism, Hawaii has achieved some success in diversifying across visitor sources. When the U.S. Mainland slid into recession in the early 1990s, strength in Japan supported Hawaii's economy. Similarly, the drop in eastbound visitor arrivals as a result of the Asian crisis was offset by surging westbound arrivals from the strong Mainland economy.

Further, Hawaii's traditional surf and sand is garnering remunerative by-products in terms of large scale business and professional conventions and wealthier clientele seeking medical treatment or health maintenance.

Economic diversification has been an elusive goal in Hawaii. Small, market-oriented economies that are open to trade often specialize in a few export industries. Specialization raises productivity and, ultimately, standards of living.

Still, the pursuit of diversification not only makes sense in its own right, it can also serve as the mechanism for identifying the next major areas of economic activity.



Across industries, Hawaii's economy has become less diversified over the last three decades.

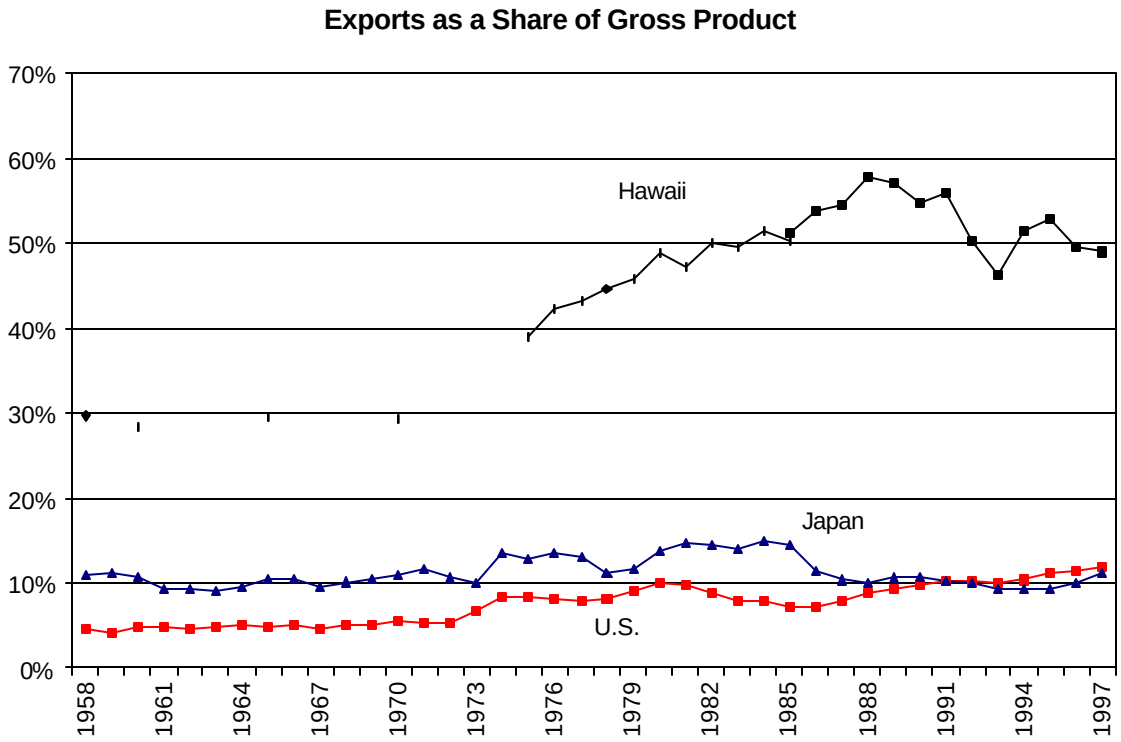
3. **Hawaii as a full and active participant in the global economy (i.e., globalization.)**

Hawaii must participate in the global economy if it is to fulfill the goals of achieving a healthy economy, full employment, and a rising standard of living. Without engagement in the global economy, Hawaii risks becoming a backwater, stagnant economy with fewer jobs and lower incomes.

Global participation requires openness to both exports and imports; building on competitive advantages; a responsive, dynamic economy; rapid adoption of technological advances that raise productivity; and a friendly business climate.

Economic development based on export promotion has enjoyed worldwide success in raising incomes and standards of living. The success has been felt not only by wealthy, developed economies, but also by developing economies that have searched for their niche in the world rather than turning inward.

Yet exports imply imports. Policies that remain open to the forces of external competition ultimately improve the productivity of local businesses and industries and lower the cost of living for residents.



Hawaii is much more export-oriented than either the U.S. as a whole or Japan

4. **A fair and equitable economy for all participants. (i.e., distributional equity)**

   A fair and equitable economy allows the best performers to succeed, thereby assuring rapid, innovative development. It is an economy that focuses on equal opportunity, rather than equal outcomes. It is an economy that rewards success, but minimizes the costs of beginning again after a temporary setback.

   A level playing field is most likely to identify the firms and industries that will raise society's standard of living. Special treatment for some at the expense of others may provide short-term benefits, but it undermines loyalty and trust in the long-run.

5. **Develop an economy that preserves and enhances Hawaii's environment and quality of life (i.e., environmental quality)**

   In addition to incomes and jobs, our standard of living depends on a high-quality environment and other amenities. Economic development that ignores this is counter-productive. On the other hand, economic growth generates the resources to build and

maintain parks and cultural attractions. Such resources also prevent or solve pollution problems and help improve health conditions.

Consensus already exists in Hawaii that our natural resources must be protected—both to preserve them for future use and because our current economic activities (like tourism) depend on a clean, healthy environment. This is a solid basis for reaching agreement on methods to achieve resource protection to satisfy diverse interests and promote the common goal of raising living standards.

6. Getting Hawaii fully and firmly into the New Economy (i.e., the New Millennium Strategy).

Before considering the extent to which Hawaii may already be "in" the New Economy, the steps we must take to secure more of its benefits, and the role we might play or the niche we can establish as we move in its direction, it would be useful to characterize what it is.

The New Economy is typically characterized as a knowledge and idea-based economy where the keys to job creation and higher standards of living are innovative insights and adaptive technology embedded in services and projects; an economy where risk, uncertainty, and constant change are the rule, rather than the exception.

It is an environment where an increasing share of economic value is derived from electronic means, when a majority of the economy and society are linked through digital networks, and economic functions are conducted mainly through digital information technology.

According to this terminology, it might be said that, qualitatively if not quantitatively, Hawaii is at least at the brink of entering the New Economy. This being the case, pervasive use of digital electronic technologies can increase efficiency and productivity and bring the kinds of economic benefits that mechanization brought in the early 20th century. Further, the "network effect" would be in play – the more we use these technologies (e.g., Internet, smart cards, broadbands), the more applications will be developed, and the more boost they will give for users. When and if all this happens, traditionally slow productivity could very likely be run over by a productivity and income boom.

Policy Initiatives for Hawaii's New Economy

This summary discussion of the growth strategy has enumerated basic economic goals, but has not elaborated upon specific policies or actions designed to reach these goals. Such policies or actions may be included in the analysis of key economic sectors, which follows this section. At this point we diverge a bit from this approach and suggest the following New Economy guide-posts which override the overall strategic discussion. This again with the caveat that future developments are very likely to occur at a pace beyond the control of well-

conceived policy or the knowledge comprehension of well-intended policymakers.

Hawaii's move and stance in the New Economy then might well be based on the following policy initiatives:

Encourage economic activities that build on Hawaii's assets and have a clear competitive advantage.

Focus on what works-on appropriate activities that have a high probability of success in competition with others. This contrasts with the temptation to focus on activities with large benefits but that overlook some of Hawaii's high costs (for land, water, labor, and so on.)

Promote quick response to new circumstances, challenges, and opportunities, arising from technological progress.

A dynamic economy exhibits rapid adaptation or commercialization of research advances, a consumer-oriented regulatory framework that eases business startups and the entry of new enterprises, robust competition, a mobile workforce, and retraining to allow workers to move into new positions quickly.

Increase public and private (including foreign) investment in the New Economy foundations of education, training, and scientific and technological research. There is need for more business-funded R&D or research tax credits to offset the continuing drop-off in Federal support.

Develop programs to enable Hawaii's workforce, including the self-employed, to acquire the tools they need to navigate and prosper in a continually changing technological environment. Additional support for technical equipment and instructional backup at the community colleges appears a natural force for implementation.

Foster robust competition among existing and new companies.

Competition compels businesses to become more productive and offer better services and/or lower prices. Consumers enjoy a wider selection of goods and services, improved service, lower prices, and a higher standard of living. Other businesses benefit from lower costs and improved support services. Robust competition requires a transparent, efficient, and customer-oriented regulatory framework that allows for easy startup and entry of new business.

Awaken attention to the supportive intermediary services (accounting, law, marketing, finance) and reorient the relevant professions required to transform scientific breakthroughs into robust technological industries. Promoting local public and private trade groups and affiliations in a cooperative environment can

facilitate primary and secondary development such that viable technology clusters can emerge.

Re-engineer government to make it fast, responsive, and flexible, with an open and flexible regulatory and trade regime that supports rather than inhibits growth and innovation. It can also be noted that government can play a key role in advancing the digital economy by refocusing its procurement power and providing a potential critical mass of digital services, from smart cards for welfare recipients to online tax filing and voting.

Provide a full spectrum of support and assistance to new and developing businesses.

Such support and assistance would involve State agencies, the University of Hawaii, the Counties, Federal agencies, semi-private institutions, etc. It would include: research support, technology transfer to commercialize advances in research, assistance in obtaining patents, entrepreneurship and workforce training, investment capital and business loans, marketing and promotion, incubator facilities, infrastructure development, assistance with securing land and obtaining permits. In turn, firms benefiting from this assistance would assume costs of such services as certain thresholds in their growth are attained.

All this and more will be required to sustain a solid income and employment base, while allowing Hawaii to partake of the fruits of the New Economy.

In sum, if we are to ask managers, workers, and professionals to take the risks inherent in embracing the New Economy, we must equip them with the environment and tools to enable them to cope with change and uncertainty***. If we fail to invest in a knowledge infrastructure – world class education, training, science, and technologically oriented support services*** – our enterprises will not have the cutting-edge tools they need to create lasting and well-paying jobs. And if Industrial Age government does not transform itself into Information Age government, it will become an inefficient and out-of-touch albatross**.**

II. The New Millennium Growth Strategy: Making It Work

Hawaii's growth strategy for the new millennium - the vision that underlies it and the means for its implementation-has been presented in the foregoing chapter. Essentially, the strategy seeks to accelerate the growth and diversification of our New 21st Century Economy. It relies basically on our ability to recognize and react to the requirements of the new economy, to upgrade our knowledge capacity, and to uplift our productivity in both public and private sectors.

This section follows upon the strategies and policies set forth, provides background and further detail, and suggests actions in key areas that will be instrumental in shifting our economy from one that is tradition-based and input-driven to one that is dynamically far-seeing and technology-driven. The keys as we have reiterated are economic diversification, backed up by enhanced knowledge and technological innovation.

In a sense, while the strategy may be new, the means of making it work are not. From the technology-based sectors of biotechnology and information technology to the more traditional economic sectors of tourism, agriculture, and small industry, the key players remain the same.

- Industry is responsible for investment in plants and equipment, in hiring, training and retaining its workforce. It also must increase public awareness and support for entrepreneurship, increased deployment of research and development, and public support for quality education.
- Government serves as a catalyst and facilitator to industry, providing the infrastructure and support that allows it to flourish. The federal government, with its ability to fund basic research in a variety of technology sectors, and an awakened focus on civilian and commercial adaptation of defense-related technologies underpins industry's ability to seek new products for development.
- The educational process from the State's K-12 system, community colleges and universities is responsible for producing a high quality workforce that can analyze and solve problems, work cooperatively and contribute to the economic prosperity of the state. They also have the capacity to provide the educational resources to retrain workers as they seek employment in growth industries like biotechnology. And the strong research enterprise at the University of Hawaii in Manoa and Hilo provides the basis for receiving National Science Foundation and National Institutes of Health funds and other extramural resources for basic and applied research.

  For most of the programs and activities described in this report, there will be involvement of the key players, some individually, others jointly. But we do not purport to suggest the extent, timing or direction of their involvement. It is hoped that the context presented will provide guidance as to how individual programs might be organized or implemented to meet objectives and circumstances existent at time of decision.

The report employs a rather arbitrary denotation of the key economic sectors that will be involved. First, on the market or demand side, the focus is on the technology-based industries that are expected to drive the economy forward in the new millennium, namely, biotechnology and information technology.

The next section deals with economic growth opportunities stemming from Federal expenditures on defense-oriented technologies and mandates, which encourage their eventual commercialization. Further, in the discussion of growth strategies in the more traditional tourism, agriculture, health, ocean resources, and environmental service sectors, technological adaptations or potentials are highlighted.

Similarly, on the resource or supply side, technological implications in human resource and workforce development, venture capital, infrastructure energy requirements for growth, and quality of life are brought out.

Next, Hawaii's role in the Asia-Pacific (the oft-termed Pacific Century) is examined, including initiatives underway and those that require further deliberation or resource support.
All this is followed by statewide planning scenarios as to what can take place logistically and how it might be managed, through new technology and new thinking.

Finally, in areas where Hawaii can establish future destiny, but which do not command an immediate timetable, there are suggestions for grand development schemes. These scenarios include:

1) The Big Island as the agricultural and technological research center of the Pacific, presuming the Hilo campus will be given resources and opportunity to develop alongside the Manoa campus as a future university, equivalent in stature to a Michigan State, Iowa State, or Washington State.
2) Revitalizing Honolulu's Waterfront. Can visionary planning and community determination transform this unfinished jewel into the New Millennium haven of culture, commerce, technology, sports, and recreation to be crowned with a majestic edifice at the entrance to Honolulu Harbor and our Civic Center?

III. (A) High Technology

The high-technology (high-tech) sector of the economy is comprised of a number of inter-related activities which generally involve a large number of scientists, engineers and/or technicians who develop and/or apply new or evolving technologies to improve existing products and services or to develop new ones. High-tech industries overlap with, encompass parts of, and complement many other existing industries, such as agriculture, aquaculture, medical care, ocean resources, and alternative energy.

Hawaii has a considerable and growing amount of high-tech economic development, including:

- University research in areas having potential for commercialization;
- astronomy involving the operation of large telescopes on two islands and considerable research at UH;
- high-tech companies located in five technology centers and industrial parks;
- a number of software companies,
- companies engaged in developing test equipment;
- companies engaged in environmental monitoring and finding innovative solutions to pollution problems;
- seed-corn companies, and many components of health care.

The State has also passed legislation designed to accelerate high-tech development, including: special tax incentives, reorganization of State agencies that are associated with high-tech development, changes in marketing the industry, and development of programs to provide a workforce that is trained for high-tech employment.

Competitive Advantages

Hawaii enjoys a number of competitive advantages for high-tech development; some of which are universal while others are specific to particular activities. Major assets and competitive advantages include:

- Access to advanced research laboratories, researchers, and experts in areas of excellence at UH as well as in Federal and private research facilities (e.g., computer studies, engineering, alternative energy, biotechnology, environmental studies, tropical agriculture, aquaculture, ocean and earth sciences, marine biology, cancer research, cloning technology, geophysics and planetology, and Asian and Pacific studies).
- For astronomy, superb observing conditions, many of the world's best telescopes, and observing time on the telescopes for Hawaii astronomers.
- An active volcano which is of value for research as well as for generating geothermal power.

- The Natural Energy Laboratory of Hawaii Authority (NELHA), a unique facility of value for energy, materials, and aquaculture research and, in the case of aquaculture, for commercial production.
- The Maui Supercomputer, one of the most powerful computers in the world.
- The Pacific Missile Range Facility on Kaua'i, the world's largest range for tracking surface, underwater, air and space operations.
- Advanced medical equipment and facilities at military and private hospitals.
- Access to near-shore resources and deep-ocean resources, including fish, minerals, precious coral, and algae having potential value in new medicines.
- Access to tropical forests which have unique plants and insects that may also have potential value in new medicines.
- An extensive and modern telecommunications infrastructure which, because of the Internet and near-instant communications, greatly reduces Hawaii's historic problem of remoteness.
- A workday that bridges time zones in America and East Asia, which is an advantage to call centers and to providers of customer service serving both regions.
- Frequent passenger and cargo flights to many American and Asian cities.
- A workforce loyal to employers, which includes highly skilled former residents who would like to return to Hawaii.
- A high quality of life which aids in recruiting.
- Multi-lingual and multi-cultural resources with ties to North America, Asia, the Pacific and Europe.
- As part of the U.S. legal and economic system, a safe and familiar investment climate.

Problems for Technology Development

Hawaii also has a number of problems which limit high-tech development; fortunately, many are solvable. Such problems include:

- Hawaii lacks a high-tech business image, mainly because our high-tech assets, competitive advantages, and activities are largely unknown among the international community of high-tech companies.
- Private venture capital to fund the start-up of high-tech companies in Hawaii is difficult to attract compared to the situation for established technological centers.
- Hawaii lacks sufficient land and building space conveniently close to UH Manoa for new and expanding high-tech companies.
- Hawaii lacks a critical mass of high-tech companies that can trigger a self-sustaining growth of additional high-tech companies.
- Hawaii's pool of skilled labor and managers having high-tech experience is small.
- Hawaii has an inadequate pool of support services and suppliers in high-tech fields (e.g., patent attorneys, specialists in venture capital).

- Development of biotechnology is limited because of cumbersome or absolute restrictions on the importation of organisms for research and development.

Hawaii's high construction and operating costs, combined with its remote location and high overseas transportation costs, make it difficult to be competitive in supplying most manufactured products to large overseas markets.

Progress in Technology Development

Hawaii's need to diversify its economy to make it less vulnerable to recessions in economies on whose tourist expenditures and investments it depends has become openly apparent. With the rapid advances occurring throughout the world in all types of technology – related activities and with an imposing array of natural, physical, and human assets, it has been only logical that the State has turned to the high technology sector as a means for industry diversification and renewed growth.

The advantages and benefits appear substantial. First, high technology tends to be a high-growth, high-return economic sector. It generates rapid growth of new types of companies, new industry sectors, high-paying jobs, new investments in education, and a stronger tax vase with which to provide superior public services. Second, a high technology industry, if planned appropriately, is not harmful to the environment. This is an important benefit to consider because the state's environment is a critical part of Hawaii's culture and everyday life.

However, it was not until a series of meetings convened by the governor of key officials, and stakeholders, legislative enactment of a comprehensive measure (Act 178, 1999 session) and publication and widespread distribution of an Hawaii Science and Technology compendium that a consensus has emerged for a coordinated public-private sector move into high technology development.

Act 178 mandated appointment of a special advisor to the Governor for technology development, establishment of an industry advisory council, and coordinated activity among public, academic and private sector representatives. To date, the group has identified four high-tech clusters as a focus for initial deliberation. They are:

- Information technology/Telecommunications
- Biotechnology
- Medical/Healthcare Technology
- Earth/Ocean/Space Sciences.

In turn, inquiries are being launched in each sector in the areas of research, workforce development, infrastructure, business climate, marketing, and funding. This semi-official grouping is being backed by formation of a High Technology Trade Association (Some 300 members at last count).

Two early initiatives of the high-tech organizations are creation of a statewide marketing and promotional effort and enlistment of venture capital through an overture to the State Employees Retirement and enticement of an Hawaii Angel Network consisting initially perhaps of Hawaii-based capitalists who have gained success in overseas operations.

However, there is realistic feeling that an upward struggle lies ahead, but the stakes are high enough and the chances are good enough that the battle is worth waging.

Goals

A prime economic goal is to develop a high-tech industry which provides the State's primary source of new jobs and income growth, and which grows to rival tourism in its contribution to the economy.

As discussed, the strongest effort for economic development is being placed on high-tech development. This is because of a high probability of success, its potential for providing a wide choice of high-quality jobs that pay well, and its contribution to a more diversified economy. Also, the industry is environmentally friendly.

A second goal is to have high-tech activities permeate all sectors of Hawaii's economy.

The purpose is to increase productivity within all of Hawaii's economic sectors, thereby contributing to their economic strength and competitiveness in the global economy. The application of technology and increased productivity and competitiveness also contributes to higher quality jobs, job security, and higher salaries.

Policies

- Provide an economic environment and business support designed to foster high-tech development.

In addition to general improvements in the business climate and business support (see above), support geared specifically to high-tech development would include:

- strong support for research facilities, researchers, and technology transfer to entrepreneurs,
- expansion of incubator facilities for high-tech companies,
- ***marketing to improve awareness of Hawaii's high-tech assets and competitive advantages,***
- marketing and promotion of Hawaii's technology-based products and services,
- tax incentives geared specifically to accommodate beneficial high-tech development (e.g., tradeable tax credits),
- streamlining the approval process for importing organisms for research and development, and
- supporting further developments in the telecommunications infrastructure and encouraging competition among providers to assure optimal business and consumer use

Policies designed to attract venture capital and develop a skilled workforce are discussed below.

Also, for high-tech companies taking advantage of UH patents, the competitive advantage of locating in Hawaii can be strengthened by allowing low royalty payments for that portion of commercial production which takes place in Hawaii. Compensating UH for the foregone royalty payments may require sharing State tax revenues derived from the venture.

- Target niche opportunities for high-tech development.

  The assets, competitive advantage, and liabilities mentioned above dictate a high-tech development strategy based on niche opportunities where Hawaii offers a clear competitive advantage. Opportunities that have been identified for Hawaii as being deserving of emphasis and special treatment include:

Information Technology

- This would include development of software, multimedia, and other digital products for the U.S. and/or Asian markets;

- the development and management of advanced information systems (medical records, diagnostic procedures, natural disaster management, environmental quality, real estate transactions,.);

- call centers for providing customer service and technical assistance to Asian markets; and

- e-commerce, etc.

Hawaii's advantages for information technology include advanced telecommunications; the desirable physical and cultural environment; the multilingual workforce; cultural ties and sensitivities; and Hawaii's time zone.

Also, digital products can be delivered via the Internet to nearly any place in the world, delivered nearly instantaneously, and delivered at negligible cost. Hawaii's historic problems of remoteness, high shipping costs and shipping delays are irrelevant for digital products.

Biotechnology

For Hawaii, biotechnology would center primarily on factors that are unique to or pertain to Hawaii. This would include applications of biotechnology to:

- tropical agriculture to develop new or improved varieties of plants that resist diseases and other pests, are more attractive, have more flavor, have a longer shelf-life, etc.;

- aquaculture covering similar advancements;
- the development of food additives, vaccines, chemicals and other products from marine and terrestrial plants found in Hawaii; and
- environmental remediation using biological receptors for wastes and pollutants.

A more detailed treatment of Biotechnology as Hawaii's niche in the New Economy is presented in a subsequent section of the report. It draws from a plan for industry development prepared with the assistance of BIO, the national association for biotech enterprises, and submitted for approval of local industry and government representatives.

Natural Resources and the Environment

The emphasis would be on activities that take advantage of factors that are unique to or pertain to Hawaii, including such activities as: (1) space sciences; (2) alternative energy (geothermal power, ocean thermal energy conversion, etc.); (3) materials research at NELHA; and (4) development of environmental and other sensors to monitor land and water use, air and water quality, pollution discharges.

Medical and Healthcare Technology

This would include:

- health-care education, with the content being developed in Hawaii for Asian and Pacific healthcare providers and for the public at large, using both instruction in Hawaii and on the Internet to deliver information;

- telemedicine, with O'ahu serving as a hub where (a) health and medical information is stored for distribution throughout Asia and the Pacific to hospitals, healthcare providers, and the public-at-large using the Internet and televised broadcasts; and (b) specialists are available for consultation and distance learning via online-interactive video conferencing; and

- health information technology to store and provide ready but controlled access to integrated records of physicians, hospitals, pharmacies and patients.

- **Focus high-tech development in clusters of related companies and technologies**.

  Clustering related economic activities is a fundamental principle of successful economic development. Clustering contributes to synergy among companies and individuals, to a critical mass for sustained development, and to the development of support services because demand for services is concentrated in a small area.

- **Help assemble land and building space near UH Manoa and other viable areas for high-tech companies.**

High-tech development is greatly accelerated though synergy between entrepreneurs and university researchers. For Hawaii, this will require substantial space for high-tech companies near UH Manoa.

Given that the neighborhood surrounding UH Manoa is developed, some alternatives are development of a smart park in Kaka'ako, or in Kapolei in conjunction with the future development of the West Oahu campus of the University of Hawaii.

- **Encourage and support the use of high-tech to increase productivity throughout the economy.**

This would include: (1) greater use of computers, the Internet, e-commerce, monitoring and control, etc.; (2) developing new or improved goods and services based on the new technology; (3) appropriate education, training and retraining; and (4) investing in equipment and infrastructure.

- **Market Hawaii' to attract large subsidiaries of high-tech companies.**

This would involve the general marketing of Hawaii's assets and competitive advantages in trade publications, as well as approaching specific companies which, based on market research, might be interested in locating operations in Hawaii. Such interest may go beyond Hawaii's assets and advantages to include former residents who want to use their companies to reestablish a presence in Hawaii, or the head of a company who frequently vacations in Hawaii and may even have a second home in Hawaii and, as a result, may wish to expand operations to Hawaii.

The probability of attracting major subsidiaries of high-tech companies may be lower than the probability of developing large companies by nurturing local entrepreneurs. However, the cost of marketing Hawaii to major subsidiaries is comparatively low and, if successful, the development of Hawaii's high-tech industry will be greatly accelerated because well-established high-tech companies often supply their own capital, technical and management talent, and training. They also bring substantial resources to partner with UH.

Furthermore, large high-tech subsidiaries can serve as "anchor companies" or as a nucleus of a cluster of companies that provide a "critical mass" for sustained high-tech development. They would put Hawaii on the map as a place that should be considered as a location for high-tech development and, over time, they would become a major source of entrepreneurial, technical and management talent. This would help attract venture capitalists and additional high-tech companies to Hawaii.

- **Foster the start-up and growth of Hawaii-based high-tech companies**.

This approach to high-tech development, for which UH is taking the primary lead through its University Connections program, involves a strong emphasis on:

- attracting talent to UH and providing necessary research facilities and support in the areas of excellence targeted for commercial development in Hawaii;
- establishing close links between industry and researchers to identify needs of industry and opportunities presented by research;
- working with entrepreneurs and venture capitalists to commercialize research findings and discoveries,
- nurturing start-up companies by providing space in incubator facilities, helping to secure financing, arranging for training and internships.

While this approach to high-tech development may take longer and be more expensive than attracting large subsidiaries of high-tech companies, the probability of success may be higher, particularly for activities which are built on strong competitive advantages that, in combination, are unique to Hawaii.

In baseball parlance, the alternatives would appear to be: (a) a home-run strategy of landing a Ken Griffey and satelliting around the heavy hitter or (b) a scratching out hits and advancing bases strategy built around encouraging local talent.

III. (B) Biotechnology: Hawaii's Niche in the New Economy

Because of its strategic geographical and geological location in the Asia-Pacific, a critical mass of life science research centers, and of course the accolade-laden glow and promise of the mice-cloning Honolulu Technique, Hawaii is uniquely positioned to establish itself in the New Millennium as the State's leading technology sector and a national center for genetics research in a wide variety of biotechnology related industries.

At present there are close to 50 biotech related companies conducting research and producing products and services in the state. They employ over 2,000 Hawaii residents and generate over $320 million in revenues. Companies in international food manufacturing, crop production, aquaculture science, public-private science consortiums, genetics research laboratories, and environmental remediation firms are all a part of this technology-intensive industry.

They have already drawn from cutting-edge research and paid dividends in both quality jobs and revenues for companies in four important sectors – agriculture, marine sciences, environmental remediation, and human therapeutics.

In agriculture, biotechnology employs the results of several scientific disciplines-agronomy, biochemistry, botany, genetics, soil science and others. The University of Hawaii's College of Tropical Agriculture and Human Resources and the Hawaii Agriculture Research Center are leaders in applied research on tropical fruit, forestry, and plant production and preservation. The commercial value of that effort has benefited several companies in Hawaii through innovations in disease control and tropical crop production.

In the sea and on the shore, marine biotechnology is another Hawaii strength that is providing significant advancement in biomaterials, health care diagnostics, nutraceuticals, new polymers and biofilms and corrosion science. The Marine Bioproducts Engineering Center at the University of Hawaii (MARBEC) and the Oceanic Institute, for example, are attracting worldwide funding for Hawaii's drug, nutraceuticals, and fish and shrimp research platforms. The Natural Energy Laboratory of Hawaii Authority (NELHA) is an important incubator for commercial marine biotechnology ventures.

A subset of marine biotechnology, aquaculture, is being used to develop and commercialize vaccines and therapeutics to treat seaborne diseases, thus preserving and managing commercially important fish populations. Worldwide it has been estimated that diseases that affect aquatic species cost international aquaculture and fishing industries more than $7 billion each year. Using modern methods developed in Hawaii, researchers have already developed means to counter this damage and at the same time increase the economic viability and availability of these important food sources.

The earth's environmental problems in the coming millennium will certainly be one of the industry's great challenges. For the first time, humanity has the capability to both threaten the global environment and manage it beneficially. Biotechnology is already being used to clean up oil and chemical spills, and conserve natural environments through increasing public awareness of the need for biodiversity. Hawaii's islands ecosystem has served the Asia-Pacific region as a model for the use of environmental remediation research, demonstration, and education programs, including those administered through the Pacific International Center for High Technology Research. These programs, together with Hawaii's diversity of climates, plant species, and geology make the state a strategic player in this discipline.

In human drugs and therapies, the state's diverse population offers ideal conditions for epidemiological studies at several facilities, including the University of Hawaii's Cancer Research Center and Pacific Biomedical Research Center, the Hawaii Biotechnology Group, and Queen's Medical Center.

In 1999, over $69 million in federal support was granted to the University of Hawaii and other research centers for important life sciences research. More than 80 faculty researchers at the University of Hawaii campuses at Manoa and Hilo are working on basic and applied biological research for treatment of disease like Alzheimer's cancer, AIDS, and asthma. That research has led to 14 approved US patents in just the past three years.

Biotechnology Fits the State's Agenda

From the perspective of the industry and public officials in Hawaii, commercial development of biotechnology fits well into the State's overall economic growth strategy.

First, biotechnology in Hawaii takes advantage of the technical infrastructure already in place through its public and private research facilities. As has been noted, the state's universities are a national leader in securing funding and producing relevant research results.

Second, biotechnology's presence in the state provides an important addition to the state's traditional economic base, without endangering the environment in which it operates. Marine and agricultural development in biotechnology are parallel with the tourism industry as they, too, promote the island's unique physical environment.

Third, because biotechnology companies require large amounts of capital to begin operations, they generally commit to a location for a longer period of time than other industries. If successful, these companies may emerge as headquarters and/or research centers. While there is a temptation to utilize significant resources to attract one large company from outside the state, the most successful technology clusters primarily focus on retention, expansion, and attraction for their long-term growth.

Fourth, successful models include and provoke public and business investment in knowledge infrastructure. Providing a readily available labor pool is probably the best support mechanism State and local governments in Hawaii can provide to the industry. Recent innovations in workforce training for displaced workers from agriculture illustrate the value of close interaction between various islands' companies and state community colleges.

What might inhibit biotechnology growth in Hawaii

Despite what may appear to be a highly optimistic outlook, a variety and imposing list of concerns about technology growth and biotechnology development in Hawaii in particular have been expressed.

- For one, biotech is still in infant industry in Hawaii and will undoubtedly experience growing pains. It was no more than two years ago that Governor Cayetano convened the first statewide conference of researchers and practitioners among the diverse fields that now make up the industry. It was at these sessions that the melding of public-private-academic cooperations was initiated and an industry presence established.
- A scarcity of affordable wet laboratory space for early stage biotechnology companies raises the costs for available space for current occupants and hinders would-be companies' ability to move into facilities.
- Low investment in state-based biotechnology companies by both mainland and Hawaii-based venture capital mangers has limited industry growth.
- Cumbersome procedures and minimal interaction between state research institutions and entrepreneurs inhibit commercialization of relevant discoveries.
- Thus while the basic building blocks for continued biotechnology development in Hawaii are in place, the reality is that biotechnology industry is very competitive, and many states and nations have also focused on the industry as a priority. They have created biotechnology-specific development initiatives, including wet labs, tax incentives and technology transfer mechanisms to lure companies to their areas. Unless Hawaii further addresses these items, it could easily find itself at a real long-term disadvantage in retaining expanding company presence.

Strategies and Actions for industry growth

To their credit, industry advocates at official, academic, and enterprise levels have joined forces to investigate their capabilities and limitations and with the assistance of the Washington D.C. – based Bio Industry Association, come forth, with pertinent recommendations to improve their competitiveness. Some have already been anticipated through administrative or legislative action, such as the Governor's request that the State Retirement Fund, invest an initial $15 million in Hawaii based technology start-up and legislative support of promotional funds for technology developments.

Recommended bio-industry strategies follow:

Expand venture capital and marketing efforts targeted for the technology sector and increase the number of Hawaii-based venture capital funding sources, including banks, private placement, retirement funds, and other institutional investors.

Develop and implement a state tax structure that provides incentives for high-technology product development companies, and create an effective regulatory structure that minimized impediments.

Substantially strengthen public-private partnerships to increase the number of commercially viable patents emanating from research laboratories at the University of Hawaii and other research sources located in the state.

Establish formal communications mechanisms between technology-based industries and the state's education community to plan for and meet the anticipated increases in the industry's employment and training needs.

III. (C) Defense and Dual-Use Technology

Traditionally, Federal expenditures have contributed heavily to Hawaii's economy. While this fact is probably well known, the impact of these expenditures on technological innovation and Hawaii's future growth potentials has not been fully appreciated

Although the underlying data and methods of calculation may not be strictly comparable, the Federal sector may be regarded as second only to tourism in terms of economic contribution. Current estimates indicate defense spending in Hawaii accounts for 10% of gross state product, versus 20% for tourism. In the last 5 years, Federal R&D projects in Hawaii, in related areas of defense, medicine, agriculture, ocean sciences and UH programs, have exceeded $1 billion in appropriations. Although the numbers have fallen well below their world war heights, it is clear that the Federal establishment continues to occupy a key role in Hawaii's economic development. Moreover, the Federal account balances will continue to favor Hawaii, since its residents receive income benefits greatly in excess of their Federal tax payments (in 1998, about $2.8 billion surplus).

In addition to this favorable balance of receipts for Hawaii residents, there is a dynamic factor in today's Federal expenditures that has not been fully recognized, particularly in its longer-term impact, as Hawaii enters the 21st century and the age of high-technology. This refers to the potential influence on productivity and economic progress of what has been termed "dual-use technology."

For Hawaii, Federally-funded projects and the technologies they develop, particularly in areas covered by Defense appropriations, can help raise the state's productivity level and growth output. With development of these new technologies, there is innovation and management skill transfer, which in turn result in a more skilled workforce and a greater potential to support new industries.

Some dual-use Federal projects.

It is particularly significant that federal agencies such as the Defense Department, NASA, and the Commerce and Energy departments have focused on programs and facilities that not only meeting national security objectives, but also have early and feasible application to civilian and commercial use. The rationale is that industry gets the opportunity to commercialize government R&D, and federal agencies can draw from a broader commercial technical base and receive royalties should the commercialization result in a commercially successful product or service.

Among the many Federal projects that relate to or promote high technology development in Hawaii are:

- **Agriculture-based Bioremediation**: The dual goal has been to demonstrate environmental cleanup technologies to maintain Hawaii's clean environment, as well as to encourage a local environmental restoration industry to work in the Asia-Pacific.

- **Hawaii agricultural initiatives**: Construction of the U.S. Pacific Basin Agricultural Research Center in Hilo to serve the entire U.S. affiliated Pacific Basin, which includes Hawaii, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands.

Hawaii's senior Senator Dan Inouye has been instrumental in securing funding to provide the state with access to the highest levels of agricultural research available. In addition to establishment of the Hilo research Center, the Senator's FY 00 initiatives include funding for tropical and subtropical research, tropical aquaculture research, sugarcane and diversified crop research. Molokai Agricultural Development and Conservation, non-toxic fruit fly control, and agricultural diversification and specialty crops.

- **Air Force Space Command – Haleakala**: Over the past six years, about $230 million has been spent to develop, research, and improve atmospheric and space imagery technology atop Haleakala, including an Advanced Electro-optical Systems telescope, a principal beneficiary being the University of Hawaii's Institute of Astronomy

- **Akamai/Pacific Medical Network**: Through the program at Tripler Army Medical Center, infrastructure has been installed allowing tele-health to be demonstrated to serve remote Pacific areas and deployed military forces throughout the Pacific. Funds have also been used to fund research and development of new telemedicine, technologies being developed by Hawaii companies.

- **Center for Excellence in Research in Ocean Science (CEROS)**: Projects selected are to encourage technology development and commercial use of ocean and marine research and demonstrate dual civilian and military use, with the vast majority of funds being directed to local businesses.

- **Pacific Missile Range Facility (PMRF)**: As the largest multi-environmental range in the world, PMRF's capabilities provide a wide variety of simulations for training, research, development, testing and evaluation as well as education endeavors.

- **Maui Supercomputer and the Maui High Performance Computing Center (MHPCC)**: The Maui Supercomputer provides the computational capability necessary to process and enhance the images of satellites and other objects collected at the Maui Space Surveillance Site. The MHPCC mandate has been to increase the percentage of its paying customers, whether private sector or government to reduce operating costs.

- **SLICE***:* The joint venture of Pacific Marine and Lockheed Martin has developed, constructed and tested the SLICE vessel, which has participated in a variety of exercises and demonstrations. The SLICE technology is also applicable to high-speed ferry program and has provided the basis for testing of a commuter alternative along the Leeward Oahu Coast-line.

- **Pacific Disaster Center**: The PDC mission is to aid in disaster relief efforts, from early warning and better and faster response to more thorough mitigation planning and implementation. In addition to operations, an economic development component utilizing mapping, modeling, and satellite simulations, is being developed.

Goals

One economic goal is the continuation of a large military presence in Hawaii.

The continued presence of the military is desirable because the services provide directly a large number of high-quality jobs to civilians, and also support additional jobs through purchases of goods and services. In addition, the military contributes to economic diversification and, as a result, economic stability.

A second goal is an expanded commercial application of dual-use facilities and research.

Dual-use activities add to the number of high-tech jobs and helps diversify the economy.

Policies

Support a large military presence in Hawaii consistent with their missions, plans and policies, and consistent with Hawaii's environmental concerns and community values.

The support would come largely from Hawaii's Congressional delegation, and would include support for additional military units assigned to Hawaii, higher military pay, and investment to upgrade military facilities in Hawaii.

Support additional investment in and commercial use of dual-use facilities and research.

For Hawaii, dual-use activities provide expensive facilities and research grants funded largely by the Federal government while also increasing the Federal commitment to Hawaii. However, in order to realize the full economic potential, an organization will be required that is charged with the responsibility of identifying and facilitating the development of promising commercial applications.

- ***Review of official mandates or procedural directives relating to commercialization of Federally funded projects.***

- ***Investigation of Hawaii-based projects and Hawaii impacted nationally-based program to ascertain technological and commercialization potential.***

- ***In view of the information gathered from the above activities, assess Hawaii's natural, physical, and human resources to determine levels of interest or capabilities to pursue identified opportunities or develop new compatible ventures.***

- ***Maintain close interaction with Hawaii's congressional delegation to provide information on new or additional possibilities for Federal funding in identified areas of dual-use technological development.***

- ***Energize a collaborative effort between all sectors of government, the University of Hawaii, and private enterprise, to encourage a Federal input with regard to the state's world premier facilities at the Mauna Kea astronomy observations, Maui Supercomputer, and Pacific Missile Range of Kauai, together with research and development advances in such areas as ocean science, remote sensing, data archiving, telemedicine, and telecommunications.***

- ***In addition, the state must develop and maintain a competitive workforce. While the University of Hawaii has shown prowess as a premier research institution and has built supportive offsite facilities, there remains need for investment and programmatic focus in developing skills that will support technology-based ventures.***

It is clear that Hawaii's surge into the 21st century via technology-oriented growth will be greatly enhanced by dual-use applications that are being promulgated by the country's defense establishment. What is required to seize upon these advantages is the knowledge that can only come from an open-marketed economic structure and a goal-oriented education system (Silicon Valley garages notwithstanding).

III. (D) Tourism In the New Economy

Tourism is Hawaii's dominant industry and, for more than a quarter century ending in 1991, it was the primary driving force to Hawaii's economic growth. Since 1991, however, the growth of tourism stalled as a result of the Persian Gulf War in 1991, Hurricane Iniki in 1992, a short recession in the U.S., a prolonged recession in Japan, and strong competition from other visitor destinations.

Growth in the number of visitors from the U.S. mainland has resumed, while the number of visitors from Japan has gradually dropped, though hopes for an economic rebound and strengthening of the yen may bring about a reversal. Also, resort development stagnated during the 1990s, following a period of rapid development in the 1980s.

Competitive Advantages

Hawaii's visitor industry is built on a strong combination of assets and advantages, many of which are unique to the Islands. Simply put, Hawaii is an "island paradise," blessed with a year-round temperate climate, stunning vistas, some of the most highly-rated beaches in the world, dramatic mountain ranges, lush rainforests, erupting volcanoes, clear waters featuring colorful fish and coral reefs, a rich variety of flora and fauna, surf ranging from gentle to awe-inspiring.

In addition, Hawaii offers one of the most diverse and successful blends of cultures in the world, as exemplified by our world-renowned *aloha* spirit. This is complemented by a multilingual workforce.

Hawaii also offers a great many attractions and activities, including tours, shows, cruises, museums, special events, water sports and land-based sports, shopping, entertainment, fine restaurants, etc.

Other assets include a favorable worldwide reputation, frequent flights from many American and Asian cities, a new convention center, many highly-rated hotels, a developed infrastructure, a low crime rate and, for investors, political stability. Also, Hawaii's access to markets in small cities has increased as a result of new long-range aircraft that are small, efficient to operate, and can operate from short runways.

Hawaii's Film Industry

These same assets have spurred the growth of a film industry – movies (Jurassic Park), television series (Baywatch), commercials. They have generated a significant amount of income for Hawaii from the U.S. mainland, Japan, and other countries, and provide considerable local employment (actors, drivers, equipment operators), and purchases of goods and services (hotels, restaurants, food service, car rental, clothing, etc.). However, many of the jobs are temporary, depending upon the duration of a filming project in Hawaii.

In addition to these direct economic benefits, the film industry contributes greatly to the visitor industry by providing extensive exposure of Hawaii to national and international audiences – extremely valuable marketing which occurs at little or no cost to Hawaii. This indirect benefit to the visitor industry may exceed by several orders of magnitude the direct economic benefit from filming in Hawaii.

Sustaining Growth in the New Millennium

However, we must realize that Hawaii is no longer the fast-growing resort destination it was in the 1960s, 70s, and 80s. We have reached a level of maturity as a destination and have found ourselves relying much more on repeat business than in the past. Moreover, we find that we must compete vigorously for visitors with the many established and new destinations that have entered the world tourism market in recent years, including the enhanced competition of global cruise lines. We know that to keep and expand our visitor markets in the face of this competition, Hawaii must maintain its reputation for high quality and become more efficient. ***We must revitalize our visitor infrastructure and provide an ever-changing menu of attractions and events for new and repeat visitors.***

In addition, we will need to explore and exploit new niches, and the possibilities are many. ***Much greater emphasis must be placed on diversification of the industry, both in markets that we seek and attractions that we must provide.*** We have initiated promising programs in health tourism, cultural tourism, sports tourism, eco-tourism and education tourism, and large volume business and professional gatherings at our new convention center. Each of these programs can appeal to new visitors, and they are areas where we have and can maintain a competitive advantage in the forthcoming century. These are also areas where our Neighbor Islands can play an increasingly important role and secure a greater share of the tourism market. ***We must also extend our market outreach. Certainly Japan and Western United States remain our prime sources, but there is potential in Europe and both American continents, and China and other advancing counties in Asia are within our reach.***

Policies for the New Tourism Economy

Toward a goal of restoring a more balanced industry growth process, the following policies are being recommended:

- ***Support the development of new attractions, experiences, a year-round series of annual signature events and festivals, and special events that contribute to a healthier visitor industry***. This would: (1) increase the appeal of Hawaii as a visitor destination for recreation and activity; (2) broaden the appeal to cater to more interests; (3) contribute to attracting a steady flow of visitors throughout the course of a year, particularly during the slower spring and fall seasons; and/or (4) increase Hawaii's exposure on television, in movies, in magazines, and in commercials, thereby increasing awareness of Hawaii attractions.

- ***Focus marketing to maintain or increase Hawaii's visitor appeal in major markets now served by Hawaii, and to broaden the appeal in additional markets, both in terms of region and interests.*** To realize the largest impact, marketing expenditures should be leveraged with those of travel partners. Also, the Internet, multi-media and other technological advances should be used to better present Hawaii's attractions and better reach a variety of markets.

- ***Support and invest in the revitalization of Waikiki.*** Waikiki is the heart of our visitor industry and the window through which Hawaii is viewed and revitalization and re-enhancement is paramount to its health.

Needed improvements include upgrading hotels, replacing old hotels with new ones, dredging the Ala Wai Canal, developing an Ala Wai promenade, replenishing Waikiki Beach, building an interpretive center and making other improvements at Diamond Head, making improvements to improve traffic circulation, landscaping and developing open space, making architectural enhancements to give a Hawaiian sense of place, providing exhibits showcasing Waikiki's history, and possibly replacing the Ala Wai Golf Course with a park that features Hawaiian culture.

Tax and zoning initiatives will be required to stimulate private investment to upgrade hotels, replace old hotels with new ones, and upgrade other facilities which may be inadequate.

- ***Cluster development in designated resort areas, and support investment in infrastructure and improvements that strengthen the industry on each island.*** This would include highway beautification, improvements to existing beach parks, new parks, hiking trails, preservation and enhancement of natural and cultural attractions.

- ***Provide strong support to film production through assistance with permitting and obtaining access to sites for filming; occasional price concessions by airlines, hotels, and labor unions.***

In these initiatives toward revitalization, much will depend on the energy and creativity of the newly-constituted Hawaii Tourism Authority. With a greatly enhanced and dedicated funding source ($55 million for its first year of operation), the Authority has proclaimed a series of strategic goals which will underlie its planning process into the New Millennium. The HTA will seek to:

- **Pursue a high level of communication and coordination** with the various stakeholders in Hawaii tourism – visitors, community, industry and government – all of which have different areas of interest and concern.

- ***Reconfigure the overall marketing strategy with appropriate emphasis paid to major Marketing Areas (MMAs) throughout the world.*** The nine MMAs identified

and extending beyond traditional large markets, are Japan, Western US, Eastern US, Canada, Europe, Latin America, Other Asia, Oceania.

- ***Create and support a year-round series of high profile events*** to reinforce the "proactive" identity desired for Hawaii as a world destination. This includes several of the major signature events already in Hawaii's inventory, such as the annual NFL Pro Bowl, the Sony Open, Mercedes Challenge, and Aloha Festivals.

- ***Provide for and support the development of new visitor products and attractions*** in a variety of fields. These "niches" include such areas as Agri-Tourism, Cultural Tourism, Eco-Tourism, Edu-Tourism, Health & Wellness and Sports Tourism. Of this end, the HTA dedicates several million dollars each year as a partner, sponsor, or grantor.

- ***Facilitate growth in airlift to Hawaii by commercial carriers.*** The HTA intends to launch a series of efforts which will result in the increase of airline service to Hawaii in a way that is profitable to air carriers.

- ***Advocate for the effective management and revitalization of visitor infrastructure and support services,*** including support of appropriate funding for beach and park maintenance, for the revitalization and renewal of key visitor destination areas such as Waikiki and the Honolulu International Airport, and for enhanced levels of public safety and emergency services.

- ***Provide for the modernization of laws and regulations to enhance investment and tourism diversification.*** This includes realignment of land use and county zoning regulations to enhance new tourism products and services, establishing tax incentives where applicable, while recognizing the need to be sensitive to the community's cultural and environmental values.

The Authority takes special note of our state-of-the-art convention center, which underscores Hawaii's diversity, announces that "Hawaii is Open for Business," and features the infrastructure which facilitates serious and meaningful business. ***With its strategic geographic location, and multi-cultural host community, Hawaii is emerging as a desirable destination, extremely adaptable to the different needs and values of today's global business traveler*** whether he or she be a dental conventioneer from Waterloo, Iowa or a Hong Kong entrepreneur attending the Pacific Basin Economic Council's International General Meeting in March 2000.

Amidst the requirements and realities of the New Economy, a natural question arises. **Is a subtropical tourism-based economy, which has suffered through almost a decade of slow or no growth, up to the task?** The answer can be positive. In the New Economy, the important point is that economic innovation and knowledge utilization extend to all aspects of economic activity, production of services as well as goods. Technological progress, properly nurtured, embraces not only the development of new products, materials, and production methods, but also new ways of working, financing,

marketing and distributing goods and services, and better ways of organizing the workplace and managing a business, whether it be hotels, travel services, or visitor attractions. ***For long-term sustainable growth, beyond proclamations and promotions, these are the necessities.***

III. (E) Health and Medical Care

Health Care as a Potential for Economic Growth and Diversification

Healthcare tourism offers considerable potential not only as a niche market for diversification of Hawaii's tourism industry, but also as a major contributor to the State's Asia-Pacific presence in the New Millennium.

As an economic sector, healthcare tourism consists of two components: one involving medical treatment by professionals at specialized facilities; and two, fitness and wellness tourism involving exercise and/or nutrition through use of resort or hotel facilities.

Spurred by the increasingly comprehensive coverage at both Federal and State levels as well as scientific and technical advances, the medical and health services area was one of the few industries that showed steady growth in the last 10 years while our economy overall has been stagnant.

Between 1987 and 1997, employment in medical and health services grew by 42% from 24,400 to 34,650. This compares with the growth of jobs in the hotel industry of 23% from 31,250 to 38,450, and overall increase in nonagricultural employment of 15%.

It is obvious that adequate and superior healthcare stands to benefit Hawaii's consumer population and that provision of medical and health maintenance services results in residential income and employment. However, additional employment in medical and health services will be constrained if limited to serving only Hawaii residents. Thus, the need to look outside to international markets.

Expanding the Healthcare Market

In terms of visitors, foreign medical patients tend to spend more than do the typical tourist, and can therefore make a larger contribution to our economy. Providing medical services is much more labor-intensive than providing goods. For example, the visitor will need to see local doctors and nurses. In contrast, a large share of the money spent by the visitor buying a Gucci purse is used to pay for the import, so the leakage is larger. In looking outward to expand the healthcare market, it will be necessary to target the rich, the elderly, and the sickly. These groups tend to be less sensitive to prices and less affected by adverse fluctuations in the exchange rate, for example.

Research indicates that the greatest potential for Hawaii lies in the large number of upper-income individuals from the Asia-Pacific. This region has 30 million people, mostly Japanese, with incomes that are sufficient to warrant travel to the U.S. for healthcare. Moreover, the demand for health services will increase as populations grow older. Adding room and board for each hospital stay and the additional days the patient might have to spend in Hawaii before and after hospital discharge, together with expenditures

during these periods by accompanying friends and relatives, further increase the overall economic contribution of the healthcare sector.

The benefits are certainly attainable, but Hawaii will face stiff competition from Singapore, Hong Kong, Australia, New Zealand, and other areas which offer health-related services to many of the same markets at costs significantly lower than Hawaii's. To counter this, Hawaii will need to emphasize its cultural advantages, the quality and range of its resort facilities and services, its healthy lifestyle, excellent health care facilities, and reputation for visitor satisfaction, in order to develop the health tourism market.

Tapping into Overseas Markets

While Japan and other Asian countries offer great opportunities for medical and health services providers, the State will need to more closely examine, what will it take to tap into these markets. At the start, it is acknowledged that Hawaii has excellent physicians, nurses and health-care facilities, many of which are on the cutting edge of research, education and training. But Hawaii is not well-known for these assets, and this perception needs to be changed.

First, it will be necessary to enhance Hawaii's reputation as a provider of high-quality health services for Asia-Pacific patients. One means of doing so is to establish alliances with medical institutions that already have international reputations and immediate name recognition. It also stands to reason that such institutions will not enter into such arrangements unless they are convinced that the proposed Hawaii partners have the capability of performing up to required medical standards.

Along these lines, the Governor has been in contact with both the Mayo Clinic and the M.D. Anderson Cancer Center and has facilitated an agreement between Mayo Clinic and Queen's Medical Center to develop a medical laboratory in Hawaii that will serve the Asia-Pacific. This development can serve as a prototype for further arrangements and other institutions. More recently, Queen's has teamed up with Hamamatsu Photonics, a Japanese company, to have a PET (positron emission tomography) scanner placed for operation in Hawaii. This high-tech machine is one of only two in the world and the only one in the U.S. that Japanese physicians can recommend for patient travel to Hawaii for diagnosis and treatment of strokes, epilepsy, heart disease, and cancer.

On the other side of the spectrum, Hawaii's intermediary position enables it to provide treatment in complementary and alternative medicine. Traditionally the basis for cure in many parts of Asia and the Pacific islands including Hawaii, complementary and alternative medicine has become a multi-billion dollar industry in the U.S. Alternative therapies include, but are not limited to the following disciplines; folk medicine; herbal medicine; diet fads; homeopathy; faith healing; new age healing; chiropractic; acupuncture; naturopathy; massage; and music therapy.

The Promise of New Technology for Hawaii's Healthcare Development

- Hawaii is one of the first states to facilitate telemedical applications using its advanced telecommunications infrastructure. It has implemented a variety of remote healthcare demonstrations, using NASA's Advanced Communications Technology satellite and other broadband connections. The purpose of these experiments has been to link our healthcare institutions with major mainland healthcare facilities to support the delivery of state-of-the-art medical services to difference locations.

In this regard, the State of Hawaii Telehealth Access Network (STAN) has been established by the Hawaii Health Systems Corporation (HHSC), the High Technology Development Corp. (HTDC) and the Telecommunications and Information Policy Group (TIP-G) of the Social Science Research Institute of the University of Hawaii to facilitate development of an advanced health and medical care telecommunications and information infrastructure in Hawaii and the Pacific regions.

Goals for Healthcare Tourism Development in the New Millennium

The State's commitment to diversifying the economy through the export of medical and health services will need to be solidified through both private and public initiatives. The long-term potential for this economic sector can be reached with adherence to the following goals:

- ***Continue working with the private sector to ensure that facilities, programs and services, either through indigenous development or extramural infusions, are available;***
- ***Tailor promotional efforts to the style and requirements of the respective international markets that we are seeking to tap (e.g., in Japan and the rest of Asia, developing personal relationships are key, and take a long time to establish);***
- ***Similarly for U.S. and other markets for complementary and alternative medicine;***
- ***Focus on specific areas and quantify the number of people who are likely to travel to Hawaii for medical or health reasons;***
- ***Promote the medical, health, and wellness sector through write-ups in magazines, journals, and tourism media to inform international markets of Hawaii's medical facilities and services; and***
- ***Expand the referrals network of international patients to Hawaii through institutionalization of professional exchanges among hospitals, local providers, and the UH School of Medicine with Asian counterparts.***

III. (F) Resource Development

1. Agriculture in the New Millennium*

For more than 100 years, agriculture has been a major contributor to the economy of Hawaii. More importantly, the great sugar and pineapple plantations provided a sense of place and belonging; a social structure and a set of values that live on today throughout much of Hawaii. Most people thought that the plantations, especially "King Sugar" would always be in business. However, there were a few who recognized that changing dynamics in the world economy, high costs of production, and changing environmental laws would lead to the ultimate decline of the Hawaii sugar industry. And even these few prognosticators couldn't have predicted the rapidity with which the industry declined.

The result of recent changes in the agricultural sector of Hawaii's economy has been to focus attention on new alternatives. The decline of sugar has released a large amounts of prime agricultural lands for other purposes. On one hand, a simple approach may have been to find a suitable crop to occupy all of the acreage, making management of the lands, production, marketing, and labor relatively easy propositions. Some may still be seeking such a solution. But like any robust economy, the real key to future success lies in a diverse portfolio of options.

Today, the outlook for agriculture is particularly bright. The agricultural industry is now truly diversified. Of course sugar and pineapple are still produced, but so are a variety of fruits, flowers and vegetables, seeds, coffee, nutriceuticals, and wood products. The question is: "Are there additional opportunities for Hawaii agriculture?"

In identifying future opportunities, we must recognize the context in which the future will be played out. The world fast becoming a "Global Community" connected instantaneously through a number of real-time communications links. As development continues to progress, so does the standard of living, creating an increased demand for a variety of goods and services. At the same time there will be an increased awareness of the value of green space and the need for a safe, clean environment. Land planning will be widely used to address the urban-agriculture interface and natural resources will be increasingly used for leisure activities

The food production system will be challenged to provide sufficient food to feed the growing population. Earth's population exceeded 6 billion in October 1999 and is expected to reach 8 billion by 2030. The food production problem will be severe as current crop plants are operating near theoretical efficiencies and agriculture is being relegated to less productive lands. Biotechnology offers a solution to this future dilemma. Biotechnology will enhance the nutritional qualities of foods and will lead to the development of the biocarbon revolution. Industrial chemicals, plastics and fuels will be derived from plants rather than petroleum. But to fully realize the vast potential that biotechnology offers, care must be taken to educate consumers and provide adequate assurances that products are safe for consumption and the environment.

**Contributed by Dr. Michael Harrington, College of Tropical Agriculture & Human Resources, University of Hawaii*

Given the context described above, let's return to the question: Are there opportunities for Hawaii? Absolutely! But there are steps to be taken to insure success. First, we must recognize that all of the agriculture in Hawaii is niche market-driven and as such there are several crucial steps to success beginning with strong Hawaii branding. Each endeavor must begin with a business plan that meets a market need. To do so, a detailed understanding of markets and a system to provide a real time market date are needed. This information system is crucial to business planning and should be readily accessible on the Web to facilitate business planning, scheduling, and mid-course adjustments.

What are some of the opportunities?

Vegetables. Current value of this segment of the agricultural industry is about $49 million, yet local production does not meet the local demand for most products. However, local markets demand a consistent supply and at a competitive price. Increased success in this segment will require the detailed understanding of the market as described above, precise business planning, a willingness to become customer focused, and perhaps, a willingness to cooperate with other producers to meet the market's needs

Tropical Fruits. The recent "discovery" of tropical fruits by many people has created a large opportunity for Hawaii agriculture. One exporter indicates that he could sell every piece of tropical fruit he could ship. The rebirth of the papaya industry with the release of the Rainbow papaya and the recent export of bananas to Japan and Guam are fine examples of how Hawaii is able to benefit. Other exotic tropical fruits such as rambutan and mangosteen should help to expand $25 million industry by at least 50% over the next few years.

Tropical flowers. Hawaii orchids and other exotic flowers are recognized as some of the finest available at any cost. Hawaii is also gaining an excellent reputation for the quality of its Protea varieties. Currently, the farm gate value for tropical flowers is approximately $70 million. Yet with each new luxury hotel in Las Vegas, a new market is born that nearly equals the entirety of Hawaii's production. This segment could easily double with a ready supply of new varieties, increased marketing and effective post harvest treatments.

Nutriceuticals. The medicinal plant/nutriceutical/botanicals market is the fastest growing segment of the health industry. These products include whole plants, plant parts, as well as crude and purified extracts. Worldwide this market exceeds $11 billion with annual increases of 10 to 20% predicted over the next decade. The North American market for these products is currently $1.5 billion.

Hawaii is positioned to take advantage of the explosive growth in the nutriceuticals industry. Tropical plants such a kava or 'awa have long been valued for their spiritual/ceremonial, social/recreational, or industrial/medicinal properties. Other examples include noni, natural dietary aides, and natural sweeteners. Hawaii offers near ideal environmental conditions for rapid growth of the many of kava varieties and other valuable plants.

Value added products. The development of a value-added product increases the end cost of an item by as much as 10-fold. This segment will provide new products for niche markets and jobs for a diversified economy. Efforts in this category might develop a variety of health-conscious foods from taro such as ice creams, sorbets, flours, pastas and breads. Other examples include the use of cull fruits and vegetables to produce unique products such a salsas, sauces, and convenience foods. The papaya industry typically has 30% culls that are discarded. No business can afford to discard 30% of its production. Imagine Toyota or Nissan scrapping 3 out of every 10 cars produced.

The seed industry. While less that 30 years old, the seed industry is growing by 20% annually due in part to the ready availability of agricultural lands. Current value is approximately $27 million. A major reason these investments are being made is that Hawaii is perceived to be one of the leading centers for plant genetics in the world. Our highly predictable weather and climate combine to yield a low risk environment that is ideal for developing new plant varieties. Under normal conditions in a temperate climate up to 12 years may be needed to develop a new variety of seed. In Hawaii's climate, it is possible to produce 3 crops each year cutting development time to as little as two years. Pioneer Hi-Bred International recently opened a $4 million research facility and other seed companies are making additional investments in Hawaii. Over the next decade, private growers will enter into contracts with seed companies to produce a variety of seeds.

Biotechnology. Biotechnology is the use of living organisms to create commercial products using biological and engineering processes. Biotechnology includes the techniques of recombinant DNA, gene transfer, embryo manipulation and transfer, plant regeneration and tissue culture, monoclonal antibodies, bioremediation, bioprocess engineering and a host of other technologies. The most current estimate of the world market for biotechnology approaches $200 billion. A conservative estimate indicates that the value of biotechnology products in Hawaii will exceed $7 billion annually by the year 2020 if current rates of development continue.

Through biotechnology, scientists can produce plants with enhanced nutritional qualities, ripening characteristics, altered or enhanced color, and resistance to pests and viruses. The latter improvements not only increase production efficiency, but can also reduce the need for chemical pesticides preventing soil and water contamination and health risks.

With 90% of the World's arable land currently in use and world consumption of food and natural resources on the rise, there is an urgent need to increase food production. Hawaii can play a key role in this development as one of the leading centers of biotechnology research and development in the world. Many scientists perceive Hawaii to be one of the premier sites in the world for marine and agricultural research.

With careful planning, better knowledge and understanding of markets, new technologies, and some essential infrastructure discussed above, the agriculture sector is positioned to realize increased success in the new Millennium.

2. Sugar

For the greater part of a century, sugar was the main pillar of Hawai'i's economy. However, the industry has undergone a major contraction, resulting in a single large but efficient operation on Maui, and three smaller plantations on Kaua'i. Sugar is no longer cultivated on O'ahu and Hawai'i Island.

The Maui plantation is making large investments to improve its productivity, expand into new markets and products, and change its practices to eliminate the burning of sugarcane prior to harvest.

Competitive Situation

Hawai'i's principal advantage in producing sugar is its excellent agronomic conditions which allow the highest sugarcane yields in the world. Other advantages include investment in research, technology and infrastructure to improve yields and productivity, economies of scale, and Federal restrictions on imports to maintain favorable prices for sugar sold in the U.S.

Since the 1970s, Hawai'i's competitive advantages have been weakened by (1) increased competition from producers of sugar and sugar substitutes on the U.S. mainland, and (2) higher labor costs in Hawai'i because wages were bid up by tourism. U.S. competition resulted from the introduction of high-fructose corn syrup, the increased yields and productivity of sugar beet and sugarcane growers, and the introduction of aspartame and other artificial sweeteners.

Goal

The economic goal for sugar is continued operations on Maui and possibly on Kaua'i.

Survival of sugar operations is desirable because they still provide considerable employment, generate considerable income from overseas, and provide attractive greenery.

Policies

Continue support of Federal programs that maintain favorable prices for U.S. sugar by restricting imports.

This policy helps Hawai'i sugarcane growers as well as mainland producers of sweeteners, but it is done at the expense of U.S. consumers who pay slightly higher prices for sugar.

Support efforts of Hawai'i sugar operations to improve their productivity and diversify into new high-value markets and products.

This includes farming and mill improvements, increased production of energy from waste products, production of large crystal sugar for the gourmet market, fiberboard from bagasse, etc.

Support efforts to eliminate the burning of sugarcane.

This benefits both residents and the visitor industry.

3. Pineapple

Once the second largest industry in Hawaii, the pineapple industry suffered a major contraction in decades past when production of most pineapple for the canned market moved to foreign countries where labor costs and other costs are much lower.

However, the three remaining plantations are reasonably healthy and stable, having undergone minor expansions and contractions, depending upon the plantation.

The two plantations on O'ahu produce for the fresh-pineapple market and for the cut-fresh-chill market. The plantation on Maui produces mostly canned pineapple for private labels, thereby avoiding high marketing costs. Exports of fresh pineapple from Maui are limited because of the lack of air cargo capacity which, in turn, is due to a runway that is too short to accommodate departing wide-bodied aircraft.

Competitive Situation

The development of pineapple as a major crop in the world market began in Hawai'i, following substantial plantings soon after 1900. The initial advantages included: its agronomic requirements on lands which were too high for sugarcane, low water requirements, the fact that Hawai'i was first to begin large-scale commercial production, the early adoption of advances in canning, extensive promotion to develop the market, duty-free access to the U.S. market following annexation, and research to overcome problems and increase productivity. Many of these advantages have since been lost to foreign producers who incur much lower costs.

Nevertheless, Hawai'i retains three major advantages for pineapple production. First, for the fresh-pineapple and cut-fresh-chill markets, growers on O'ahu enjoy the best air cargo service in the world from a semi-tropical area to the U.S. mainland—thanks to tourism and available cargo space on return flights in the bellies of wide-bodied aircraft. Second, Hawai'i pineapple growers have a marketing advantage because pineapple is associated with Hawai'i and Hawai'i enjoys a fine reputation for high-quality fruit. Third, Hawai'i pineapple grown for the canned market has a price advantage because of Federal protection from foreign canned pineapple that would otherwise be “dumped” on the U.S. market.

Goal

The economic goal for pineapple is to maintain plantations near their current sizes.

The continuation of pineapple operations is desirable because they provide considerable employment, generate considerable income from overseas, and provide attractive greenery.

Policies

Protect pineapple lands from urban development.

Loss of fields without replacement and an adequate lead time can be extremely disruptive to plantations that grow for the fresh and cut-fresh-chill markets, because a steady flow of fruit is needed to maintain Hawaii's reputation as a reliable supplier, and the loss of a field results in a large dip in deliveries which is repeated in subsequent years due to the fact that pineapple has a crop cycle of about 5 years producing three crops.

Extend the main runway on Maui to accommodate departures of overseas flights with larger fully loaded aircraft.

Although the primary purpose of the longer runway is to accommodate and increase passenger travel, the runway extension and direct flights would also allow more fresh pineapple to be flown from Maui to the mainland, thereby contributing to the economic health of pineapple operations there.

Support the expansion of fresh pineapple and cut-fresh-chill pineapple into new markets.

4. Diversified Agriculture

Diversified agriculture includes all agricultural activities other than sugar and pineapple, including vegetables, melons, tropical fruits, coffee, macadamia nuts, herbs, taro, seed crops, flowers and nursery products, cattle grazing, dairies, egg production, hogs and pigs, etc.

Many of these activities are expanding, including a number of crops that are being grown to displace a portion of the large volume of food and feed imports (e.g., vegetables, melons, bananas, alfalfa), and crops being grown for exports

Most of the plantings are occurring on former sugarcane lands. The two largest new farms are located on O'ahu in areas which, for import substitution, provide ready access

to the large Honolulu market and, for exports, ready access to the Honolulu Airport and Honolulu Harbor.

Plantings of Hawai'i's macadamia nut industry slowed in the 1980s and early 1990s because of increasing competition from lower-cost producers in other countries

Competitive Situation

Diversified agriculture enjoys the following competitive advantages:

- ample land and water (due to the contraction of plantation agriculture);
- semi-tropical year-round growing conditions and a variety of climates which allow, for many crops, high yields and high quality;
- for seed corn, multiple crops annually which accelerates the development of new hybrids;
- for many crops (coffee, flowers, etc.), a developed reputation of high quality;
- for exports of certain high-value items that have short shelf-lives (e.g., tropical fruits, vegetables in the winter, flowers), the best air cargo service in the world from a semi-tropical area to the U.S. mainland (thanks to tourism);
- for certain crops, protection from imports because of long shipping times and/or high shipping costs (an advantage which diminishes with continuing improvements in transportation);
- a head start on planting certain new crops that have long periods before bearing fruit, thereby beating the competition (an advantage once held by pineapples and macadamia nuts);
- strong research support from UH, the Hawaii Agricultural Research Center (HARC), certain companies (e.g., seed corn), and a new Federal research facility to be constructed in Hilo; and
- support services and infrastructure for agriculture (research support, extension service, farming supplies and equipment, marking and shipping services, etc.).

In spite of the above advantages, many foods, feeds, and other crops can be imported more cheaply than they can be grown in Hawaii. Hawaii growers must deal with the following competitive disadvantages:

- the semi-tropical climatic is unfavorable for growing temperate-climate crops;
- many crop-destroying pests which, on the mainland, are often killed during winter freezes;
- Hawaii's small consumer market which, for many crops, limits economies of scale and is easily glutted (an oversupply of a given product causes prices to drop, resulting in all producers losing money);
- fruit flies, which prevents the exportation of many tropical fruits or requires expensive treatment of the fruit to kill the insect; and
- the comparatively high cost of labor, land, water, supplies, etc., for delivery to overseas markets.

Goal

The economic goal for diversified agriculture is a large and growing industry that provides new jobs and income growth, based largely on exports but also including import substitution.

With the release of land and water from plantation agriculture, diversified agriculture offers significant potential for economic growth which, because of Hawai'i's small market, must be based largely on exports.

In addition to its economic benefits, diversified agriculture also provides attractive greenery, a desirable lifestyle for many residents, and fresher produce.

Policies

Preserve and protect high-quality farmland and water-irrigation systems to allow time for farmers to explore and develop new markets.

With the release of land and water from plantation agriculture, farmers are exploring the potential of many crops and products. Based on past successes (e.g., pineapple, macadamia nuts, papaya), developing a crop into a major new export requires decades of effort. Given the uncertainty as to which crops will become major successes, the farmland that is preserved should include a variety of elevations and climatic zones.

Provide strong support of diversified agriculture.

Designed to accelerate the development of diversified agriculture, this would include research, extension services, infrastructure improvements, marketing and promotion, etc. Research would emphasize biotechnology and other technologies to increase quality, yields, variety, resistance to pests, thereby giving Hawai'i growers an advantage over competitors.

Extend the main runways at the major airports on Kaua'i and Maui to accommodate departures of overseas flights having larger fully loaded aircraft.

5. Aquaculture

Aquaculture in Hawai'i is a developing industry in which many entrepreneurs are exploring new products, technologies, and markets. Their efforts include traditional aquaculture in Hawaiian fishponds, low-tech aquaculture in small backyard ponds, semi-intensive aquaculture in large earthen ponds, high-tech intensive aquaculture in large ponds, and caged mariculture in offshore waters.

Commercial products include: (1) shellfish (freshwater prawns, shrimps, lobsters, clams, abalones, oysters, scallops, snails, etc.); (2) algae (spirulina microalgae, dunaliella algae, *ogo* seaweed, *eleele* seaweed, *nori* seaweed, etc.); (3) finfish (tilapia Chinese catfish, *awa* (milkfish), mullet, *moi* (Pacific threadfin), *hirame* (Japanese flounder), trout, *mahimahi*, etc.; and (4) nonfood products (ornamental aquarium fish, seed stock, broodstock, and pearls, etc.). Products are sold to Island fish stores, markets, and restaurants, and also to overseas markets.

The aquaculture industry utilizes biotechnology to advance species, reproduction, processing, etc. For example, "high health" genetically improved shrimp have been developed that are immune to viruses.

Many of the high-tech aquaculture operations are located at the NELHA, an incubator/industrial park located in West Hawaii. A company at the NELHA is the world's largest supplier of spirulina.

Competitive Situation

Overseas markets for fish are enormous and growing. At the same time, a number of fisheries around the world have reached and, in some cases, exceeded their sustainable yields. In evaluating Hawaii's prospects for supplying this market with aquaculture products, Hawai'i's advantages and disadvantages are similar to those for diversified agriculture. Advantages include:

- A climate where year-round growing conditions and many sunny days stimulate production and allow the production of both tropical- and temperate-zone aquatic species. For aquaculture, Hawaii's climate is superior to that of most developed countries, but not all developing countries.
- Available land that is suitable for aquaculture, much of which became available in the 1980s and 1990s due to the contraction of plantation agriculture. In certain areas, an adequate supply of fresh water and brackish water, much of which also came available with the contraction of plantation agriculture.
- Ready access to extensive research, training, and consulting services in aquaculture operations. Few other places in the world have such a concentration of support services—particularly advanced technology for tropical areas.
- Hatcheries to produce disease-free, genetically superior broodstock and seed stock to supply Hawaii and overseas producers; Hawaii's mid-Pacific location helps control the transmission of diseases.
- A highly educated labor force compared to that of developing countries.
- Excellent and frequent airfreight service to the U.S. mainland, Canada and Japan.

In addition to the above, the NELHA offers advantages which are found nowhere else in the world: large volumes of cold nutrient-rich and pathogen-free sea water which is pumped up from the deep ocean off Keahole Point, warm surface water, very high solar radiation, a location adjacent to an international airport, major governmental permits are in place, and infrastructure was financed by the State and Federal governments.

The competitive disadvantages for aquaculture operations in Hawaii include:

- Comparatively high costs for labor, land (especially coastal land), freshwater for certain species, electricity to run pumps, and imported feed, equipment and supplies.
- For exporters, high overseas shipping costs as compared to costs for producers who are located near major markets.
- Permitting problems, and health and environmental regulations which increase the time, costs and risks associated with aquaculture operations.

Goal

The economic goal is for aquaculture, including production and services, to become a major component of Hawai'i's high-tech industry, and a major supplier of new jobs and income growth.

For the large export market, Hawai'i aquaculture operations are likely to involve high-priced, premium-quality products that are air-flown to overseas market. They are also likely to involve advanced, capital-intensive, low-labor technology, and to exhibit high stocking densities that use little land and water in relation to the volume produced. Operations with these characteristics reflect an economic response to Hawai'i's competitive advantages and its cost structure.

Policies

Provide support to accelerate the development of aquaculture.

State support would include: contributions to the funding of research, development and demonstration projects; evaluations of market potentials; lobby to change local and Federal laws and regulations to better support the needs of the industry; assistance in obtain land, permits, and capital; extension services; marketing; training to support the industry; etc.

Provide incubator facilities to foster the growth of aquaculture.

The principal incubator facility is NELHA which will require additional investment in infrastructure to accommodate expansion.

6. Commercial Fishing

In recent decades, commercial fishing has grown into a significant industry, supply swordfish, tuna and other species to markets in Hawai'i, the U.S. mainland, Japan, and even Europe.

The commercial fishing industry is based on a high diversity of species although broadbill swordfish, the tunas, other pelagics, and bottomfishes dominate the catch. Assuming no major changes in overall fleet composition and size, revenue increases will derive largely from the realization of some additional fisheries potential. Additional fisheries potential exists for several pelagic species either currently underutilized or fished by U.S. Mainland or foreign fleets.

Obstacles to realizing these fishery potentials include competing Japanese (and other Asian) domestic production, highly restrictive quality and handling requirements for sashimi-grade product and in the case of albacore, at-sea transshipment options to canneries in American Samoa and Puerto Rico.

Competitive Advantage

Hawai'i offers three major advantages for commercial fishing: (1) proximity to rich fishing grounds, (2) harbors and other support facilities, and (3) excellent air-cargo service, thanks largely to tourism.

Goal

The economic goal for commercial fishing is an expanded role as a major provider of jobs and income.

In addition to its economic benefits, commercial fishing provides a desirable lifestyle for many residents, and fresher fish.

Policy

Support further development of commercial fishing at sustainable and environmentally sound levels.

Ongoing needs of commercial fishing are to determine sustainable yields of fishing grounds, and appropriate management practices to safeguard resources and the environment.

7. Forestry

Forestry in the form of sandalwood was Hawai'i's first large-scale export industry, but the industry collapsed because of high, unsustainable rates of harvesting.

Forestry is again developing into a significant export industry, with major plantings of fast-growing high-value trees occurring on former sugarcane lands on the Big Island and, to a lesser extent, on Kaua'i. Generally, these are lands beyond those needed for growing

crops. In addition to the forestry activities on private lands, mature trees on State lands above Hilo are to be harvested and the lands replanted with trees.

Depending upon the amount of land planted in forest and the market for wood products, large lumber and processing mills may also be built in Hawai'i to produce lumber and wood products.

Hawai'i also has a sizeable craft industry which is based on *koa* and other specialty woods.

Competitive Situation

Hawai'i's principal advantages in forestry are the availability of land (due to the contraction of sugar operations), high yields for certain tropical species, and its access to nearby ports for shipping. In addition, high-value specialty woods can be grown in Hawai'i, including *koa* and sandalwood.

For new forests in Hawai'i, profitability may be enhanced by carbon sequestration payments from companies as an offset of carbon emissions.

Competition comes from countries having virgin forests which can be harvested without the costs and delays associated with planting new trees, and from new plantings in areas where production costs are lower.

Also, forestry requires a long-term commitment of land which may preclude a future more profitable use of the land for growing crops.

Goal

The economic goal is for forestry and milling to become a significant supplier of jobs and income.

Forestry is desired because of its potential to use productively excess lands released from sugar production, its contribution to employment and income, and because it provides attractive greenery. In addition, the trees will make a small contribution to a healthier planet.

Policies

Aid in securing private lands and lease out State lands that would be appropriate for growing high-value trees, but excluding land that is needed for growing crops.

This would include lands which have already been cleared of native vegetation. However, priority in the use of lands is given to crop production because of its greater economic contribution.

Support development of non-polluting mills in Hawai'i to produce chips, fiberboard, veneer, and logs.

The purpose of this is to capture the economic benefits associated with milling but without compromising the environment.

8. Ocean Industries

Hawaii's ocean industries consist of maritime (ocean transportation), ocean recreation, seafood marketing, ocean science & technology, commercial fishing and aquaculture. Together, these industries generated an estimated $3 – 3.5 billion in revenues in 1998 and employed approximately 20,000 persons.

After the rapid rate of growth realized during the 1980's, deceleration to the more sustainable level likely realized during the 1990's required adjustment to new market-based realities. Most notably, opportunities began to be more aggressively sought in the international arena with growing emphasis placed on Asia and the Pacific islands. Discussion of potentials in aquaculture and commercial fishing has been included in previous separate sections.

Ocean Science & Technology

The ocean science & technology industry is comprised of multiple sectors including private businesses, nonprofit organizations, academic institutions and diverse government agencies. Research and development (R&D) on virtually every important facet of ocean activity is carried out, new ocean technologies are being developed, and coastal resource management consulting services are being directed to export markets.

Traditionally, the industry has relied very heavily on U.S. Department of Defense (DOD) funding (amounting to almost half of all federally supported ocean R&D in Hawaii), with much of the work being classified and the resulting products being of limited commercial potential. Increasingly, the industry is turning to the development of technology for the commercialization of new products and services aimed at creating compensatory demand in new niches. This change in focus is creating innovations in both marine science and technology and is being accompanied by the development of new facilities and infrastructure support.

New capabilities are emerging as clusters of applied technologies, especially from within the university and private sectors, which often are acting together as partners. The technology clusters include: mapping and surveying, remote sensing and imaging,

ship design and construction, acoustics and sonar, and, most recently, marine biotechnology. In many cases, these capabilities derive from government interest in dual use (defense and commercial), with the emphasis and necessary support being provided by DOD programs.

In a related context, coastal resources management (CRM) is an important subset of Hawaii's marine science and technology activities. With human populations in the Asia-Pacific region continuing to increase and moving to the coast, and a global middle class emerging, the demand for coastal resources access and use only continues to grow. So too does the need for natural disaster prediction (e.g. typhoons, tsunamis) and pollution control and mitigation. ***A more widespread application of CRM and the concomitant need for sophisticated marine environmental services (inclusive of greater scientific understanding and better technological tools for monitoring, surveying, mapping and remote sensing), is being driven by that demand***.

Seafood Marketing Program

Initiated in 1989, this program promotes the development of underutilized fishery resources and encourages substitutions for high demand species that may be at risk of overfishing. In so doing, the program contributes to a more balanced harvest of the resource and provides marketing support for fisheries management.

The marketing program encourages the taking of fish more evenly throughout the year and creates price incentives to distribute fishing effort across multiple species. It helps stabilize fish prices so that both the small and large producer benefits more equitably than is possible when marketing and promotional support is lacking or is insufficient. It does not discriminate among fishing gear types. It is based on a resource conservation ethic.

Ocean Recreation

The ocean recreation industry is highly segmented and dynamic. The kinds of marine activities generating expenditures include: tour boats and inter-island cruise ships, dive shops, ocean activity product manufacture and sales, charter boat fishing, recreational fishing, personal boating, major yacht races, competitive ocean swims, Hawaiian canoe races, wind-, board-, and body-surfing events, jet skiing, parasailing and ocean kayaking.

A number of important local factors greatly influence expansion of this industry. Of particular note, limited (and aging) harbor infrastructure and facilities, access and allocation issues, resource overuse and degradation and increasing concern for public safety are triggering regulatory and public policy changes of consequence to the industry and acting to constrain growth.

Growth will be highest in those sectors catering to an active clientele and providing a nature-based offering. Free of the constraints imposed by limited infrastructure and ocean and coastal regulatory policies and capitalizing on Hawaii's positive image as an ocean sports capital, ocean activity product manufacture and sales, including franchising and licensing of brands and intellectual properties (e.g. logos, designs), may well out-perform other sectors.

Maritime

The maritime industry is based primarily on ocean transportation services (i.e. cargo carriers) and shipbuilding and repair, but includes a broad array of support activities (e.g. marine fuels and bunker services, marine insurance, freight handling, salvage and towing, etc). Support activities make up nearly half of the total industry value. This classification does not include Pearl Harbor Naval Shipyard, the revenue and employment estimates for which are otherwise considered under defense spending.

The maritime industry anticipates an expanding Hawaii economy and the increasing cargo volume that will accompany rising levels of population, consumer spending, tourism and construction. Tariff rate hikes by the major carriers are likely and would increase total expenditures. A major increase in port calls by cruise ships is expected, especially to neighbor island harbors.

Outlook

After rapid growth during the 1980's, Hawaii's ocean industries in the 1990's saw growth slowing to more sustainable levels. As we cross into the next millennium, foreign markets and visitors, particularly Asian, will play a much greater role than previously in the development of these industries, especially for ocean science & technology and ocean recreation. The Pacific islands will become a more important source of raw product for seafood marketing and for seafood trading nationally and internationally by Hawaii firms. The value of aquaculture production will grow appreciably and greatly surpass revenues generated by that industry's service sector. Maritime growth will continue at a rate in line with changes in Hawaii's population base and the derived demand afforded by a generally improving economy.

To accelerate growth of Hawaii's ocean industries, government and industry emphasis will have to shift. Market share gained during the 1980’s and 1990’s will have to be protected and new markets will have to be developed. Costs will have to be contained for businesses to remain or become more price competitive. Permit simplification and possibly some form of regulatory relief to lower the government-imposed costs of doing business will become more critical. Ocean and coastal environmental assets will have to be better protected to remain attractive. Harbor infrastructure will have to be maintained to remain serviceable and even improved to support growth opportunities. And, facing stiff competition from just about everywhere else, Hawaii will have to target and more aggressively promote its ocean industry products and services in the international marketplace.

A major role for government can be in helping to identify economic opportunities and facilitating business access via infrastructure improvements, financing, training, regulatory relief and generic promotion. It can also involve assisting industry in strategic investigation and development of new markets and additional production resources, such as land, labor, raw materials and technologies.

III. (G) Environment and Development in the New Economy

As we enter the New Millennium, it is apparent that economic development, population growth, and world poverty have created increasing environmental damage. It has also become manifest that key resources are being used up. As both advanced economies and newly industrialized countries develop, they increase air and water pollution, deforest large areas, destroy the habitats of many species, contribute to global climate change, and pose increasing health risks to their populations. Yet as the deleterious consequences of accelerated development become more apparent; ironically, the greater wealth produced by economic development makes it more and more possible to meet societal needs and also increase protection of the environment.

New Thinking on Environmental Protection

Thus the New Economy not only calls for recognition of the changing product environment in which business enterprise operates, but new thinking as to the social consequences of the productive process. Properly designed environmental standards can induce innovation that can offset the costs of complying with them. Reducing pollution is often coincident with improving productivity. Firms can actually benefit from properly crafted environmental regulations that are more rigorous than those faced by competitors in other countries. By stimulating innovation and efficiency, environmental regulations can actually enhance competitiveness. And, as other countries raise their environmental standards, they become markets for environmental protection technologies.

Hawaii has long recognized that maintaining a clean and superior environment is basic to the health and continued sustenance of tourism, currently our main industry. It is vital for Hawaii's economic future that its environment be preserved and protected, and that economic development must be environmentally sustainable. In our New Economy thinking, we must appreciate that this environmental focus can also be the principal support of new technology-driven or inspired export industry.

Opportunities for Hawaii Enterprise

Several examples of ongoing programs within the State of Hawaii amply illustrate these New Economy opportunities. Take the example of infrastructure development within the growing Asia-Pacific region. In March, 1999, the Far East Economic Review estimated that eight Asian economies, China, Japan, South Korea, Hong Kong, Taiwan, Thailand, and India, would require $515.4 billion of basic infrastructure investments annually for the next 3 to 5 years. Much of this investment will be for clean energy and environmental technologies due to worldwide concern for sustainable development practices. In the U.S., we have succeeded in developing advanced technologies which have been driven by the desire to reduce dependence on conventional fossil fuels, reduce air and water pollution, and reduce the effects on global climate change.

In particular, Hawaii has shown that it is capable of facilitating exports of environmentally-sustaining technologies and related services, especially in the areas of renewable energy, energy efficiency, environmental management, control, and remediation, and ocean resource development. Government policies and regulations remain the major drivers creating the markets for commercial deployment of clean energy and environmental technologies and related services. Hawaii has taken the lead in entering into partnerships with host country governments that can directly result in business opportunities from environmental policies.

The State has signed an agreement with the Department of Energy of the Republic of the Philippines to provide advice on policies that will increase the commercial application of renewable energy and energy efficiency technologies in the Philippine economy. ***Assessment of biomass-to-energy conversion using waste materials from the agricultural sector, based on Hawaii experience, hold promise not only to increase the supply of green electricity, but also produce business opportunities for Hawaii companies that have perfected the technique.***

Both governments are currently working on a program to introduce performance contracting for energy efficiency investments in the Philippines, establishing in the process, a vibrant energy service company sector in the Philippine economy. Hawaii professionals in these fields have also been exposed to revenue-gaining opportunities in Vietnam and Hainan Province of China.

Agricultural Remediation

In the New Economy, there will be increasing opportunities for enterprising companies in the field of environmental remediation of contaminated sites left from the military-industrial complexes of the 20th Century. Increasingly rigid standards for environmental cleanup are being applies not only in the U.S., but throughout the world.

Throughout its history, the US Department of Defense (DOD) has mirrored the waste disposal practices of society as a whole, resulting in damage to the environment and the need for environmental restoration on military installations and training areas. It is estimated that DOD contaminated sites requiring some form of environmental remediation number some 21,000, with cleanup costs in excess of $25 billion. These sites are located throughout the world, including Asia and fragile Pacific Island ecosystems. Many of these sites contain petroleum products, industrial solvents, and other hazardous wastes that can be particularly damaging to the confined and limited natural resources of Pacific Islands.

These environmental challenges can be tackled through the development and demonstration of agriculture-based bioremediation techniques that utilize biotechnology to develop unique strains of plants and microorganisms to remediate contaminated soils and water resources. ***Hawaii has taken the lead through an Agriculture-based Bioremediation Program (ABRP) to protect and preserve vital agribusiness infrastructure. Through this Federally-supported dual-use process, exceptional***

economic opportunities can be opened throughout the world as both developing and industrialized societies direct more resources toward a cleaner environment.

Hawaii and the Kyoto Protocol

Hawaii industry can also play a significant role in dealing with global issues of carbon emission and climate change. One of the most innovative elements of the Kyoto Protocol was the recognition of carbon sinks. Newly-planted forests on previously cleared or non-forested lands are one of the main sinks recognized. Trees absorb carbon dioxide from the atmosphere and store or sequester the gas in solid form as new growth and increased soil organic matter that accompanies forest growth.

With large tracts of fallow agriculture lands in Hawaii remaining from now-closed sugar plantations, new business opportunities in sustaining forestry can assist energy companies in satisfying society's increasing demand for electricity while addressing serious long-term global environmental issues. ***Sizable investments in carbon sequestration can be attracted from outside Hawaii by partnering with the State and private landowners to mitigate global warming and create a sustainable local forestry industry, with value to be derived from the system of tradeable international emission credits established through the Kyoto Protocol.***

These examples illustrate that Hawaii needs and can profit from entirely new ways of thinking about the relationship between environment and industrial competitiveness—one closer to the reality of global competition. ***The focus should be on relaxing the environment-competitiveness tradeoff rather than accepting and, worse yet, embroiling it. The thought process must shift from pollution control to resource productivity.*** No lasting victory can come from policies that promise that either environmentalism or development must reign supreme. Instead, Hawaii's natural environmental emphasis can bring about innovation-based solutions that promote both environmentalism and global competitiveness.

IV. (A) Human Resource and Workforce Development

Hawaii's strategic technology-related assets – state-of-the-art telecommunications and supercomputing infrastructure, abundant renewable resources, and its unique research capacities in such areas as astronomy, ocean sciences, biotechnology, tropical agriculture, healthcare, and information technology – position our state to advance technology-based industries to fuel economic growth. But, Hawaii must also address the need for appropriately skilled workers in order to realize the economic diversification and growth potential offered through the emergence of newer knowledge-based industries.

Hawaii's economy was productive in the past because it had a population whose education and training matched the requirements and expectations of its major industries, agriculture, defense, and later tourism. However, as the mix of industries and required skills have changed, the education and training providers have not yet been able to produce enough individuals with the new skills and knowledge necessary to match current market demand. In addition, there is not yet a sufficient number of trainees in the "pipe line" to meet anticipated future needs.

Major changes in Hawaii's economic base have resulted in transformation of the types of skills needed to support new growth industries. While Hawaii's unemployment rate has remained at comparatively high levels over the past six years, there are many skilled jobs going unfilled. Thus, it is imperative that plans for technology-based economic development provide for investment in human capital to ensure the mobility and employability of workers in emerging industries, as well as increasing the productivity of existing enterprises. This calls for structural change and expeditious action along several fronts.

Education and Training Requirements for the New Economy

The first is recognition of the changing technology base and employee performance expectations of existing and new employers. Hawaii's current employers are often compelled to adopt many new technologies and operating practices to remain competitive. They need avenues to train their current workers and the assurance that people entering the workforce will have a set of core skills and knowledge consistent with new workplace demands. These new expectations include: higher levels of basic literacy skills, customer service skills, appropriate use of computers and software, etc. It is also important that this education and training be designed at a level that measures up to globally competitive expectations.

Second, this new competitive atmosphere, not exclusive to Hawaii, has caused many employers to make dramatic changes in their work environment. To reduce the time it takes to develop, produce, and distribute products, firms are reducing the managerial/supervisor support staff and are delegating functions downward to the workspace level and broadening worker responsibilities. Thus, workplace "re-engineering", coupled with workforce downsizing, has put great demands on remaining workers to become more skilled and more productive.

Third, if Hawaii is to be successful in developing and sustaining a competitive workforce, it is critical that training prepare individuals to meet national and international standards and industry recognized certification programs. It is essential that Hawaii develop local capacity to deliver the education and training necessary to meet these standards and thus increase the productivity of existing industries and facilitate the adoption of new technology and processes into the current workplace. In addition, in those areas where we have quality programs with sufficient capacity to satisfy local employment needs, there is opportunity to pursue regional and international outlets. If we are able to meet external market requirements, education and training can become a significant export opportunity.

Fourth, workforce training and education programs can capitalize on Hawaii's strategic competitive advantages. These advantages include: culture, location, and geography. Our rich Asian and Pacific cultural heritage and population provide us with ready entrée to developing economies in the region. Our location can allow us to play a role in educating and training people from throughout Asia and the Pacific. Our geography provides us with unique physical advantages. For example, our mountains, ocean, and relative isolation from the continental U.S. provide a natural laboratory for agricultural, biological science; oceanographic, atmospheric, and astronomical research; and the economic product development, education, and training that can evolve from these activities.

Millennium Workforce Development Initiative

To deal with these issues a Millennium Workforce Development Initiative was created through the vision of Governor Cayetano and implemented under the direction of the Department of Labor and Industrial relations (DLIR) with support from the Department of Business, Economic Development and Tourism (DBEDT). The Initiative's short term objectives were to identify immediate technology workforce needs and to recommend education and training programs in response to those needs. Its longer term objective was to identify needs, goals, and actions to build the skilled workforce necessary for sustained technology-based industry development. The short-and long term objectives of the Initiative address the preparation of new workers as well as retraining of incumbent workers to keep pace with changing science and technology demands.

In their early deliberations, the Initiative's private sector-led focus groups were consistently reminded that economic innovation is predicated not only on the development of new products, materials, and production methods, but also on new ways of working, financing, marketing, and distributing goods and services, as well as better ways of organizing the workplace and managing business. All of these factors are tied to the skills and availability of the workforce, and to a large extent, the success of economic innovation is predicated on appropriate workforce training.

This truth is manifest in growing income inequalities which largely follow patterns of investment in education. Income has grown steadily among the top 15 – 20% of the U.S. workforce (largely among professionals and managers), who continually receive an

estimated 70% of all training expenditures by private business. The jobs they perform also tend to enhance their knowledge and skills on a consistent basis, thus allowing them to become more productive and efficient – and, in turn, more highly paid.

By contrast, the lion's share of the U.S. workforce is trained largely in public elementary and secondary schools, and receive little or no additional training during their professional career. Their jobs rarely expose them to new information or new ways of thinking, which eventually translates into a decrease in productivity and efficiency, as well as a cap on their professional remuneration.

Human Resource and Workforce Development Recommendations

As such, in Hawaii as elsewhere, greater attention should be given to establishing linkages between industry and the state's education community to plan for and meet the anticipated increases in the industry's employment and training needs – both in terms of programs that teach entry-level workers relevant skills, as well as to empower current workers to upgrade their skills to match industry expectations. To support this objective, the following recommendations are proposed:

- ***Create workforce development programs for technology companies that include classes tailored to company needs and product development scheduled. Vocational education in high school and community colleges must be retooled from established trade skills to job skills in fast-paced technology sectors.***

- ***Develop K-12, community college, and university technology teacher and student internship programs with Hawaii technology companies. The opportunity for teachers to participate in the real world of science and development would provide additional insights for the teacher and transmit the knowledge back to the classroom.***

- ***Reach out to corporate technology partners in the state and on the Mainland to create a statewide web site that coordinates information exchange between teachers, students, and technology firms to share insights into the future of science and technology in Hawaii and beyond. A coordinating committee comprised of representatives from industry and education should approach companies that have interactive web sites that provide information and educational materials to school districts and community colleges.***

Essentially, the Initiative's findings clearly indicate that human capital development is a key area where Hawaii can gain competitive advantage. We are already at the forefront in many strategic areas. To encourage further progress, we need to emphasize programs, for example, that teach skills such as information technology in our schools and make optimal use of our extensive telecommunications facilities. It is essential that the University of Hawaii continue to expand and improve the scope of its technology-related research and development efforts. In particular, the UH should be encouraged to increase its partnership with firms and State government offices to transfer efficiency-enhancing

technology and help develop facilities and a support network for the various areas in which Hawaii can excel.

By strengthening our educational and training programs, we can improve the competitiveness of our existing industries and, at the same time, attract new businesses that will be the driving force in the worldwide technology development effort.

IV. (B) Venture Capital and Investment

Hawaii lacks capital to help fund new companies, particularly high-tech ventures for which the main asset is intellectual property. This has hindered the development of some companies, while other companies have been forced to move to the mainland in order to receive venture capital.

Across the country, venture capital has been critical to the development of emerging growth and high technology industries and small businesses in regions such as Silicon Valley, California; Route 128 in Boston; Austin, Texas; and Research Triangle in North Carolina. Nationally, approximately $14 billion dollars in venture capital funding was invested last year.

Hawaii has many exciting opportunities in the areas of biotechnology, diversified agriculture, telecommunications and information technologies, including new technologies utilizing research conducted at the University of Hawaii. New companies and industries built around such technologies offer the hope of attaining competitive advantage for Hawaii's economy. However, without sufficient venture capital to finance companies that can successfully commercialize promising technologies, the potential for growth and diversification will not be fully realized.

The issue was highlighted recently when the local biotechnology company with the right to license the "Honolulu" mouse cloning technology, which received so much national and international attention last year, seriously considered moving to the mainland, due to the shortage of venture capital in Hawaii to fund its growth.

Other start-up companies in the fields of pharmaceutical research, high value, genetically engineered agricultural crops, aquaculture, and micro-algae product development are seeking equity financing to expand their businesses.

The need for venture capital, private equity and alternative financing is not limited to high technology alone. Numerous existing low and "mid-tech" companies in Hawaii need startup, expansion and growth financing beyond what commercial banks can legally provide under existing regulatory constraints.

The problem and consequences are perhaps best demonstrated by successful local companies, which have been funded primarily by mainland money. These include, Verifone, which was acquired by Hewlett Packard for approximately $1 billion, Aloha Networks, which developed some of the basic technologies for the Internet, and Digital Island, which was founded in Hawaii and has become a leading global provider of Internet services.

Goal

- ***The goal is for Hawaii to have a supply of investment capital that is sufficient to fund all deserving ventures.***

Policies

- ***Encourage private lending to and capital investment in technology-based ventures in Hawaii.***

This will require wealthy "angel" investors, investment *hui*, and Hawaii financial institutions to develop expertise on evaluating technology-based ventures that are secured by intellectual property rather than by real estate, and a willingness to invest in such ventures.

- ***Encourage the Employee Retirement System (ERS) and other large institutional investors to allocate a portion of their funds to support high-tech ventures in Hawaii.***

Funds are invested in high-tech ventures on the mainland but generally not in Hawaii. In this regard, Governor Cayetano has taken the lead in introducing legislation urging the State Employees Retirement System to set aside as much as $30 million for investment in Hawaii's high-tech start up companies.

- ***Increase funding of State loan and venture-capital programs that support technology-based ventures, and leverage State financing to attract matching private funding of these ventures.***

State funds would compensate for the inadequate supply of private financing available in Hawaii for technology-based ventures. Leveraging the funds with private investors increases the available funding, reduces risk because of the involvement of professional evaluators, and helps build a network of Hawaii investors as well as the professional expertise necessary to evaluate investments.

IV. (C) Energy, the Economy, and New Technology

Energy is essential to Hawaii's economy. Energy is used by the jets bringing visitors to the islands and provides ground transportation, air conditioning, hot water, and lights to make their stay more comfortable. Energy supports Hawaii's military installations and the military's Hawaii-based operation. Energy is used to grow, harvest, and refine Hawaii's agricultural products. Energy use by Hawaii's residents is a major component of consumption activity. Energy-related companies make up a large segment of Hawaii's economy. As many of the new technologies are information based, energy is essential for the operation of computers and telecommunication devices.

As an historically isolated, but globally emerging island economy devoid of fossil fuel resources, Hawaii has become dependent, perhaps over dependent, on external sources, considering that the State uses oil to meet almost 90% of its energy needs. Yet, internal technological progress has been instrumental in maintaining Hawaii's past economic development, providing for a stable current resource base for growth and diversification, and positioning the State to meet both domestic and global challenges in the New Millennium.

State Energy Policies

Hawaii's management of its energy requirement over time clearly reflects knowledge of and adaptation to technical change.

As recently as 1962, 18% of Hawaii's primary energy came from renewable energy -- biomass-fired electrical generation and hydroelectricity produced by sugar plantations. As Hawaii grew and rapidly developed, electricity needs were met by new oil-fired utility generation as the sugar industry declined. In the 1990's, the addition of municipal solid waste-to-energy plant, geothermal energy, a large hydro plant, and a coal plant helped offset declines in biomass electricity production. By 1997, oil use was 87.9%, with recent trends showing roughly a 6.7% share for renewable energy use, a percentage that should be increased with future technological improvements.

In its efforts to promote the efficient use of energy in the face of external threat, the State has adopted the following energy objectives:

- Dependable, efficient and economical energy systems capable of supporting statewide needs,
- Increased energy self-sufficiency toward the objective of increasing the ratio of indigenous to imported energy use, and
- Greater energy security in the face of threats to Hawaii's energy supplies and systems.

An integrated resource planning approach (IRP) has been employed to evaluate progress toward meeting these objectives. IRP is an approach to regulated utility planning which

evaluates all potential energy options, including supply-side (energy production by conventional fuels and renewable energy resources and demand-side management (energy conservation, efficiency and load management) as well as the social, environmental, and economic costs of these options. The goal is to see whether consumer energy needs can be met on an efficient and reliable manner at the lowest reasonable cost.

Still Hawaii is far away from its sources of oil and remains dangerously dependent on oil for its energy needs. At the present Hawaii is not dependent on "insecure" sources of oil from politically unstable regions. Hawaii has had no oil and coal supply problems during the recent Asian economic crisis despite considerable political and social unrest in Indonesia -- the source of 31% of the oil imports in 1997. Nevertheless, future domination of the world oil market by Middle Eastern oil produces could raise the price of oil, with serious negative effects on a travel-dependent economy.

Energy and Environment

There is also an important link between energy use, the economy, and the environment. Hawaii enjoys a beautiful natural environment, which provides pleasant living conditions for residents and is the major reason tourists come to the Islands. Climate change due to greenhouse gas emissions that cause global warning may have many potentially negative effects on health, coastal areas, water resources, agriculture, forestry, ecosystems, and the economy in Hawaii unless measures are taken to mitigate its effects

Just as the technological improvement has sustained Hawaii's past economic performance, it has an important role to play in the New Millennium. Hawaii must balance its energy needs, economic growth, and environmental protection. In general, efforts to improve energy efficiency can reduce energy costs and permit businesses and consumers to spend their money in ways more productive to the local economy. In addition, investment in alternate energy resources within the state, may not necessarily reduce, but more of the money spent will remain in the local economy and less oil use will reduce economic and environmental risks. While they are not likely to overcome a massive reliance on overseas oil, the technologies Hawaii uses or develops to protect its environment and mitigate the effects of climate change can provide for economic and export opportunities.

New Technology for Hawaii's New Millennium

New technology is clearly needed to make major changes in Hawaii's energy system, to reduce energy costs, and reduce fossil fuel use and resultant greenhouse gas emissions. Hawaii research and development projects give promise of major contributions to national energy resource development and alleviation of international concerns over greenhouse gas reduction and climate change mitigation. Continuation and extension of these programs should receive high priority early in the new millennium.

Hydrogen: Fuel of the Future. Hydrogen has been called the fuel of the future. It may be the ultimate energy carrier -- a versatile, transportable fuel that can be converted easily and efficiently to other forms of energy without producing harmful emissions. In the past, the cost of production, difficulties in storage, and lack of infrastructure have been obstacles to everyday use of hydrogen. The U.S. department of Energy Center for Excellence for Hydrogen Research and Education at the University of Hawaii's Hawaii Natural Energy Institute (HNEI) is conducting research to address the cost and storage issues. Work is underway in the area of photoelectrochemistry, biomass gasification of hydrogen, and hydrogen storage technologies.

New Technology for Charcoal Production. Charcoal has been made in virtually the same way for 6,000 years. The process is long, causes severe air pollution, and has low yields. An innovation by HNEI researcher Dr. Michael J. Antal, Jr. offers the potential to greatly reduce production time to an hour or less, while reducing smoke and other pollution, and doubling or tripling yields. This technique could help slow deforestation and reduce pollution in the many developing nations that use large amounts of charcoal, reducing greenhouse gas emissions.

Open-Cycle Ocean Thermal Energy Conversion (OTEC). The technology for generating electricity from different ocean temperatures is known as ocean thermal energy conversion or OTEC. OTEC makes use of the difference in temperature between the warm surface water of the ocean and the cold water in depths below 2,000 feet to generate electricity. As long as a sufficient temperature difference (about 40 degrees Fahrenheit) exists between the warm upper layer of water and the cold deep water, net power can be generated.

Almost all of major U.S. OTEC experiments in recent years have taken place in Hawaii. The Natural Energy Laboratory of Hawaii Authority (NELHA) on the Big Island is recognized as the world's foremost laboratory and test facility for OTEC and OTEC-related research. The State of Hawaii funded the facility, with significant USDOE participation. OTEC continues to offer a way to generate greenhouse emission-free electricity. Additional research, component cost-reduction, and funding of a utility-scale plant are needed to create a viable commercial technology.

International Co Ocean Sequestration Field Experiment. During the Third Conference of the Parties of the Framework Convention on Climate Change at Kyoto in December 1997, agencies of the governments of the United States, Japan, and Norway signed a major international research agreement to develop technologies to sequester Co removed fossil fuel combustion from the atmosphere. The objective of the experiment is to identify safe and practical means of reducing Co emissions while ensuring a stable and inexpensive energy supply. The Pacific International Center for High Technology Research (PICHTR) of Honolulu is the general contractor. The experiment will take place in the ocean research corridor offshore of the Natural Energy Laboratory of Hawaii Authority at Kailua-Kona, Hawaii.

Facilitating exports of sustainable technology to the Asia-Pacific region

As in the discussion of how the State might capitalize on its knowledge of technological advances in environmental management to provide professional guidance and services to developing Asia-Pacific economies, similar opportunities exist in the area of energy technology.

Hawaii's Strategic Technological Market Assessment and Development (STMAD) Program has been designed to facilitate increased exports of U.S. energy, environmental and other sustainable technologies and related services into Asia/Pacific markets. STMAD focuses on Asia-Pacific markets due to their high growth and future potential. Key objectives of STMAD are to facilitate sustainable, technology-related economic development, create higher valued jobs, and diversify the State's economy. Potentials for Hawaii and U.S. exports of sustainable technology abound in renewable energy; energy efficiency; advanced high-efficiency fossil fueled energy; recycling reuse, and remanufacturing; information technologies; health care; ocean science and technologies; and environmental management, control, protection, and remediation. The energy-related elements of STMAD in particular will help reduce fossil fuel use and mitigate and reduce greenhouse gas emissions, which contribute to global climate change.

Partnerships with industry through business opportunity missions, government-to-government contacts throughout Asia, and business leads through workshops and conferences in Hawaii are the central component of STMAD efforts. STMAD seeks to match commercial applications of sustainable technologies and related services to targeted demand in the Asia-Pacific region.

Unlike straightforward product exports, business, and technical transactions inherent to development of environmental infrastructure in the Asia-Pacific require strong cross-cultural understanding. Hawaii has a strong Asian orientation, so there is an inherent and valuable knowledge of the various Asian cultures among its citizens. This could enhance the State of Hawaii's ability to fill the emerging need for individuals who can operate cross-culturally in supporting the delivery of hands-on energy and environmental technologies.

IV. (D) Telecommunications

As the State moves into the New Economy business environment, an important and strategic component of its infrastructure is its telecommunications network. Situated at a diversified hub of trans-Pacific fiber optic cables, satellite links and cellular and wireless networks, Hawaii provides a full range of telecommunications services to local communities as well as to all domestic and foreign destinations.
In view of its strategic mid-Pacific location, state-of-the-art infrastructure, and resident expertise, Hawaii has become a strategic node on the Information Superhighway serving the Asia-Pacific Region. A variety of satellite and terrestrial networks have been developed to service a broad range of applications in electronic commerce:

More than 29,000 miles of intra- and inter-island fiber optic cable link our island communities to the world. One undersea cable, a "super-carrier", increases total capacity by 130 thousand circuits and provides a separate, redundant back-up for the entire fiber cable network in the Pacific.

In 1998, 100% of local telephone lines were converted from analogue to digital switching and a new inter-island fiber optic cable system was established, affording customers competitive choice and pricing for telephonic service.

High data rate links with more than 30 state-of-the-art telecommunications satellites complement Hawai i's terrestrial fiber network, and provide rapid connectivity to remote locations throughout the Asia-Pacific region.
Hawaii also has the highest per capita use of cellular telephones in the nation, and companies statewide now provide a wide range of cell services.
A progressive state regulatory framework that is recognized as one of the best in the nation complements Hawaii's state-of-the-art telecommunications infrastructure and capabilities.

This extensive telecommunications capability is facilitating a broad range of applications statewide.

Cable television extends to 97% of residents on Oahu, and cable franchises operate on all major islands, which can be used to support a wide variety of digital services.
The State maintains fiber and microwave telecom networks (voice, date, video-conferencing) to facilitate public education programs and inter-agency communications.
Internet web page designers and telecommunications software producers are well established throughout the state.

In all, telecommunications technology in Hawaii has generated over 6,000 skilled jobs statewide, and continues to grow as one of the state's most promising industries.
The High Technology Development Corporation (HTDC) is implementing the Hawaii Telecommunications and Information Resource Network (HTIRC) ÿ an ATM system that is enabling the development of information products and services in the fields of telemedicine, distance learning, earth sciences, and date vaulting. HTIRC links the major

Hawaii islands to each other, as well as to the Pacific Region, North America, Asia, Europe, South America, Australia, Africa, and the Middle East via fiber optics, digital microwave, and communications satellites.

The University of Hawaii's Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT) program provides public service telecommunications to the Pacific arena in support of: (1) medical and environmental emergency management, (2) health and medical services, (3) distance learning, (4) basic research, (5) economic development, and (6) training and technical assistance. Its primary mission is to enable Pacific states to share information with each other in addressing problems common to the region.

On the cutting edge of telecom technologic, the City of Kapolei on Oahu's central plain has been designed to provide optimal telecommunications connectivity in the 21st century. A central feature of this strategic development is the Kapolei Teleport, which is ideally positioned to serve as a relay point connecting telecommunications satellites serving the Asia-Pacific region and the Americas.

The teleport is expanding to provide interconnectivity between terrestrial fiber optic networks and the earth segment connections to numerous new regional satellites making it a true gateway to Asia. This will enhance many applications, such as the extension of Internet services into the Pacific and Asia. The Teleport is also linked via T-3 fiberoptic cable to the Maui High Performance Computing Center. Plans for expanding the facility include establishment of interconnectivity between overseas terrestrial and satellite links that will enable Hawaii to serve as a trans-pacific bridge for high definition video transport.

V. Hawaii and the New Asia-Pacific Millennium

Hawaii's role in the Asia-Pacific has been well trumpeted if not fully chronicled. Hardly a speech or an article goes by without reference or obeisance to the economic benefits that would accrue to the islands if only we had the knowledge or foresight to look West to the Far East.

The University of Hawaii, East-West Center, other Federal and State institutions, as well as the private sector have made contacts and proceeded with activities individually or jointly, that have promoted Hawaii's prominence in the Asia-Pacific.

Among the state agencies, the Department of Business, Economic Development, and Tourism has been charged with fostering economic and business interaction with agencies, firms, and officials of key Asia-Pacific countries. Suggestions or proposals for New Millennium activities are based on the department's previous initiatives and experience in dealing with Asia-Pacific markets and overriding issues throughout the region. They do not exclude, but rather welcome the participation or cooperation of other public or private agencies.

Hawaii's Asia-Pacific New Millennium agenda will therefore include:

> ***Expanded exports of professional services (and related goods) to Asia-Pacific developing countries.***

The State's endeavors are being monitored by the Department's Strategic Technology Marketing and Developing Program (STMAD) which focuses on Asia-Pacific markets. In particular, Hawaii is seeking to facilitate U.S. exports of technologies and related services, especially those related to renewable energy, energy efficiency, advanced highly efficient fossil energy, recycling, reuse, and remanufacturing, ocean science and technology, information technologies, healthcare, and environmental management, control, protection, and remediation.

Since competition for such projects is fierce and the returns can be quite high, Hawaii's New Millennium approach has to be the building of genuine partnerships between industry and the private sector so that the official (necessary for Asia) contacts between governments and the professional expertise of private firms can be brought to bear in the securing and implementation of contracts.

This was clearly evidenced in the initial exchange between Governor Cayetano and, then Philippines President Fidel Ramos, which led to an award to Hawaii's Energy, Resources, and Technology Division and the University's Natural Energy Institute to conduct field studies and make recommendations to the Philippines government to apply the most economic, environmentally responsible technologies for conversion of biomass materials into commercial energy. The experience developed in Hawaii's sugar plantations gave the State's technologists the initial edge in securing this project.

The database and networking that stem from this effort ultimately will help to identify opportunities and strategies for Hawaii companies to serve markets in the Philippines and other countries such as Vietnam and Cambodia for commercial deployment of bio-energy technologies, products, and services.

Opportunities for engagement of Hawaii-based technical professional services also exist in the development of basic infrastructure and, as indicated in a previous section, in the installation of up-to-date environmental technologies.

> ***Provision of intermediary technical services, emphasizing the state's ability to bring together Asia-Pacific officials and U.S. (Hawaii) enterprises to consummate a great variety of infrastructure development and financing transactions.***

This approach was inspired by the State's Infrastructure Project Finance seminar in 1997 with Provincial leaders from the People's Republic of China. The seminar provided participants with the latest knowledge of many innovative options available analysis of specific projects that Chinese seminar participants presented for discussion with private sector financial experts and Hawaii project developers. Furthermore, personal contacts with company representatives were initiated at the seminar to provide a starting point from which the actual project finance and negotiations for actual development by Hawaii companies may proceed.

In the New Millennium, Hawaii will seek to regularize the beneficial aspects of this approach through expansion of the outreach of DBEDT's Center for Asia-Pacific Infrastructure Development (CAPID). In partnership with private companies and other organizations, such as the Asian Development Bank and the U.S. Department of Commerce, the Center will assist firms in establishing relationships crucial to successfully entering markets in the Asia-Pacific. CAPID's overarching mission will be to promote exports of U.S. energy, environmental, transportation-related and other infrastructure technologies and related services to facilitate sustainable economic development throughout the Asia-Pacific region, while helping to diversify and strengthen the American (and Hawaii's) economy.

In addition, its New Millennium agenda will seek to facilitate institutional capacity building efforts in Asia, designed to foster best practices in infrastructure regulatory reform, government financing and incentives, and to achieve greater coverage and efficiency in critical social infrastructure areas such as health, nutrition, and education.

> ***Extension of technological exchange and technical assistance to countries where working relationships have already been established. These include: the Hawaii-Okinawa Partnership which addresses both micro and macro issues that may be common to the two entities.***

To date, joint project teams in six "macro" areas have been established, including fruit fly management, coral reef monitoring, environmental preservation, ***sustainable*** tourism,

healthcare, and applications of deep sea water technologies. Format project proposals and funding requests (to Japan's central government and the Japan Foundation) are currently under development, including a plan to establish an Asia-Pacific Development Center in Okinawa, with assistance from Hawaii, to address "macro" issues (e.g., trade and education).

Japan-U.S. Science, Technology & Space Applications Program (JUSTSAP).

This program provides a forum for scientists, scholars, businessmen, and government officials from both nations to explore areas for bilateral collaboration in science and technology. To date, five working groups have been established satellite telecommunications, disaster management and observation, the development of small satellites, microgravity research, and other science and technology areas (telemedicine is currently being discussed) to spearhead collaborative activities.

A highly promising and useful program is being developed under JUSTSAP that will enable Hawaii's Pacific Disaster Center to share real-time and archived data sets with the Asian Disaster Reduction Center in Japan, providing critical disaster-related information to key officials to reduce the loss of life and minimize the environmental impacts of natural and man-made hazards (including impacts on Hawaii). Further, this provides opportunities for Hawaii-based companies to contribute their technical experience and expertise in developing a "seamless" disaster management network bridging Hawaii to the Asia-Pacific region.

Exploration of potentials and development of economic and business relations with newly-emerging but large market economies such as the People's Republic of China.

The Seattle WTO fiasco notwithstanding, the China market can offer vast returns to Hawaii firms and productive relationships with Hawaii agencies in the New Millennium. High-ranking officials, such as Wang Daohan, the Senior Advisor on Taiwan negotiations Chen Yuan, Deputy Governor of the People's Bank, Long Yongtu, Vice Trade Minister, and the Governors of Hainan, Guangdong, and Jiangsu provinces, have urged closer economic and business relations in Hawaii. This provides ample opportunity for future entrance into this vast market.

Hawaii as a mecca for international firms seeking entry into Asia-Pacific markets.

An outstanding entry has been the establishment of a permanent secretariat in Honolulu by the prestigious Pacific Basin Economic Council (PBEC). This organization will hold its first New Millennium conference in Honolulu, March 2000, with the expectation that annual or periodic events will be scheduled here hereafter. Such programs can be buttressed by State action in establishment of computer-generated data bases: bi-country market assessments; technical exchange and business opportunities missions;

government-to-government contacts throughout Asia, often at the ministerial level: and helping industry develop business leads through workshops and conferences in Hawaii.

Establish an Institute on High-Tech Development in Asia

Supported by contacts in Asia, the Institute would closely monitor selected high-tech progress in Asia (e.g., Japan, Taiwan, Korea, People's Republic of China, India), build a physical and electronic library on these subjects, and become the recognized national resource on high-tech activities in Asia. Aided by scanners and computerized translation programs, bilingual technical staff would translate into English selected high-tech materials that are not normally available to Americans. Other services would include publishing newsletters describing new technological developments in Asia and their implications, hosting a series of annual seminars and conferences on high-tech themes, maintaining a directory of high-tech Asian companies and their capabilities, consulting with mainland companies and possibly brokering deals between Asian and American companies.

Funding would come from Federal agencies and U.S. companies who stand to benefit from monitoring high-tech developments in Asia. Their interest would stem from two factors: (1) Asian organizations may be first to make discoveries or advances in certain fields, and (2) high-tech advances occur more quickly and more cheaply if they build on the progress of others.

Such an Institute would advance Hawaii's high-tech industry in three ways. First, the Institute would provide high-skilled or high tech jobs. Second, it would define a highly visible niche in the high-tech field for Hawaii. In this regard, the Institute would help draw companies and venture capitalists to Hawaii so that they are more likely to consider high-tech opportunities in Hawaii. Third, the knowledge gained could result in the spin-off of high-tech companies in Hawaii.

Hawaii as the Knowledge Center for Asia-Pacific trade, finance, and development.

In tune with the general Millennium focus of this report and possibly overlapping with some of the previous suggestions for Hawaii's Asia-Pacific agenda, the state will be the place which accumulates knowledge in this area and exudes this knowledge in meeting their objectives.

Hawaii's New Millennium tasks in this context will be to:

- Assess the important ingredients of the Asian development model in light of current developments stemming particularly from the financial and capital account crises;

- Focus on the inherent strengths of the Asian development process to see how they might be enhanced to sustain economic recovery;

- Analyze weaknesses that may have been exposed during the current crisis, and recommend policies and actions that can ensure long-term economic growth;

- Recognize individual country distinctions and differences that may be critical for policy and decision making for successful recovery and long-term sustenance;

- Highlight key lessons and insights that may be particular useful or applicable to other developing and emerging economies; and

- Provide the research and policy analysis backup for future trade; investment, and development ventures.

VI. Planning and Quality of Life*

A Historical Perspective

Looking ahead at the next millennium is without a context unless one looks back at some of the key forces shaping Hawaii's growth and land development.

As Hawaii strode forward in the early 1960s with a newly-won statehood, its economy was confronted with multifold challenges. The plantation pillars, sugar and pineapples which had sustained economic growth from the beginning of the century were experiencing steady decline due to a combination of falling overseas revenues and rising domestic cost. They were also facing increasing opportunity cost as an emerging tourist industry began to sprout its post statehood wings.

The overall economic climate was exacerbated by the postwar drop-off in defense expenditures which had propped up the Hawaii economy during and immediately following the conclusion of the second world war.

There was increasing competition over use of prime agricultural lands for residential, hotel and commercial use. At that time, the choices were stark. A rush to the fast lane could lead to pell-mell, hell-bent development of choice parcels without reasoned assessment of public costs versus private benefit, or worse yet expose the islands to speculative urges or surges at high cost to the state fisc.

Under Governor John Burns, Hawaii opted for a controlled but flexible growth policy—controlled in terms of State jurisdiction over the use of scarce land and water resources but flexible in terms of allowing changes when warranted or justified.

Thus the State Legislature enacted the Hawaii Land Use Law, the first statewide developmental law of any of the 50 states. This law has withstood the test of time and unfolding events, despite numerous attempts at repeal.

Its implementation was placed under the jurisdiction of a nine-person Land Use Commission (in its original status, private citizens representing each county together with two State government directors; subsequently, transformed into an all-citizenry body.

Under the land use law, the State is divided into urban, rural, agricultural, and conservation districts, each based on specific criteria. Changes in designation must be approved by the commission through a hearings procedure in which proponents and opponents of the change are given opportunity to present their case.

The law has thus provided both a substantive and legal basis for implementation of a State growth policy, which in the post-statehood era has focused on public infrastructure, primarily in educational facilities and neighbor island development.

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* *Contributed by Mary Lou Kobayashi, Office of Planning*

An often uncited aspect of this policy has been the leeway given Hawaii's four county governments in determining the types of activities permitted in the Urban land use district within which the majority of economic development occurs.

It is also significant to note that this basic framework was laid out prior to the upsurge of the tourist industry in the 1970s. Both visitors from the U.S. mainland seeking to capture the subtropical magic of their newest state and newer incomers from Japan endowed with their strengthening yen, have been able to witness an environment which has met their expectations, the economic slump notwithstanding.

The State's vision to attract high technology companies and to retain its economic driver, the visitor industry, rests on its ability to maintain its quality of life. High tech industries are not subject to the same locational constraints as typical smokestack industries. Many have relocated to areas, which are "nice places to live". For example, the area between Boulder and Denver, Colorado has experienced explosive growth due to the influx of high tech firms.

Hawaii's ability to attract and keep such firms and the skilled workers that they need depends on keeping Hawaii a desirable place to live and work. In addition, Hawaii's beautiful scenery, mild weather, friendly people and many cultural and recreational opportunities make it a premier destination area. Hawaii is consistently rated as one of the best states to live in when criteria include environmental factors, low crime incidence, quality education and longevity. Hawaii's quality of life reflects the advantages of the state's climate, health, recreation and cultural opportunities.

As Hawaii approaches the 21st century, the intensity of growth and development issues is likely to increase. ***Several challenges are apparent: 1) increasing threats to agricultural lands; 2) the need to better plan and coordinate infrastructure development; and 3) the need for an improved growth management system.***

Agricultural Lands

Although the importance of agriculture in Hawaii's economy has declined over the past twenty years, agriculture remains a significant economic force in the State. Agriculture in Hawaii generates $2.9 billion and provides 42,000 direct and indirect jobs.

There are also some exciting new players in Hawaii agriculture with increased investment from seed companies and interest from biotechnology companies. The number of mid- and small- sized entrepreneurs have also increased. There are also opportunities to be gained from the existence of plantation agriculture, especially irrigation systems.

Nationally, farmland preservation is a hot issue tied to curbing urban sprawl. In addition, the federal government and other states see this as an economic issue as agriculture is one of the United State's largest exports.

In Hawaii, the 1987 Constitutional Convention gave additional support to important agricultural land by adding explicit language to the State Constitution.

The as yet uncompleted task is to develop and obtain legislative approval of standards and criteria to identify important agricultural lands.

Infrastructure Planning

Infrastructure planning is critical because of the close inter-relationship between infrastructure and the location of growth and development. The presence of infrastructure often directs where growth occurs although one could argue that land use policy should direct both.

In addition, under the existing tight fiscal conditions, it is imperative that public infrastructure spending be carefully evaluated so as to make the best use of public funds. The location of such infrastructure should not encourage sprawl which in turn increases public costs.

A stronger role for planning is also needed in the coordination of public infrastructure in support of private economic development projects. Infrastructure spending has always been used as a means of promoting economic development. Roads, airports, harbors and other publicly-financed infrastructure elements are essential to the conduct of business.

Responsibility for administering the State's capital expenditures is presently fragmented. It is divided among Department of Transportation-airports, harbors, highways; Department of Land and Natural Resources-water, parks, small boast harbors; Department of Accounting and General Services-public buildings, stadium; Department of Budget and Finance; and the Governor's Office. Projects tend to address agency or at times special interest priorities and thus hinder the achievement of State economic development priorities.

There is a need to assure that state capital expenditures in support of economic development are allocated strategically so as to achieve the greatest potential benefit in job growth and increased competitiveness.

Infrastructure planning is also critical for the development community so that they will know what to expect in terms of government projects and their timing and implementation and can plan their investments accordingly.

Better coordination and strategic direction can be achieved in this area by designating a single agency to prepare a summary of projects in relation to economic development goals so that the Governor has the means to set priorities and coordinate expenditures.

Growth Management and Quality of Life

Global and national trends are omens of increased development pressures on our island State.

The earth has been compared to a spaceship where life is dependent on a limited supply of air, water, food and fuel. As an island State, Hawaii resembles the planet earth in this sense more closely than any of the other states. Hawaii has limited land, water and other natural resources and there is a need to protect our fragile and unique resources.

From a global perspective, population growth and its impacts pose significant challenges. A thousand years ago, there were 500 million people on this planet. In the year 2000, the world's population will be 6.2 billion persons.

On the national scene, over the next 50 years, planners across the country will be trying to accommodate another 125 million people, four times the current California population.

In Hawaii, planners will need to accommodate an additional 293,971 persons and 164,826 new dwelling units between 1990-2020. Residential uses under existing densities could require an additional 17,435 acres statewide, 7,721 acres on Oahu alone. Where should this growth be accommodated, especially when large acreages are in steep slopes e.g. the Koolau and Waianae Mountains, gulches or hazard areas.

National trends, as evidenced by past development patterns, suggest that future growth will be concentrated in coastal communities. It is anticipated that this trend will be felt more strongly in Hawaii than elsewhere. No place in Hawaii is greater than 29 miles from the coastline. The recent rush to buy oceanfront lots by mobile new high tech millionaires is a tangible example of this trend. But this is only one aspect of the ever increasing impacts foreseen on our coastal resources-loss of scenic views and coastal open space, loss of traditional access, greater competition for fishing, swimming, surfing and other recreational and subsistence sites, armoring of the shoreline, increased nonpoint source pollution and loss of natural resources such as coral reefs, wetlands etc.

Another national trend is low density sprawl. Hawaii has also experienced suburban sprawl and its costs in terms of consumption of agricultural land, natural resources and open space. These trends pose questions and challenges for planners in the new millennium:

Can future population and economic growth be accommodated while maintaining a high quality of life for the next generation. Can a sustainable development pattern be designed. Can the quality of life in Hawaii be improved for ourselves and our children and grandchildren?

At this millennium transition point, with the majority of the State's large district issues at least momentarily resolved, the planning and development focus shifts toward marginal or incremental changes and importantly, the role of the counties under State law. Once

the urban designation is set, the county planning process takes over in terms of zoning, infrastructure, and other development requirements. Thus, the scope, scale, and timing of development projects depend on county rules, procedures, and decisions, although interaction with the State in terms of educational, health, infrastructure, resource, and environmental issues remain essential.

Both the State and the counties can benefit from the findings of the President's Council on Sustainable Development. The Council found that many communities are increasingly adopting what is being called "smart growth", a term that describes the design and management of the physical expansion of existing communities and the creation of new ones to make communities more livable. To achieve more livable communities, planning in the new Millennium should be guided by the following principles:

- *Understand the interdependence of various issues and the need to develop cross-cutting strategies;*
- *Discourage sprawl and make efficient use of land resources by redeveloping underutilized areas and clustering development;*
- *Support industries and economic activities that sustain our natural resources and environmental quality;*
- *Protect important agricultural land and significant historic, cultural and natural resources and provide a network of open space, parks and natural areas;*
- *Coordinate land use and transportation design to bring activities, jobs and people closer together;*
- *Support materials reuse and resource efficiency;*
- *Ensure a safe, healthful and equitable community for everyone.*

Hawaii's Islands: Visions for the New Millennium

This chapter concludes with recognition that each of Hawaii's island counties has its own special qualities that enhance its quality of living. So with apologies for inadvertent omissions or misinterpretations, we list some elements which make each of them special and which illumine their vision for the New Millennium.

Kauai: The Garden Island

- A place where visitors go to experience the natural beauty of and scenery of Hawaii and a setting for adventure and eco-tourism.

- An island known for its special botanical gardens which are both visitor attractions and research facilities.

- A productive agricultural island with a wide variety of crops and products.

- A film mecca drawing national and international film producers.

A high tech center specializing in commercial applications that are the byproduct of military research.

Maui: No Ka Oi

- A first class visitor destination area known for the magic and excitement that it generates.
- An active destination area known for its entertainment, events, ocean sports and attractions, luxury resorts and golfing opportunities.

Building upon its visitor appeal and implementing the county's economic development plan

- An international center for conferences, summits, negotiations, meetings, and similar activities.
- Development of a sports industry and film industry taking advantage of Maui's natural attractions.
- An art and cultural center promoting art galleries, music studios, theatre and symphony, native Hawaiian cultural activities, art, music and film festivals and similar activities.

- Molokai as the truck garden of Hawaii, an aquaculture center with revitalized fishponds and small scale eco-tourist hub.

- Lanai as a popular but secluded luxury resort area with ocean and mountain recreational activities.

Hawaii: (The Big Island)

- A world renown center for research in astronomy, alternate energy, volcanology, geology, oceanography, agriculture, forestry and aquaculture.

- A learning laboratory with campuses in Hilo and West Hawaii providing opportunities for hands-on application and research and providing students with opportunities for close relationships with their teachers, Big Island researchers and the community.

- A "Healing Island" where people go to improve their physical and mental well being.

- A Gold Coast with high quality, master planned resort in designated visitor destination nodes and bed and breakfast accommodations in rural areas throughout the island.

Oahu: The Gathering Place

A Gathering Place where visitors from all over the world come to relax, rejuvenate and enjoy the beauty and attractions of a world class resort destination area.

A new Waikiki recapturing the Magic of Waikiki, an exciting and vibrant urban resort:

- A place where pedestrians are first;
- Greenways and parks from Diamond Head, Kapiolani Park, both sides of the Ala Wai canal to the Hawaii Convention Center, Ala Moana Park and Kakaako to the Aloha Tower Marketplace;
- Wide, expansive beaches along the length of Waikiki Beach;
- A place to showcase Hawaiian culture; and
- An improved Ala Wai Canal with landscaping, walkways, bikeways and clean water;

- A Center for Technological Change and Innovation with a critical mass of high tech firms that sustain a major portion of future economic growth.

- A place renown for its world class university system including the cutting edge campus of the new University of Hawaii at West Oahu and a center for excellence in research and development.

- An Oahu which has an international reputation for advanced medical services and health care with an emphasis on telemedicine.

- A popular filmmaking and television production location advertising Oahu's scenic beauty and natural attractions.

VII. Some Grand Schemes for New Millennium Development

Transforming the Big Island into a Major Pacific Research Center

The Big Island is the most resource rich and diversified of all our islands. It is also the home of world renowned research facilities—the astronomy observatories at the top of Mauna Kea; the ocean thermal energy labs off the Kona coast; the geothermal resource base in the Puna volcano area. Its varied climatic and soil conditions have enabled it to support diversified agricultural industries ranging from sugar plantations to cattle ranching to coffee farms. Even with the demise of sugar due to unfavorable market conditions, Hawaii retains potential for smaller-scale but economically remunerative agricultural activity. The island also possesses natural and scenic amenities, which with a complement of 5-star hotels and both sea and land recreational attractions have nurtured a budding tourist industry. Its resource and economic base has also fostered a skilled and diverse work force which can provide the foundation for economic growth in a number of directions.

All of this provide both the means and the rationale for the establishment or expansion of research oriented institutions focusing on the Hilo campus of the University of Hawaii. This institution will not be built in a day. But through a step by step approach, taking advantage of existing components, available grants and resources, and judicious curriculum allocations, institutional goals can be attained over a period of one or two decades.

In fact, careful thought and deliberation have already been initiated. The Federal government has taken note of this potential and with a Congressional appropriation sponsored by Hawaii's Senator Inouye, has established an Agricultural Research Center in Hilo designed to serve all the Pacific Islands. Funding has also been increased for crop, marine, and biotech research at Big Island facilities. The transfer of some of the instructional and research functions of the College of Tropical Agriculture at Manoa has provoked much often heated discussion. A persistent argument against such a move has been that the Hilo campus does not provide the diversified curriculum backup that a graduate level program would require.

However, if other key elements of a research oriented facility were to be similarly established in Hilo, such as astronomy, oceanography, geophysics, all with computer technology support (such as the proposed foreign-financed Subaru supercomputer to support astronomy observation at Mauna Kea) a viable basis of needed curriculum could be built up. This would apply not only to the core science and technology areas, but also to business administration and liberal arts, which are increasingly recognized as required support areas.

Development of a major institution of higher learning on the Big Island along the lines of a Michigan State, Iowa State, or Washington State, would thus augment the State's human resource base and provide a significant stimulus to Hawaii's economic growth.

Revitalizing Honolulu's Waterfront

Honolulu's waterfront is a special public asset. It serves as the State's principal harbor and provides boundless opportunity for economic development, public enjoyment, and civic identity. Much planning and several major developments have already taken place in the waterfront area. These have mostly been of an ad hoe nature.

The time is here for institution of a visionary but pragmatic planning and development process. We need to specify our long-range goals and engage the private sector and the community in project by project implementation. To keep the process within manageable bounds, we should focus first on the extended area between Fort Armstrong and Keehi Lagoon, although the waterfront may logically be interpreted as embracing Waikiki and the Diamond Head slopes on one side and Barber's Point on the other.

For economic development, our task is made easier by the fact that the State owns most of the land in the makai oceanfront. Our fragile financial situation will limit the number of bold initiatives we can undertake. However, by leveraging private sector funds where development has commercial viability, we can enhance the value and potential application for state assets and directly stimulate the overall economy.

Ample developmental opportunities exist. Keehi Lagoon can be transformed into a water-sports center capable of handling world class events like the America's Cup and Olympic caliber events such as kayaking and canoeing. Private developers can be solicited through an RFP process to build or restore the needed facilities and provide a significant revenue return to the state. This in turn would enable the provision of year-round water recreational pastimes for our residents.

Moving in the Diamond Head direction, there remains much economic stimulus and development potential in the reconfiguration of Honolulu harbor to meet the needs of our commercial cruise, maritime, and fishing industries. In fact, the Navy has shown renewed interest in Honolulu's shipbuilding capabilities by the commissioning of its new technologically advanced ship, Slice, to our Pacific Marine company. Of course, the Aloha Tower complex has been beset with major financial problems. Intensive negotiations will be required to clear these up. Once this is accomplished, new private sector development, including an aquarium, hotels, business and residential space can be built.

Extending to Fort Armstrong, we find the state has already redeveloped much of the makai front into a Kakaako waterfront park. Plans for a Children's Discovery and Recreational Complex are proceeding apace, and there is much interest in augmenting this center with a Technology Expo pavilion, where major adventures into space, the

ocean depths, and the virtual learning process can be highlighted. An Hawaiian Music Hall, featuring both traditional and contemporary music with surrounding arts and crafts, has been proposed for the Diamond Head – facing amphitheater site within the park. All things considered, there is ample room and reason for development of the Smart Park as the nurturing ground for high technology industries whether in biotech, computer software, or various combinations thereof.

What this whole area and indeed the entire waterfront needs is a spectacular architectural symbol, which would signify Honolulu's civic identity. Sydney has its opera house promontory, Hong Kong and Manhattan have their high-rise skylines. For Honolulu we need a majestic element – be it a structural edifice, a promenade, pure greenery—to provide character to the entrance to Honolulu Harbor and the face of our civic center. For this element, a worldwide competition might be sponsored in which our own architects and artisans would naturally participate to bring forth this identification.