

Benchmarking Hawaii's Emerging Industries

SUMMARY REPORT



Department of Business, Economic Development and Tourism
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Legislative Report Requirements

This report also satisfies requirements under HRS 201-19 (b), which requires the department to submit to the legislature no later than twenty days prior to the convening of each regular legislative session, a report that provides an update on the criteria used to measure growth of emerging growth industries.



Hawaii Department of Business, Economic Development & Tourism

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Introduction

Over the years the Legislature, State administrations, counties, industry groups and independent studies have identified a range of industries and activities they felt held promise for growth and development in Hawaii's economy and which could make the state less dependent on tourism, military activity and plantation agriculture (sugar and pineapple). These activities have been labeled variously as *emerging*, *targeted* and *growth* industries.

Some of these industries like technology, filming, music and diversified agriculture have been highly promoted, sometimes with incentives and program support from the state, counties, the University of Hawaii, and private sector organizations. Other industries, like seed corn research, have blossomed with minimal support. Still others, such as apparel and call centers have seemingly moved to the back burner of economic development hope and interest.



THE JOHN A. BURNS SCHOOL OF MEDICINE ANCHORS AN EMERGING BIOTECH & LIFE SCIENCE COMMUNITY NEAR DOWNTOWN HONOLULU.

Act 148 (2007) directed DBEDT to identify and measure systematically the performance of *emerging* industries in Hawaii's economy. That effort began with the development of an inventory of industries that have been proposed over the years as possible new or expanded growth industries for Hawaii. Documents and sources reviewed to develop the inventory ranged from the original Hawaii State Plan to the very recent technology profile report of the Hawaii Science and Technology Council (HiSciTech).

From more than a dozen major studies, reports and efforts, a list of nearly 50 proposed industries or activities was generated that together comprises Hawaii's Targeted Industry Portfolio. By "targeted" we simply mean that at some point in the past an activity was of interest for its potential contribution to growth and diversification by an agency, organization or stakeholders. In some cases the industries were actively pursued as potential growth activity with public sector assistance. In other cases activities were simply suggested as potential growth industries. , Some like a number of technology and creative sector industries, resulted from adapting a national definition for the sector but may or may not have proponents. The goal in building the targeted industry portfolio was to be inclusive so that many industries and variations of industries could be assessed for their contribution to economic growth and diversification.

This report summarizes a more extensive study which will be available soon on the DBEDT website (<http://hawaii.gov/dbedt>). The purpose of the study was to define, measure and assess the performance of the targeted industry portfolio. It does not judge whether the industries should have

been a part of the portfolio or if they should now be eliminated from the portfolio. Rather, it identifies those industries that have performed the best in recent years and those that have not apparently fulfilled achieved that goal. In the process, the report tries to clarify the notion of *emerging* industries.

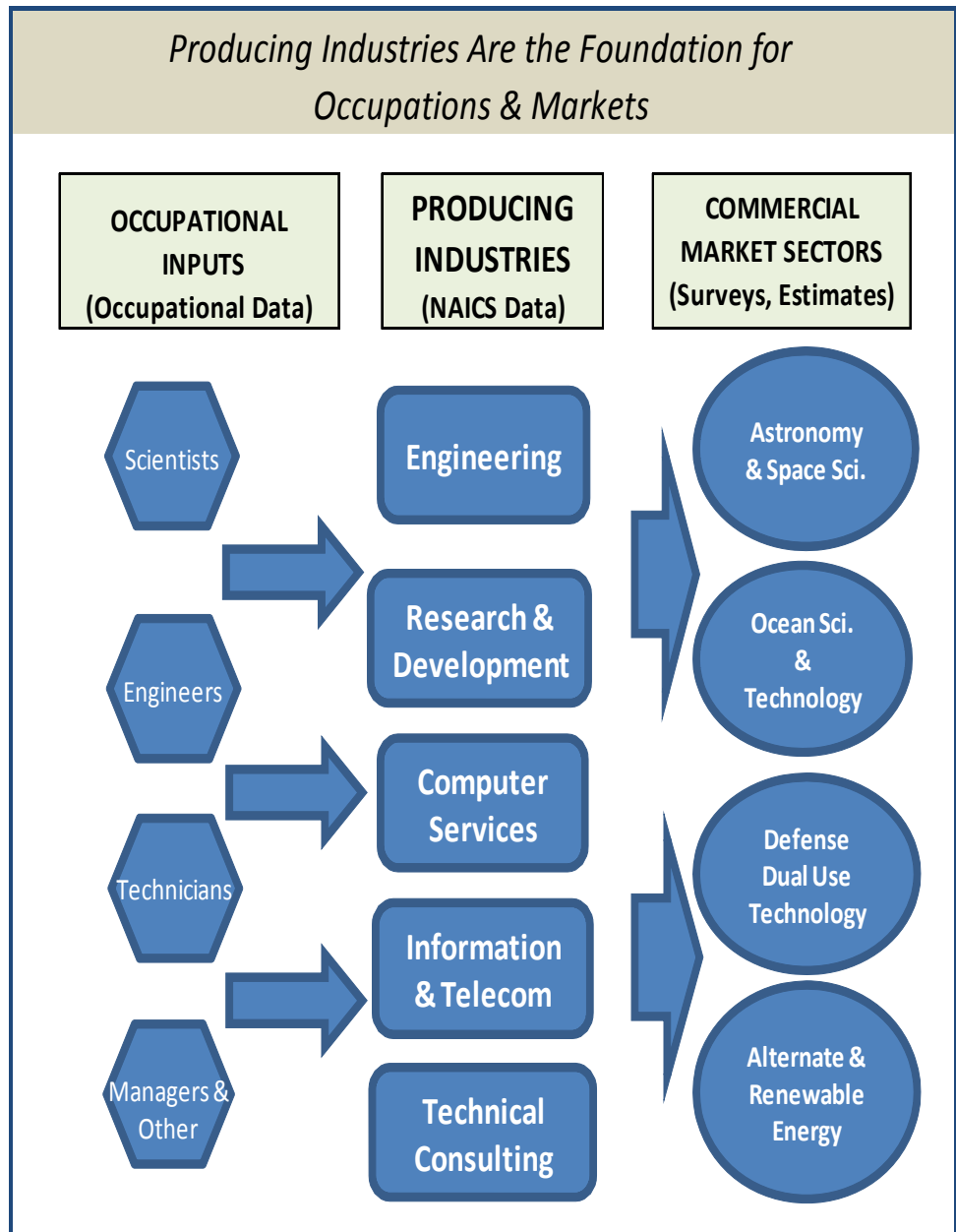
The Challenge of Measuring Targeted and Emerging Industries

To measure industry performance we need a definition of the activity and a source of data. It was immediately apparent that finding good data depends on how the industry is defined. Rich sets of statistics are available if the activity is definable as a producing industry under the industry coding system used by the major statistical agencies. The system used is called the **North American Industrial Classification System** or *NAICS*.

Nearly all data on industry employment, earnings, GDP and output are reported by a NAICS producing industry or combination of NAICS industries. Further, data on occupations, skills and training are tied into the NAICS system, so that we not only have good data on NAICS industries but can profile their occupational needs and even identify the kind of training needed to supply the industries' workforce needs.

However, a number of the activities in the targeted industry portfolio do not readily fall into a NAICS category. Rather they are more of a *market* or *product* definition of the activity. This is the case for such activities as astronomy, space science, dual-use technology and

FIGURE 1. PRODUCING INDUSTRIES VS. COMMERCIAL MARKET PERSPECTIVE



ocean science. HiSciTech has identified these as *commercial market activities* and there are no official or standard set of data collected for them on a regular basis.

The relationship between producing activities and commercial market sectors is illustrated in Figure 1. Commercial market sectors usually need special surveys or estimating procedures to develop data. On the other hand, major data generating programs usually produce employment and occupational data that is well tied into NAICS producing industries.

Assembling a Targeted Industry Portfolio

Table 1 lists the major industry groups in the targeted industry portfolio and their total jobs (wage/salary and self-employed/sole proprietors) in 2008. The portfolio contains two major groups. Those industry groups that can be reasonably measured by NAICS as *producing industries* are in the first two columns. Those that represent more of a *market or product* definition are in the last column.

TABLE 1. HAWAII'S TARGET INDUSTRY PORTFOLIO; PRODUCTION VS. MARKET SIDE ORIENTATION

PRODUCTION SIDE TARGET GROUPS				MARKET SIDE ACTIVITIES	
TECHNOLOGY	2008 Jobs			TECHNOLOGY	Jobs
Computer Services	6,583	Design Services	1,453	Astronomy/Space Science	279*
Engineering and Related Services	4,842	Radio and TV Broadcasting	1,361	Alternate Energy	na
Biotechnology	3,927	Film, TV & Video Production	1,231	Agricultural Bio-Tech	na
Technical Consulting Services	3,760	Music	1,106	Ocean Science & Tech.	1348*
Research & Development Services	3,604	AGRIBUSINESS	2008 Jobs	Environmental Tech	na
Info and Telecom Tech Services	2,196	Farm Production	12,235	Defense Dual Use	na
Medical and Diagnostic Testing	1,695	Agric. Processing	6,462	Other Targets	Jobs
Technology Equipment Distrib.	871	Fishing	1,497	Captive Insurance	na
Technoogy Manufacturing	716	Agric. Support Services	1,248	Specialty Tourism	na
CREATIVE INDUSTRIES	2008 Jobs	Agric. Inputs	414		
Performing and Creative Arts	8,531	Aquaculture Production	221		
Engineering/R&D	7,336	Agric. Packaging & Warehsg	197		
Computer and Digital Media	6,657	Forestry & Hunting	101		
Marketing & Related	4,918	OTHER TARGETS	2008 Jobs		
Business Consulting	4,291	Health & Wellness	51,346		
Publishing & Information	2,887	Education	7,581		
Cultural Activities	2,311	Apparel	1,165		
Architecture	2,280	Call Centers	435		

*Survey results. Data for 2007

The list is also organized by some major sectors, particularly technology, creative industries and agribusiness. The identification and definitions for the technology industries were developed in a 2008 study by the Hawaii Science and Technology Institute, which included participation by the DBEDT Research Division. Definitions for the creative and agribusiness sectors were developed in cooperation with the DBEDT Creative Industries Division, and input from the State Department of Agriculture and UH College of Tropical Agriculture. The full report details development of definitions and data for the other targets as well as data sources.

Portfolio Performance Metrics

As a starting point for assessing the performance of the target industry portfolio and emerging industries, Figure 2 shows the growth in total jobs posted by each of the target industry groups between 2002 and 2008 (data were not available before 2002). These 38 groups represent the major industries in the portfolio. Each major industry group may consist several specific industries (discussed in the full report). Health and Wellness has been broken down into more detailed industry groups for this performance review.

FIGURE 2.

Industry Growth

Just in terms of jobs growth, the portfolio seems to have performed well. Fully 26 of the 38 target industry groups showed net job growth over the period. Of the targets, 17 registered as *high growth* industry groups by outperforming the overall state jobs growth rate of 13%.

Call centers topped the list in terms of job growth. Ten of the 17 high-growth target groups were in either the technology or creative sectors.

Of the 11 industry groups losing jobs over the period nearly half were in the agribusiness sector. Jobs were also lost in several information industries, film/TV production activity and among health practitioners.

Competitive National Share of Jobs

Another performance measure for target industries is the gain or loss of competitive national share. This metric goes beyond simply measuring growth. It shows whether growth has been enough to improve the competitive position of the industry in a national context. This would indicate that the industry has been enjoying comparative advantages over the measurement period.

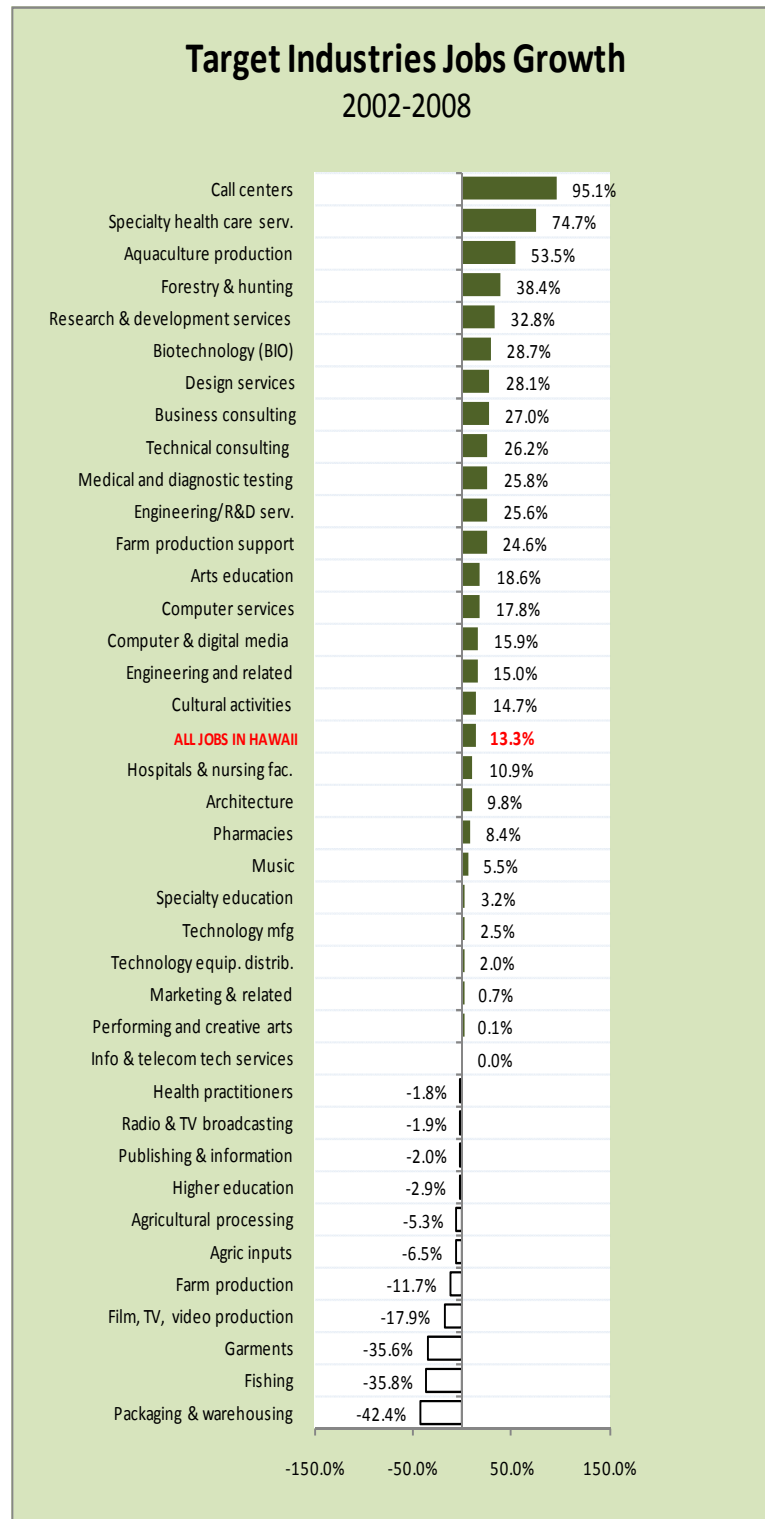
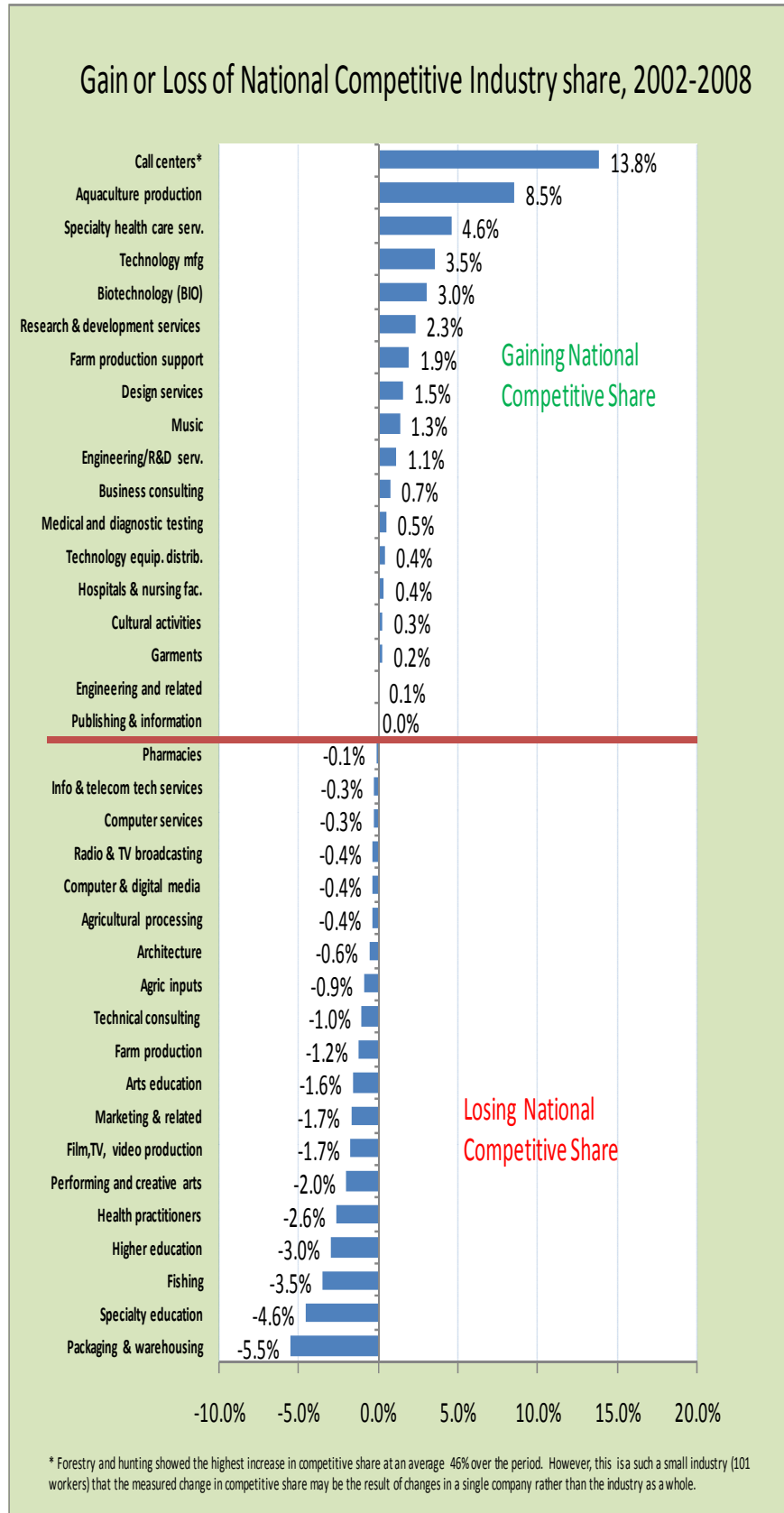


FIGURE 3.



An industry’s change in competitive national share is measured by the average difference in growth between the state and the same national industry over the period. If the difference is positive the state industry group has grown faster than the national industry and has gained competitive national share. If the result is negative, it indicates that the state industry has grown slower than the national industry and has lost competitive national share.

Figure 3 shows how Hawaii’s targeted industry portfolio performed in terms of gain or loss of competitive national share. Not surprisingly, most of the industry groups that did well in terms of growth also tended to show gains in competitive national share. Call centers grew on average nearly 14% faster per year than the same industry nationally over the 2002 to 2008 period, but mainly due to exceptional growth in 2002 to 2004.

Also among industry groups increasing competitive national share were several technology industries including biotechnology, research and development, medical testing and engineering.

A number of high growth industry groups lost competitive national share, however. Computer services, technical consulting and arts education all grew faster than the state’s economy in terms of jobs, but

not as fast as the same as fast as the same nationally.

Finally, two industry groups, garments and publishing/ information gained competitive national share even though they lost jobs in the 2002 to 2008 period. This occurred because the local industries lost fewer jobs than nationally, thus gaining competitive share by default.

Target Industries and the Export Base

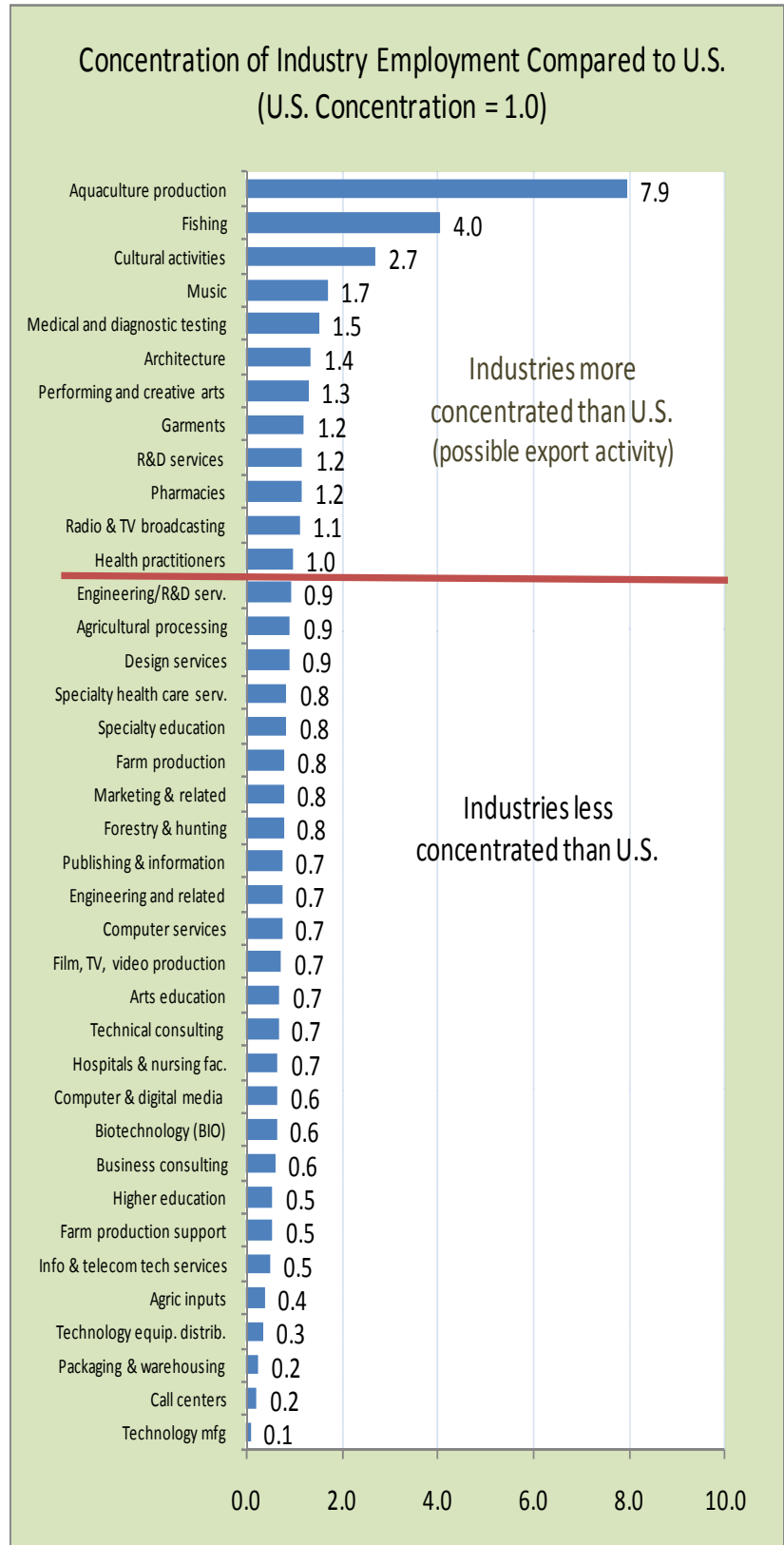
A third performance metric that helps in the evaluation of the targeted industry portfolio is industry job concentration, which sheds light on the industries' export orientation.

Export activity brings new money into the state and is a basis for long-term industry growth. Determining the actual amount of export activity generated by the target industries will require intensive research, since that information is not a part of any standard industry data program.

However, it is possible to identify a likely export industry by measuring the concentration of its employment in the state's economy. An industry that employs a significantly higher proportion of jobs in Hawaii than does the same industry nationally is relatively more concentrated and is likely to be exporting at least some of its output.

Figure 4 ranks the target industry portfolio by each industries measure of concentration. The concentration of each industry at the U.S. level is 1.0. Therefore, the measure for aquaculture

FIGURE 4.



tion, for instance, means that employment in Hawaii's aquaculture industry is 7.9 times more concentrated than for the U.S. as a whole.

This suggests that the aquaculture industry is relatively more important to Hawaii and may be exporting some of its output. This could be direct exports, such as sales to visitors and the U.S. military, or sales to other industries which, in turn, export to these and other markets.

Industries with concentrations below 1.0 may also be exporting some of their output, but have not yet demonstrated the strong comparative advantage shown by the more concentrated industries above the 1.0 level.

The Performance Map Framework: Identifying Emerging Industries

A regional economic analysis tool that maps the typical industry life-cycle process provides a way to combine the performance information including growth, competitive national share and concentration into an overview framework for assessing the target industry portfolio performance. In addition, it helps to establish a measureable definition for an *emerging* industry.

As shown in Figure 5, the first stage of the life cycle map (lower right corner) is usually called the *emerging* stage of an industry. This characterizes newer, fast growing activities that are usually serving new markets inside or outside the local economy.

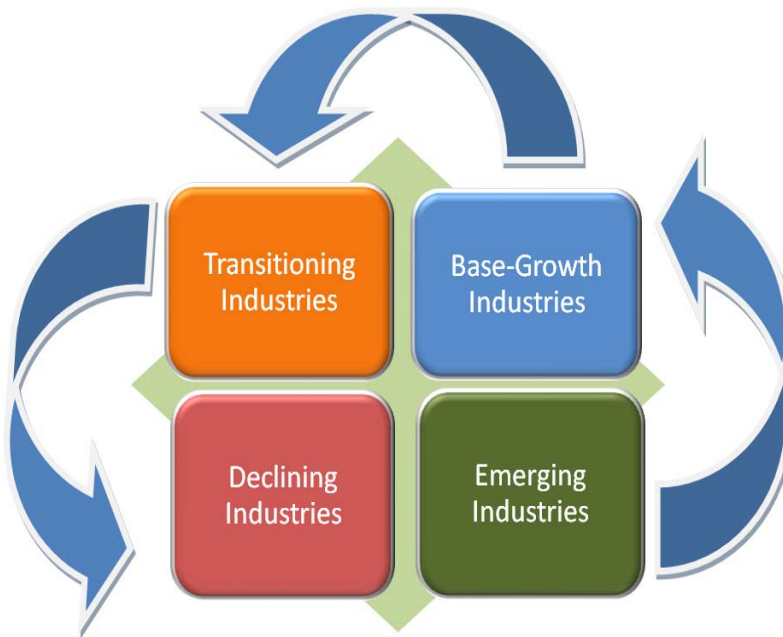
The second stage, in the upper right quadrant, identifies *base-growth* industries. These are industries that have passed through the emerging stage and have become strong, competitive sources of economic growth in the economy. These are generally export-oriented industries.

As a base-growth industry matures it reaches its full market potential. This represents the *transition* stage in the upper left quadrant. These are still specialized, important activities, but are slowing and may be becoming less competitive over time.

Finally, in the lower left quadrant are industries that are shrinking as a proportion of the economy by losing jobs over time. These are the economy's *declining* industries. If the industry is unable to reinvent itself with new products and markets, it will continue to wither away.

Not all industries fit nicely into this generalized life-cycle framework, at least over the period of only one or two business cycles, and the model probably works best using longer term data over several business cycles. Still, it provides a way to classify and visualize the situation in an industry and what strategies for addressing the industry might work best.

FIGURE 5. INDUSTRY LIFE CYCLE MODEL



Performance Map Criteria

The specific criteria for placing industries on the performance map are summarized in table 2. The three performance measures -- job growth, change in competitive national market share and concentration -- are the primary criteria for placement onto the map.

TABLE 2. CRITERIA FOR PLACEMENT ON THE PERFORMANCE MAP

TRANSITIONING	BASE-GROWTH
<ul style="list-style-type: none"> • Positive job growth • Losing competitive national market share. 	<ul style="list-style-type: none"> • Positive job growth • Highly concentrated in the economy • Increasing competitive national market share
DECLINING	EMERGING
<ul style="list-style-type: none"> • Losing jobs over period 	<ul style="list-style-type: none"> • Positive job growth • Current low concentration in the economy • Increasing competitive national market share

The best performing industries are on the right side of the map. The base growth and emerging industries show positive growth in jobs for the period and are gaining in national competitive share. The only major difference is that base-growth industries have achieved high concentration within the local economy and are likely among the driving industries. Emerging industries, while showing high growth and competitiveness, are not highly concentrated in the economy. Whether they eventually will join the base-growth industry group remains to be seen.

The left side of the map contains the balance of the industries in the portfolio. Transitioning industries are showing positive job growth for the period but are losing competitive share of the national industry. If they are also showing high employment concentration in the local economy, they may be in a matured stage that could lead to future decline or movement towards the base-growth industry side of the map if they can be revitalized.

Target industries that are showing net jobs losses over the 2002 to 2008 period fall into the declining quadrant of the performance map. Most are also losing competitive share of the national industry. However, while these targeted industries' lack of jobs growth is a concern, it may reflect reversible difficulties rather than a stagnate industry.

Overall Target Industry Performance

Table 3 shows how the targeted industry portfolio is distributed on the performance map based on the criteria above. The 'best performing' industries on the right side of the map encompass about 37% of all jobs in the targeted industry portfolio.

Five industry groups with about 5% of the portfolio employment registered as *base-growth* industries. This means that they increased their job counts over the 2002 to 2008 period, were highly concentrated in the economy and gained in competitive national share. Earnings among the base-growth targets averaged \$51,400 for 2008. Another 32% of portfolio jobs were in *emerging* industries, which also gained jobs and competitive national market share, but have yet to reach concentration levels matching the same national industries. Earnings among the emerging groups averaged \$58,200.

Transitioning industry groups, which are those that lost competitive national share but otherwise either grew jobs or held steady, accounted for 24% of portfolio jobs. Earnings for the transition-

ing industry groups averaged \$41,200. Finally, declining industry groups in the portfolio accounted for 39% of jobs, with an earnings average of \$46,200.

TABLE 3.

Target Industry Groups Mapped by Performance , 2002-2008					
Total Jobs in Targeted Industry Groups, 2008*: 131,684					
Average Annual Earnings All Groups, 2008: \$49,100					
Net Change in Jobs 2002-2008: 4.8%					
Transitioning Groups: 24% of jobs			Base-Growth Groups: 5% of jobs		
Groups	Chg in Jobs	Ave. Earnings	Groups	Chg in Jobs	Ave. Earnings
Technical consulting services	26%	\$52,159	Aquaculture production	54%	\$39,882
Arts education	19%	\$13,190	Research & development services	33%	\$70,946
Computer services (technology)	18%	\$67,965	Medical labs and imaging centers	26%	\$55,240
Computer & digital media (creative)	16%	\$68,244	Cultural activities	15%	\$43,557
Architecture	10%	\$64,145	Music	6%	\$26,229
Pharmacies	8%	\$39,330			
Specialty education	3%	\$30,107			
Marketing, & related	1%	\$40,027			
Performing & creative arts	0%	\$14,393			
Information/telecom tech serv.	0%	\$61,301			
Ave. change in jobs 2002-2008:	6%		Ave change in jobs 2002-2008:	42%	
Average 2008 Earnings for Group:		\$41,200	Average 2008 Earnings for Group:		\$51,400
Declining Groups: 39% of jobs			Emerging Groups: 32% of jobs		
Groups	Chg in Jobs	Ave. Earnings	Groups	Chg in Jobs	Ave. Earnings
Health practitioners	(2%)	\$63,921	Call centers	95%	\$16,726
Radio and television broadcasting	(2%)	\$58,442	Specialty health care services	75%	\$43,803
Publishing & information	(2%)	\$63,183	Forestry & hunting	38%	\$36,784
Higher education (Pvt)	(3%)	\$33,626	Biotechnology (BIO)	29%	\$55,288
Agricultural processing	(5%)	\$43,727	Design services	28%	\$42,135
Agricultural input materials & serv.	(7%)	\$48,878	Business consulting	27%	\$52,948
Farm production	(12%)	\$26,227	Engineering/R&D serv. (creative)	26%	\$79,672
Film, TV, video production/distrib.	(18%)	\$33,793	Farm production & support serv.	25%	\$33,569
Garment mfg	(36%)	\$23,798	Engineering & related serv. (tech.)	15%	\$71,649
Fishing	(36%)	\$21,955	Hospitals & nursing facilities	11%	\$60,295
Agric. packaging & warehousing	(42%)	\$78,231	Technology Mfg	3%	\$64,493
Ave. change in jobs 2002-2008:	(9%)		Ave. change in jobs 2002-2008:	21%	
Average 2008 Earnings for Group:		\$46,200	Average 2008 Earnings for Group:		\$58,200

*After eliminating duplication from overlapping target sectors.

Target Industry Performance by Major Sectors

Technology Sector Producing Side Industries

Six of the nine technology industry groups in the target industry portfolio registered as either base-growth or emerging industries. None of the technology sector groups fell into the declining quadrant of the performance map. (text continued on page 14)

Side Bar: Hawaii's Economy on the Performance Map

The mapping process can also be used in a broader context to help illustrate the performance of Hawaii's major producing industries. The map below shows that Hawaii's base-growth industries (the ones Hawaii was most specialized and competitive in) were private education and miscellaneous services, transportation retailing, government, and utilities for the 2002 to 2008 period.

Major Industry Groups by Performance, 2002-2008					
Total Jobs, 2008: 804,200					
Average Annual Earnings All Groups, 2008: \$43,900					
Net Change in Jobs 2002-2008: 13%					
Transitioning Groups: 26% of jobs			Base-Growth Groups: 44% of jobs		
Groups	Chg in Jobs	Ave. Earnings	Groups	Chg in Jobs	Ave. Earnings
Real estate and rental and leasing	37%	\$28,422	Educational services	25%	\$31,595
Professional and technical services	15%	\$56,442	Other services, except public administr	23%	\$23,901
Accommodation and food services	13%	\$29,937	Utilities	17%	\$98,491
Arts, entertainment, and recreation	3%	\$21,477	Administrative and waste services	15%	\$29,622
			Transportation and warehousing	12%	\$49,107
			Federal government (exclds USPS)	11%	\$93,164
			Retail trade	9%	\$28,873
			State government	6%	\$53,541
Ave. change in jobs 2002-2008:	16%		Ave change in jobs 2002-2008:	13%	
Average 2008 Earnings for Group:		\$34,400	Average 2008 Earnings for Group:		\$41,500
Declining Groups: 6% of jobs			Emerging Groups: 23% of jobs		
Groups	Chg in Jobs	Ave. Earnings	Groups	Chg in Jobs	Ave. Earnings
Manufacturing	(1%)	\$59,951	Construction	43%	\$64,512
Information	(7%)	\$61,597	Health care and social assistance	17%	\$46,761
Agriculture, forestry, fishing and hunting	(14%)	\$25,123	Management of companies and enterpr	16%	\$84,598
			Wholesale trade	14%	\$54,062
			Finance and insurance	8%	\$53,227
			Local government	8%	\$64,282
Ave. change in jobs 2002-2008:	(7%)		Ave. change in jobs 2002-2008:	20%	
Average 2008 Earnings for Group:		\$49,300	Average 2008 Earnings for Group:		\$56,000

Construction, finance and management services also performed well, in the emerging quadrant at a lower level of specialization. Professional services, accommodations and arts entertainment grew, but were not as competitive so fell into the transitioning quadrant. By losing jobs over the period, manufacturing, information and agriculture fell into the declining quadrant of the performance map for the period. The emerging industry group accounted for the most jobs, highest job growth and also the highest average earnings on the map. This strong emerging sector performance was the primary driver of state earnings and jobs growth over the period. The declining group had average earnings more than the state average, which is a concern, but were a relatively small part of the economy (7%).

This is just an illustration of how performance mapping can be used to better visualize the strengths and weaknesses of the entire economy for a period of time. At this high-level view the example just scratches the surface of such visualization. But the same approach with a more detailed industry list can provide many insights into Hawaii's changing growth patterns, industry strengths and competitiveness.

- The highest performing technology industry group was research and development. This activity feeds into a number of commercial market specialties such as astronomy, ocean science & technology and biotechnology. R&D had one of the highest annual average earning levels at nearly \$71,000. Most significantly, R&D achieved a concentration exceeding the national level in 2008, which suggests that the activity has found a comparative advantage in Hawaii. Biotechnology, medical labs, engineering and even technology manufacturing also registered in the high performing right side of the map, but their concentrations have yet to match national levels.
- Computer services, technical consulting and information/telecom technology services registered as transitioning industries on the performance map. Computer services and technical consulting grew faster than Hawaii's economy, so these are by no means problematic industries. However, because the same national industries managed to grow faster, there was a slight loss of competitive national share.
- Information/telecom technical services, on the other hand showed no net growth over the period. However, the industry lost only a slight amount of national competitive share, indicating that it is reflecting nationwide trends in information and communications technology. That trend is towards higher productivity in providing services, which in turn slows jobs growth.

Technology Commercial Market Sectors

As Table 1 showed, information on the commercial market sectors of technology is limited. However, efforts have been made through surveys and estimates to provide some information on these market sectors. A summary of that information is presented below. Information on digital media is in the section on the Creative Sector. More information on the commercial markets is available in the full, emerging industries report.

Astronomy & Space Science; The primary invested assets in Hawaii's Astronomy sector include:

- *Telescopes:* These vary greatly in size and in the type of light they capture.
- *Instrumentation:* Lenses and similar equipment used to gather the light collected in the telescopes.
- *Summit buildings and infrastructure:* Solid, sophisticated housings that protect equipment and minimize changes in wind, heat and other conditions that could disrupt viewing.
- *Facilities in Hilo and Waimea:* Several observatories have headquarters with much office space, machine shops, and computing resources which allow astronomers to analyze great amounts of data away from their institutions.

Table 4 provides an overview of employment and earnings in Hawaii's astronomy sector developed in the 2007 HiSciTech study of the technology sector.

TABLE 4. HAWAII'S ASTRONOMY MARKET SECTOR, 2007

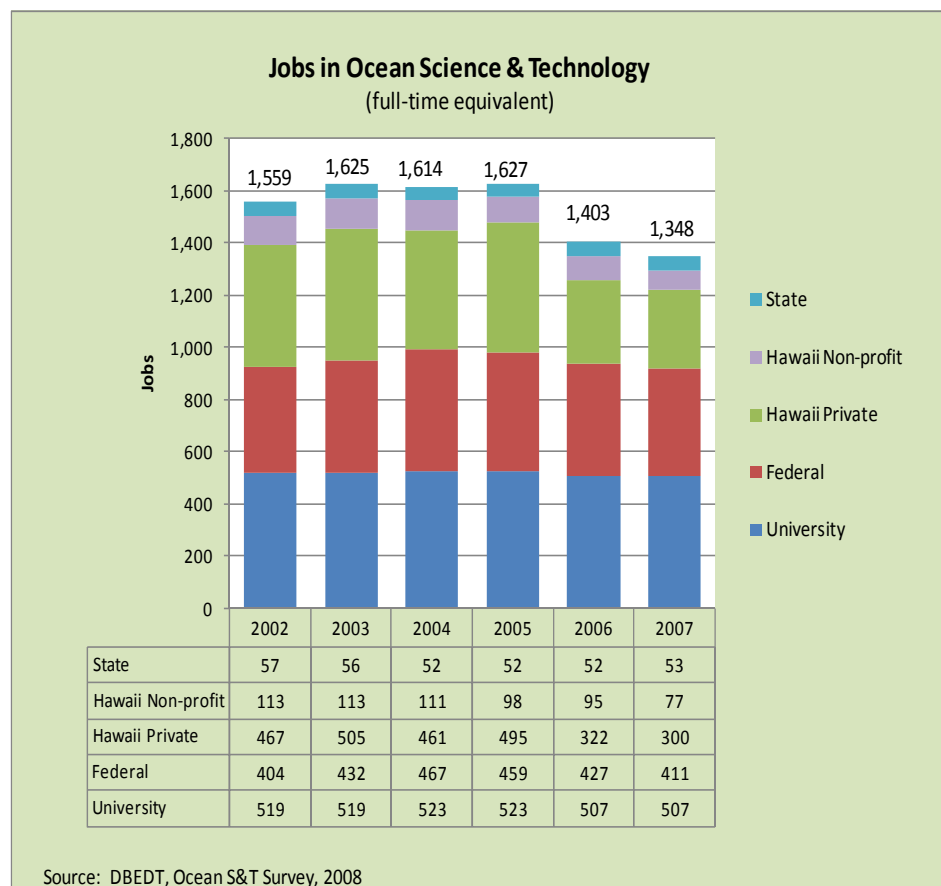
Astronomy Market Segment	Hawaii	US
Employment (all astronomy jobs)	885	n/a
Employment (private-sector astronomy jobs)	342	222,685
% of all private-sector employment	0.0%	1%
Annual private-sector employment growth rate ('02-'07)	7.3%	1.2%
Avg. earnings	\$70,951	n/a
Avg. earnings - private-sector only	\$83,654	\$106,567
Establishments	28	n/a

Source: The Hawaii Science & Technology Institute, *Innovation and Technology in Hawaii: An Economic and Workforce Profile*, October, 2008

Ocean Science and Technology

Ocean science and technology includes a mix of different fields including biology, chemistry, geology, physics, engineering and others. In Hawaii, the ocean science and technology sector encompasses both the public and private sectors. The majority of activities in

FIGURE 6



this sector are in research and technical development projects funded by the government, non-profit organizations and some private sources.

Figure 6 charts the trend in jobs associated with Ocean S&T activity from 2002 to 2007 differentiated by performing sector, that is, the firms and agencies that received funding for projects.

The decline in total Ocean S&T jobs after 2004 corresponds to a decline in funding for those activities. A more thorough discussion of Ocean Science and Technology funding is presented in the full, Emerging Industries re-

port.

The most recent survey on Ocean Science & Technology may be accessed at http://hawaii.gov/dbedt/info/economic/data_reports/OceanScTechReport2007.pdf.

Energy Technology

Energy technology targets a number of emerging markets by engaging a multitude of traditional industries. Those industries have allocated some of their activity to focus on the replacement or conservation of fossil fuels. While the NAICS system for industry classification does contain a classification for *other power generation*, it captures only a small part of the emerging field of alternate energy activity.

There are two major subsectors in energy technology. *Energy efficiency* is focused on reducing the use of energy in the economy, particularly buildings. *Energy Replacement* (re-

newable or alternate energy) is focused on replacing fossil fuel with alternative, preferably renewable sources like solar, wind, and other types.

Energy efficiency and energy replacement involve numerous traditional industries ranging from heating and plumbing to engineering and architecture. For instance, solar panels may be installed by a number of different contracting specialties. About 20 different industries service some aspect or provide support for renewable energy and conservation. The full emerging industry report shows the range of industries associated with the alternate energy sector.

Dual Use (The Military Technology Market)

Dual use technology has been a market opportunity for Hawaii companies to leverage investment in technology developed for military applications into products to serve commercial markets. For instance, a company developing corneal regeneration technology to treat battlefield eye injuries will likely find a market for that technology in the commercial medical sector.

Like other targets that represent market or product activities (ocean science, digital media, astronomy) data and information on the workers and revenues of firms serving the military technology market are difficult to develop. This is because they do not fit into the scheme of NAICS producing industries for which a rich set of standard data are produced on a regular basis. Data for market and product based activity like dual use technology must be developed through surveys or other estimating methods.

The most structured effort to gather data on the dual use sector was by the State Department of Labor and Industrial Relations (DLIR) in 2005. In support of the Workforce Development Council and Enterprise Honolulu, the Research and Statistics (R&S) Office of DLIR surveyed 132 companies in the dual use sector. The R&S survey estimated employment in the dual-use technology industry to be 1,204 workers in 2005 with an additional 108 positions vacant and needing to be filled.

Creative Sector

The creative sector consists of 13 industry groups, which were distributed around the performance map. The creative and technology sectors share some industry elements in the areas of research and development, engineering and computer services.

Creative Sector Producing Industries

- Cultural activities and music registered as base-growth industries, while design services business consulting and engineering/R&D series fell into the emerging industry quadrant. All but music exceeded the jobs growth rate for the state as a whole.
- Five creative industries fell into the transitioning quadrant. All of the creative industry groups in the transitioning quadrant lost competitive national share over the period. However two groups, arts education and computer and digital media, grew jobs faster than the state as a whole. Architecture grew jobs slightly slower than the state as a whole, while marketing and performing/creative arts showed little or no net jobs growth over the 2002 to 2008 period.
- Three creative industry groups lost jobs over the period and therefore registered as declining industries for 2002 to 2008. Radio/TV broadcasting and publishing/information showed

slight job declines of 2% each for the period. Due to competition from other media, the internet and productivity increases, these two industries are struggling nationally as well as in Hawaii.

- Film, TV and video production also fell into the declining industry category for the period in terms of jobs. Part of the reason is the volatility of production employment. The gain or loss of a major film project can affect the data on production workers significantly. For instance, if the base for measuring jobs growth had been 2003 instead of 2002, the industry would have shown a slight, 3% jobs growth for the period, enough to boost it into the transitioning quadrant. Also, only the production workforce of established companies can be effectively measured for this industry. However, the Hawaii State Film office has estimated that between 4,000 to 5,000 people spend some time working in the industry each year. Therefore film production employment may be providing a fragmentary picture of industry performance.

Digital Media Commercial Market

While not an easily definable or measurable activity within the creative sector, digital media is a direct and indirect product of computer activity. Evolving digital technology is an opportunity for musical artists, programmers and content developers to compete in a market that has been dominated by large firms in the past. Through affordable digital technology it is possible for film, music, speech, literature, historical documentation, games, educational instruction, as well as computer programs and data to share similar, digitized formats and be distributed and consumed on common platforms. These platforms are quickly evolving beyond computers and iPods to multipurpose cell phones and direct internet broadcasts. New products for this market are evolving as fast as new platforms are developed. Examples of such products are shown below.

TABLE 5

Examples of Digital Media Products	
Video games and interactive virtual worlds	Blogs and social websites
Multimedia CD-ROM publishing	Email and attachments
Digital music publishing and distribution	Podcasting New media
Mobile devices and content	Internet Art
Software for the various devices and content	Interactive television
Web sites including 'brochureware'	Hypertext fiction
Electronic kiosks	Mashups (combining bits and pieces of existing digital content into original content.)

There are a multitude of firms in numerous industries that dedicate some fraction of their work to digital media markets. It is likely that the NAICS computer services industry will contain many of these firms. But there are probably firms serving this market in other NAICS industries such as the music, film production, and information industries. Work is needed to better identify and measure the mix and scope of these firms across industries and digital markets.

Agribusiness Sector

Of the seven agribusiness industry groups in the targeted industry portfolio, only three registered in the high performing categories of either base-growth or emerging industries. The remaining five agribusiness industries fell into the declining quadrant for 2002 to 2008.

- With 221 jobs in 2008, aquaculture production registered in the base-growth quadrant of the performance map, posting a 54% increase in jobs from 2002 to 2008 and an average gain in competitive national share of 8.5% per year. Aquaculture's concentration in Hawaii's economy was nearly 8 times that of the same industry nationally.
- The small, forestry and hunting industry, with 101 jobs in 2008, ranked with the emerging industries. This activity showed a 38% increase in jobs for the 2002 to 2008 period and posted an average 46% per year average increase in competitive national share. In 2008 employment in the activity was about 80% as concentrated in Hawaii as it was nationally. The performance in this small and volatile industry must be viewed with caution. The acceleration in this industry resulting in the high performance measures was primarily caused by the addition of just 26 jobs to timber tract activity.
- Farm production and support services with 221 jobs in 2008 also ranked with the emerging industries. With a 25% increase in jobs over the period, the activity also gained competitive national market share at an average 1.9% per year. This is another activity whose performance must be viewed with caution. An increase in Support services for forestry helped the performance of this category, but most of the growth was in veterinarian services which also services the household pet market.
- Farm production and food processing activity fell into the declining industries category in the 2002 to 2008 period. Together these two activities accounted for 18,700 jobs, so the decline is of concern. It has been primarily the decline in sugar and pineapple production that has dragged down the performance of the agribusiness sector. Increases in seed crops, coffee and flowers/nursery products have been unable to counter the overall decline.

Health & Wellness

Health and wellness (H&W) includes five industry groups covering the range of medical services from full service hospitals to medical labs and diagnostic testing. Three of the H&W industry groups (medical labs & diagnostic testing, specialty health care, and hospitals/nursing facilities) were high-performing, falling on the right side of the performance map. Pharmacies fell in the transitioning quadrant, while the health practitioners industry was a declining group.

- Medical labs & diagnostic testing (a group also shared with the technology sector) was the highest performing industry group for H&W. Jobs increased by more than 26% over the 2002 to 2008 period. The group gained competitive national share over the period and in 2008 was about 50% more concentrated in Hawaii's economy than the same industry nationally.
- Specialty health care and hospitals registered as emerging industries with growth in jobs, increasing competitive national share, but still less concentrated than the same industry groups nationally.
- Pharmacies fell into the transitioning group while health practitioners registered as a declining group due to modest jobs losses.

Other Target Industry Sectors

- The **call centers industry group** turned in the most impressive growth in the targeted industries portfolio with a 95% increase in jobs for the 2002 to 2008 period and the highest gain in competitive national share. However, the growth in this industry took place from 2002 to 2004. There has been no jobs growth since that high mark. Time will tell if this industry can

reinvigorate earlier growth in the coming years.

- Hawaii's **apparel industry**, on the other hand, contracted by about one-third over the period. Ironically, since it declined less severely than the industry nationally, the garment industry actually gained a small amount of competitive national share.
- The performance of the **private education sector** was mixed. Specialty education showed a modest 3% increase in jobs, but slipped in competitive national share, registering as a transitioning industry for the 2002 to 2008 period. However, private higher education lost 3% of its jobs for the period, falling into the declining industry category.
- **Specialty or Niche tourism** represents an effort to increase the stability and value of tourism for Hawaii by diversifying the visitor base into nontraditional areas of tourism that may be experiencing increasing interest and demand. Often referred to as "niche tourism," developing such markets can help fill in seasonal or cyclical lows in tourist activity or provide higher than average return per visitor.

Table 6 shows the specialty or niche markets for which the Hawaii Tourism Authority is able to collect periodic data. The largest specialty market in 2008 was Honeymoons/Weddings, followed by cruise visitors and conventioners.

Most specialty tourism markets appear to have reached their cyclical peak growth for arrivals in 2006 with only one major specialty market, cruises, showing growth in 2007. By 2008 all markets had been impacted negatively by the recession although, except for the cruise market, not quite as negatively as tourism arrivals overall in that year.

TABLE 6. SPECIALTY TOURISM MARKETS

Specialty Market	2006		2007		2008	
	Number	% change	Number	% change	Number	% change
Honeymoon/Weddings	637,000	11%	627,000	-2%	577,000	-8%
Cruise	416,000	31%	503,000	21%	267,000	-47%
Conventions:	318,000	-12%	279,000	-13%	254,000	-9%
Sports events	144,000	na	114,000	0%	112,000	-2%
Cultural events	44,000	na	35,000	-21%	32,000	-9%
All Visitors	7,528,106	1.5%	7,496,820	-0.4%	6,713,436	10.4%

There are two other specialty tourism markets that have been the subject of discussion recently. These are agricultural tourism (agri-tourism) and technology tourism (techno-tourism). These have yet to be well defined or measured in terms of visitor numbers and profiles.

- **Captive insurance** is a very complex area of insurance activity that essentially permits a company, usually with diverse business interests and establishments, to form an insurance company that will provide the insurance needs of the related businesses. The impact of captive insurers on jobs and income is difficult to measure. Captive insurance companies themselves apparently have very few employees. NAICS data for insurance companies does not isolate captive insurance companies, although since those companies probably outsource most of their activity, the data would not reflect the actual size of captive insurance activity.

Non-Targeted Activities to Monitor

The targeted industry portfolio has accounted for the bulk of growth outside of tourism and development related activity. However, an effort was made determine if any other small, high-growth activities apart from these targets may have been overlooked.

- Very few non-portfolio industry groups (except for those clearly connected to tourism or development) registered as either a base-growth or emerging activity for the period. The most significant activity (about 730 jobs) was ship building/repair, which increased jobs by about 30% over the period. However, this activity was likely linked to the increase in cruise activity during the period as well as the start of commuter ferry activity.
- Other areas of small industry group growth included electronic shopping/mail order activity, soaps & fragrances and a range of small structural building components and cabinet manufacturing industries. The export activity among these industries was probably very limited if any and their import replacement potential appears to be tied mainly to growth in tourism and construction activity. Still they were of interest because they are producing products that would have otherwise been imported. This suggests that there are pockets of competitiveness in the manufacturing area that could help support the net impact of growth-driving industries by reducing Hawaii's import costs and keeping those jobs in the state.

The performance of these activities will be tracked over time to better monitor their impact on the economy.

Performance Map Limitations

It must be emphasized that this performance map framework is more of a guide to analysis rather than a conclusion about the value of a given target industry to the state. In addition to competitiveness, the current placement of an industry on the performance map can be affected by the time period used for the measure, the timing differences in the Hawaii and U.S. business cycles, and other factors.

A slightly different period for the measures as well as changing performance in major industries such as tourism and defense spending could result in some reshuffling of the industries among the quadrants of the map, although those would likely be modest changes.

Also, within industries that did not show strong performance there may still be a few very successful firms that have been experiencing positive growth because of a particular product or market they have developed.

What the mapping provides is a starting point for understanding the strengths and weaknesses of the industries in the portfolio. It identifies those industries that have shown the most promise in diversifying the economy and helps us diagnose the problems in industries that have not. Over time the period for the performance measures will increase and provide a more long-term and ongoing monitoring system for portfolio and emerging industry performance

Targeted Industry Performance by County

This section summarizes the county performance of the statewide targeted industries with 100 or more jobs (paid employment and self-employed/sole proprietors). The performance of industry groups below 100 jobs tends to be volatile and affected by statistical factors (such as a single firm changing its NAICS reporting category). Performance has been organized by *Best Performing Targets* (registering as base-growth & emerging industry groups) and *Other Targeted Industry Performance* (those that fell into the transitioning and declining categories).

Honolulu County

As shown in Table 6, 13 of the targeted industry groups were high performing in Honolulu County in the 2002 to 2008 period. These groups not only grew jobs during the period but also increased their competitive share of the activity by exceeding national growth for the industry.

- Medical labs & diagnostic testing and cultural activities performed as base-growth industries over the period. This means that these industries not only gained competitive national market share, but also enjoyed more concentrated activity in Honolulu County than nationally. These industries may also be exporting at least a portion of their outputs to markets that cater to visitors or the military.
- Call centers had the highest job growth in the County, although the annual earnings average at \$17,000 was far below the national 2008 average earnings of around \$50,000 for this industry.
- Besides call centers, the top performing emerging industries included specialty health care services, medical devices, research and development services, and farm production support.
- While they were not among the best performing industries from a national competitive standpoint, several of the transitioning industries grew jobs at an impressive rate in Honolulu over the 2002 to 2008 period, including technical consulting services (31%) and computer services (16%). A number of other transitioning industries provided positive growth in jobs, even though not as vigorously as state economy as a whole.
- Among the weakest performing industries, fishing, garments, music, and farm production showed the sharpest declines. Film and TV production also showed job declines. As discussed earlier, Film/TV can be a volatile industry from year to year and many jobs in the industry may be captured in other NAICS industries such as artists, performers, and food services among others.

TABLE 6

Targeted Industry Performance in the City & County of Honolulu					
Industry Group Description	Sector	Performance Class	Job		
			2008 Jobs	Growth 2002-08	County Ave. Earnings
Best Performing Targets					
Call Centers	Call Centers	Emerging	387	115%	\$17,002
Specialty Health Care Services	Health & Wellness	Emerging	5,419	94%	\$43,870
Medical Device Manufacturing	Technology	Emerging	434	68%	\$39,435
Research & Development Services	Technology	Emerging	2,101	34%	\$75,505
Farm Production Support Services	Agriculture	Emerging	780	31%	\$32,341
Medical and Diagnostic Testing	Technology/H&W	Base-Growth	1,335	31%	\$57,745
Business Consulting	Creative	Emerging	3,436	31%	\$58,142
Engineering and R&D	Creative	Emerging	5,117	23%	\$80,946
Design Services	Creative	Emerging	994	22%	\$40,256
Cultural Activities	Creative	Base-Growth	1,795	17%	\$47,160
Hospitals & Nursing Facilities	Health & Wellness	Emerging	16,374	12%	\$61,851
Packaging & Warehousing	Agriculture	Emerging	342	6%	\$88,057
Agricultural Processing	Agriculture	Emerging	4,623	3%	\$40,844
Other Targeted Industry Performance					
Technical Consulting Services	Technology	Transitioning	2,955	31%	\$57,587
Computer Services	Technology	Transitioning	5,931	16%	\$69,817
Computer and Digital Media Products	Creative	Transitioning	5,989	14%	\$70,065
Engineering and Related Services	Technology	Transitioning	4,053	13%	\$74,921
Pharmacies	Health & Wellness	Transitioning	2,873	8%	\$39,611
Architecture	Creative	Transitioning	1,809	7%	\$68,627
Arts Education	Creative	Transitioning	214	6%	\$12,894
Information & Telecom Tech Services	Technology	Transitioning	1,665	1%	\$59,654
Technology Equipment Distribution	Technology	Transitioning	833	0%	\$78,679
Higher Education	Education	Declining	5,024	-4%	\$33,820
Publishing & Information	Creative	Declining	2,202	-4%	\$66,606
Performing and Creative Arts	Creative	Declining	4,620	-4%	\$14,157
Health Practitioners	Health & Wellness	Declining	14,161	-4%	\$65,323
Marketing & Related	Creative	Declining	3,685	-5%	\$43,991
Radio and television Broadcasting	Creative	Declining	1,099	-7%	\$63,574
Specialty Education	Education	Declining	1,858	-7%	\$29,292
Film, TV, Video Production	Creative	Declining	1,161	-10%	\$33,135
Agricultural Input Materials & Services	Agriculture	Declining	165	-27%	\$61,787
Farm Production	Agriculture	Declining	2,334	-35%	\$27,355
Music	Creative	Declining	518	-37%	\$26,281
Garment Manufacturing	Apparel	Declining	1,047	-38%	\$23,625
Fishing	Agriculture	Declining	689	-39%	\$29,961

NOTE: Excludes industries with fewer than 100 jobs in 2008

Kauai County

Only 19 statewide targeted industry groups had employment of 100 or better on Kauai in 2008 (Table 7). Ten of those groups were high performing; growing jobs over the six-year period and increasing their competitive share relative to the same industry groups nationally.

- Encouragingly, half of the best performing industries on Kauai were in technology or in the overlap of technology and the creative sector. These include research and development, computer services and engineering services.
- All but one of the best performing industry groups exceeded statewide job growth for the period.
- Among the other industries, technical consulting did well in terms of job growth (25% over the period), but lost some competitive share because of even higher growth nationally. Performing and creative arts as well as cultural activities grew slightly while five of the statewide targets showed net job declines over the period.

TABLE 7

Targeted Industry Performance in the County of Kauai					
Industry Group Description	Sector	Performance Class	2008 Jobs	Job Growth 2002-08	County Ave. Earnings
Best Performing Targets					
Engineering and Research & Development	Creative	Emerging	340	258%	\$68,787
Specialty Education	Education	Emerging	103	243%	na
Computer Services	Technology	Emerging	154	79%	\$32,331
Computer and Digital Media Products	Creative	Emerging	159	75%	\$31,315
Research & Development Services	Technology	Emerging	363	52%	\$62,482
Engineering and Related Services	Technology	Emerging	155	48%	\$51,803
Marketing & Related	Creative	Emerging	202	46%	\$20,874
Specialty Health Care Services	Health & Wellness	Emerging	279	40%	\$30,611
Business Consulting	Creative	Emerging	155	27%	\$22,126
Hospitals & Nursing Facilities	Health & Wellness	Emerging	726	10%	\$54,520
Other Targeted Industry Performance					
Technical Consulting Services	Technology	Transitioning	140	25%	\$24,497
Performing and Creative Arts	Creative	Transitioning	633	8%	\$9,545
Cultural Activities	Creative	Transitioning	174	5%	\$33,858
Farm Production	Agriculture	Declining	1,289	-1%	\$32,015
Pharmacies	Health & Wellness	Declining	203	-11%	\$37,980
Health Practitioners	Health & Wellness	Declining	744	-13%	\$73,426
Agricultural Processing	Agriculture	Declining	214	-16%	\$19,110
Publishing & Information	Creative	Declining	107	-24%	\$49,539
Fishing	Agriculture	Declining	143	-33%	\$10,299

NOTE: Excludes industries with fewer than 100 jobs in 2008

Maui County

As shown in Table 8, there were 25 industry groups in the statewide targeted portfolio with more than 100 jobs in Maui County. Thirteen of the industry groups were high performing as either base-growth or emerging industries.

- The music industry group in Maui outperformed all other performing industries in terms of robust job growth and a strong increase competitive share. However, average earnings in music were relatively modest at around \$29,600 per year.
- Research and development was one of the highest performing target industries in Maui County for the period, growing jobs 42% over the period.
- Among the targeted industries outside of the high performing groups, specialty education showed the best growth at 32% for the period. That industry is not among the highest performing groups only because it lost some competitive share to the U.S. industry which grew even faster. The low average earning for specialty education indicate that it is probably a predominantly part-time activity for most workers.
- Other industries growing but losing competitive share to the national industries were marketing, performing & creative arts, architecture and health practitioners. Only four of the targeted industry groups lost jobs in Maui County. Besides farm production, jobs losses were experienced in hospitals, business consulting and technical consulting services

TABLE 8

Targeted Industry Performance in the County of Maui					
Industry Group Description	Sector	Performance Class	Job Growth		County Ave. Earnings
			2008 Jobs	2002-08	
Best Performing Targets					
Music	Creative	Base-Growth	430	400%	\$29,555
Design Services	Creative	Base-Growth	251	52%	\$28,697
Radio and television Broadcasting	Creative	Emerging	133	45%	\$22,107
Research & Development Services	Technology	Base-Growth	769	42%	\$55,204
Specialty Health Care Services	Health & Wellness	Emerging	487	38%	\$11,791
Farm Production Support Services	Agriculture	Emerging	169	36%	\$32,234
Engineering and Research & Development	Creative	Emerging	463	36%	\$73,176
Computer and Digital Media Products	Creative	Emerging	269	27%	\$51,591
Pharmacies	Health & Wellness	Emerging	545	26%	\$36,825
Computer Services	Technology	Emerging	258	25%	\$53,790
Engineering and Related Services	Technology	Emerging	358	17%	\$55,373
Information and Telecomm Tech Services	Technology	Emerging	309	9%	\$77,816
Publishing & Information	Creative	Emerging	323	3%	\$42,816
Other Targeted Industry Performance					
Specialty Education	Education	Transitioning	246	32%	\$18,395
Marketing & Related	Creative	Transitioning	629	11%	\$27,842
Performing and Creative Arts	Creative	Transitioning	2,226	6%	\$16,202
Architecture	Creative	Transitioning	216	4%	\$47,488
Health Practitioners	Health & Wellness	Transitioning	2,483	1%	\$59,116
Cultural Activities	Creative	Declining	172	-2%	\$25,413
Farm Production	Agriculture	Declining	2,849	-5%	\$36,898
Hospitals & Nursing Facilities	Health & Wellness	Declining	637	-8%	\$40,441
Business Consulting	Creative	Declining	279	-17%	\$27,005
Technical Consulting Services	Technology	Declining	264	-21%	\$28,539
Fishing	Agriculture	Declining	211	-30%	\$13,165
Agricultural Processing	Agriculture	Declining	715	-35%	\$61,738

NOTE: Excludes industries with fewer than 100 jobs in 2008

Hawaii County

Seventeen statewide targeted industry groups were high performing in the 2002 to 2008 period, registering as either base-growth or emerging (Table 9).

TABLE 9

Targeted Industry Performance in the County of Hawaii					
Industry Group Description	Sector	Performance Class	2008 Jobs	Job Growth 2002-08	County Ave. Earnings
Best Performing Targets					
Aquaculture Production	Agriculture	Base-Growth	125	116%	\$26,827
Music	Creative	Base-Growth	136	62%	\$15,904
Technical Consulting Services	Technology	Emerging	409	43%	\$33,742
Business Consulting	Creative	Emerging	414	41%	\$33,335
Marketing & Related	Creative	Emerging	411	40%	\$17,696
Specialty Education	Education	Emerging	287	39%	\$19,577
Architecture	Creative	Emerging	163	36%	\$50,984
Design Services	Creative	Emerging	132	32%	\$40,644
Engineering and Related Services	Technology	Emerging	283	29%	\$53,055
Publishing & Information	Creative	Emerging	271	27%	\$34,245
Cultural Activities	Creative	Base-Growth	171	27%	\$29,675
Computer Services	Technology	Emerging	245	24%	\$39,690
Computer and Digital Media Products	Creative	Emerging	250	23%	\$38,896
Pharmacies	Health & Wellness	Emerging	396	21%	\$42,098
Engineering and Research & Development	Creative	Emerging	567	18%	\$77,094
Agricultural Input Materials & Services	Agriculture	Base-Growth	131	16%	\$43,364
Hospitals & Nursing Facilities	Health & Wellness	Emerging	1137	16%	\$54,825
Other Targeted Industry Performance					
Specialty Health Care Services	Health & Wellness	Transitioning	620	17%	\$20,929
Health Practitioners	Health & Wellness	Transitioning	2519	15%	\$54,514
Farm Production Support Services	Agriculture	Transitioning	232	10%	\$35,564
Performing and Creative Arts	Creative	Transitioning	1106	6%	\$13,567
Research & Development Services	Technology	Transitioning	371	0%	\$86,030
Farm Production	Agriculture	Declining	5767	-4%	\$10,524
Information and Telecom Technology Serv.	Technology	Declining	167	-9%	\$36,942
Agricultural Processing	Agriculture	Declining	882	-10%	\$26,534
Medical and Diagnostic Testing	Technology/H&W	Declining	208	-21%	\$40,953
Fishing	Agriculture	Declining	449	-35%	\$15,683

NOTE: Excludes industries with fewer than 100 jobs in 2008

- The highest job growth was turned in by aquaculture, although at 125 jobs, it just made the cut for consideration. The average earnings in aquaculture were also somewhat low, at \$26,800 in 2008.
- Music also ranked high for growth, although it too is very small and average earnings are even lower than aquaculture.

- Among the higher paying industry groups that performed best were R&D, engineering, hospitals, and architecture.
- A number of transitioning industries that were slipping in terms of national competitive share did contribute to the growth of Hawaii County jobs. Specialty health care grew jobs faster than the statewide average for all job growth. Farm production support services and performing/creative arts also showed job growth over the period.
- Target industry groups with the poorest performance in a national context were fishing, medical/diagnostic testing, information/telecommunications technology services and agricultural production and processing. All of these industry groups lost jobs over the period.

Conclusions & Next Steps

The primary objective of this study was to define and benchmark Hawaii's emerging industries. To do that, industries suggested over the last several decades as potentially promising targets for growth were compiled and more sharply defined for measurement, particularly within the NAICS producing industry system where possible.

This process resulted in a portfolio of targeted industry groups encompassing about 132,000 jobs, which was then subjected to several key performance measures. Using a framework from the field of economic development research, the performance measures were combined in a way that provided an operational definition and measure for Hawaii's *emerging industries* as well as for *base-growth*, *transitioning* and *declining* industries in the portfolio.

It was found that Hawaii has a range of growth activity not tied exclusively to tourism or development activity. Most of this activity was in the technology and creative sectors. Eleven activities encompassing around 28,000 jobs registered as *emerging* industry groups from 2002 to 2008, growing 21% in jobs over the period. Moreover, five growth activities with nearly 7,000 jobs qualified as *base-growth* industries, meaning that they were not only growing in national competitive share, but were also becoming more concentrated within Hawaii's economy than nationally. This group averaged a 42% increase in jobs over the six-year period.

Another 10 activities accounting for around 32,000 jobs and growing an average 6% over the period showed more modest performance as *transitioning* industries. However, most jobs in the target industry portfolio, 51,000 or 39%, were in 11 industry groups that experienced average job declines of about 9% over the 2002 to 2008 period, thus falling into the *declining* industry category for the period.

It must be stressed again that the results of the analysis are simply a guide to understanding the opportunities and challenges among these industries. The time frame for measuring performance was relatively short and factors that may have influenced performance over the period outside of long-term competitiveness are not yet clear.

It is also not yet clear how much the industries are contributing to the state's export base or the particular markets that are driving growth of the emerging and base-growth activities. These questions will take more concentrated research to address, but with the industries now benchmarked for performance, the priorities for that research are clearer.

Emerging industry research beyond this benchmarking phase would logically take several directions, which could be expanded depending on the comments and needs of policy makers and stakeholders.

As indicated, information is needed on the market sectors served by industries in the portfolio beginning with the most promising based on benchmarked performance. Understanding those markets, their dynamics and Hawaii's competitive strengths and weaknesses in serving them is important for understanding how the public sector can best help. This will involve close collaboration with the industries, relevant trade groups and county economic development organizations

A second, but closely related direction is the need to better document the linkages among portfolio industries and with industries outside of the portfolio. These linkages (also called value chains) show how the industries depend on one another as suppliers or customers and can help illuminate key growth clusters. This effort can also help sort out which activities are primary export industries and which may be further back in the value chain that supports exports. Hawaii is one of the few states that maintains statewide and county Input-Output models, which will be invaluable in establishing these inter-industry value chains.

A third direction would focus on the occupational needs of the high performance industries in the portfolio. There are rich sources of data relating industries to their occupational needs and even the supply and demand for training in these occupational areas. Despite current levels of unemployment, the supply of skilled labor is expected to be a limiting factor in economic growth in the decades ahead as the baby boom generation retires. Even before the current recession, Hawaii was facing shortages in key areas of technology and education. Knowledge about how many new workers with what types of skills will be needed by our growth industries can be matched against expected future labor supply to better understand how to meet economic growth needs on the educational and occupational side of the equation.

Finally, for each of the preceding research directions, the emphasis should shift from a statewide to a county/island focus. State level data and performance results are really just the sum of results and interrelationships among the locations where economic activity is taking place. It is important to better understand the conditions, opportunities and challenges' facing each county's industry portfolio in order to ensure that statewide performance is maximized.

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