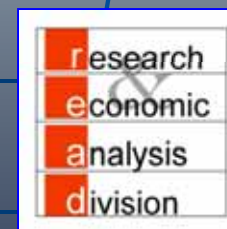


Hawaii Innovation Indicators



Update 2010



State of Hawaii
January 2010



This report was prepared by the Economic Information Staff Branch of the DBEDT Research and Economic Analysis Division, Dr. Pearl Imada Iboshi, Division Head. Data collection and graphs were assembled and prepared by Dr. Ming Zhang, Economist. Analysis and narrative sections were prepared by Robert Shore, Branch Chief.



Hawaii Department of Business, Economic Development & tourism

January 2010

Table of Contents

I. Executive Summary	4
II. Innovation and Hawaii's Economy	8
III. Innovation Indicators	11
A. Capacity for Innovation	11
B. Innovation Sector & Support Assets	26
C. Economic Transformation	32
IV Conclusions	38

I. Executive Summary

Hawaii's Innovation Indicators

This is an update report on the performance of Hawaii's Innovation Indicators. The innovation indicators were developed and first reported in December 2008, in order to track Hawaii's progress in utilizing innovation and technology to diversify its economy and provide a higher proportion of high-skilled, high-wage jobs. The 2008 report describes in detail the innovation process and how each of the indicators chosen for Hawaii is important in helping monitor that process. That report can be accessed at <http://hawaii.gov/dbedt/innovation/innovation-indicators>. This report focuses on the first update of those indicators. It also incorporates revisions in data and any change of specific indicators due to program decisions by data source providers. During preparation of the initial report it was found that data for many important indicators are released late in the year. Consequently, this and subsequent update reports hereafter will be targeted for January of each year.

This system of indicators has drawn from many efforts to construct relevant measures of the innovation progress in both Hawaii and across the nation. Through those efforts has emerged a view of how innovation works and how it might be measured. While the innovation process has been explained and broken down in many ways, it can be seen as having three fundamental components that represent phases in a successful innovation process.

- First there must be the capacity for innovation, which then leads to;
- A thriving innovation sector and supporting assets, prompting;
- Economic transformation and a strong, prosperous and sustainable economy.

The important feature of this innovation process is that the components are sequential. That is, before a prosperous efficient and sustainable economy can emerge, there must be a well-developed and thriving innovation sector to drive that overall prosperity. But to have that thriving innovation sector, there first must be the capacity to develop a highly skilled workforce and generate the ideas, research and development such a sector needs.

Summary of Indicators

The indicators presented in this report have been structured under these three components of the innovation process. The table below provides a snapshot of the indicators and changes in the measures and trends since the 2008 report. The performance level and trend for each indicator are represented. Performance and trend for both the 2008 report and this update are presented, in order to more easily see changes. Green symbols mean that the performance level exceeds the national benchmark or that the recent trend is positive. Red symbols are used for performance below the national level or if the most recent trend data show deterioration. Amber symbols indicate performance near the national benchmark or a flat recent trend. The introductory sections for each indicator should be consulted for more complete interpretation of current status and trends.

Summary of Indicators

INDICATOR	Hawaii	U.S.	Performance/Trends 2008 Report (as revised)		Performance/Trends 2010 Report	
			Performance ¹ (compared with nation)	Latest Trend ¹ (improving or worsening)	Performance ¹ (compared with nation)	Latest Trend ¹ (improving or worsening)
Capacity for Innovation						
Education						
H.S. grad. rate (2006)	75.5%	73.4%	0	↑	+	↑
H.S. dropout rate (2006)	4.7%	3.8%	-	↑	-	↔
College Readiness (2009, Ave. SAT score)	981	1016	-	↓	-	↓
College going rate of H.S. grads (2006)	59.8%	61.6%	-	↑	-	↑
Freshman retention 4 yr colleges (2007)	68.1%	75.5%	-	↓	-	↑
Freshman retention 2 yr colleges (2007)	51.4%	53.0%	-	↑	-	↔
Percent of High school graduates ultimately earning a:						
4 yr college degree (2006)	43.7%	56.4%	-	↓	-	↑
2 yr college degree (2006)	19.4%	29.1%	+	↓	-	↓
Entrepreneur training* (2008)	0.37%	na	na	↑	na	↑
Education attainment -% coll. degrees (2007)	39.11%	34.93%	+	↑	+	↔
Research & Development						
R&D spending in public sector- \$ per \$1000 GDP (2005)	\$5.95	\$6.63	+	↑	-	↓
R&D spending in private sector- \$ per \$1000 GDP (2005)	\$2.90	\$16.81	-	↓	-	↑
Patents issued per 1,000 workers (2007)	0.13	0.61	-	↑	-	↓
Capital Availability						
Venture capital investments per \$1,000 GDP (2008)	\$0.11	\$2.01	-	↓	-	↑
Innovation Research Grants per \$1,000 GDP (2008)	\$0.12	\$0.13	0	↔	0	↔
Tech Transfer Grants per \$10,000 GDP (2008)	\$0.001	\$0.017	+	↔	-	↓
Workforce Development						
% College degrees in Sci & Tech (2007)	18.43%	na	na	↓	na	↑
Life-long learning -% of 25-49 yr olds. (2007)	5.2%	5.6%	+	↑	-	↓
Worker recruitment H-1B Visas per 1,000 workers (2008)	1.41	2.68	-	↓	-	↓

INDICATOR	Hawaii	U.S.	Performance/Trends 2008 Report (as revised)		Performance/Trends 2010 Report	
			Performance ¹ (compared with nation)	Latest Trend ¹ (improving or worsening)	Performance ¹ (compared with nation)	Latest Trend ¹ (improving or worsening)
Infrastructure						
Connectivity – Megabits per second download speed (2009)	2.97	5.07	-	-	-	↑
Innovation Sector & Support Assets						
Technology sector						
% jobs in tech sector (2008)	3.0%	5.1%	-	↔	-	↑
% Growth in tech jobs (2002-2008)	17.9%	12.4%	-	↑	+	↑
% jobs in R&D (2008)	0.45%	0.38%	-	↑	+	↑
% growth in R&D jobs (2002-2008)	22.8%	16.4%	+	↑	+	↑
Creative sector						
% jobs in creative sector	5.55%	6.27%	-	↓	-	↑
Highly Trained Technical Workforce						
% of workforce in STEM occupations (2008)	7.10%	8.57%	-	↓	-	↓
Average earnings in STEM occupations (2007)	\$51,200	\$64,389	-	↓	-	↑
Technology Diffusion						
STEM occupations in non Tech Industry (2008)	5.57%	5.91%	-	↑	-	↑
Entrepreneurial Activity						
Startup companies per 1,000 workers (2008)	7.66	9.26	-	↑	-	↓
Economic Transformation						
Growth & Efficiency						
Technology Contribution to Growth (2002-2007)	41.2%	48.5%	-	↔	-	↔
Labor productivity - real GDP per worker (2008)	\$79,214	\$79,272	0	↑	0	↑
Diversification						
Diversification -% alignment with U.S. (2007)	87.2%	na	na	↔	na	↔
Global Integration -merch exports per \$1,000 GDP (2006)	\$4.68	\$78.60	-	↑	-	↑
High Wage Jobs						
Jobs above \$50K (2007)	16.9%	17.4%	0	↓	-	↓

INDICATOR	Hawaii	U.S.	Performance/Trends 2008 Report (as revised)		Performance/Trends 2010 Report	
			Performance ¹ (compared with nation)	Latest Trend ¹ (improving or worsening)	Performance ¹ (compared with nation)	Latest Trend ¹ (improving or worsening)
Median Income						
Median family income (2007)	\$71,784	\$60,374	+	↑	+	↑
Median household income (2007)	\$64,022	\$50,233	+	↑	+	↑
Energy Efficiency						
Energy efficiency - mil. BTUs used per \$1,000 GDP (2007)	6.89	8.87	+	↑	+	↓
¹ +: above nation. -: below nation. 0: same as nation. ↑: improving. ↓: worsening. ↔: no change.						
*Percent of class registrations in entrepreneurial program classes, Kapiolani CC.						

Conclusions:

Capacity for technology and innovation:

Between the base report in 2008 and the most recent update, Hawaii remains behind in meeting national benchmarks for most indicators. The period covered by the new indicators show that the U.S. improved in a number of areas faster than Hawaii resulting in fewer plus signs and more minus signs in the Capacity category. On the other hand, there were slightly more indicators that were showing a positive trend the Capacity category than in the last report. Thus while stronger performance nationally in many indicators affected comparative performance, Hawaii was showing some improvement overall in turning more trends positive.

Innovation Sector and Support Assets:

Hawaii is still behind the U.S. in most innovation sector indicators with respect to performance but the situation improved between the two reports. Overall, more innovation sector asset indicators showed improvement in both performance and trends between the original and update reports. Particularly due to stronger performance in technology, the innovation sector showed more indicators positive for comparative performance and for improved trend.

Economic Transformation:

The performance and trends in the economic transformation category showed little or no change in either performance comparison or trends between the two reports. Hawaii continues to do comparatively better and trends are positive in family/household income, and labor productivity. Performance and trends are still lagging in jobs above \$50,000. In the latest report energy efficiency dropped slightly (BTUs used per GDP rose). However, efficiency had been making slow progress in the preceding four years, so this slight uptick is not troubling. Of more concern is that the rate of improving energy efficiency is slower than the national level, which has been making very consistent progress since the early 1990s.

II. Innovation and Hawaii's Economy

Innovation

Innovation is the process whereby new ideas and new approaches are conceived and introduced into the economy, resulting in new or substantially improved products and services. The concept of innovation as a driver of economic activity has been rooted in economic growth theory for several decades. Research has shown that most economic growth in the U.S. has been the result of the application of technology and innovation to the economy.

Hawaii faces a number of challenges if it is to compete effectively in the more global and technology-driven economy of the 21st century. The State's ability to maintain a prosperous economy and to preserve its quality of life depends on transforming the economy through innovation to compete in the new global economy. Innovation promotes economic diversification by creating higher paying jobs in knowledge intensive firms. But it is not just new industries that benefit from innovation. Traditional and even sun-setting industries can increase their productivity and find new markets for their core competencies through innovation. The overall result of effective innovation is an increased standard of living and a more competitive economy.

The system of indicators presented in this report draws from many efforts to construct relevant measures of innovation progress in both Hawaii and across the nation. Through those efforts has emerged a view of how innovation works and how it might be measured. While the process has been explained and broken down in many ways, the innovation process can be seen as having three fundamental components that represent phases in a successful innovation process.

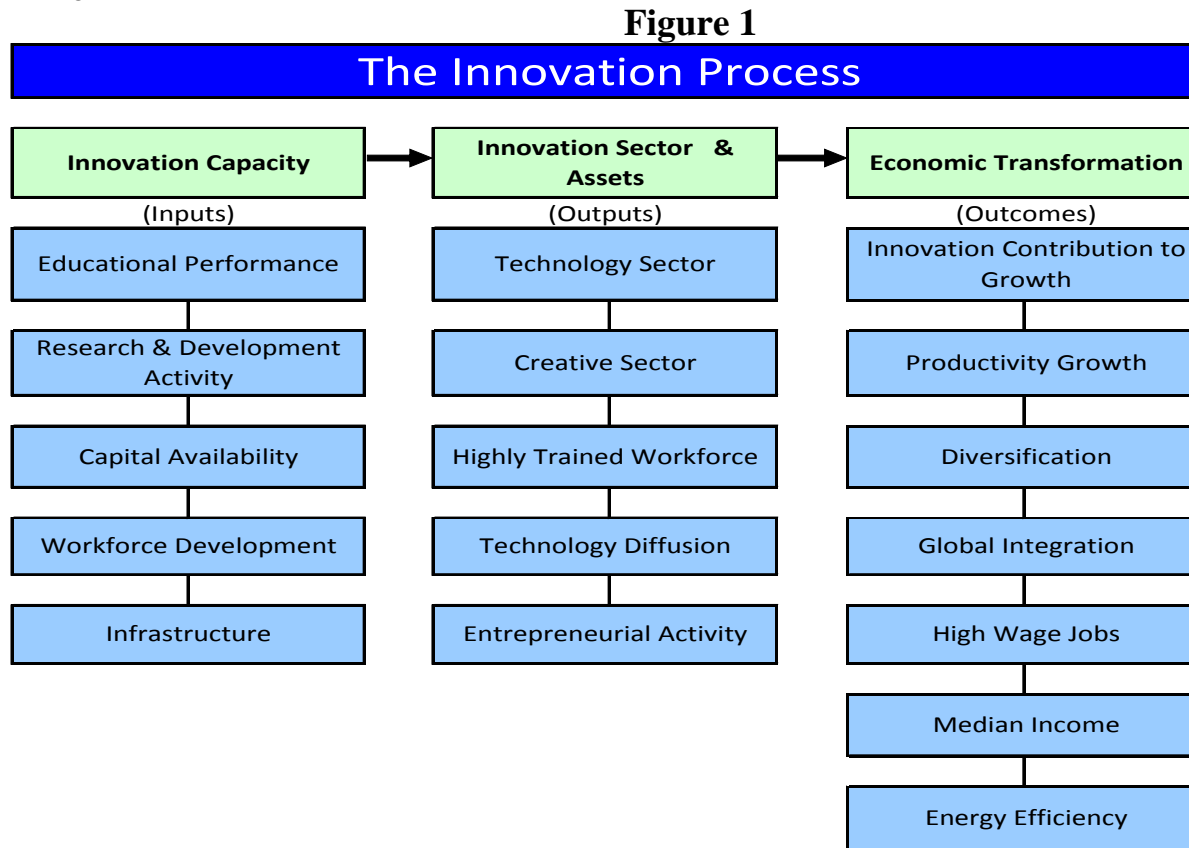
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The important feature of this innovation process is that the components are sequential. That is, before a prosperous efficient and sustainable economy can emerge, there must be a well-developed and thriving innovation sector to drive that overall prosperity. But to have that thriving innovation sector, there first must be the capacity to develop a highly skilled workforce and generate the ideas, research and development such a sector needs.

Measuring & Tracking Innovation

The system of indicators presented in this report draws from many efforts to construct relevant measures of innovation progress in both Hawaii and across the nation. Among the Hawaii efforts have been the Hawaii Pathways to Advancement project in 2005, sponsored by the National Governors Association (NGA), reports by the Hawaii Institute for Public Affairs (HIPA) and work by such groups as Enterprise Honolulu, the economic development boards of Hawaii, Maui and Kauai Counties, the Hawaii 2050 Task Force, Hawaii Science and Technology Council, and the Workforce Development Council. National efforts include the New Economy Index published by the NGA, work by the Milken Institute, a number of state efforts, and work to identify an innovation framework by the U.S. Council on Competitiveness.

Through this body of work and effort has emerged a view of how innovation works and how it might be measured. While the process has been explained and broken down in many ways, innovation as an economic driver can be seen as having three fundamental components. Those components and their key elements are shown in Figure 1.



The first component is the *capacity* to innovate. This requires a well performing educational system that brings out the full educational potential of individuals, including the building of strong skills in **science, technology, engineering and math**, referred to as **STEM** skills. Basic capacity also includes well-supported research and development efforts, in the university system and in the private sector. Capital availability is a critical input if innovation is to be commercialized, as well as the development of workforce skills that can help translate innovation capacity into leading edge products and services. Finally, innovation capacity must include the infrastructure needed to support a digital economy.

The result or output of effective innovation capacity leads to the second component of the process – a thriving *innovation sector and key support assets* in the economy. This sector and support assets commercialize creativity. They consist of firms developing and applying various forms of creativity and

technology, highly trained occupations and entrepreneurial activity. This component includes not only core technology development, but also the creative sector of the economy that fuses technology with arts and entertainment to produce such products as digital music, digital entertainment productions, animation and electronic games. Other key measures of this component include the proportion of high-skilled workers in the economy and entrepreneurial startup activity.

The third component represents what we would expect to be the outcome of healthy innovation capacity and a thriving innovation sector. That outcome is *economic transformation*, resulting in a strong, prosperous and sustainable economy. Such an economy derives a high proportion of growth through the application of technology and innovation rather than simply adding more labor, or physical development. It has high productivity growth, increased trade and export activity, and an expanding global reach. It is also increasingly more efficient in the use of energy and most importantly, generates a rising level of household and family income based on a high proportion of jobs that pay a relatively high wages.

The indicators that follow have been structured under these three components of the innovation process. Efforts have been made to select pivotal indicators along the continuum. For some of the indicators, data are not available to establish the metric at this time. However, because they relate to important underlying components of the innovation process, they are introduced with the expectation that data will become available in the future. For some components of the innovation process, better or more comprehensive indicators are needed and research is ongoing to locate those.

These indicators are not set in stone. As data sources change and new components are identified for measurement, the mix of indicators will also evolve. Likewise, indicators that do not appear to be adequately representing critical real-world elements of innovation will need to be replaced.

Most importantly, stakeholder review and input are an essential part of choosing, evaluating and adjusting indicators. DBEDT seeks continuous feedback on the structure and performance of the indicator set so that the best possible measures and data sources are used to track Hawaii's innovation process.

III. Innovation Indicators

This section presents data and graphics for Hawaii's Innovation Indicators as updated and revised. Due to the complex nature of compiling data such as graduation rates, R&D spending and others, the latest information is still often several years old. Also many factors can affect year-to-year changes in the data. For these reasons it is best to interpret the indicators on a long term basis (four of five years) which will tend to show the longer term trends. Therefore, where possible a number of years of data are provided so that the trends are more apparent.

Generally, new data for this update has been highlighted in yellow for this report. In some cases replacement for indicators have been made as source agencies discontinue or make major revisions in data series. In order to streamline presentation of the information, detailed explanations of the nature and reasoning behind the indicators has not been included. Those discussions are contained in the base report on the innovation indicators, which can be reviewed at <http://hawaii.gov/dbedt/innovation/innovation-indicators>.

A. CAPACITY FOR INNOVATION

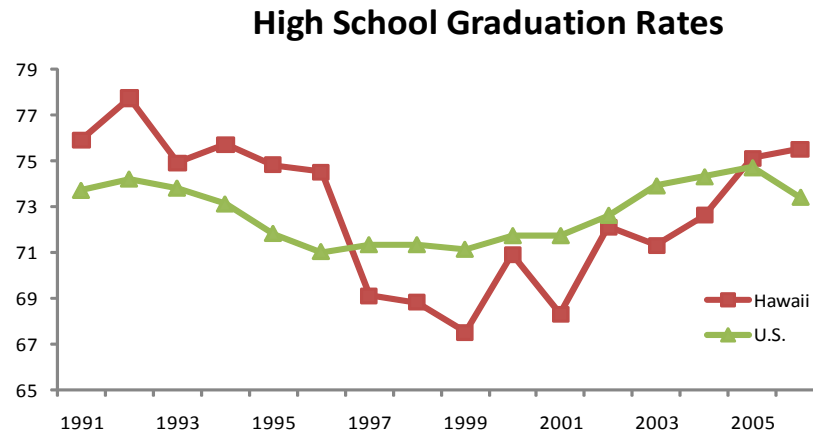
These indicators track the basic ingredients that provide capacity for innovation. The first is a well performing educational system that can generate a strong human resource base for innovation. The second is a robust research and development component focused on marketable innovations. Third is adequate access to capital. Fourth is the workforce development task of delivering skilled workers to the economy through post-secondary education, attracting them from outside the state, or retraining incumbent workers to give them cutting edge skills. Fifth is the infrastructure to support Innovation sector development. Without these key ingredients it is very difficult to develop a sustainable commercial technology-innovation sector in the economy.

1. Education Attainment & Progress through the Educational Pipeline

- The public high school graduation rate increased slightly in the latest report and remained ahead of the U.S. The high school dropout rate remained the same in the latest report but somewhat higher than the U.S. level. There has been criticism of the way these two statistics are calculated and an improved method is expected to be implemented over the next several years.
- In terms of college readiness, Hawaii SAT scores continued their slow decline in the latest report while the U.S. held steady. The larger proportion of students taking the SAT in Hawaii compared to nationally may be partially responsible for the U.S. Hawaii difference. College going rates for both Hawaii and the U.S. turned up sharply in the latest period (2006), although Hawaii is still slightly below the U.S. on this indicator.
- For college completion, no significant changes have occurred in the college freshmen retention rates for Hawaii and these remain below national rates. The rates at which high school graduates entered and graduated from college on time inched up slightly for four year institutions in 2006 but the community college associate degree rate declined. However, these two metrics are also problematic because they are not tracking individuals, only comparing numbers of graduates to earlier high school graduation numbers. More or less students attending college out of state or transferring in-state can affect these data. Efforts are being made to establish more reliable longitudinal data bases, that track individuals through education.
- Increasingly more students continue to enroll in Kapiolani Community College's entrepreneurial program. The University of Hawaii has recently approved a bachelor's degree for entrepreneurship at the Shidler Business School. Enrollment and eventually graduation data will be picked up from this program as it progresses.
- Finally, Educational attainment of Hawaii's adult population remained relatively unchanged in the latest report but is still significantly higher than the U.S. as a whole.

Public high school graduation rate:

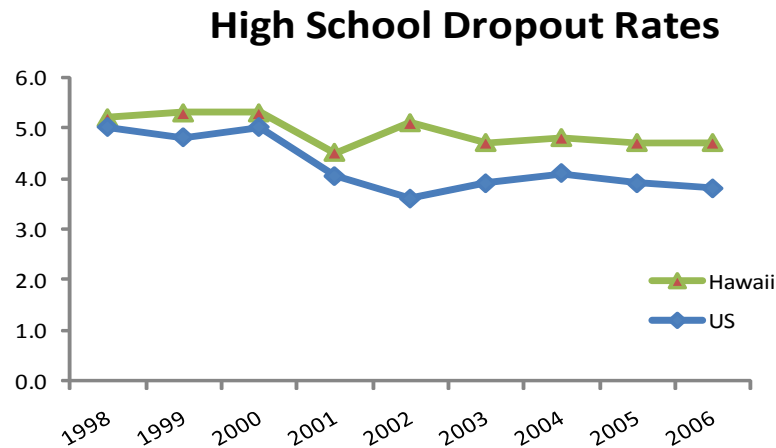
Year	Hawaii	U.S.
1991	75.90	73.70
1992	77.70	74.20
1993	74.90	73.80
1994	75.70	73.10
1995	74.80	71.80
1996	74.50	71.00
1997	69.10	71.30
1998	68.80	71.30
1999	67.50	71.10
2000	70.90	71.70
2001	68.30	71.70
2002	72.10	72.60
2003	71.30	73.90
2004	72.60	74.30
2005	75.10	74.70
2006	75.50	73.40



Source: U.S. Dept of Education, National Center for Education Statistics, 1998-2006.

High School Dropout Rate:

Year	Hawaii	US
1998	5.20	5.00
1999	5.30	4.80
2000	5.30	5.00
2001	4.50	4.04
2002	5.10	3.60
2003	4.70	3.90
2004	4.80	4.10
2005	4.70	3.90
2006	4.70	3.80

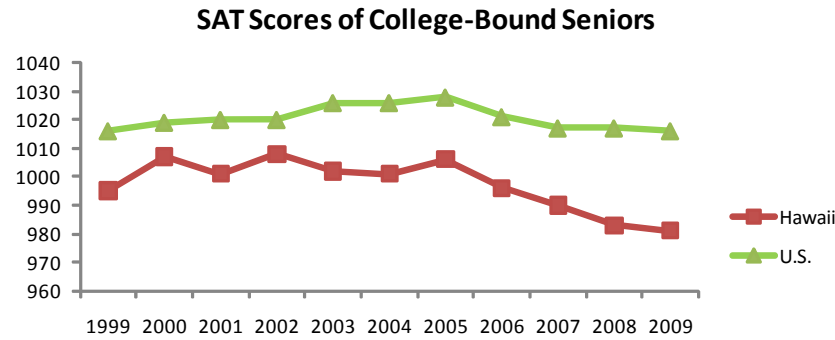


Source: U.S. Dept of Education, National Center for Education Statistics

College Readiness

SAT Scores for College-Bound Seniors

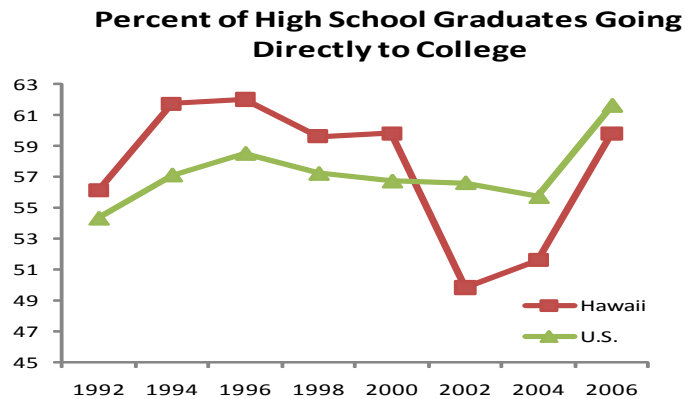
Year	Hawaii	U.S.
1999	995	1016
2000	1007	1019
2001	1001	1020
2002	1008	1020
2003	1002	1026
2004	1001	1026
2005	1006	1028
2006	996	1021
2007	990	1017
2008	983	1017
2009	981	1016



Source: The College Board, New York, NY, College-Bound Seniors, 1999-2009.

College going of high school graduates:

Year	Hawaii	U.S.
1992	56.1	54.3
1994	61.7	57.1
1996	62.0	58.5
1998	59.6	57.2
2000	59.8	56.7
2002	49.8	56.6
2004	51.6	55.7
2006	59.8	61.6



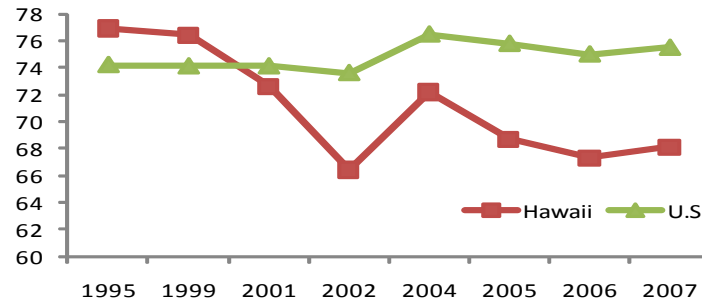
Source: National Center for Higher Education Management Systems, 1992-2006.

College Completion

Freshman retention rate:

Year	Hawaii	U.S.
1995	76.9	74.2
1999	76.4	74.1
2001	72.6	74.1
2002	66.4	73.6
2004	72.2	76.5
2005	68.7	75.8
2006	67.3	75.0
2007	68.1	75.5

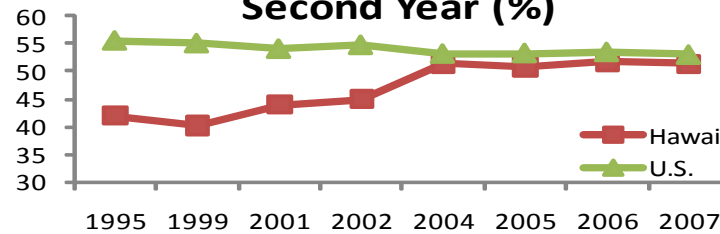
First-Time 4-year College Freshmen Returning for Their Second Year (%)



Source: National Center for Higher Education Management Systems.

Year	Hawaii	U.S.
1995	42.0	55.6
1999	40.2	55.1
2001	43.9	54.1
2002	45.0	54.8
2004	51.5	53.2
2005	50.8	53.3
2006	51.7	53.5
2007	51.4	53.0

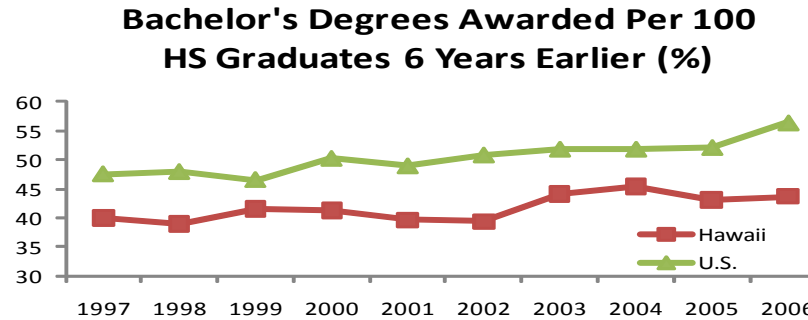
First-Time 2-year College Freshmen Returning for Their Second Year (%)



Source: National Center for Higher Education Management Systems, 1992-2004.

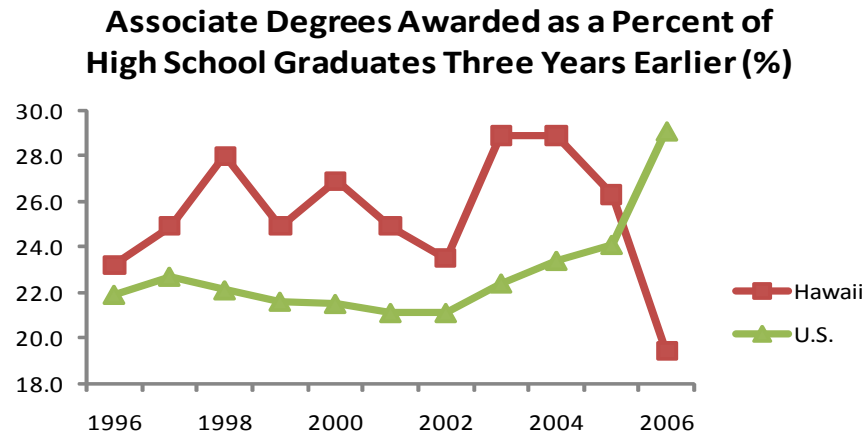
Bachelors & Associate Degrees Awarded:

Year	Hawaii	U.S.
1997	40.0	47.5
1998	38.9	47.9
1999	41.5	46.5
2000	41.3	50.2
2001	39.6	48.9
2002	39.4	50.8
2003	44.1	51.8
2004	45.4	51.8
2005	43.1	52.1
2006	43.7	56.4



Source: National Center for Higher Education Management Systems, 1992-2005.

Year	Hawaii	U.S.
1996	23.2	21.9
1997	24.9	22.7
1998	28.0	22.1
1999	24.9	21.6
2000	26.9	21.5
2001	24.9	21.1
2002	23.5	21.1
2003	28.9	22.4
2004	28.9	23.4
2005	26.3	24.1
2006	19.4	29.1



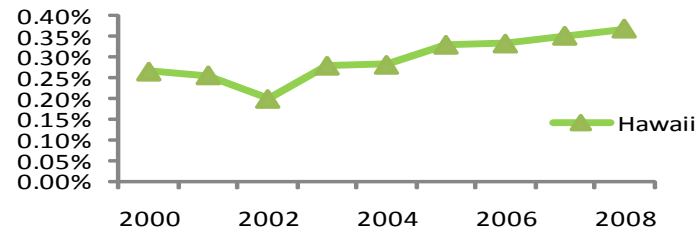
Source: National Center for Higher Education Management Systems, 1992-2005.

Entrepreneurial Training:

Year	Total Student Registration	Entrepreneurial Course Registration	% of Total
2000	20,300	54	0.27%
2001	21,004	54	0.26%
2002	20,967	42	0.20%
2003	21,783	61	0.28%
2004	20,544	58	0.28%
2005	20,577	68	0.33%
2006	21,000	70	0.33%
2007	21,297	75	0.35%
2008	23,009	85	0.37%

Data for Fall Semesters

Percent of Student Registrations in Kapiolani Community College, Entrepreneurship Certificate Courses

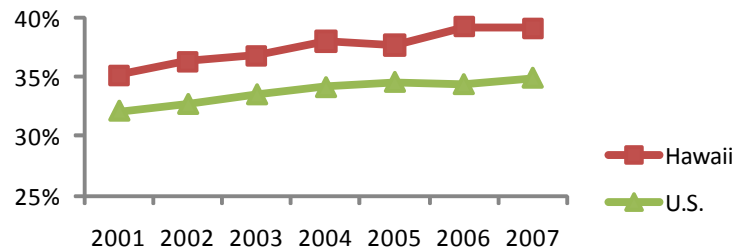


Source: Course Registration and Average Class Size Summary, Kapiolani Community College (Fall of each year).

Educational attainment of the Adult Population:

Year	Hawaii	U.S.
2001	35.11%	32.12%
2002	36.27%	32.69%
2003	36.81%	33.52%
2004	37.99%	34.12%
2005	37.68%	34.57%
2006	39.20%	34.38%
2007	39.11%	34.93%

Percent of Adults, 25 Years & Older, with Associate Degrees & Above



Source: U.S. Census Bureau, American Community Survey, 2000-2007.

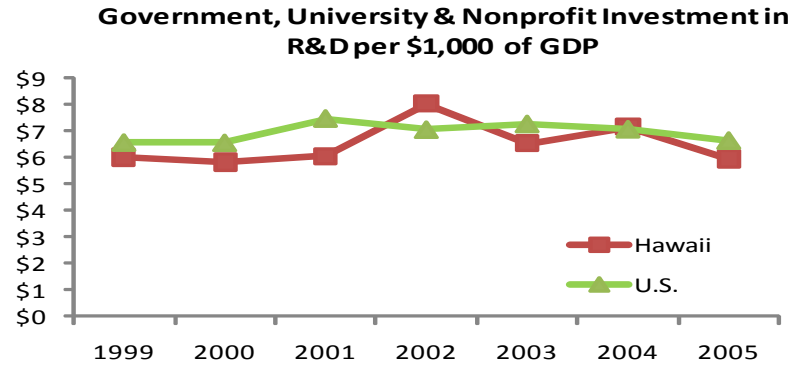
2. Research & Development Effort

- The rate of R&D spending as a proportion of GDP by universities and government slipped in the most recent year (2005) but the figure tends to be volatile from year to year. From 1999 to 2005 the rate generally has stayed in a relatively narrow range and has been comparable to U.S. rates.
- On the other hand private industry R&D as a proportion of GDP remains much smaller than the U.S. level, although it inched up in the 2005 survey.
- Patents per 1,000 workers remained very low in Hawaii compared to the U.S. level.

Research and Development Funding

University & Government R&D spending per \$1,000 of GSP:

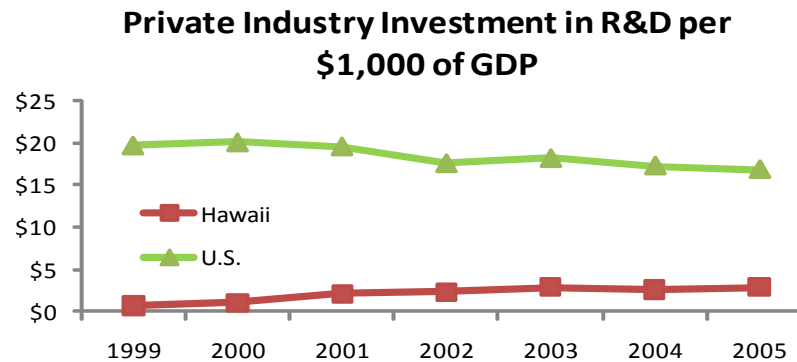
Year	Hawaii	U.S.
1999	6.00	6.56
2000	5.83	6.55
2001	6.06	7.47
2002	8.02	7.04
2003	6.54	7.26
2004	7.14	7.06
2005	5.95	6.63



Source: National Science Foundation, National Patterns of R&D Resources.

Private R&D spending per \$1,000 of GSP:

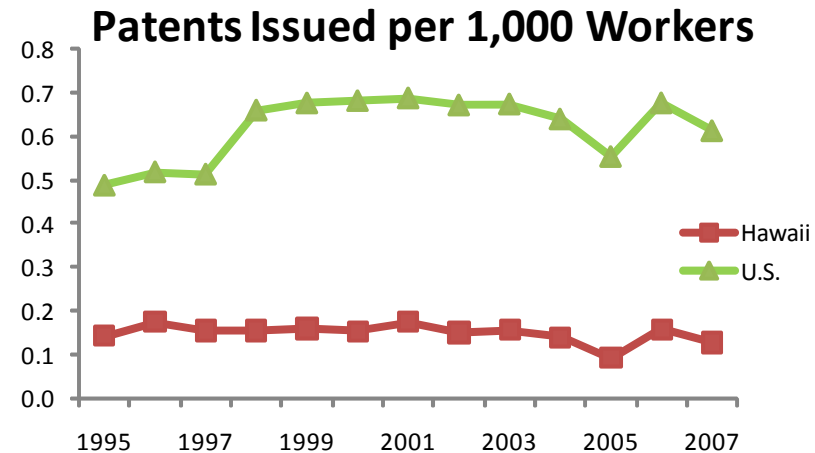
Year	Hawaii	U.S.
1999	0.67	19.69
2000	1.04	20.07
2001	2.13	19.58
2002	2.34	17.53
2003	2.85	18.15
2004	2.61	17.26
2005	2.90	16.81



Source: National Science Foundation, National Patterns of R&D Resources.

Patents Issued:

Year	Hawaii	U.S.
1995	0.14	0.49
1996	0.17	0.52
1997	0.15	0.51
1998	0.15	0.66
1999	0.16	0.68
2000	0.15	0.68
2001	0.17	0.69
2002	0.15	0.67
2003	0.16	0.67
2004	0.14	0.64
2005	0.09	0.55
2006	0.16	0.68
2007	0.13	0.61



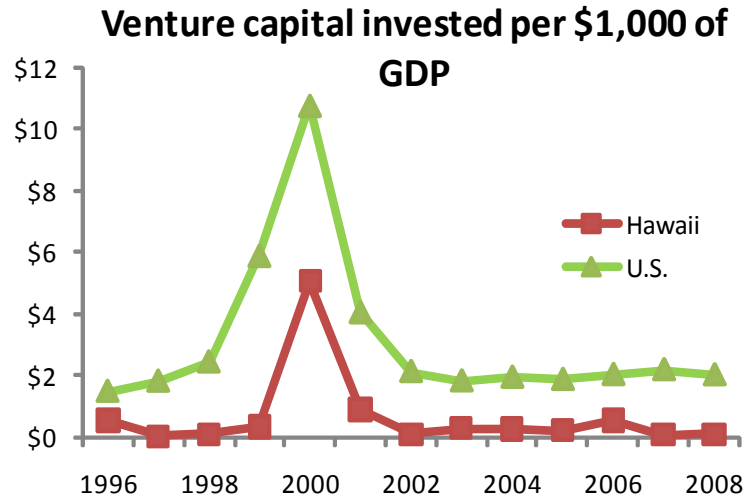
Source: U.S. Patent Office, Patent Counts by State and Year, 1977-2007.

3. Capital Availability

- Venture Capital Availability also remained low according to national data, although this may not be capturing the range of private investment into technology.
- The small business innovation research grant program continued to provide funding comparable to national rates, but the technology transfer grant program has remained low for several years.

Venture Capital Investments:

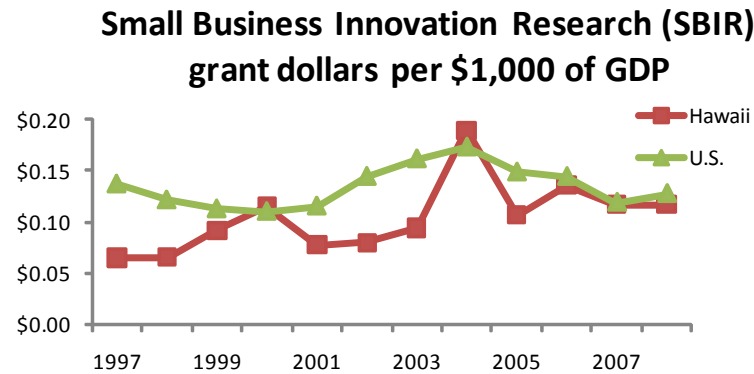
Year	Hawaii	U.S.
1996	\$0.55	1.47
1997	\$0.04	1.81
1998	\$0.11	2.43
1999	\$0.33	5.88
2000	\$5.05	10.77
2001	\$0.90	4.04
2002	\$0.10	2.12
2003	\$0.28	1.81
2004	\$0.27	1.93
2005	\$0.22	1.86
2006	\$0.55	2.02
2007	\$0.08	2.18
2008	\$0.11	2.01



Source: PriceWaterhouseCoopers, Moneytree Venture Capital Profiles, 1996-2007.

SBIR and STTR grant funds:

Year	Hawaii	U.S.
1997	0.06	0.14
1998	0.07	0.12
1999	0.09	0.11
2000	0.12	0.11
2001	0.08	0.12
2002	0.08	0.14
2003	0.09	0.16
2004	0.19	0.17
2005	0.11	0.15
2006	0.14	0.14
2007	0.12	0.12
2008	0.12	0.13

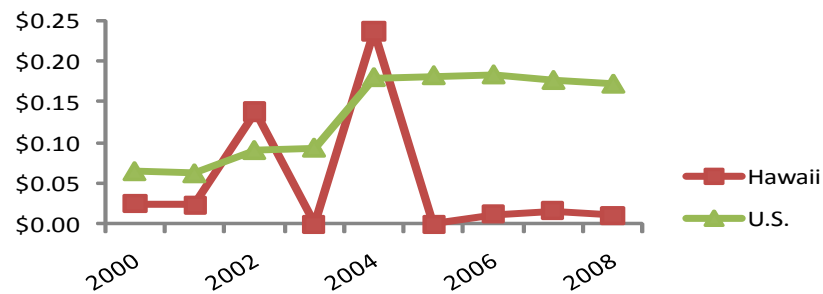


Source: U.S. Small Business Administration, The Small Business Economy, 1997-2008.

Year	Hawaii	U.S.
2000	0.02	0.07
2001	0.02	0.06
2002	0.14	0.09
2003	0.00	0.09
2004	0.24	0.18
2005	0.00	0.18
2006	0.01	0.18
2007	0.02	0.18
2008	0.01	0.17

(Series revised back to 2005)

Small Business Technology Transfer Program (STTR) grant dollars per \$10,000 of GDP



Source: U.S. Small Business Administration, The Small Business Economy, 2000-2008.

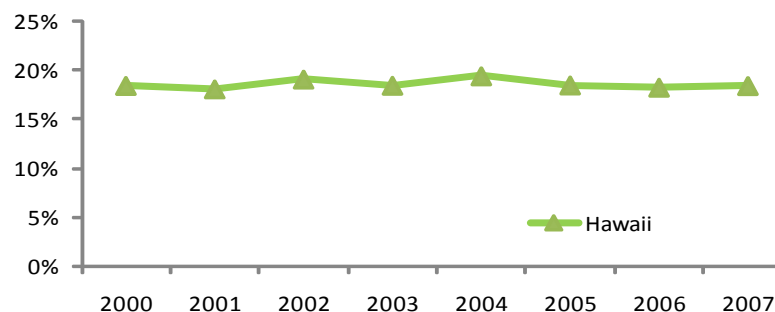
4. Workforce Development

- The percent of UH Manoa students earning science and technology degrees has remained in a narrow range since at least the beginning of the decade.
- The data series for Lifelong learning has been revised by the source agency and now reflects ages up to 29. The revised data are available for only certain years and show that most recently the enrollment rate for older residents is slightly lower than earlier in the decade. These rates tend to reflect economic conditions, and may have accelerated more recently with the economic decline.
- Hawaii continues to utilize the H-1B visa program for skilled foreign workers at about half the U.S. rate.

Degrees in Science and Technology

Year	% of total degrees	Natural Sciences	Sch of Ocean, Earth Science & Tech	College of Enginrg	College of Trop Ag & Human Res	School of Med.
2000	18.44%	347	40	148	69	123
2001	18.10%	286	42	132	91	101
2002	19.08%	283	41	115	87	133
2003	18.46%	307	45	150	59	201
2004	19.41%	348	54	130	66	151
2005	18.49%	358	64	144	75	131
2006	18.27%	360	57	161	82	144
2007	18.43%	375	56	133	106	125

Percent of Degrees Earned in Science & Technology Majors*, University of Hawaii at Manoa



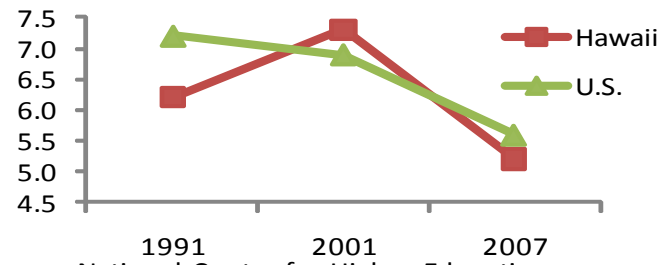
*:Including majors in Natural Sciences, School of Ocean, Earth Science & Tech, College of Engineering, School of Medicine, College of Tropical Agriculture and Human Resources (exculding Family and Consumer Science).

Source: Degrees Earned by Level, Gender, Field of Study; University of Hawaii at Manoa.

Life-long learning

Part-Time Undergraduate Enrollment as a Percent of 25-49 Year Olds (%), Hawaii & US

Year	Hawaii	U.S.
1991	6.2%	7.2%
2001	7.3%	6.9%
2007	5.2%	5.6%



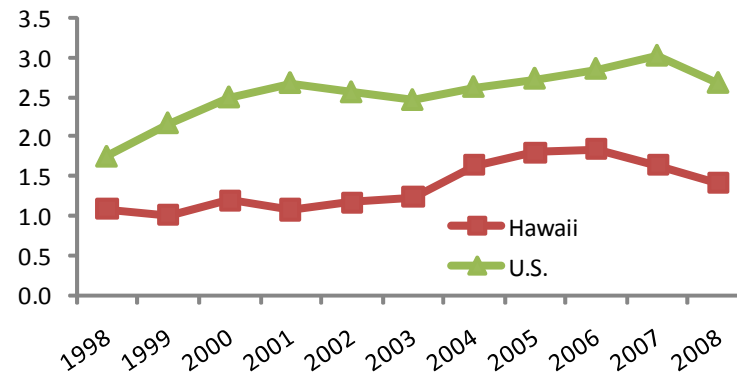
Source: National Center for Higher Education Management Systems.

Worker Recruitment

H-1B Visas:

Year	Hawaii	U.S.
1998	1.08	1.75
1999	1.01	2.17
2000	1.19	2.49
2001	1.07	2.67
2002	1.17	2.56
2003	1.23	2.46
2004	1.64	2.62
2005	1.80	2.73
2006	1.84	2.85
2007	1.64	3.02
2008	1.41	2.68

H-1B Visas per 1,000 Workers



Source: U.S. Dept of Homeland Security, Yearbook of Immigration Statistics.

5. Infrastructure

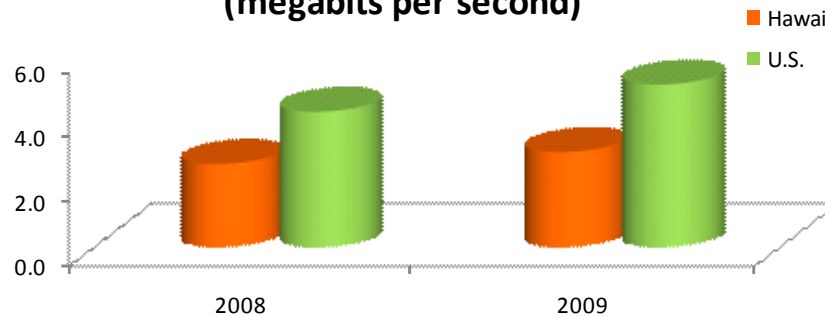
Infrastructure refers to the basic support assets, usually tangible, that allow commerce to be conducted. Roads, power lines, communications, water, waste disposal systems, and transportation systems are just a few examples of the economy’s infrastructure. For the innovation sector more specialized infrastructure such as broadband connectivity, conferencing and teleconferencing centers, technology incubator facilities, and specialized processing and testing facilities usually found in universities are a few examples. No single indicator can represent the scope of infrastructure capacities needed to support the innovation economy.

- A universally essential element in the digital age is broadband connectivity. The measure used has been adjusted by the source agency to reflect average rather than median internet speeds but still shows similar results. Hawaii speeds reported are just a little above half the U.S. speeds although both have been increasing over time.

Broadband Connectivity

	2008	2009	increase
Hawaii	2.60	2.97	14.24%
U.S.	4.23	5.07	20.07%

**Average Broadband Internet Download Speed
(megabits per second)**



Source: Communications Workers of America, Speed Matters, www.speedmatters.org

B. INNOVATION SECTOR AND SUPPORT ASSETS

Strong innovation capacity should translate into an innovation sector and support assets that can help transform the economy. This includes competitive enterprises in the technology and creative sectors and such assets as the proportion of high-skilled occupations, diffusion of technology to other sectors of the economy and strong entrepreneurial activity.

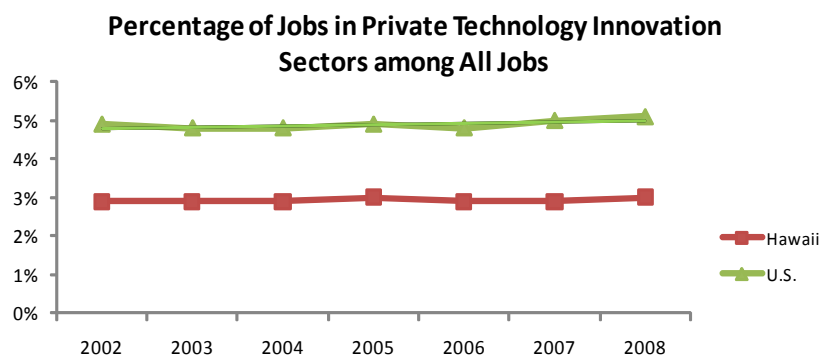
1. Size and Growth of the Technology Sector

Hawaii's technology sector has shown encouraging performance in recent years.

- The overall proportion of technology jobs in Hawaii remains well below the U.S. level, however this primarily reflects the absence of a technology manufacturing component in the state, which in turn reflects the comparative disadvantage Hawaii has in the manufacturing of goods. The proportion of technology jobs has remained relatively consistent in Hawaii and the U.S. in recent years; about 3.0% for Hawaii and 5.0% for the U.S.
- However, Hawaii's technology sector has grown faster than the U.S. over that period
- The Research and Development component of technology in Hawaii has shown growth in both proportion and absolute numbers. In 2008 the R&D sector exceeded the national R&D industry proportion in the economy.

Technology Sector Growth and Proportion of Jobs

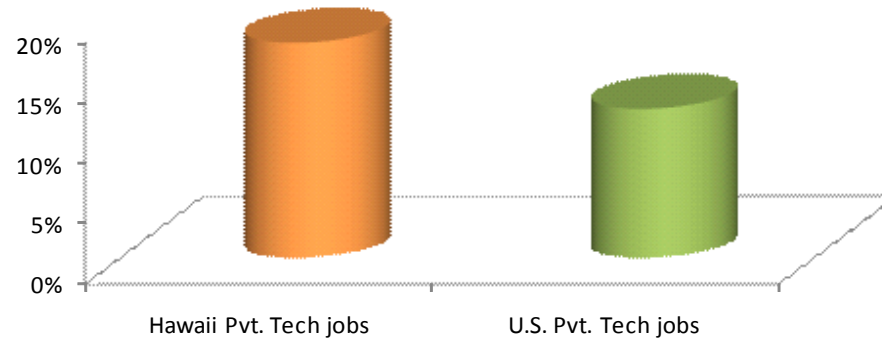
Year	Hawaii	U.S.
2002	2.9%	4.9%
2003	2.9%	4.8%
2004	2.9%	4.8%
2005	3.0%	4.9%
2006	2.9%	4.8%
2007	2.9%	5.0%
2008	3.0%	5.1%



Source: DBEDT based on Hawaii Science & Technology Council, methodology

Growth of Jobs in Private Technology Innovation Sector 2002-2008

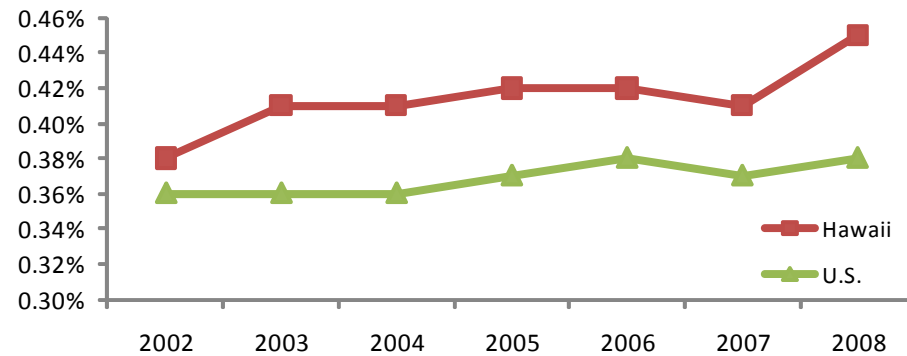
2002-2008	
Hawaii Pvt. Tech jobs	17.9%
U.S. Pvt. Tech jobs	12.4%



Research and Development Growth and Proportion of Jobs

Year	Hawaii	U.S.
2002	0.38%	0.36%
2003	0.41%	0.36%
2004	0.41%	0.36%
2005	0.42%	0.37%
2006	0.42%	0.38%
2007	0.41%	0.37%
2008	0.45%	0.38%

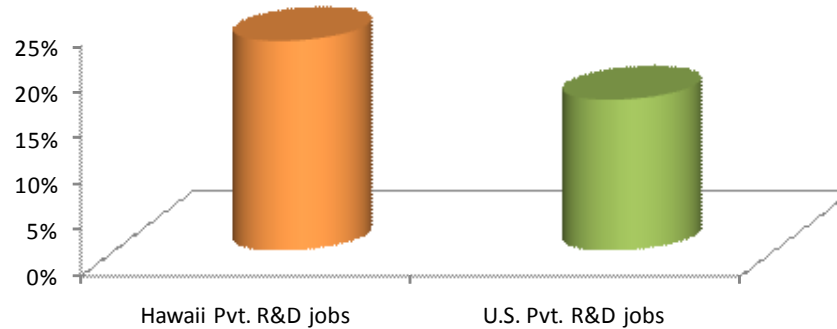
Percentage of in R&D among All Jobs



Source: DBEDT based on Hawaii Science & Technology Council methodology

Growth of Jobs in Research & Development, 2002-2008

2002-2008	
Hawaii Pvt. R&D jobs	22.8%
U.S. Pvt. R&D jobs	16.4%



Source: DBEDT

2. Creative Sector

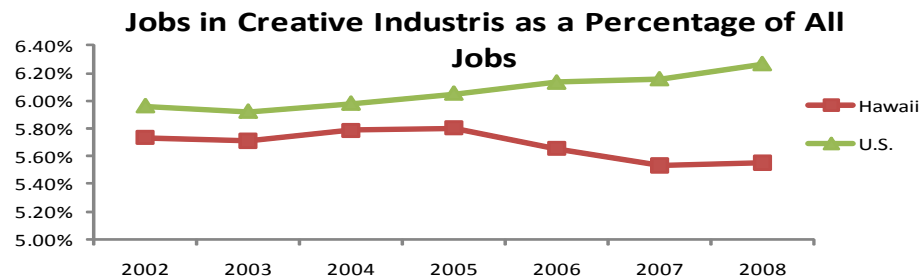
The creative sector includes artistic and related technical activity resulting in artistic and entertainment products and services. These include not only live performances, but also digital products such as music, film, computer animation and computer gaming. Preliminary estimates of the creative sector have been developed by DBEDT

- While jobs grew in absolute numbers, the proportion of jobs in the economy accounted for by the creative sector declined slightly between 2005 and 2008. However, in 2008 that proportion rose slightly. At the national level the proportion has continued to increase.

Jobs in the Creative Sector

Year	Hawaii	U.S.
2002	5.73%	5.96%
2003	5.71%	5.92%
2004	5.79%	5.98%
2005	5.80%	6.05%
2006	5.66%	6.13%
2007	5.53%	6.16%
2008	5.55%	6.27%

New Series for Creative Industries



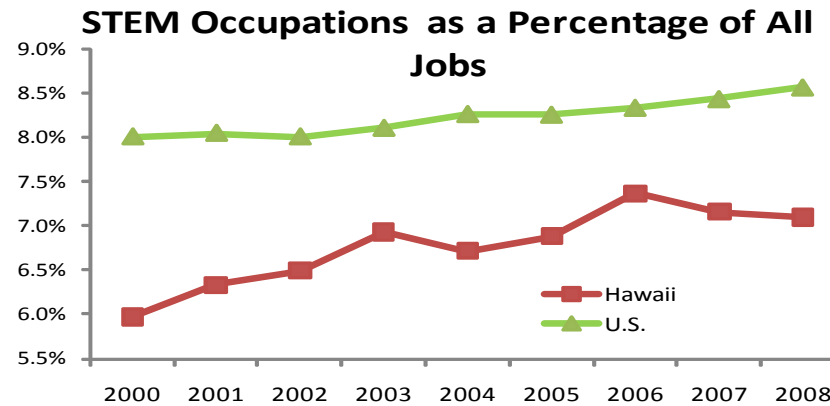
Source: DBEDT.

3. Highly Trained Technical Workforce

- The proportion of science, technology, engineering and math (STEM) occupations has generally been increasing over the years in the U.S. and Hawaii although the percentage for Hawaii tends to fluctuate from year to year.
- Earnings in STEM occupations have increased steadily for both Hawaii and the U.S. in nominal terms (not corrected for inflation) but are significantly higher for the U.S.

Percentage of Stem Occupations in the Economy:

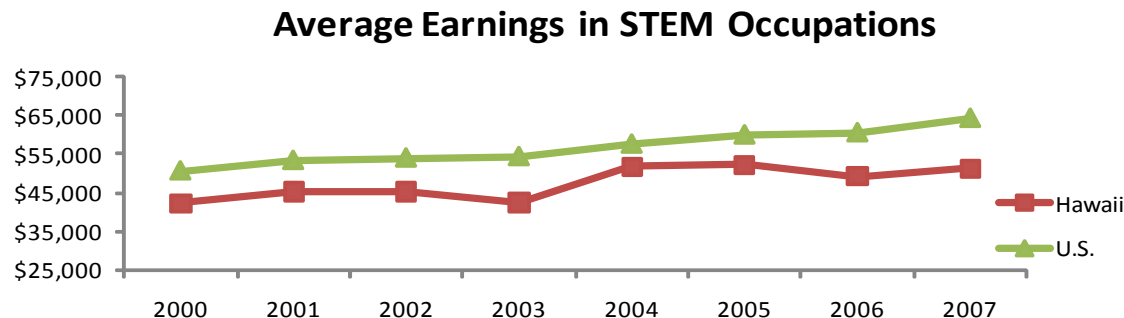
YEAR	Hawaii	U.S.
2000	5.97%	8.01%
2001	6.33%	8.05%
2002	6.49%	8.01%
2003	6.93%	8.10%
2004	6.71%	8.26%
2005	6.88%	8.26%
2006	7.37%	8.34%
2007	7.16%	8.44%
2008	7.10%	8.57%



Source: Bureau of Labor Statistics, May Occupational Employment and Wage Estimates. For occupations included, see Appendix B.

Average Earnings in STEM Occupations:

Year	Hawaii	U.S.
2000	\$42,314	\$50,589
2001	\$45,305	\$53,339
2002	\$45,312	\$53,990
2003	\$42,478	\$54,356
2004	\$51,726	\$57,626
2005	\$52,288	\$60,045
2006	\$49,195	\$60,614
2007	\$51,200	\$64,389



Source: U.S. Census Bureau, American Community Survey, 2000-2007. For occupations included, see Appendix B.

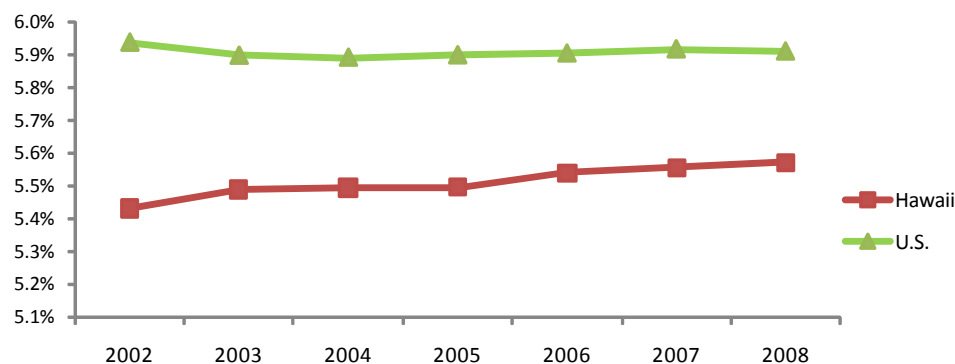
4. Technology Diffusion Beyond the Technology Sector

- The proportion of STEM jobs outside the technology sector have increased proportionately in Hawaii while declining slightly nationally.

Proportion of STEM Occupations Outside the Technology Industry:

Year	Hawaii	U.S.
2002	5.43%	5.94%
2003	5.49%	5.90%
2004	5.50%	5.89%
2005	5.50%	5.90%
2006	5.54%	5.91%
2007	5.56%	5.92%
2008	5.57%	5.91%

Proportion of Jobs Outside Technology That Are in STEM Occupations



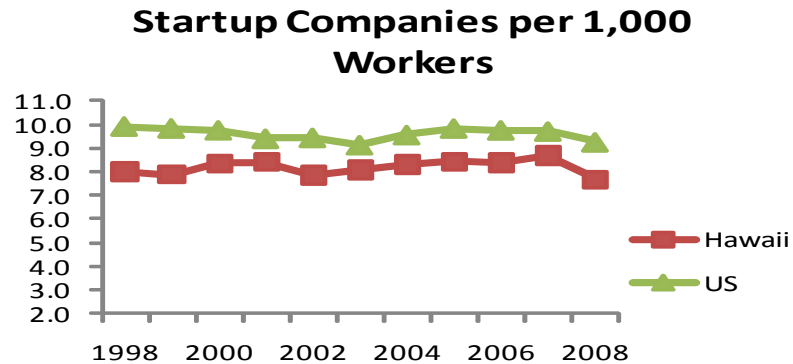
Source: Compile from data provided by EMSI, Economic Modeling Specialist, Inc

5. Entrepreneurial Activity

- Data for startup companies as a proportion of the workforce declined recently at both the Hawaii and U.S. levels. Over a longer period of time, however, the metric has shown little change in Hawaii but has softened nationally.

Year	Hawaii	US
1998	7.99	9.91
1999	7.86	9.84
2000	8.35	9.76
2001	8.39	9.41
2002	7.85	9.44
2003	8.08	9.14
2004	8.31	9.56
2005	8.43	9.83
2006	8.38	9.75
2007	8.67	9.70
2008	7.66	9.26

(Series Revised 2009)



Source: U.S. Small Business Administration, The Small Business Economy; Bureau of Labor Statistics, Business Employment Dynamics.

C. ECONOMIC TRANSFORMATION

The ultimate purpose of fostering innovation capacity and assets is the overall prosperity and competitiveness it generates in Hawaii’s economy. A strong innovation sector and innovation assets should result in more sustainable growth by ensuring that growth in the economy is driven by technology and productivity rather than just more people and more physical development. As a result, the economy will tend to become naturally more diversified and reach out to global markets. Median incomes should reflect the impact of more knowledge-intensive activity as the number of jobs that pay sustainable wages increase as a share of the total. Importantly to Hawaii, innovation in energy production and use should make the State increasingly more energy efficient.

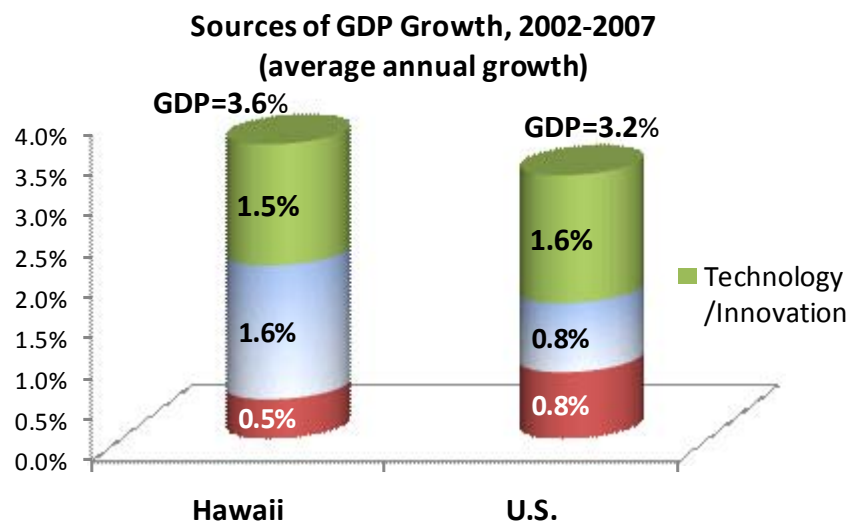
1. Growth & Efficiency

Proportion of STEM Occupations Outside the Technology Industry:

- The estimated proportion of economic growth in Hawaii due to innovation and the use of technology has tended to be lower than nationally, although recently the proportion nationally has dropped a bit. Hawaii’s proportion remains nearly the same as in the previous report.

Percent of Growth from Tech/Innovation

	Hawaii	U.S.
2002-2006	42.6%	56.8%
2002-2007	41.2%	48.5%

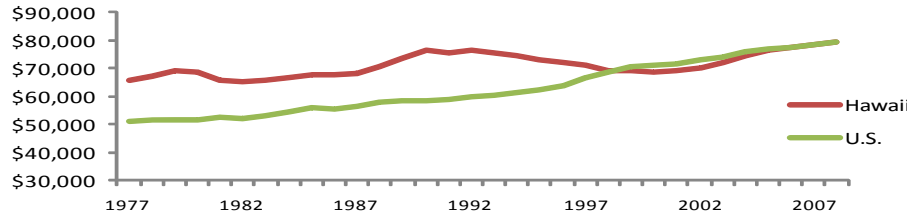


Labor Productivity:

- Hawaii appeared to have recovered from a long period of stagnant productivity growth in the 1990s and has been tracking favorably with national productivity increases since about 2002.

Hawaii and U.S. Labor productivity (Real GDP per worker)

Year	Hawaii	U.S.
2000	\$68,739	\$71,218
2001	\$68,951	\$71,835
2002	\$70,323	\$73,135
2003	\$71,871	\$74,241
2004	\$74,617	\$75,979
2005	\$76,514	\$76,993
2006	\$77,686	\$77,678
2007	\$78,588	\$78,326
2008	\$79,214	\$79,272



Source: State of Hawaii Databook; Statistical Abstract of the United States.

2. Diversification

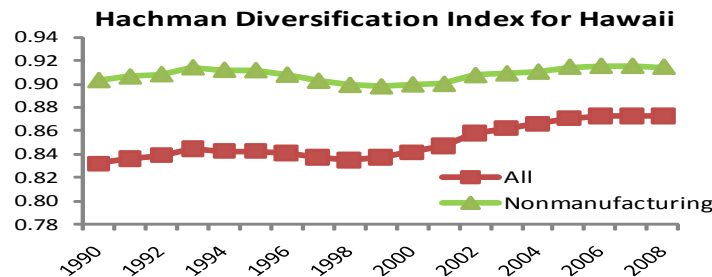
- Research continues to better exactly what kind of diversification Hawaii should strive for and how that should be measured. In the meantime a common index of industrial diversification is presented called the Hackman Index. This measures the diversification of jobs by industry in Hawaii’s economy against the U.S. economy as a whole. The U.S. level index always equals 1.0.
- Global integration is a difficult concept to quantify. The proxy is usually the value of international trade. Hawaii has only limited trade data on services and trade data on goods must be adjusted for enormous transshipment values. As more useful measures are sought for global integration the closest proxy is the proportion of adjusted merchandise exports per \$1,000 of GDP.

Diversification Index:

- Hawaii’s level of diversification has remained fairly steady over the last eight years.

Year	All Indys	Non-mfg
2001	0.85	0.90
2002	0.86	0.91
2003	0.86	0.91
2004	0.87	0.91
2005	0.87	0.91
2006	0.87	0.92
2007	0.87	0.92
2008	0.87	0.91

U.S. Index = 1.00 for all years



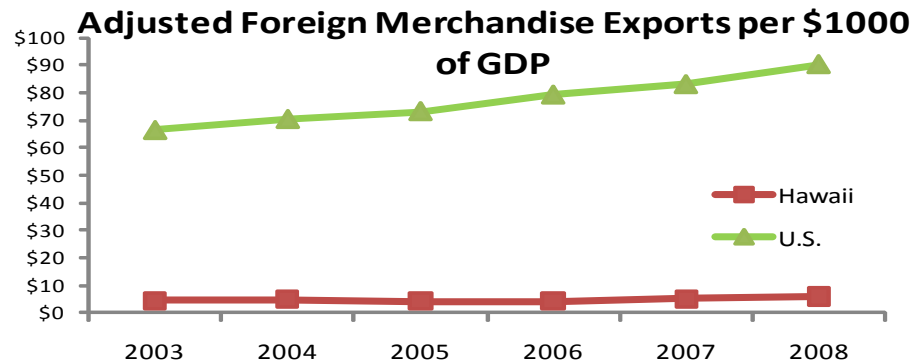
U.S. Index = 1.00 for all years

Source: DBEDT, Measuring Economic Diversification in Hawaii, 2008

Global Integraion

- Since 2006 Hawaii’s merchandise foreign trade adjusted for transshipments, military and used equipment has increased. However it is about 7% the proportion that international merchandise trade represents nationally.
-

Merchandise Exports per \$1000		
	Hawaii	U.S.
2003	\$4.52	\$66.48
2004	\$4.96	\$70.47
2005	\$4.41	\$73.29
2006	\$4.40	\$79.23
2007	\$5.13	\$82.97
2008	\$5.94	\$90.15

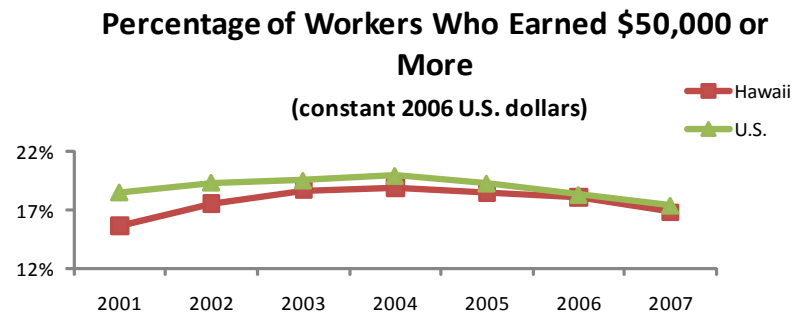


Source: U.S. Department of Commerce, DBEDT adjustments..

3. High Wage Jobs

- Both Hawaii and the U.S. have experienced a slight decline in the proportion of workers earning \$50, 00 or more (in constant 2006 dollars).

Year	Hawaii	U.S.
2001	15.68%	18.54%
2002	17.56%	19.39%
2003	18.70%	19.56%
2004	18.91%	19.98%
2005	18.52%	19.30%
2006	18.12%	18.32%
2007	16.86%	17.37%



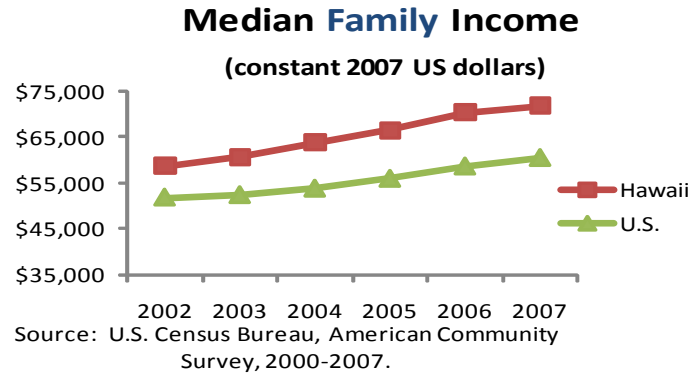
Source: U.S. Census Bureau, American Community Survey, 2000-2007.

4. Median Income

- Both family and household median income for Hawaii are above the national level. In recent years the increase in income has been proportionally stronger in Hawaii.

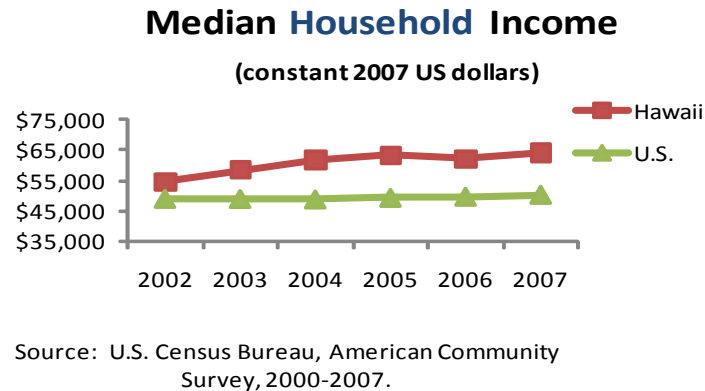
Median Family Income:

Year	Hawaii	U.S.
2002	58,703	51,742
2003	60,647	52,273
2004	63,813	53,692
2005	66,472	55,832
2006	70,277	58,526
2007	71,784	60,374



Median Household Income:

Year	Hawaii	U.S.
2002	54,518	48,878
2003	58,436	48,835
2004	61,736	48,665
2005	63,285	49,202
2006	62,185	49,568
2007	64,022	50,233

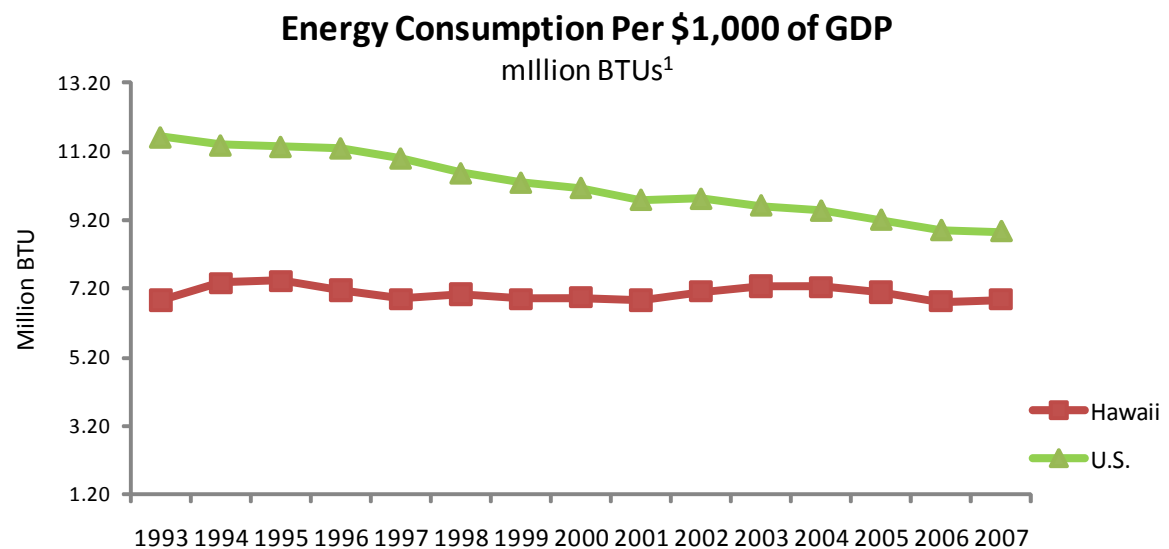


5. Energy Efficiency

- Hawaii has continues to be more efficient in the use of energy to generate economic output. However as pointed out in the last report, the U.S. as a whole is becoming measurably more efficient while Hawaii has not increased significantly in efficiency. These data are pre, Clean Energy Hawaii Initiative and reflect a fairly strong economy. Hawaii’s efficiency may increase as the effects of that initiative and a slower economy are felt.

Energy consumption – Million BTUs per \$1,000 of real GDP

Year	Hawaii	U.S.
1993	6.87	11.63
1994	7.38	11.39
1995	7.43	11.35
1996	7.16	11.31
1997	6.90	11.01
1998	7.04	10.57
1999	6.91	10.29
2000	6.94	10.14
2001	6.87	9.79
2002	7.11	9.82
2003	7.28	9.63
2004	7.25	9.47
2005	7.10	9.21
2006	6.82	8.90
2007	6.89	8.87



¹ British Thermal Units, a common measure of energy.

Source: U.S. EIA and BEA.

Source: U.S. EIA and BEA., 1993-2007

IV. Conclusions

Capacity for technology and innovation:

Between the base report in 2008 and the most recent update, Hawaii remains behind in meeting national benchmarks for most indicators. The period covered by the new indicators show that the U.S. improved in a number of areas faster than Hawaii, resulting in fewer plus signs and more minus signs in the Capacity category. On the other hand, there were slightly more indicators that were showing a positive trend for the capacity category than in the last report. Thus, while stronger performance nationally in many indicators affected comparative performance, Hawaii was showing some improvement overall in turning more trends positive.

Innovation Sector and Support Assets:

Hawaii is still behind the U.S. in most innovation sector indicators with respect to performance but the situation improved between the two reports. Overall, more innovation sector asset indicators showed improvement in both performance and trends between the original and update reports. Particularly due to stronger performance in technology, the innovation sector showed more indicators positive for comparative performance and for improved trend.

Economic Transformation:

The performance and trends in the economic transition category showed little or no change in either performance comparison or trends between the two reports. Hawaii continues to do comparatively better and trends are positive in family/household income, and labor productivity. Performance and trends are still lagging in jobs above \$50,000. In the latest report energy efficiency dropped slightly (BTU's used per GDP rose). However, efficiency had been making slow progress in the preceding four years, so this slight uptick is not troubling. Of more concern is that the rate of improving energy efficiency is slower than the national level, which has been making very consistent progress since the early 1990s.