

Consumer behaviour and environmental quality in Hawaii

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Abstract

Purpose – The purpose of this paper is to add to the body of knowledge on the relationship between consumer behavior and environmental quality. The specific purpose is to gauge the predisposition of Hawaii residents to purchase a hybrid auto and their level of agreement to support legislation that improves and protects environmental quality.

Design/methodology/approach – The research is a case study based on a literature review of relevant Hawaii, national, and international publications and a survey of Hawaii consumers. The survey is an exploratory study using a non-random sample of 350 Hawaii residents identified as owners of non-hybrid cars.

Findings – Regardless of age and gender, respondents agreed that they would purchase a hybrid car if the cost was the same as a traditional gas fueled car. There were significant correlations between agreement to purchase a hybrid car and agreement to support legislation that provides tax credits to consumers who purchased a hybrid car and other environmentally safe products, tax credits to companies that produce environmentally safe products, and penalties for government agencies, private organizations, and individuals who pollute the environment.

Originality/value – The paper is based on primary data from a survey of Hawaii consumers. Its content is not only valuable to people in the same field, but generates hypotheses for future research.

Keywords Consumer behaviour, Cars, Social responsibility, Legislation, Environmental management, United States of America

Paper type Case study

The role of consumer behavior in improving and protecting environmental quality is essential to sustainable communities. The 1992 Rio Earth Summit Conference Document (Agenda 21) emphasized the need to change consumption patterns at the individual level, which has since been the focus of related research on consumer behavior and sustainability (Perico, 2005). Olander and Thøgersen (1995) maintained that consumer behavior is a prerequisite to environmental protection.

Other studies, based on survey research suggest that there is a positive relationship between attitudes of environmental concern and environmentally friendly consumer behavior (Minton and Rose, 1997; Roberts and Bacon, 1997; Roberts, 1996; Gatersleben and Steg, 2002). One study by Gatersleben and Steg (2002) concluded that pro-environmental behavior is strongly related to attitude variables. Further, Rose and Minton and Rose (1997) noted the overall positive effect of behavioral intentions that foster environmentally friendly consumer behaviors such as signing, joining, supporting, and contributing to anti-pollution programs at the community, state and national levels.

The authors declare that they have no financial or otherwise participation in the automobile industry.

With respect to consumer behavior, automobile emissions are the single largest contributors (almost 50 percent of personal pollution) to several pollutants including carbon dioxide and nitrous oxide, both designated as greenhouse gas (GNG) emissions under the environmental protective Kyoto Protocol (UN, 2005).

The purpose of this research is to add to the body of knowledge on the relationship of consumer behavior and environmental quality. It includes a survey of consumers in the State of Hawaii that gauges the predisposition of Hawaii residents to purchase a hybrid auto and their level of agreement to support legislation that provides tax credits to environmentally friendly companies and consumers and increased penalties for polluters. In this exploratory study, the survey represents the first attempt to document a state population's preference for hybrids in the context of costs to the consumer and the environment.

Comparing hybrid sales in Hawaii and US mainland

Hybrid autos have a combined gasoline and electric engine; familiarity with its use will require some adaptation by consumers. However, automakers predict that over 50 hybrid models will be available in the next ten years, with sales of hybrid cars comprising 80 percent of the total market. In addition to the hybrid technology, numerous other environmentally conscious improvements are available to reduce emissions in both hybrid and gas powered vehicles, and many foresee the coming of fuel cell technology that is expected to run vehicles at 20 percent or less of today's emission levels.

The overall sale of Hybrids in the USA is quite low; only 1 percent of the 17 million autos sold in 2004 were Hybrid (Durbin, 2005). Analytical Solutions for R.L. Polk & Company collect and analyze car data; they maintain that federal and state tax credits have given the consumer an incentive to purchase hybrid cars (Durbin, 2005).

Hawaii is among the first states in the US to purchase hybrid models from the start. The Toyota Prius, the most popular hybrid-only model, was the 21st most popular car sold in Hawaii in 2006, up from 23rd in 2005. Because of the growing popularity of some hybrid models, Hawaii auto dealers have reported difficulty in acquiring them and typically charge a premium. Except for the first seven months of 2007, the sale of hybrid autos in Hawaii has been and continues at a higher rate than on the US mainland, around 2 percent as compared to 1 percent of total sales (Mendoza, 2008). When the gas prices reached over \$4.00 a gallon, it created an immediate demand for hybrid cars.

Sales of hybrids and other green vehicles increased significantly in April 2009. Honda's Insight sold 2,096 units in its first full month of sales and Honda's Civic Hybrid was up almost 17 percent in March 2009. In May of 2009, Ford Motor Company was up 20 percent over April 2009 figures (Product Team, 2009). Its combined sales for the Fusion and Milan hybrids and the Ford Escape and Mercury Mariner hybrids set a company record for hybrid sales in a single month. Auto manufacturers realize that hybrids, and especially improved models, are in greater demand among new car buyers. In 2010, Honda's Hybrid Insight is expected to compete well with the popular Toyota Prius in terms of price and performance.

President Obama's tax incentives for purchasers of efficient green vehicles, including hybrids, plug-ins, and other green car alternatives should help to accelerate

growth in the hybrid sector. Similarly, China's entrance into the hybrid auto industry is expected to stimulate competitive growth. Chinese auto manufacturer, BYD Company Ltd., already has a hybrid car that can be mass-produced. It will be interesting to see what happens when it is launched in the US in 2010 (Product Team, 2009).

In 2008 US car sales decreased dramatically and the major US automakers reported an 18 percent decrease in overall auto sales. However, Hawaii government services and many Hawaii consumers continue to invest in the long-term promise of hybrid and other alternative-power transportation. Although auto sales in Hawaii dropped an estimated 22 percent through October 2008, Servco Hawaii reported that its sales of hybrid vehicles seemed to have bucked the local and national trends. Sales of Toyota hybrids Prius, Camry, and Highlander increased in 2008 to where they now account for 10 percent of all Toyota sales (Tsai, 2009).

Hawaii's environmental initiatives

Long-term considerations by consumers seem to be in step with continued explorations into alternative-energy transportation by private business, the continued use of hybrid vehicles by the city's TheBus and Handi-Van services, and the state's Hawaii Clean Energy Initiative. The state's wide-ranging and ambitious plan includes a commitment by the state and the Hawaiian Electric Company (HECO) to "a program that will identify and implement incentives needed to encourage adoption of electric vehicles for individual and fleet use, and also lead by example by acquiring hybrid or electric-only vehicles for government and utility fleets" (Tsai, 2009, p. 2).

The state and HECO have endorsed a plan by the Palo Alto-based Better Place Company to build a network of charging and battery-exchange stations that would serve electric vehicles with rechargeable batteries. Under the plan, users would pay for access to the network via subscription. Better Place says there would be no need to swap batteries for drives shorter than 100 miles. Hawaii is seen as an ideal locale for the Better Place model given its relatively limited system of roads and high fuel costs compared to the US mainland. Israel, Denmark, Australia and San Francisco have also endorsed the model. Thomas Quinn, director of the Hawaii Center for Advanced Transportation Technologies, favors the Better Place model, which allows consumers to make the switch to electric cars at a lower initial cost and to plug into an oil-free power grid, which Hawaii's Clean Energy Initiative intends to build. However, the charging stations are intended only to "top off" the battery's charge during trips. Full charging would likely be done at the driver's residence, which would require electricity traditionally produced by burning oil (Tsai, 2009).

Maui Electric Co. is working with Ontario, Calif.-based Phoenix Motorcars on a trial program that will include the construction of an electric-vehicle infrastructure on Maui for use by up to 30 Phoenix sport utility trucks. The trucks operate off a lithium-titanate battery capable of running the vehicles for 100 miles off a 10-minute charge.

To further promote alternatives to gasoline-powered cars, the Hawaii Center for Advanced Transportation Technologies (HCATT) was first established in 1993 as the Hawaii Electric Vehicle Demonstration Project to represent the Hawaii Consortium in the Defense Advanced Research Projects Agency's Electric and Hybrid Vehicle Technology Program. In 1999, the program transitioned to the Department of

Transportation's Advanced Vehicle Technology Program, and in 2001 it formed a partnership with the Air Force Advanced Power Technology Office and established the National Demonstration Center for Alternative Fuel Vehicles at Hickam Air Force Base in Honolulu.

The High Technology Development Corporation (HTDC), which manages HCATT, is a state agency established by the Hawaii State Legislature in 1983 to facilitate the development and growth of Hawaii's commercial high technology industry. Under its supervision, HCATT has organized public/private partnerships between the federal government and private industry to develop advanced low emission and zero emission vehicles centered on electric drive technologies. Additionally, HCATT entered into a partnership with the Hawaii Natural Energy Institute and Hawaii Volcanoes National Park to introduce zero emission, hydrogen fuel cell/battery powered hybrid electric buses into the park to support environmentally friendly tours for the millions of annual visitors to the park. HCATT also helped to showcase both the Better Place and Phoenix Motorcars systems in Hawaii and has participated in several alternative-energy transportation programs over the years. HCATT now does most of its work in conjunction with the US Air Force, helping to develop hydrogen and fuel-cell powered buses, vans, movers, and other vehicles that could one day be introduced commercially. HCATT helped Hickam Air Force Base develop and install a hydrogen production and fuel station.

There is ample evidence of the government's growing interest in alternative-energy transportation. In 2008, the state Department of Transportation purchased eight new "clean diesel" buses. Clean diesel, also called ultra-low sulfur diesel, is more refined and cleaner than traditional diesel; it has proven to be more fuel-efficient in commercial use. The City and County of Honolulu is planning to significantly expand its growing fleet of hybrid buses. In December 2008, as part of Hawaii's economic stimulus plan delivered to President-elect Obama's transition team, Mayor Mufi Hannemann proposed the purchase of 100 new hybrid buses and 50 paratransit vehicles at a cost of \$85 million. Also in January 2009, the Honolulu Police Department (HPD) began a six-month trial of using hybrid vehicles. The department is evaluating six Toyota Camry hybrids for performance and cost savings. Officers who drive the vehicles provide weekly reports on their performance (Tsai, 2009).

Greenhouse gas emissions in Hawaii

Hawaii's Greenhouse Gas (GHG) Emissions Reduction Law (Act 234), in effect since July 1, 2007, requires that State policy regulating GHG emissions reductions and limits be set at or below the best estimates and updates of the inventory levels of GHG emissions for 1990, by January 1, 2020. To achieve this reduction, Act 234 required that the Hawaii Department of Business, Economic Development, and Tourism (DBEDT) and the Department of Health (DOH) update the Inventory of Hawaii's Greenhouse Gas Emissions Estimates for 1990, by December 31, 2008 (Hawaii Greenhouse Gas Inventory: 1990 and 2007, 2008). ICF International, a global professional consulting firm, partnered with DBEDT to accomplish this and other environmental initiatives. The updated estimates rely on the latest methodologies and emission factors available from the Intergovernmental Panel on Climate Change (IPCC), US Environmental Protection Agency's (EPA) Inventory of US Greenhouse Gas Emissions and Sinks:

1990-2006, and other sources. This approach ensures that the Hawaii GHG Inventory aligns with the accounting methodologies used by other states at the national level and other countries at the international level. The updated inventory estimates focused exclusively on emissions due to human activities and determined that carbon dioxide is the largest single contributor to emissions from in-state sources at 91 percent of the total emissions (Hawaii Greenhouse Gas Inventory: 1990 and 2007, 2008).

Based on the November 2008 ICF report, Hawaii's updated GHG inventory shows better progress than expected toward meeting the Kyoto Protocol reduction goals. The ICF report shows that Hawaii's GHG increase since 1990 has been somewhat slower – up 3 percent versus the 8 percent increase that was the preliminary estimate earlier provided by DBEDT. This slower than expected increase in Hawaii's GHG emissions is offset by some of the new data, including first-ever estimates of Hawaii's GHG “sinks”. These new data show that Hawaii's forests and fallow agricultural lands only absorb 12 percent of the state's GHG emissions.

One reason Hawaii's emissions increase is lower than expected is because the 1990 benchmark data were significantly higher, reflecting revisions made by the advancing state of the art methodologies in accounting. The new inventory includes estimates for air travel from Hawaii, including military jets, which account for over one-half of Hawaii's transport emissions. This amounts to just over 1 ton of air travel emissions for every ton of ground transport emissions from cars and trucks. Summary GHG estimates are also provided for each island. For example, 83 percent of Kauai's emissions are from electricity and transport as compared to 90 percent statewide, and forests and lands absorb 25 percent of Kauai's emissions as compared to 12 percent statewide. The efforts by ICF International have advanced and improved Hawaii's accounting methodologies in calculating GHG emission estimates. The results and reports in 2008 by ICF International are still a work in progress that will continue to be monitored by Hawaii's Greenhouse Gas Emissions Reduction Task Force.

It should be noted that the lives of Hawaii's residents were improved by the reduction of GHG emissions, through the ingenuity of a Hawaii resident, who was honored with the 2008 Environmental Achievement Award from EPA's Region IX office for “innovative research” and “unwavering commitment to achieve this environmentally friendly product” (Wilson, 2008, p. 3). The EPA approved the homemade HCR-188c formula as a refrigerant in home appliances and air-conditioners that is safer for consumers and the environment. The HCR-188c hydrocarbons blend is a replacement for refrigerants that deplete the Earth's ozone layer and/or contribute “greenhouse” gases to the atmosphere. The precise mixture of ethane, propane, isobutene, normal butane and other naturally occurring compounds has zero ozone-depleting potential and very low global warming potential. Because appliances using HCR-188c require only one-quarter of the usual amount of refrigerant, the danger from fires and leaks is extremely low. Independent testing also showed that appliances with HCR-188c use less energy and provide a greater degree of cooling (Wilson, 2008).

Survey of Hawaii consumers

A survey of Hawaii residents 18 and over was conducted in March and April 2009. A consumer behavior questionnaire developed by the authors was distributed island-wide to a non-random sample of 350 respondents identified as owners of

non-hybrid cars. The respondents were asked to indicate their level of agreement with the eight questions in Table I.

Of the 298 responses (85 percent) to the questionnaire, 39 percent was male and 61 percent female. The breakdown in ages: 31 percent was 18-26 years old, 21 percent was 27-35, 20 percent, was 36-45, 23 percent was 46-65, and 5 percent was 66 years and older.

The purpose of this exploratory survey was to determine the predisposition of Hawaii residents, measured in terms of level of agreement, to purchase a hybrid auto, advocate for other environmentally friendly products, and support legislation which provides tax credits to improve and protect environmental quality, as well as penalties for environmental polluters. It is hoped that the results of this exploratory study will help to generate hypotheses to be more fully tested by further research.

Based on gender, there was no significant difference in the respondents' level of agreement to the questions (Table II). All age groups were in agreement to support legislation giving tax credits for purchasing environmentally friendly cars. All age groups also agreed with legislation for tax credits to companies that produce products that are safe for the environment, and tax credits to consumers who purchase products that are environmentally safe for the community, such as hybrid automobiles. Further, all respondents, regardless of age or gender, agreed that they would purchase an

No.	Question	1	2	3	4	5	6
1.	I would purchase an environmentally friendly hybrid automobile even if it cost 10 percent–15 percent more than the gas-fueled automobile						
2.	I would purchase a hybrid automobile that is environmentally friendly if it cost the same as the gas-fueled automobile						
3.	I am willing to pay more taxes to fund anti-pollution programs						
4.	The government should give tax incentives for companies that produce products that are environmentally friendly						
5.	I would join in a community effort advocating the development and production of environmentally friendly products						
6.	I would support legislation that gives tax credits to companies that produce products that are safe for the environment						
7.	I would support legislation that gives tax credits to consumers who purchase products that are environmentally safe for the community, such as hybrid automobiles						
8.	I would support legislation that increases penalties for government agencies, private organizations and individuals who pollute the environment						

Notes: The respondents were asked to indicate with an X their level of agreement with the eight questions where 1 = Disagree very much; 2 = Disagree moderately; 3 = Disagree slightly; 4 = Agree slightly; 5 = Agree moderately; 6 = Agree very much

Table I.
Consumer behavior
survey form

environmentally friendly automobile if the cost was the same as a traditional gas-fueled car.

Table III shows significant correlations between the respondents' agreement to purchase a hybrid automobile that is environmentally friendly if it cost the same as the gas-fueled automobile and their agreement to support legislation that gives tax credits to companies that produce products that are safe for the environment and consumers who purchase products that are environmentally safe for the community, such as

Table II.
Breakdown of
respondents by question

Rate	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1	11	3	21	5	7	3	1	1
2	33	3	19	4	16	5	3	7
3	55	12	53	4	37	8	8	23
4	81	38	88	38	77	43	32	35
5	61	69	82	97	76	85	62	55
6	57	173	35	150	85	154	192	177

Kendall's tau_b	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Q1 Correlation	1.000	0.522	0.733	0.276	0.733	0.600	0.600	0.600
Coefficient	0.0	0.126	0.039	0.444	0.039	0.091	0.091	0.091
Sig. (two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q2 Correlation	0.522	1.000	0.414	0.786	0.828	0.966*	0.966*	0.966*
Coefficient	0.126	0.0	0.251	0.032	0.022	0.007	0.007	0.007
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q3 Correlation	0.733	0.414	1.000	0.276	0.467	0.333	0.333	0.333
Coefficient	0.039	0.251	0.0	0.444	0.188	0.348	0.348	0.348
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q4 Correlation	0.276	0.786	0.276	1.000	0.522	0.690	0.690	0.690
Coefficient	0.444	0.032	0.444	0.0	.126	0.056	0.056	0.056
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q5 Correlation	0.733	0.828	0.467	0.522	1.000	0.867	0.867	0.867
Coefficient	0.039	0.022	0.188	0.126	0.0	0.015	0.015	0.015
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q6 Correlation	0.600	0.966*	0.333	0.690	0.867	1.000*	1.000*	1.000*
Coefficient	0.091	0.007	0.348	0.056	0.015	0.0	0.0	0.0
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q7 Correlation	0.600	0.966*	0.333	0.690	0.867	1.000*	1.000	1.000*
Coefficient	0.091	0.007	0.348	0.056	0.015	0.0	0.0	0.0
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6
Q8 Correlation	0.600	0.966*	0.333	0.690	0.867	1.000*	1.000*	1.000*
Coefficient	0.091	0.007	0.348	0.056	0.015	0.0	0.0	0.0
Sig.(two-tailed) <i>n</i>	6	6	6	6	6	6	6	6

Notes: *Correlation is significant at the 0.05 of level: two-tailed. Tau b: This tests the strength of association of the cross tabulations when both variables are measured at the ordinal level. It makes adjustments for ties and is most suitable for Square tables. Values range from -1 (100 percent negative association, or perfect inversion) to +1 (100 percent positive association, or perfect agreement). A value of zero indicates the absences of association.

Sources: Kedall (1938; Abdi (2007)

Table III.
Correlation coefficient of
agreement by
respondents by question

hybrid automobiles, and increases in penalties for government agencies, private organizations and individuals who pollute the environment.

Summary and conclusion

Unlike all other states in the US, Hawaii's geographical isolation from any large land mass and major sources of man-made pollutants combined with very minimal locally generated man-made air pollution contributes toward its worldwide reputation for clean air. State and county government officials have supported environmental initiatives to prevent pollution and taken positive action to preserve and protect Hawaii's environmental quality. Hawaii Clean Energy Initiative, continued use of hybrid vehicles by the city's TheBus and Handi-Van services, and the Better Place model are just a few examples of the state and county commitment to improve Hawaii's environmental quality. State and county environmental quality controls and standards are continually updated and improved. This is reflected in Hawaii's Greenhouse Gas (GHG) Emissions Reduction Law (Act 234), effective July 1, 2007, that requires State policy for GHG emissions reductions and limits to be set at or below the best estimates and updates of the inventory levels of GHG emissions for 1990, by January 1, 2020. Based on the November 2008 ICF report, Hawaii's updated GHG inventory shows better than expected progress toward meeting Kyoto Protocol reduction goals.

This commitment to environmental quality by state and county officials was demonstrated by the work of the Hawaii Center for Advanced Transportation Technologies (HCATT) as early as 1993. HCATT, then known as the Hawaii Electric Vehicle Demonstration Project, represented the Hawaii Consortium in the Defense Advanced Research Projects Agency's Electric and Hybrid Vehicle Technology Program. In 1999, it transitioned to the Department of Transportation's Advanced Vehicle Technology Program and has since continued to assist both the Better Place and Phoenix Motorcars systems in Hawaii and participate in several alternative energy transportation programs.

It is in the context of this commitment to improve environmental quality that this research on the role of Hawaii consumers and its relation to adapting to alternative-energy transportation represented by the hybrid auto was initiated. While exploratory, the results of the research suggest that Hawaii consumers are aware of the need to improve environmental quality and support government intervention through environmentally friendly legislation that provides tax credits for producers and consumers of hybrid autos and other related products, and increased penalties for polluters. Hopefully, the results of this study will help generate hypotheses which will be tested further in future research related to consumer behavior and environmental quality.

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Further reading

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