

New energy opinion leaders' lifestyles and media usage -- applying data mining decision tree analysis for UNIDO-ICHET website users

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Abstract

According to the innovation diffusion research, the innovators, opinion leaders, and diffusion agents play vital roles in promoting the acceptance of innovation. The innovators and opinion leaders must be able to cope with the high degree of uncertainty about an innovation and usually have higher innovation-related media usage than the majority. Based on consumer behavior studies, lifestyle analysis could help researchers divide consumers into different lifestyle groups to understand and predict consumer behaviors. Lifestyle allows researchers to investigate consumers via their activities, interests and opinions instead of using demographic variables. Similarly, more researchers are using data mining analysis to extract knowledge structures represented in models or patterns from information or raw data. Recently, the advances in hardware and software have enabled the application of a variety

of data mining analysis methods in a wide range of fields.

The purpose of this research has been to investigate how new energy innovators and opinion leaders' different lifestyles affect their new energy product adoption, and examine their media usage regarding new energy reports or promotion. Given this goal, the researchers then applied data mining decision tree analysis to discover the best target groups of new energy innovators for promoting new energy-related media message. In order to achieve the purposes listed above, the researchers needed to locate and contact the potential innovators and opinion leaders in this field. Thus the researchers cooperated with UNIDO-ICHET to launch this survey.

This cross-discipline online survey was formally launched from Aug 2005 to Oct 2006. The survey successfully collected 2,040 new energy innovators and opinion leaders' information. The researchers analyzed the data using SPSS statistics software and Data Mining decision tree analysis. Then the researchers divided new energy innovators into four groups: the "outdoorsman group", the "young modern group", the "family-oriented professionals group", and the "egocentric youth group". Compared with the other lifestyle groups, the new energy innovators in the "family-oriented professionals group" have the highest interest in new energy products and in getting involved in new

energy-related or environmental protection organizations. They play a primary role in promoting the acceptance of new energy products' information.

Regarding the results of data mining decision tree analysis, researchers found 68.7% of new energy innovators are highly interested in new energy-related media issues. The variables most able to predict a person's interest include: his (or her) level of interest in media advertisement and campaigns concerning energy issues, his residing in Asia or Europe, his belonging to the "young modern group" or the "family-oriented professionals group," and his primary source for information concerning technology development being newspapers and broadcast. The model prediction accuracy was 71%. The variables found to best predict which persons will be more attentive to energy-related advertisements and campaigns include: their level of understanding about the Kyoto Protocol, their browsing of new energy-related websites," and their media usage for information about technology development being primarily the internet, radio and television." The model prediction accuracy was 77%.

I. Introduction

Data mining (DMM), also called Knowledge-Discovery in Databases (KDD) or Knowledge-Discovery and Data Mining, is the process of extracting hidden predictive information and patterns from large volumes of data using tools such as decision trees, association rule mining, clustering, etc. DMM is a powerful technology with great potential to help researchers focus on the important information in their data or information. Most DMM tools also help researchers or companies predict future trends and consumer behaviors. Hence, DMM helps decision makers make knowledge-driven decisions.

Compared with traditional analysis tools, data mining tools can answer some questions that traditionally were too time-consuming to resolve. They could mine data deeply from databases for hidden patterns, finding predictive rules that some researchers may have missed before. Recently there have been more researchers from different fields applying data mining to their research. In this paper, the researchers used decision trees, one of data mining tools, to investigate new energy opinion leaders' lifestyles and media usage. The purpose of this paper was to uncover new energy opinion leaders' lifestyles, and the best rule for predicting who are more interested in new

energy related media issues and campaigns and to discover the best target on which new energy innovation agents should focus.

The past research about new energy focused more on the development of technologies instead of the analysis of communication approaches or social science. However, acceptance of new energy technology, products and environmental protection is, in effect, an attitude toward life.

Concerns over global warming, the impact of climate change, plus the pollution and high cost of fossil fuels have urged more governments and people to adopt a plethora of new energy technologies. According to past research related to the process of the diffusion of innovation, the innovators and other adopters -- most of them also opinion leaders in society -- play vital roles in promoting the acceptance of new technologies. They not only take more risks by accepting the new technology first, they also expose relevant information about the innovation to others. Furthermore, based on consumer behavior studies, lifestyle analysis could help researchers divide consumers into different lifestyle groups to understand and predict consumer behaviors.

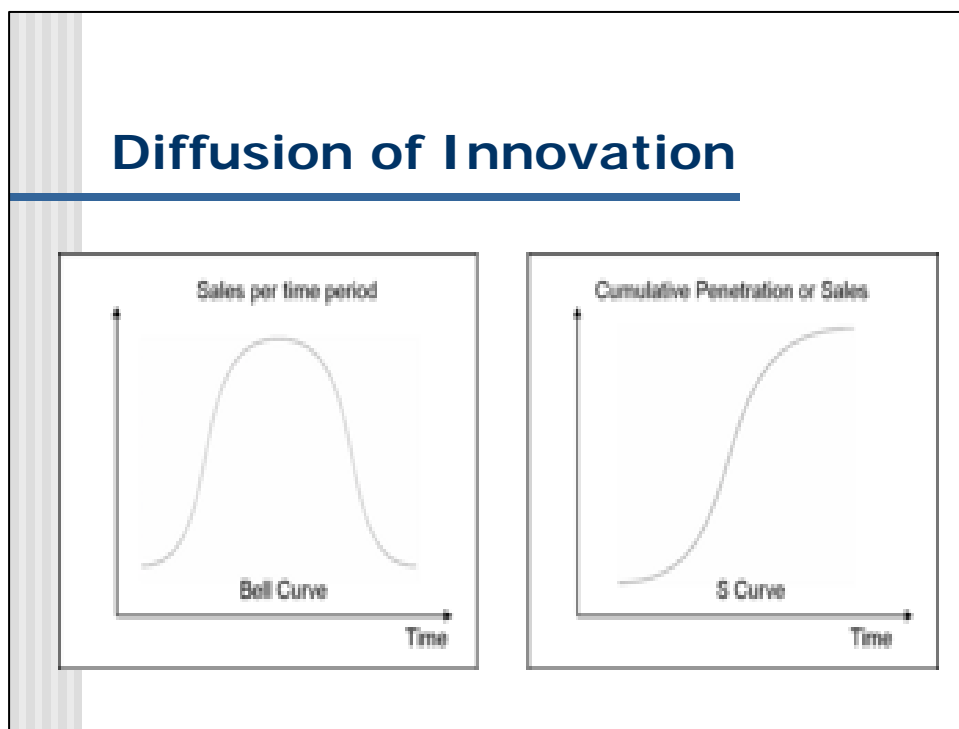
The purpose of this paper is to describe the survey for investigating the

lifestyle patterns of new energy opinion leaders, and the researchers' use of a data mining decision tree tool to ascertain those predictive variables which best establish a profile of those most interested in new energy-related media issues.

In order to achieve the purposes listed above, the researchers needed to locate and contact the potential innovators in new energy fields. Thus the researchers cooperated with UNIDO-ICHET and obtained potentially suitable interviewees' e-mail addresses online, from the library or through the assistance of new energy-related organizations. The researchers sent out e-mail or posted invitations on related blogs and forums to invite the potential interviewees to participate in this online poll. This online survey was launched from Aug 2005 to Oct 2006, and successfully collected 2,040 new energy opinion leaders' information. Researchers analyzed the data using SPSS statistics software and SPSS Clementine data mining software.

II. Literature Review

A. Innovators and early adopters (opinion leaders)



Source: Everett M. Rogers "Diffusion of Innovation" (2003: p.273, p.281)

New technologies are adopted over time. People can be classified according to their relative speed at adopting new technologies in the diffusion of innovation (Shepherd et al., 2003; Rogers, 2003: 279-281). Rogers formalized his theory in a 1962 book called *Diffusion of Innovations*. Rogers stated that adopters of any new innovation or idea could be categorized as innovators (2.5%), early adopters (13.5%), early majority (34%), late majority

(34%) and laggards (16%), based on a bell curve. Each adopter's willingness and ability to adopt an innovation would depend on their awareness, interest, evaluation, trial, and adoption. Some of the characteristics of each category of adopter include:

- Innovators: venturesome, educated, having multiple information sources, with a greater propensity toward taking risk
- Early adopters: social leaders, popular, educated, having the highest degree of opinion leadership
- Early majority: deliberate, having many informal social contacts
- Late majority: skeptical, traditional, lower socio-economic status
- Laggards: having neighbors and friends as their main info sources, with a fear of debt

Rogers showed that these innovations would spread through society in an S curve (Rogers, 2003: 273), as the innovators and early adopters selected the technology first, followed by the majority, until a technology or innovation becomes common. The adoption proceeds in a typical S-curve where a few members of society adopt early, a large portion of society picks up the technology, followed by the laggards as the last to adopt the technology.

Innovators and early adopters are at the forefront of adopting new technology

and do so before others in society. If a new technology is going to be adopted by society, then the reaction and characteristics of the innovators and early adopters are key to getting the technology accepted.

Rogers (2007: 282-283) notes that innovators' interest in new ideas leads them out of a local circle of peer networks and into more cosmopolitan social relationships; their communication patterns and friendship are common. Earlier adopters are more integrated into the local social system than are the innovators. They have the highest degree of opinion leadership in most society.

B. Global Warming and New Energy

The overwhelming consensus of scientific study is that global warming is caused by human activity (Thomas et al., 2004). Our current system of energy production relies heavily on the combustion of fossil fuels -- carbon-based compounds such as coal, natural gas, and oil. Fossil fuels contribute to global warming by releasing greenhouse gases when consumed. Large-scale simulations of global warming in response to greenhouse gases show that an increase of 2 to 11 degrees Kelvin is possible (Stainforth et al., 2005). The temperature rise can be predicted as a function of the increased amount of

greenhouse gas put into the atmosphere (Alley et al., 2005). Glaciers and ice shelves in Antarctica are melting much faster than previously predicted (Aitken, 2006). Alaskan mountain glaciers are also melting and contributing to rising sea levels (Chapin, 2005).

Studies show that increased temperatures and climate change will lead to massive extinctions that rival other man-made extinction mechanisms (Frey and Smith, 2005). Global warming will also lead to reductions in food production, and will cause drier summers, wetter springs, and reduced agricultural production (Meier, and Dyurgerov, 2002; Oreskes, 2004).

Improving the efficiency of current systems relies upon nonrenewable energy sources. Even if 100% efficiency was obtained and no greenhouse gases were created, the peak oil production (when demand outstrips supply) is estimated to be in 2007 (Duncan and Youngquist, 1999). Estimates of untapped natural gas reserves indicate that plentiful reserves still exist (Service, 2004). With increased demand by growing economies, current reserves and production cannot be guaranteed to meet this demand. The only reasonable option for long-term sustainability is clean and renewable energy sources. Such sources exist in nature: biomass, geothermal, wind, solar, and tidal forces are examples of renewable energy sources (Gul and

Stenzel, 2006).

New energy sources have the potential to not only change the course of global warming but also to completely retool major sections of our economy, change the social dynamics of a world increasingly dependent on a few oil-producing states, and alter the balance of power between developing and developed countries. Hydrogen energy, for example, is viewed as a very important and potential new energy that might replace oil and create a hydrogen-based economy in society one day.

C. Lifestyle Research

A lifestyle of one person was the way of living in the world, representing one's activities, interests, and opinions. Lifestyles describe the interaction between persons and their environment (Kotler, 2000; Engel et al., 1990).

Lifestyle analysis could help researchers divide consumers into different lifestyle groups to understand and predict consumer behaviors. Lifestyle allows researchers to investigate consumers via their activities, interests and opinions instead of just using demographic variables. Prevailing consumer lifestyles indicate how consumers live, think, and act.

The concept of lifestyle has varied over time, however, its definition has

always included the concept of an integrated system expressed by attitudes, values, opinions, interests, and activities of a group or an individual. Since its early introduction into marketing research by Lazer in 1963, consumer lifestyle analysis has become a very popular tool in consumer research (See Figure 1). Lazer defined lifestyle as "the distinctive or characteristic mode of living of a whole society or segment thereof." Lifestyle is formed throughout an individual's life and decides and guides the individual's way of life (Allport, 1965).

By the mid 1970s, lifestyle had become a popular concept in marketing and consumer behavior research. Consumer lifestyle analysis attempts to paint a multi-dimensional portrait of a consumer that represents a sub-segment for a certain product. It suggests answers to the deeper motivations and aspirations behind the consumption of a product or service (Wansink, 2000). The use of lifestyles as segmentation criteria explains more observed consumer behavioral/action variation than demographic and/or socio-economic variables, because consumer lifestyle characteristics provide a rich view of a more life-like portrait of the consumer (Wagner and Weddle, 1995). The lifestyle analysis aims at classifying consumers into identifiable market segments with specific lifestyle patterns, on the basis of numerous

scales assessing AIO's (Activities, Interest, and Opinions) and VAL's (Values, Attitudes and Lifestyles) of consumer groups. The VALS system was revised in 1989 to focus more explicitly on explaining and understanding consumer behavior. VALS2 classifies all U.S. adults into eight consumer groups based on their answers to attitudinal and demographic measures. This system combines general personality theory with research on product diffusion (Kotler, 1997).

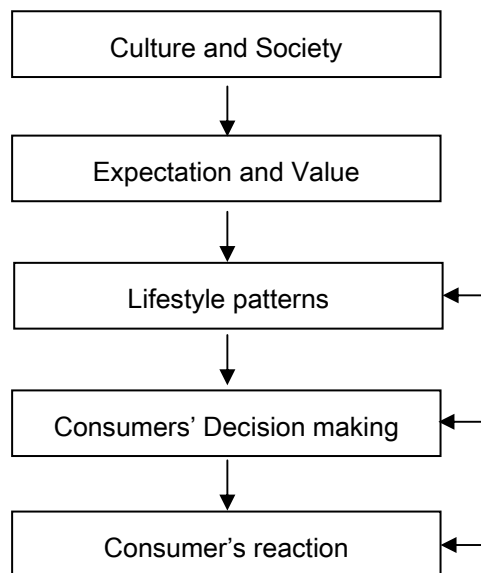


Figure1: Laser's Lifestyle Concept

Consumer lifestyle patterns are measured by asking consumers about their activities (work, hobbies, and vocations), interests (family, job, community) and opinions (about themselves, others, and about social issues, politics,

business). In some studies, these AIO questions are of a very general nature; in others some of the questions are related to specific products or services (Peter and Olsen 1990).

Lifestyle segmentation is usually explained as the process of consumers being asked questions about their lifestyles and then being grouped on the basis of the similarity of their responses (Peter and Donelley, 2003). The most popular application of general lifestyle patterns is SRI International's VALS program (Values, Attitudes, and Life-Styles Program). VALS uses psychology to analyze a systematic classification of consumers into several distinct value and lifestyle patterns.

Now, the AIO (Activities, Interest, and Opinions) and VALS (Values, Attitudes, and Lifestyles) statements are used broadly to determine different consumer market segments by researchers from a range of disciplines or companies marketing a wide variety of products or services. Past consumer behavior studies showed that there are discernible lifestyle segments which cut across cultures and transnational borders. The aim of the study is to investigate new energy potential innovators' (consumers) lifestyle patterns, information sources and their adoption intention of new energy products.

D. UNIDO-ICHET

Hydrogen fuel was proposed as a replacement for fossil fuel in 1974 at the Hydrogen Economy Miami Energy (THEME) Conference. The International Association for Hydrogen Energy (IAHE) was established soon after. The objective of IAHE is to promote the exchange of ideas among researchers and to promote the role of hydrogen energy to the general public. To this end, IAHE publishes the Journal of Hydrogen Energy and organizes World Hydrogen Energy Conferences (WHECs) and World Hydrogen Energy Technologies Conventions (WHTCs).

As the economic importance of finding alternatives to fossil fuels increases, developed countries are expending resources to research and implement hydrogen as an energy source. The United States Department of Energy has the Hydrogen, Fuel Cells and Infrastructure Technologies Program which funds hydrogen-related research. Japan has the New Energy and Industrial Technology Development Organization (NEDO) with plans for infrastructure development and promotion of fuel cell vehicles for Japan. The European Union's European Hydrogen and Fuel Cell Technology Platform has the mission of mapping the EU's transition to a hydrogen-based economy. The developed countries have the resources available for these tasks.

The United Nations Industrial Development Organization (UNIDO) is

charged with helping undeveloped nations create sustainable industries.

UNIDO has various activities related to this mission: technology transfer, food safety, business partnerships, improved trade, and others. As part of any long-term development strategy, a sustainable energy supply is needed. In 2003, UNIDO and the Turkish Ministry of Energy and Natural Resources created the International Center for Hydrogen Energy Technologies (ICHET).

UNIDO-ICHET is chartered to share hydrogen energy knowledge and technology between the developed and developing nations. Hydrogen-based energy is its focus because it is a clean-burning, cost-effective and efficient alternative to carbon-based combustion. Developed countries have intensive research and long-term planning to use hydrogen-based energy in the future whereas developing countries do not have these resources. UNIDO-ICHET bridges the knowledge and technology gap between developed and developing countries to ensure that a future hydrogen-based economy is available to all countries. UNIDO-ICHET is a focal point for hydrogen energy innovators.

E. Data mining and decision tree analysis

Through a variety of techniques, data mining identifies nuggets of

information in bodies of data. Using data mining techniques, the hidden information in the data is extracted and able to be used as an aid for forecasting and decision-making (Clementine User's Guide, 2002: 39). Data mining has also been defined as "the nontrivial extraction of implicit, previously unknown, and potentially useful information from data" (Frawley et al., 1992); and "the science of extracting useful information from large data sets or databases" (Hand et al., 2001). Thus, data mining (DMM), also called Knowledge-Discovery in Databases (KDD) or knowledge-Discovery and Data Mining, is the process of extracting hidden predictive information and identifying pattern from large volumes of data using tools such as decision trees, association rule mining, clustering, etc.

Basically, researchers or companies in different fields use data mining to extract information from large data sets. Researchers have long used computers to sift through and analyze volumes of data to produce reports. The continuous improvements in both computer hardware and software are dramatically increasing the accuracy and usefulness of data mining analysis. Besides the progress in computer equipment and statistic softwares, in data mining, success comes from combining researchers' knowledge of the data with advanced, active analysis techniques in which the computer identifies the

underlying relationships and features in the data (Clementine User's Guide, 2002: 39). So researchers' knowledge of the data would likewise be crucial in the usage of related data mining techniques and in explaining the results.

Usually, the goal of data mining is prediction. The process of data mining consists of three stages: (1) the initial exploration, (2) model-building or pattern identification with validation/verification, and (3) deployment. There are many model-building techniques, such as the K-means model, the decision tree model, the neural network and so on.

A decision tree is one of data mining modeling tools that uses a graph model of decisions and their possible consequences. A decision tree could be used to identify the strategy most likely to reach a goal, or as a descriptive means for calculating conditional probabilities. So, in data mining, a decision tree is a predictive model. Decision Trees provide a highly effective structure within which the researchers can lay out options and investigate the possible outcomes of choosing those options. They also help to form a balanced picture of the possibilities associated with each possible course of action.

III. Study Objective and Survey Design

The purpose of this paper is to uncover new energy innovators and opinion leaders' lifestyles, and use their lifestyle patterns and demographic variables to find the best rule for predicting those most interested in new energy-related media issues and campaigns. This would help researchers learn about the best targets on which new energy innovation agents should focus. Researchers first used factor analysis and cluster analysis to divide new energy innovators into different lifestyle groups, then used decision tree models to get some predictive rules to create a profile of those most interested in new energy issues in media.

Investigating consumer lifestyles can be very useful in profiling and targeting select consumer groups for marketing planning purposes. Past consumer behavior and psychology literature have identified different patterns of consumer lifestyle groups in different product/service markets. One purpose of this research is to determine the appraisal relevance of new energy innovators' lifestyle. Thus the researchers needed to locate and contact potential innovators in new energy fields for this study. Since May 2005, the researchers cooperated with UNIDO-ICHET and obtained potential suitable

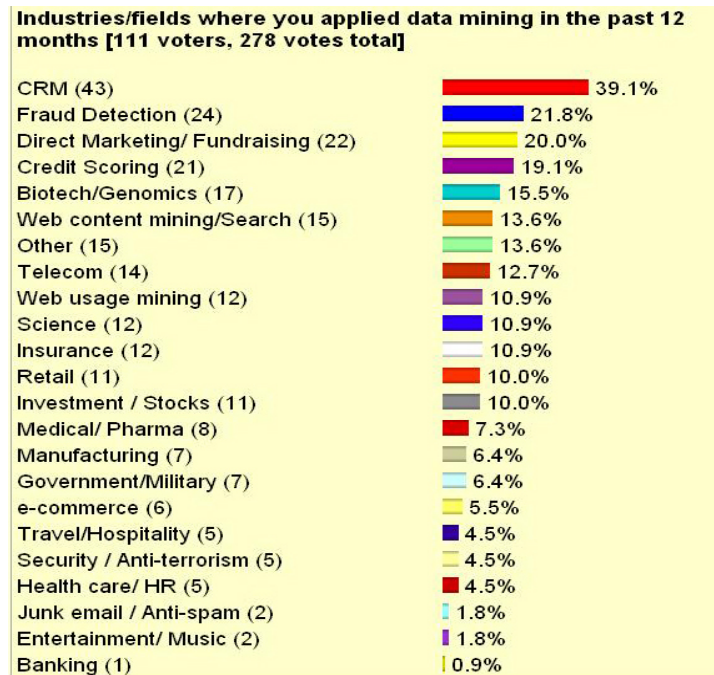
interviewees' e-mail addresses through the assistance of new energy-related organizations, as well as from library and online resources. The questionnaire of this poll for new energy potential innovators was designed in May 2005 and July 2006. The data for this survey was collected from August 2005 through October 2006, with the researchers sending out e-mail or posting invitations on related forums to invite potential interviewees to participate in this online poll. The number of valid responses remaining was 2,040 for this cross-discipline online survey of interviewees in the new energy field.

First, regarding interviewees' lifestyle analysis, the researchers analyzed the valid responses using SPSS software, and the data analysis procedure is as follows:

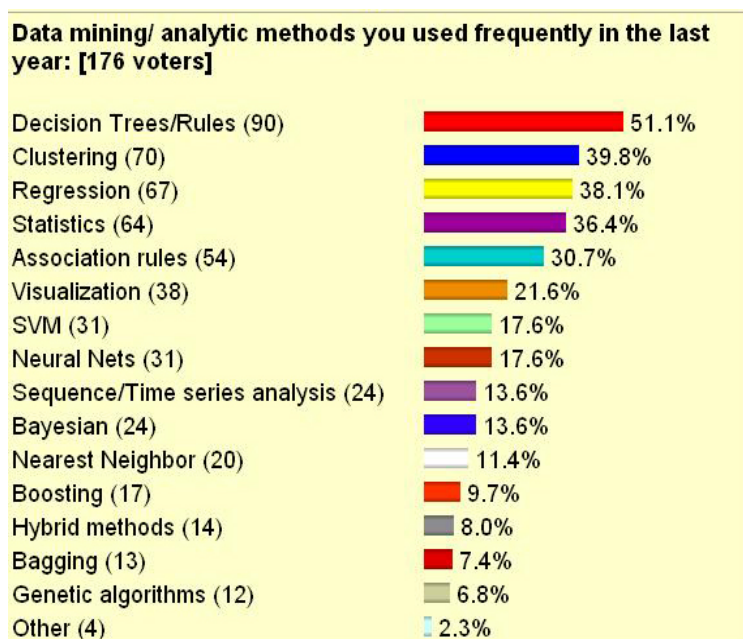


Through lifestyle variables, the researchers conducted the factor and cluster analysis using SPSS software. Four factors (including “family orientation,” “outgoing and health care orientation,” “optimistic and self-confident orientation,” and “modern and fashion elements”) were identified by the factor analysis of lifestyle variables. Using cluster analysis, the

researchers then divided new energy innovators into four groups: the “outdoorsman group”, the “young modern group”, the “family-oriented professionals group”, and the “egocentric youth group”.



Resource: [www. Kdnuggets.com](http://www.Kdnuggets.com)



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After researchers used factor analysis and cluster analysis to divide new energy innovators into four lifestyle groups, they used SPSS Clementine to run decision tree model-building processes to get distinct rules to identify those who are most interested in new energy media issues, and who are most interested in energy related advertisements and campaigns.

IV. Analysis

A. Sample Analysis

From our sample, the researchers analyzed the interviewees' demographics and opinions (see Table 1). 75.5% of the interviewees were male and 24.5% female. Most of them currently work full-time and are well-educated. It was clear that many of them are interested in "energy crisis" information in the media and "new energy" development in the media, notice environmental protection-related information and campaigns about energy saving or new energy adoption, and that many of them support the research and development of new energy technology. Most of them are between the ages of 30 and 59. Most of the interviewees, 47.1%, are from the Americas.

Table 1: Sample Analysis (N=2040)

	Percent
Gender:	
Male	75.5%
Female	24.5%
Age:	
10-19 years old	2.9%
20-39 years old	40.6%
40-59 years old	37.6%
Above 60 years old	11.3%
No Response	7.6%
Continent:	
Asia	24.8%
Americas	47.8%
Europe	11.5%

Africa	8.4%
Other	6.7%

Work Status:

Working Full-time	59.2%
Working Part-time	7.6%
Unemployed	2.8%
Retired	6.1%
In School	13.7%
Homemaker	1.0%
Disabled	1.2%
Armed services	0.5%
Other	7.9%

Degree or degrees received:

No formal school	0.4%
Did not complete high school	1.7%
High school diploma	9.8%
Associate, two-year, junior college degree	8.0%
Bachelor's degree	28.9%
Master's degree	26.4%
Doctorate	17.3%
Professional (MD, JD, DDS, etc.)	8.2%
Other	4.3%

Family Income (USD):

Under 20,000	22.4%
20,000-39,999	14.8%
40,000-59,999	11.8%
60,000-79,999	1.9%
Over 80,000	19.6%
No response	20.5%

For information about technology development, medium relied on most:

TV	5.9%
Newspaper	6.2%
Radio	1.9%
Magazine	10.6%
Internet	68.2%
Other	7.2%

Frequency of posting to Usenet news groups/BBS about energy issues:

Daily	5.9%
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Weekly	10.7%
Monthly	8.5%
Less than monthly	19.6%
Never	55.3 %

Notice environmental protection-related information:

Strongly agree	39.2%
Agree	34.0%
Slightly agree	7.9%
Slightly disagree	7.1%
Disagree	8.4%
Strongly disagree	3.4%

Understand the need for the “Kyoto Protocol”:

Strongly agree	50.8%
Agree	25.9%
Slightly agree	9.3%
Slightly disagree	3.3%
Disagree	4.5%
Strongly disagree	6.2%

B. Factor Analysis and Cluster Analysis

The Principal Factor Analysis was used in this research, and then four factors were extracted from lifestyle variables (AIO questions) according to the factor analysis (eigenvalues > 1, factor loading > .06, the cumulative percentage of variance explained by the factors is > 60%, B=12028, $p < .001$, KMO=. 818).

Table 2: Lifestyle KMO measure

Bartlett's test of	P	Kaiser-Meyer-Olkin
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sphericity		measure (KMO)
12028.652	0.000*	0.818

*P < 0.001

Table 3: Principal Factor Analysis

Factor name	Eigenvalue	Percentage of variance explained (%)	Cumulative percentage of variance explained by the factors (%)
Family orientation	4.683	31.218	31.218
Outgoing and health care orientation	1.801	12.006	43.224
Optimistic and self-confident	1.738	11.586	54.810
Modern and fashion elements	1.180	7.864	62.674

Table 4: Four clusters' differences on lifestyle factors

Factor		Family orientation	Outgoing and health care	Optimistic and self-confident	Modern and fashion elements
Mean	Cluster				
	Cluster 1 (N=668)	5.2620	4.8346	4.7886	1.7687
	Cluster 2 (N=633)	5.2468	5.1568	4.9776	4.2180
	Cluster 3 (N=422)	5.1345	5.3406	4.1564	2.6517
	Cluster 4 (N=321)	3.2952	4.6394	4.2860	2.1090
	F value	920.491	103.847	182.274	890.510
	P value	0.000*	0.000*	0.000*	0.000*
Scheffe's Test	(1 , 2)	X	*	*	*
	(1 , 3)	*	*	*	*
	(1 , 4)	*	*	*	*
	(2 , 3)	*	*	*	*
	(2 , 4)	*	*	*	*
	(3 , 4)	*	*	X	*

1. Note : “ * ”means significant difference ($\alpha=0.001$)

2. Cluster 1: the “family-oriented professionals group,” 2: Cluster 2: the “young modern group,” Cluster 3: the “outdoorsman group,” and Cluster 4: the “egocentric youth group.”

Cluster analysis (first used by Tryon, 1939) encompasses a number of different algorithms and methods for grouping objects of similar kind into respective categories. Cluster analysis can be used to discover structures in data. Based on the four factors obtained from factor analysis above, the researchers applied the two-step cluster analysis to divide new energy innovators into four groups, and used F-tests and chi-square tests to determine the differences in demographics, lifestyle, media usage, and new energy products adoption variables between these four groups. Eventually, the researchers divided new energy innovators into four groups and named them as: the “family-oriented professionals group,” the “young modern group,” the “outdoorsman group,” and the “egocentric youth group.” The different lifestyle patterns, new energy product adoption intention and media usage of the four groups are listed below:

(1) The “family-oriented professionals group”: In this group, most are interested in family life and family activities but do not pay much attention to fashion and modern elements. In this group, 81.4% are male, a higher percentage of males than in other groups, and 18.6% of them are female. Most of them are 30 to 49 years old, from the Americas, and have a higher income. Many of them have Master or Doctorate degrees. Compared to other groups,

this group has the highest interest in new energy products. Most of them are also the opinion leaders who can offer others information about new energy products. Most in this group notice environmental protection-related information.

(2) The “young modern group”: Most members of this group are interested in fashion elements. They are also family-oriented. In this group, 74.6% are male and 25.4% are female. Most of them are 21 to 40 years old, from Asia, and have lower incomes. Compared to other groups, this group’s interest about new energy products and attending new energy-related or environmental protection organizations is only lower than the “family-oriented professionals group”. Their innovation level is the highest one in all four groups. Compared with other groups, the “young modern group” is the one with the highest internet usage. For obtaining information about technology development, they also are more dependent on the internet.

(3) The “outdoorsman group”: This group pays more attention to social activities and is concerned about health-related issues, but the fashion elements do not attract them. They are not family-oriented and are more outgoing. In the “outdoorsman group,” 69.9% are male and 30.1% are female. Most of them are 21 to 40 years old, from the Americas (42.7%), and have a

lower income. Compared to the other groups, this group has only a moderate interest in new energy products, information about new energy development or campaigns. The percentage of the interviewees in this group who attend new energy or environmental protection organizations is higher than other groups. This group is not the most enthusiastic group attending these activities or organizations.

(4) The “egocentric youth group”: In this group, most are not family oriented and do not pay much attention to social interaction or healthcare issues. In this group, 72.6% are male, 27.4% are female. Most of them are 30 to 40 years old, with many from the Americas. Compared with other groups, this group has the lowest interest in new energy products and attending new energy-related or environmental protection organizations. They are also the least innovative ones. Compared with other groups, this group is the one giving the least attention to new energy and environmental protection-related issues.

C. Data mining and Decision Tree analysis

Regarding the results of data mining decision tree analysis, researchers tallied three questions' scores together as one variable called “interested in new energy-related media issues”. Those interviewees with three to ten points

were assigned to the “low interest in new energy-related media issues group.” Those with eleven to fourteen points were assigned to the “moderate interest in new energy-related media issues group.” Those with fifteen to eighteen points were assigned to the “high interest in new energy-related media issues group.” In this report, researchers found 68.7% of new energy innovators are highly interested in new energy-related media issues.

A C & R Tree model was then applied to analyze the data to identify variables that could best predict the level of “interest in new energy-related media issues”. Researchers found three tree rules in this topic; those variables most able to predict a person’s interest included: his (or her) level of interest in media advertisement and campaigns concerning energy issues, his residing in Asia or Europe, his belonging to the “young modern group” or the “family-oriented professionals group,” and his primary source for information concerning technology development being newspapers and broadcast. The model prediction accuracy was 71%.

Researchers also computed three questions’ scores of the interviewees into a new variable called “energy-related advertisements and campaigns.” Interviewees with three to ten points were assigned to the “low interest in energy-related advertisements and campaign.” Those with eleven to fourteen

points were assigned to the “moderate interest in energy-related advertisements and campaigns,” and those with fifteen to eighteen points were assigned to the “high interest in energy-related advertisements and campaigns”. In this report, researchers found 75% of new energy innovators are interested in energy-related advertisements and campaigns.

Researchers obtained three tree rules, and those variables found to best predict which persons will be more attentive to energy-related advertisements and campaigns include: the persons’ level of understanding about the Kyoto Protocol, their browsing of new energy-related websites, and their media usage for information about technology development being primarily the internet, radio and television. The model prediction accuracy was 77%.

V. Conclusion

The awareness of environmental protection and the evolution of new energy sources are the most important issues of the 21st Century. Past research regarding new energy has focused primarily on the development of technologies rather than the social science approach. The promotion and study of the acceptance of new energy, however, are very important for researchers from a diversity of disciplines. This research is a cross-discipline

cooperation for the purpose of discussing new energy innovators' lifestyle, and those innovators' adoption intention of new energy products. Researchers also used decision tree analysis in search of a predictive rule to find who are most interested in new energy-related media issues, and what variables could best predict new energy innovators' interest in new energy-related media issues. With the results, agents or policy makers can find the best target and suitable media to convey new energy related information to them.

Using factor analysis and cluster analysis, four factors were extracted from lifestyle variables (AIO questions). Those four include a "family orientation," an "out-going and healthcare orientation," an "optimistic and self-confident orientation," and "modern and fashion elements." New energy innovators and opinion leaders were divided into four groups. The researchers used F-tests and chi-square tests to find out the differences of demographics, lifestyles, and new energy products adoption variables between these four groups. The four groups were named as: the "family-oriented professionals group," the "young modern group," the "outdoorsman group," and the "egocentric youth group."

Compared with the other groups, the new energy innovators in the "family-oriented professionals group" have the highest interest in new energy

products. Many of them get involved in new energy-related or environmental protection organizations. Most of them care about new energy-related information and tend to be opinion leaders in related issues.

Concerning the “young modern group,” interviewees in this group tend to be younger, from Asia, and well educated. They are also highly interested in new energy products, related information or issues in the media. They spend a long time online and are more highly dependent on the internet to get information about technology development or new energy-related issues.

The “outdoorsman group” shows interest in new energy-related activities or information but are not as enthusiastic as the two groups described above. Of the four groups, the “egocentric youth group” has the lowest interest about new energy products, and attending new energy-related or environmental protection organizations. Their interest about new energy campaigns or energy crisis-related information in media is much lower than other groups.

Regarding the results of decision tree analysis, researchers determined distinct rules which could help predict who among the new energy innovators are those highly interested in new energy-related media issues. The profile of them is: He/she is highly interested in media advertisement and campaigns

concerning energy issues, resides in Asia or Europe, belongs to the “young modern group” or the “family-oriented professionals group,” and his/her primary source for information concerning technology development is newspapers and broadcast.

The profile of those who are more attentive to energy-related advertisements and campaigns is: He/she highly understands the significance of the Kyoto Protocol, browses new energy-related websites, and his/her media usage for information about technology development is primarily the internet, radio and television.

Basically, in this research, the data show the new energy innovators and opinion leaders are the people who are the forefront of adopting new technology. The results indicate that targeting the innovators who have a strong desire and interest to learn about new energy-related issues could accelerate the process of innovation adoption. When promoting the adoption of new energy products or when releasing related information among the new energy innovators, the innovation agents, policy makers or companies should focus on certain new energy innovators and opinion leaders first, because they are highly interested in new energy-related media issue, and are more attentive to energy-related advertisements and campaigns than other

innovators. Finding suitable targets first would help to accelerate the social acceptance process of new energy technology.

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