THE STUDY OF THE INFLUENTIAL FACTORS THAT MAKE PEOPLE SWITCH FROM TRADITIONAL BULBS TO LED (LIGHT EMITTED DIODE) BULBS IN THAILAND

BY

MR. CHOLTIT RATTANASETYUT

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
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(INTERNATIONAL PROGRAM)
FACULTY OF COMMERCE AND ACCOUNTANCY THAMMA-SAT UNIVERSITY ACADEMIC YEAR 2016

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ENTITLED

THE STUDY OF THE INFLUENTIAL FACTORS THAT MAKE PEOPLE SWITCH FROM TRADITIONAL BULBS TO LED (LIGHT EMITTED DIODE) BULBS IN THAILAND

was approved as partial fulfillment of the requirements for
the degree of Master of Science Program in Marketing (International Program)

on.....6 JAN 2016.....

Chairman .....
(Associate Professor James E. Nelson, Ph.D.)

Member and Advisor .....
(Professor Phillip C. Zerrillo, Ph.D.)

Dean .....
(Professor Siriluck Rotchanakitumnuai, Ph.D.)

Independent Study Title	THE STUDY OF THE INFLUENTIAL FACTORS THAT MAKE PEOPLE SWITCH FROM TRADITIONAL BULBS TO LED (LIGHT EMITTED DIODE) BULBS IN THAILAND
Author	MR. Choltit Rattanasetyut
Degree	Master of Science Program in Marketing (International Program)
Major Field/Faculty/University	Faculty of Commerce and Accountancy Thammasat University
Independent Study Advisor	Prof. Dr. Phillip C. Zerrillo
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ABSTRACT

The study of the influential factors that make people switch from traditional bulbs to LED (light emitted diode) bulbs in Thailand has been conducted for two reasons. The first reason is that LED bulbs are the latest technology in a fast growing industry in Thailand. The second reason is the amount of research on this topic is limited. Lastly, people are switching from traditional bulbs to LED bulbs.

This study focused on the factors that affect the consumer's buying decision and the different characteristics between buyer and non-buyers.

The research for this study was done by performing desk research, in-depth interviews with 10 people and administering an online questionnaire to 150 respondents who commented on their decisions in buying light bulbs.

The key findings show that the people who are concerned about the environment will switch from traditional bulbs to LED bulbs, but they have a low awareness of the technology. Overall, every group of segmentation has conversion rates from awareness to purchasing of more than 70%. Finally, the research indicates that the current acceptable price range of LED bulbs is between 150-200 baht per bulb.

ACKNOWLEDGEMENTS

I am sincerely thankful to Prof. Dr. Phillip C. Zerrillo for the support and guidance throughout independent study. Every stakeholder who has made this study a success through their support. Last, but not least, I would like to dedicate my study to Thammasart University.

Mr. Choltit Rattanasetyut

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CHAPTER 1
INTRODUCTION

1.1 Statement of problems and research purpose

The Led bulb is the latest innovation in the lighting industry. Research studies pertaining to the LED bulb market in Thailand are limited. There are many brands of LED bulbs which are competing with each other, not only the well-known brands-Lampton, Phillips, Osram, Toshiba, General Electric, but also new ones-Bio-bulb, Lumax, TSL, Sky, and so on. The major benefits of the LED bulb are to reduce the energy costs, increase the bulb's lifetime, and eliminate the Ultraviolet (UV) illumination. The price of LED bulbs ranges from 80 baht to more than 10,000 baht depending on the specification of Lm/w, the luminaire of light per wattage, the number of the color rendering index, brand, and warranty periods.

The purpose of this study is to conduct research based on a contemporary topic using applied marketing methods to explore the influential factors that make people switch from traditional bulbs to LED bulbs in Thailand. After the study has been constructed, it is expected to show the reasons why people do or do not buy LED bulbs. Moreover, the people were classified by behavior method to target the users of LED bulb. And this study would provide an analysis and recommendation of LED bulbs.

1.2 Research Objective

The purpose of this research is to explore the influential factors that make people switch from traditional bulbs to LED bulbs in Thailand. The research is guided by the following objectives;

1. To identify the target consumers of LED bulbs based on socio demographics and psychographics.

2. To identify the barriers preventing consumers from switching from traditional bulbs to LED bulbs.

3. To identify the triggers that cause consumers to switch from traditional bulbs to LED bulbs.

CHAPTER 2
REVIEW OF LITERATURE

2.1 Literature review

LED, light emitting diode, is the latest technology in the lighting industry. Its first launched price was very high. However, the price has decreased dramatically and the demand of LED bulb has increased significantly from the Euromonitor research (conducted in September, 2014 p.49). The current global market size of LED bulbs is 27 billion USD, accounted for 12 percent of the LED market in 2014 (LED inside, 2014). The LED bulb market is very competitive as the market size is growing rapidly. According to Prachachart newspaper (Conducted in May 22, 2015), Phillips, the market leader in light bulbs in Thailand (LED inside, 2015), lowered the product price to acquire more market share.

90 percent of people tend to buy green products when the price is not different (Sharma & Kesherwani, 2015). However, once the other factors, such as convenience, quality, and other benefits, are included, the potential is lessened (Mainieri, Barnett, Valdero, Unipan, & Oskamp 1997). People seem willing to pay more for the green products but, in actuality, their purchasing behavior is opposed. (Jeen Wei Ong, Gerald Guan Gan Goh, Choon Yih Goh, Marianne Shing Mei Too, Lee Pheng Goh , 2012). In the lighting industry, the environmental-friendly product has been developed continuously. The research shows that consumers want the light bulb to be more environmentally friendly, cheaper and longer lasting (Wang, Q. & Potter, N. 2006)

CHAPTER 3
RESEARCH METHODOLOGY

The research has been conducted from two types of research, secondary research and primary research, in this independent study as follow;

3.1 Secondary research

3.1.1 Desk research

The desk research was conducted to study the available literature. As for the industry overview, the objective is to understand the current situation of LED in Thailand which includes the situation analysis of the lighting industry, market size of LED, the growth of the LED industry and the current leader of the LED market. Next, studying on other researcher's papers is to find the other research's conclusions and their hypotheses. It can determine the area of study and determine or confirm the conclusion of others doing this research.

3.2 Primary research

3.2.1 In-depth interview

The qualitative research was conducted on October 16, October 26 and November 25, 2015. The 10 respondents, who were interviewed, live in Bangkok, 5 males and 5 females. The objective of the interview is to find the key variables affecting the purchase of electronic bulbs. The questionnaire and hypothesis were designed from the result of the in-depth interviews.

The types of question in the interview were as follows: the socio demographic question, the knowledge about LED and the reasons behind buying or not buying LED bulbs in Thailand.

3.2.2 Questionnaire survey (See the appendix A)

3.2.2.1 Sampling procedure

Sampling selection

150 respondents were selected with convenient and snowball sample. They are Thai who buy electronic bulbs by themselves or make decisions when choosing electronic bulbs.

3.2.2.2 Data collection method

Questionnaire

80% of respondents were collected, through the internet, via the survey monkey questionnaire platform. The rest were collected through offline methods in the Bangkok area. The questionnaire was designed for to be completed within 10 minutes. The entire questionnaire was conducted in Thai.

3.3 Data analysis method

The research used both qualitative and quantitative analysis. Qualitative information was gained only from the in-depth interview. The results were analyzed to generate the hypothesis, key variables and questionnaire design. Quantitative information obtained from questionnaire surveys was analyzed by using Statistical Package for the Social Science (SPSS) and other statistical methods. The statistic measurement tools included mean, mode, ANOVA, t-test, price sensitivity measure (PSM) and factor analysis.

1. Frequency analysis was conducted to study the data from several aspects:

- To examine the overall socio-demographic of a respondent.
- To examine the socio-demographics between the clusters.

2. Cross tabulation Analysis was performed to reveal the relationships between groups of data:

- To identify the top of mind awareness brand of LED users and non LED users
- To identify the current brand of LED users and non LED users
- To identify the knowledge about LED between the segmentation group

3. Net promoter score

- To identify the net promoter score of each cluster.

4. Factor analysis

- To segment the behavior question of respondents.

- The tools for analysis are rotated component matrix with varimax method with maximum Iterations for Convergence of 80.

5. Two - step cluster analysis

- To classify the group of people based on the behavior factor.

- Schwarz's bayesian criterion (BIC) using the ratio of distance measure.

6. Anova analysis (F-test)

- To identify the important triggers that make people buy LED bulbs in each segment.

- To identify the important barriers that make people not buy LED bulbs in each segment.

7. Homogeneous of Subsets (Tukey HSD), (Duncan)

- To classify the mean between the clusters

8. Van Westendorp's price sensitivity measurement

- To identify the acceptable price range of LED users.

9. Cluster bar chart with separated groups.

- To identify the parity and differentiation of behavior between clusters.

3.4 Limitation of this research

As the sample collection method of this research is convenient sampling, the data cannot generalize the population. The research was conducted in Thailand which probably cannot be applied to other countries because people may have different characteristic or behaviors regarding LED bulbs. As for the internet based collection method, it can sample the sector of Thai citizens who have higher income than the average. The measurement of data analysis will be used only in SPSS and some results of data need to be explored in more details to be executed in future researches. In case of any respondent groups having fewer than 20 respondents, they

were further analyzed by the bootstrapping method so that the distribution of data became normal.

CHAPTER 4
RESULT AND DISCUSSION

4.1 Key findings from in-depth interview.

The results of the interview were shown as follows;

The users of LED bulbs said that the price of LED decreased dramatically from a few years ago, encouraging them to make a decision to switch traditional bulbs to LED bulbs easily. Moreover, 4 out of 5 users made a decision to buy LED bulbs after they were educated by a salesperson at the point of sale. Non-users of LED said that they had not known the benefits of LED and the price was of the most concern for them. Then, LED bulb non-users did not perceive the values. The most influential benefit of LED that attracted non users to be users was its durability.

This research was found 5 key variables that affect the switching from traditional bulbs to LED bulbs. Firstly, the consumer's value perception, in terms of the price and energy saving comparison, toward LED products has a significant impact on switching from traditional bulbs to LED bulbs. Secondly, socio-demographics of people have a significant impact on purchasing LED. Thirdly, the benefits of LED -longer life, no UV and energy saving have the most impact on purchasing behaviors. Fourth, the trust in the brand of the traditional bulbs which the consumers currently use has an impact on the purchase of LED bulbs. Last but not least, the advertising channel has a significant impact on purchasing behaviors.

4.2 Key findings from survey questionnaire

The entire analysis was analyzed by SPSS programs and Microsoft excel. The 20 incomplete respondents' answers were eliminated. The methods of analysis were Cross-tabulation, Independent sample t-test, Anova analysis, Homogeneous subset, Frequency, Price Sensitivity Meter, Net promoter score, Cluster analysis and Factor Analysis

Table 1 Summary of Respondents' Demographics (N=150)

Characteristic	Data (N=150)
Gender	Male (44%), Female (56%)
Age in year	Mean (37.34), Standard deviation (9.41) , Range (22 - 60 years old)
Education	Below secondary school (1.3%), Secondary school (4%), High Vocational Certificate (3.3%), Bachelor degree (54%) Above Bachelor degree (37.3%)
Living	Bangkok (86.7%), Other (13.3%)
Occupation	Government (10%), Self-Employed (24.7%), Employee (48%), Others (17.4%)

Data Characteristic

Summary of Respondents' Demographic

Table 1 shows that the majority of the respondents are female who accounted for 56% of the sampled population data, while males made up 44% of the total sample. The mean of age is 37 years old with a standard deviation of 9 years. The minimum age of respondent was 22 years old, meanwhile the maximum age of respondent was 60 years old.

Table 1 shows that the majority of the sample's education level is bachelor degree, or 54% of total sample while above bachelor degree accounted for 37.3%. The rest of the sample is high vocational certificate, secondary school and below secondary school which account for 3.3%, 4% and 1.3 % respectively. 86.7% of the respondents live within Bangkok. Most of the sample are employees (48%) and self-employed (24.7%). Respondents who work as government officers and others are 10% and 17.4% respectively.

Table 2 Independent sample t-test of the external influence of knowledge of LED between user of LED bulb and non-user of LED bulb

	User LED bulb	**Non-user LED bulb**	**Statistic significant, P-value**
Word of mouth from family	Mean (3.04) , STD (1.14)	Mean (2.53) , STD (1.16)	P-Value 0.03
Word of mouth from friends	Mean (2.76) , STD (1.09)	Mean (3.06) , STD (.81)	P-Value .025
suggestion from the sales person at Point of sales (POS)	Mean (3.17) , STD (1.12)	Mean (3.24) , STD (1.06)	P-Value .710
Advertising from Television	Mean (3.14) , STD (1.03)	Mean (3.71) , STD (1.03)	P-Value .002
Advertising on the internet	Mean (2.74) , STD (1.13)	Mean (3.11) , STD (1.14)	P-Value .028
Advertising from radio	Mean (2.17) , STD (1.05)	Mean (2.35) , STD (.91)	P-Value .198

** Using bootstrapping method of 1000 samples.

From Table 2, the people who buy LED (Mean = 3.04, SD = 1.14) have been influenced by word of mouth from family more than the respondents who do not buy LED bulbs (Mean = 2.54, SD = 1.16). The people who do not buy LED (Mean = 3.06, SD = 0.81) have been influenced by word of mouth from friends more than the sample who buy LED bulbs (Mean =2.76, SD = 1.12).

In terms of advertising channels, the non-user of LED bulbs (Mean = 3.71, SD = 1.03) has an influence from the advertising on television more than the

LED bulb user (Mean = 3.14, SD = 1.03). The points of sale and radio advertising do not supply any evidence to show it is different between groups.

Table 3 Cross tabulation of top of mind brand awareness of user of Led bulbs and non-users of LED bulbs

		User LED bulbs	**Non-users LED bulbs**	**Chi-square, statistic significant**
Top of mind of Led bulb.	Phillips	57.1%	64.7%	Chi-square (3.27), P-value (.195)
	Panasonic	13.2%	17.6%	
	Other	29.7%	17.6%	

Table 3 There is no evidence to prove that they have knowledge of LED brand differently. For the frequency analysis, Phillips is the 'top of mind' brand awareness for both users of LED bulbs and non-users of LED with 57.1% and 64.7% respectively.

Table 4 Cross tabulation of current buying users and non-users of LED bulb

		Led users	**Non Led users**	**Chi-square, statistic significant**
Current buying	Phillips	51.6%	29.4%	Chi-square (11.85), P-value (.003)
	Panasonic	9.9%	23.5%	
	Other	38.5%	47.1%	

Table 4 Brand choosing is different between the users and non-users of LED bulbs. From each brand, LED users and LED non-users have different purchase intentions.

Table 5 Bonferroni correction for users of LED bulbs and non-users of LED bulbs

		Led users	Non Led users
Current buying	Phillips	(Non Led user)	
	Panasonic		(Led user)
	Other		

Table 5 It shows that LED users buy the Phillips brand more than non-users of LED bulbs. In contrast, non-users of Led bulbs buy the Panasonic brand more than Led users. For other brands, both users and non-users of LED bulb have no evidence to prove they have different purchase intentions.

Figure 1 Van Westendorp's Price Sensitivity Meter of LED bulb users

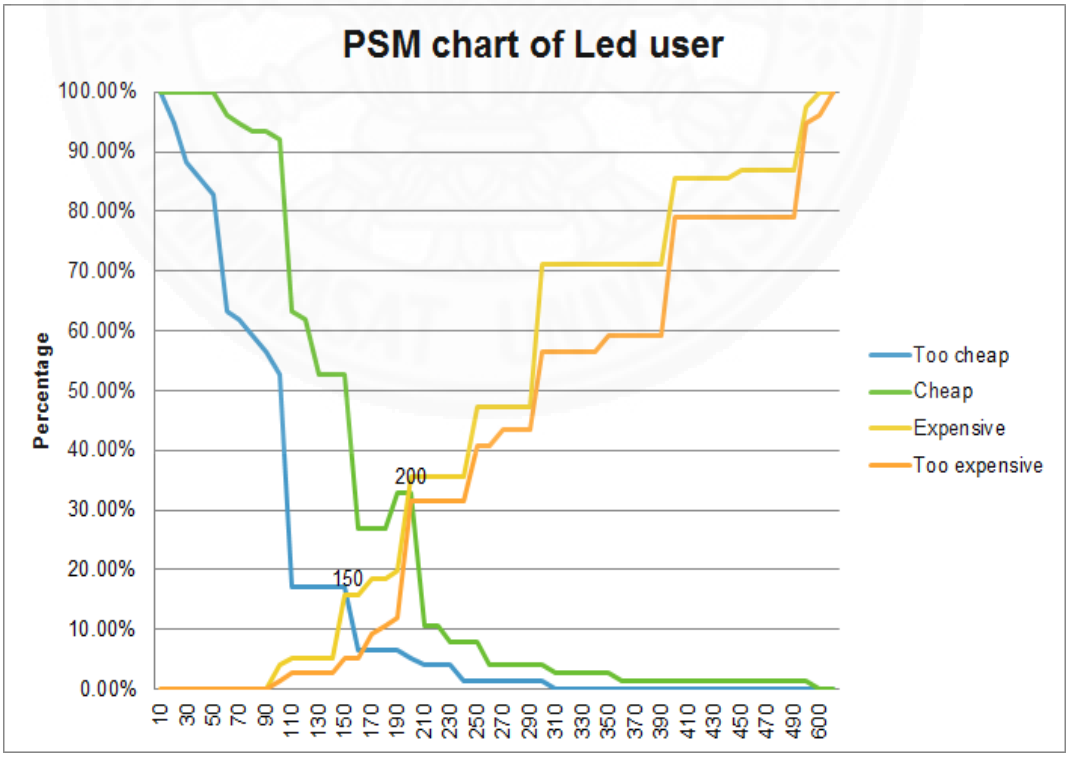


Figure 1 It shows that the acceptable price range of Led bulb users is from 150 - 200 baht per bulb.

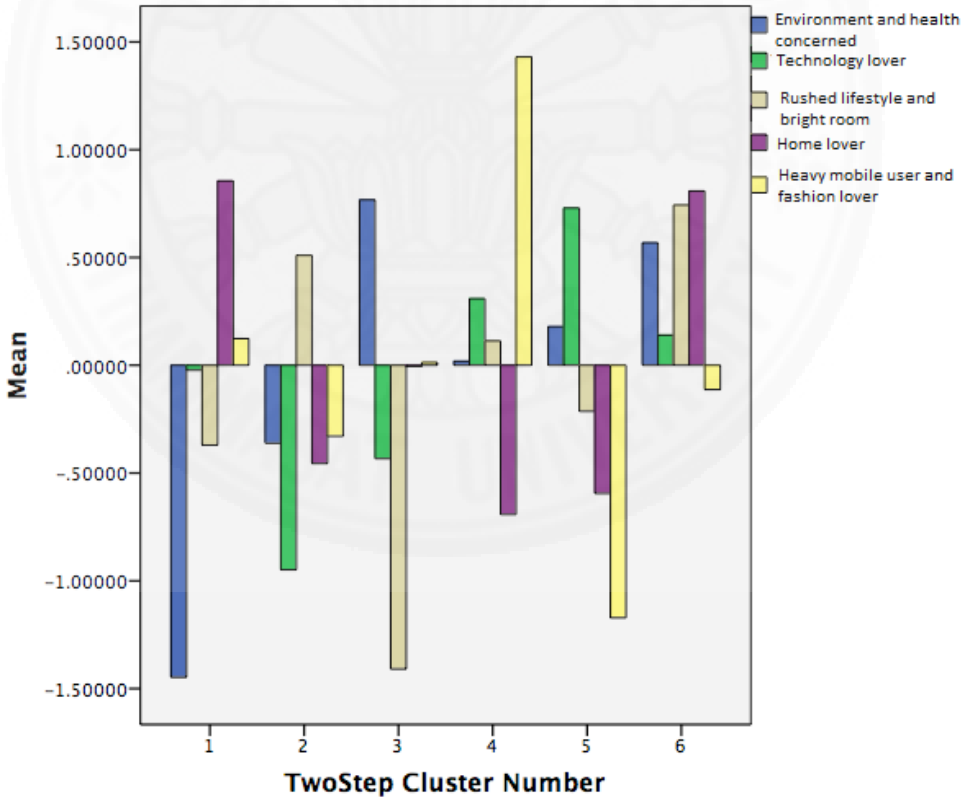
Table 6 Factor analysis of customers' behavior by Rotated component matrix

	Component rotation				
	1	**2**	**3**	**4**	**5**
I like reading a book					-0.609
I like playing computer games		0.704			
I like playing tablet games					0.491
I like using a mobile phone before going to sleep					0.447
I love a bright room			0.852		
I have a rushed lifestyle			0.697		
I love travelling				-0.734	
I love staying at home				0.795	
I love eating organic food	0.602				
I usually wear fashionable clothes					0.711
I love to buy environmentally friendly products	0.871				
I worry about global warming	0.856				
I love new technology		0.750			

Table 6 From, the rotated component matrix table, it can be seen that the factor is separated from the behavior question to avoid multicollinearity problems.

The question is separated by 5 factors. The first factor is ‘environmentally and health concerned’ included in the three questions; I love eating organic food, I love to buy environmentally friendly products and I worry about global warming. The second factor is ‘lover of technology’ included in two questions; I like playing computer games and I love new technology. The third factor is ‘love of bright rooms and rushed lifestyle’ included in two questions; I love bright rooms and I have a rushed lifestyle. The fourth factor is ‘home lover’ included in two questions; I love travelling and I love staying at home. The fifth factor is tablet addicted and fashion lover included in four questions; I like reading books, I like playing tablet games, I like using a mobile phone before going to sleep and I usually wear fashionable clothes.

Figure 2 Clustered bar chart of the behavior of separated groups



From cluster analysis, the respondents are separated into 6 groups. The first group is called home lover. The second group is called busy lifestyle. The third

group is environmentally concerned. The fourth group is fashionable person. The fifth group is technology lover. The last group is environment and home lover.

The groups of people are clustered as the following percentages; 14%, 18%, 13.33%, 16.67%, 16%, 22% respectively.

Table 7 Summary of socio demographics of each cluster

		Home lover	**Busy lifestyle**	**Environment concerned**	**Trend - follower**	**Technology lover**	**Environment and home lover.**
Age		33.86	39.07	40.95	35.16	35.17	39.33
Income		55,0095	58,444	38,300	61,600	52,750	54,818
Gender	Male	52.4%	33.3%	50%	44%	62.5%	30.3%
	Female	47.6%	66.7%	50%	56%	37.5%	69.7%
Education	Lower than Master degree	38.1%	55.6%	70.0%	76%	58.3%	72.7%
	Master degree and above	61.9%	44.4%	30%	24%	41.7%	27.3%

Table 7 It shows the socio demographics of each cluster. The environmentally concerned group is the oldest average aged group (40.95 years old) with the lowest average income per month (38,300 baht per month). Home lover has the youngest average age group (33.86 years old) and the majority of people (61%) have

education at Master degree and above. Technology lover is generally male (62.5%). Environment concerned, technology lover and environment and home lover group have a majority of people who have a highest educational level lower than master degree, 70%, 76% and 72.7% respectively.

Table 8 Cross tabulation between cluster of awareness and purchasing stage

	Home lover	**Busy lifestyle**	**Envi-ronment con-cerned**	**Trend follower**	**Technology lover**	**Environ-ment and home lover.**	**Chi-square, Statistic significant**
Awareness	57.1%	70.4%	60%	80%	83%	78%	20.728, .001
Purchase	83.3%	84.2%	100%	75%	75%	92%	18.448, .002

Table 8 Each segmentation funnel from awareness to purchase. In overall 72% of the total sample know Led bulbs and 84% of people who have awareness buy them. Between clusters, they have different awareness and purchasing stages. The home lover group have the lowest awareness of Led bulbs (57%) with 84% of purchase intention rate. The environmentally concerned group have 60% awareness but all of the awareness switched to Led bulb users.

Table 9 Cross tabulation of current knowledge the benefits of LED bulb between Clusters

	Pearson Chi-square statistic significant	
Do you know that Led bulb have a long duration?	0.067	Fail to reject Null hypothesis
Do you know that Led bulb can save you energy?	0.004	Reject Null hypothesis
Do you know that Led bulbs do not give off UV?	0.005	Reject Null hypothesis
Do you know that Led bulbs are a higher price?	0.491	Fail to reject Null hypothesis

Table 9 There is no evidence to show that each cluster has different knowledge of long duration and high price. Respondents have the same knowledge of long duration and higher price. The energy saving and no UV benefit of Led bulbs show different levels of knowledge between the segmentation.

Table 10 ANOVA analysis influence to the knowledge between clusters

		Sum of squares	**Df**	**Mean square**	**F**	**Significant (p-value)**
Factors that have influence to the knowledge of LED bulb (family)	Between group	54.572	5	10.914	9.148	0.000
	Within group	382.987	321	1.193		
	Total	437.560	326			

Table 10 (Cont.)

		Sum of squares	Df	Mean square	F	Significant (p-value)
Factors that have influence to the knowledge of LED bulb (friends)	Between group	8.293	5	1.659	1.501	0.189
	Within group	354.570	321	1.105		
	Total	362.862	326			
Factors that has influence to the knowledge of LED bulb (Point of sales)	Between group	22.423	5	4.485	3.783	0.002
	Within group	380.568	321	1.186		
	Total	402.991	326			
Factor that has influence to the knowledge of LED bulb (Television advertising)	Between group	58.173	5	11.635	10.050	0.000
	Within group	371.625	321	1.158		
	Total	429.798	326			
Factor that has influence to the knowledge of LED bulb (Internet advertising)	Between group	20.560	5	4.112	3.366	0.006
	Within group	392.118	321	1.222		
	Total	412.679	326			
Factor that has influence to the knowledge of LED bulb (Radio advertising)	Between group	33.712	5	6.742	6.915	0.000
	Within group	312.967	321	0.975		
	Total	346.679	326			

Table 10 Between the segmentation groups, Family, point of sale, internet advertising and radio advertising have different impacts on the knowledge of each group. In contrast, there is no evidence to say that friends have different impacts on the knowledge of each group.

Home lover has the lowest subset of influence to the knowledge to LED bulbs from family. Working at home people are in the highest subset (Appendix b). Technology lovers and home lovers have the lowest subset of influence to the knowledge to LED bulbs. Trend followers are in the highest subset. Technology lovers and home lovers have the lowest subset of influence to the knowledge to LED bulbs. Trend following people are in the highest subset. Working at home people, technology lovers and home lovers have the lowest subset of influence to the knowledge to LED bulbs. Environmentally concerned are in the highest subset. Working at home and technology lovers have the lowest subset of influence to the knowledge to LED bulbs. The environmentally concerned group is in the highest subset. See Appendix b, homogeneous subset of influence factor to the knowledge.

Table 11 ANOVA analysis influence factor that triggers people to purchase LED bulb between clusters

		Sum of Squares	df	Mean Square	F	Sig.
Influential factor that makes you purchase LED bulbs (Longer duration)	Between Groups	20.937	5	4.187	9.513	0.000
	Within Groups	117.525	267	0.440		
	Total	138.462	272			
Influential factor that makes you purchase LED bulbs (Energy saving)	Between Groups	7.126	5	1.425	2.995	0.012
	Within Groups	127.050	267	0.476		
	Total	134.176	272			

Table 11 (Cont.)

		Sum of Squares	df	Mean Square	F	Sig.
Influential factor that makes you purchase LED bulbs (Reduce global warming)	Between Groups	69.463	5	13.893	18.000	0.000
	Within Groups	206.075	267	0.772		
	Total	275.538	272			
Influential factor that makes you purchase LED bulbs (No UV)	Between Groups	75.545	5	15.109	14.286	0.000
	Within Groups	276.028	261	1.058		
	Total	351.573	266			
Influential factor that makes you purchase LED bulbs (Trusted brand)	Between Groups	27.860	5	5.572	6.897	0.000
	Within Groups	215.700	267	0.808		
	Total	243.560	272			

Table 11 Between clusters, people have different influential factors to purchase LED bulbs in terms of longer duration, energy saving, reduction of global warming, no UV, and trusted brand. Working at home and technology lovers have the lowest mean subset of influence to the trigger people to buy LED bulbs (Longer duration). Environmentally concerned are in the highest mean subset. As for energy saving triggers, busy lifestyle has the lowest mean subset of influence to the knowledge to LED bulbs. Environmental concern is in the highest subset. Global warming concern shows that home lovers have the lowest mean subset of influence to the knowledge to LED bulbs. Environment concerned is in the highest subset. The entirety of the rest of the cluster is in between two groups. As for no UV from LED bulbs, working at home lovers and technology lovers have the lowest mean subset of influence to the knowledge to LED bulbs. Environmentally concerned is in the

highest mean subset. For trusted brand concerns, working at home lovers and technology lovers have the lowest mean subset of influence to the knowledge to LED bulbs. The environmentally concerned group is in the highest mean subset. See Appendix C, homogeneous subset of influencing factors to make people purchase LED bulbs.

Table 12 Net promoter score for each cluster

	home lover	busy lifestyle	Environmentally concerned	fashionable person	technology lover	environment and home lover.
Detractor	30%	33%	0	13%	20%	13%
Promoter	40%	40%	8%	47%	40%	29%
Neutral	30%	27%	92%	40%	40%	58%
NPS score	0	-7	92	27	20	46

Table 12 It shows that the environment-concerned group has the highest positive word of mouth for Led bulbs with 92 points of net promoter score and the second group is the environment and home lover group with 46 points. The least points for the net promoter group is busy lifestyle with -7 points.

Table 13 ANOVA analysis influence factor that makes people not purchase LED bulbs between clusters

		Sum of Squares	df	Mean Square	F	Sig.
Influential factor that makes you not purchase LED bulbs (High price)	Between Groups	19.953	4	4.988	5.680	0.001
	Within Groups	40.400	46	0.878		
	Total	60.353	50			
Influential factor that makes you not purchase LED bulbs (difficult Installation)	Between Groups	11.324	4	2.831	2.862	0.034
	Within Groups	45.500	46	0.989		
	Total	56.824	50			
Influential factor that makes you not purchase LED bulbs (the light is not as good as traditional)	Between Groups	20.694	4	5.174	3.190	0.021
	Within Groups	74.600	46	1.622		
	Total	95.294	50			
Influential factor that makes you not purchase LED bulbs (No knowledge)	Between Groups	26.006	4	6.501	13.175	0.000
	Within Groups	22.700	46	0.493		
	Total	48.706	50			

Table 13 Among the segmentation groups, the factors, including the high price of LED, difficult installation, the quality of light and no knowledge, have different impacts for each cluster.

As for the high price, trend followers and technology lovers have the lowest mean subset of influence to the knowledge to LED bulbs. The rest are in the highest mean subset. As for difficult installation, working at home people and trend followers have the lowest mean subset of influence to the knowledge to LED bulb. Home lovers and busy lifestyle are in the highest mean subset. As for the light luminaire, trend followers have the lowest mean subset of influence to the knowledge to LED bulbs. Working at home people, home lovers and busy lifestyle are in the highest mean subset. The last one has no knowledge obstacles. Trend follower has the lowest mean subset of influence to the knowledge to LED bulb. Busy lifestyle is in the highest mean subset. See Appendix d, homogeneous subset of influence factors that prevent people from purchasing LED bulb.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The research was conducted in three phases. The first phase is secondary research. The second phase is in-depth interview. The third phase is questionnaire survey.

In secondary research, it shows that the LED market is a fast growing market. The market size has increased by 30 percent annually. Next, the in-depth interview purpose is to identify the key variables for the questionnaire survey. The last phase of the study is the questionnaire survey. The analysis result is demonstrated as follows;

The majority of Thai people have awareness of LED bulbs. The conversion rate of switching from traditional light bulbs to LED bulbs is high. The acceptable LED price range for LED users is 150 -200 baht per bulb. In cluster analysis, six groups are classified.

Home Lover and Environment Concerned group have the lowest awareness with 57% and 60 % respectively. In contrast, the people in the environment-concerned group have the highest conversion rate to be a LED users of 100 %. Moreover, the environmentally concerned group has the highest net promoter score (92) to refer and promote LED bulbs.

Among the segmentations, they have different knowledge of no UV and energy saving benefits. In addition, they also have different external influences about the LED knowledge from family, point of sale, television advertising, internet advertising and radio advertising. Moreover, the barriers that prevent each group of people from buying LED bulbs are different.

The summary of the test of significance is as follows;

Table 2, there is a significant difference between user and non-users of LED bulbs in terms of influential knowledge in word of mouth from family, friends, television advertising, and radio advertising. In contrast, there is no evidence to show

that the suggestion from salespeople at points of sale is different between users and non-users of LED bulbs.

Table 3, there is no evidence to prove that they think about ‘top of mind’ brand differently.

Table 4, there is a significant difference in the currently used brands between users and non-users of LED bulbs.

Table 5, the acceptable price range of LED bulb is 150 – 200 baht.

Table 8, there is a significant difference, between clusters, about awareness and purchase intentions.

Table 9, there is a significant difference of perception towards LED bulbs between clusters, in terms of energy saving and no UV. However, there is no evidence to indicate that different perceptions in terms of long duration and high price exist.

Table 10, there is a significant difference in the influential factors that give knowledge of LED bulbs between clusters in terms of family, point of sale, television advertising, internet advertising, and radio advertising. In contrast, there is no evidence that there is a difference in the influential knowledge of LED bulbs by friends between clusters.

Table 11, there is a significant difference in the influential factor that triggers the purchase of LED bulbs between clusters in terms of longer duration, energy saving, reduce global warming, no UV and trusted brand.

Table 13, there is a significant difference in the barriers that trigger the purchase of LED bulbs between clusters in terms of high price, difficult installation, quality, and knowledge.

5.2 Recommendation

Lighting companies should set the LED price in the range of 150 baht to 200 baht.

The result is obviously shown that the cluster “environment concerned” is the most attractive target for LED users. The characteristic of this group is that they are quite concerned about global warming. This group has the lowest number of

people compared to other groups but they tend to have the most positive word of mouth which can increase the buying rate of other groups. The environmentally concerned group is likely to switch from non-users of LED bulb to users of LED bulb if they are educated about the specific benefits of LED which are: longer duration, energy saving, and no UV. Advertising on the television is the most effective way to reach the target audience, compared to other Medias.

The second potential group is the environment and home lover group. This group has the highest number of respondents of all groups. They love to stay at home and are also concerned about the environment. This group has a net promoter score of 46 points which is the second highest score among the groups. Family is the most influential factor to increase their conversion rate. Promotional advertising should be used to convince them. The message in the media should cover the benefits of longer duration and energy saving.

Targeted groups, environment and environment and home lover group, have high net promoter scores. These groups display a positive word of mouth feature. They can convince other groups to buy LED bulbs. Moreover, both groups have similar characteristics. In terms of brands, Phillips should promote their LED products since the customers loyalty has dropped from traditional bulbs into LED bulb. For other companies, this is a promising opportunity to acquire and extend the LED bulb market share in Thailand.

REFERENCES

Euromonitor international, (2015, October 6). *Light source overview: LED lights the way*. Accessed 6 October 2015.

Jeen Wei Ong, Gerald Guan Gan Goh, Choon Yih Goh, Marianne Shing Mei Too, Lee Pheng Goh. (2012). *Are we willing to pay for green products?*. researchgate, sustainable economic development policies and strategy, conference paper November 2012, pp. 97-108.

Katait. (2012). Green marketing in India and its impact on consumer behavior. *International journal of research in commerce & management*, Volume No.5(2014), Issue No.12 pp. 71-74.

LED inside. (2015). *General Lighting Market Trends in Thailand.* Accessed 10 October 2015 from http://www.ledinside.com/showreport/2015/5/general_lighting_market_trends_in_thailand

Prachachart. (2015). *LED drive the lighting market to 2.3 billion baht. Phillip use low pricing strategy to compete in the market*. Accessed 10 October 2015 from http://e-saving.egat.co.th/new2/may58-1.html

Sharma & Kesherwani. (2015). *5 Encouraging Green Purchasing Behavior by Increasing Environmental Consciousness.* Researchgate.

Thansettakij. (2015). *10 Year LED can acquire 80 percent market share 'Thai electricity' try to compete with leading brand.* Accessed 10 October 2015 from http://www.thansettakij.com/2015/09/21/11446

Van Westendorp. (1976). *Price sensitivity meter (PSM), Market chance*. Accessed 16 December 2015 from at http://www.market-chance.com/research.html

Wang, Q. & Potter, N. (2006). 5 Incorporating life cycle costing in early product Design. *International journal of advanced manufacturing systems*, *10*(1). pp. 33-40.

APPENDIX

APPENDIX A
QUESTIONNAIRE DESIGN

Part I: Screening question

1. Do you buy the bulbs or make a decision to buy bulb to your house? [Yes/No] Question

Part II: Main question

2. Do you currently buy LED bulb for your house? [Yes/No]

3. Which brand do you currently buy? [_____]

4. Do you know that LED bulb has benefit of longer duration than traditional bulb? [Yes/No]

5. Do you know that LED bulb has benefit of energy saving? [Yes/No]

6. Do you know that LED bulb does not have UV? [Yes/No]

7. Do you know that LED bulb has higher price.

8. Do you know that LED bulb? [Yes/No]

9. What is the brand that you think of LED [_____]

10. Do you currently buy LED bulb? [Yes/No]

11. On 5-point scale [5-Most important factors, 1-least important factors], please rank the one that you think it is closely to you. Factor that have influence to the knowledge of LED bulb.

    11.1 Family

    11.2 Friends

    11.3 Point of sales

    11.4 Television advertising

    11.5 Internet advertising

    11.6 Radio advertising

12. For user only, on 5-point scale [5-Most important factors, 1-least important factors], please rank the one that you think it is closely to you. Factor that have influence to the make you

    12.1 purchase of LED bulb.

    12.2 Longer duration

    12.3 Energy saving

12.4 Reduce global warming

12.5 No UV

12.6 Trusted brand

13. For non-user only, on 5-point scale [5-Most important factors, 1-least important factors], please rank the one that you think it is closely to you. Influential factor that make you not purchase LED bulb

13.1 High price

13.2 Difficult installation

13.3 Quality of light

13.4 No knowledge

14. PSM measurement

14.1 At what price would you consider the LED bulb to be so expensive that you would not consider buying it?

14.2 At what price would you consider the LED bulb to be priced so low that you would feel the quality couldn't be very good?

14.3 At what price would you consider the LED bulb starting to get expensive, so that it is not out of the question, but you would have to give some thought to buying it?

14.4 At what price would you consider the LED bulb to be a bargain-a great buy for the money?

15. On 5-point scale [5-Most important factors, 1-least important factors], please rank the one that you think it is closely to you.

15.1 I like reading a book

15.2 I like playing computer

15.3 I like playing tablet

15.4 I like playing mobile phone before going to sleep.

15.5 I love a bright room

15.6 I have rush lifestyle

15.7 I love travelling

15.8 I love staying at home

15.9 I love eating organic food

15.10 I usually wear a fashion dress

15.11 I love to buy environment friendly product.

15.12 I worry about global warming.

15.13 I love new technology.

16. Age ____

17. Gender [male/female]

18. Occupation

19. Education [Below bachelor's degree, bachelor’s degree, Master's degree, Doctoral degree]

20. Household monthly income [_____]

APPENDIX B
HOMOGENEOUS SUBSET OF INFLUENTIAL FACTOR TO THE KNOWLEDGE

Appendix 1.1B: Homogeneous of subset (Factor that has influence to knowledge of LED bulb (Family))

Factor that has influence to the knowledge of LED bulb (Family)			
Subset	1	2	3
Home Lover	2.1		
Environment concerned	2.75	2.75	
Busy lifestyle		2.93	2.9
Technology lover		2.74	3.06
Trend follower		3.1	3.13
Environment concerned and home lover			3.58
Statistically significant	0.058	0.559	0.061

Appendix 1.2B: Homogeneous of subset (Factor that has influence to knowledge of LED bulb (Point of sales))

Factor that has influence to the knowledge of LED bulb (Point of sales)		
Subset	1	2
Technology lover	2.73	
Home Lover	2.9	
Environment concerned	3.16	3.16
Environment concerned and home lover	3.16	3.16
Busy lifestyle	3.18	3.18
Trend follower		3.8
Statistically significant	0.381	0.078

Appendix 1.3B: Homogeneous of subset (Factor that has influence to knowledge of LED bulb (Television advertising))

Factor that has influence to the knowledge of LED bulb (Television advertising)			
Subset	1	2	3
Home Lover	2.3		
Technology lover	2.33		
Busy lifestyle		3.25	
Trend follower		3.33	
Environment concerned and home lover			3.7
Environment concerned			4
Statistically significant	1	0.993	0.055

Appendix 1.4B: Homogeneous of subset (Factor that has influence to knowledge of LED bulb (Internet advertising))

Factor that has influence to the knowledge of LED bulb (Internet advertising)		
Subset	1	2
Environment concerned and home lover	2.41	
Technology lover	2.53	
Home Lover	2.6	
Busy lifestyle	2.81	2.81
Trend follower	3	3
Environment concerned		3.33
Statistically significant	0.129	0.228

Appendix 1.5B: Homogeneous of subset (Factor that has influence to knowledge of LED bulb (Radio advertising))

Factor that has influence to the knowledge of LED bulb (Radio advertising)			
Subset	1	2	3
Technology lover	1.8		
Environment concerned and home lover	1.833		
Home Lover	2	2	
Busy lifestyle	2.37	2.37	2.37
Environment concerned		2.58	2.58
Trend follower			2.66
Statistically significant	0.086	0.078	0.756

APPENDIX C
HOMOGENEOUS SUBSET OF INFLUENTIAL FACTOR TO TRIGGER PEOPLE PURCHASE LED BULB

APPENDIX 1.1C: Homogeneous of subset (Influential factor that makes you purchase LED bulb (Longer duration))

Influential factor that makes you purchase LED bulb (Longer duration)			
Subset	1	2	3
Technology lover	3.8667		
Home Lover	3.9		
Busy lifestyle	4.133	4.133	
Trend follower	4.27	4.27	
Environment concerned and home lover		4.37	4.370
Environment concerned			4.75
Significance	0.065	0.549	0.101

APPENDIX 1.2C: Homogeneous of subset (Influential factor that makes you purchase LED bulb (Energy saving))

Influential factor that makes you purchase LED bulb (Energy saving)		
Subset	1	2
Busy lifestyle	4.27	
Trend follower	4.4	4.4
Technology lover	4.47	4.47
Home Lover	4.5	4.5
Environment concerned and home lover	4.67	4.67
Environment concerned		4.75
Significance	0.065	0.549

APPENDIX 1.3C: Homogeneous of subset (Influential factor that makes you purchase LED bulb (Reduce global warming))

Influential factor that makes you purchase LED bulb (Reduce global warming)			
Subset	1	2	3
Home Lover	2.8		
Trend follower		3.73	
Technology lover		3.73	
Environment concerned and home lover		3.88	
Busy lifestyle		3.93	
Environment concerned			4.83
Significance	1	0.901	1

APPENDIX 1.4C: Homogeneous of subset (Influential factor that makes you purchase LED bulb (No UV))

Influential factor that makes you purchase LED bulb (No UV)			
	Subset for alpha = 0.05		
Subset	1	2	3
Home Lover	2.7		
Technology lover	3.07		
Busy lifestyle		3.73	
Trend follower		3.78	
Environment concerned and home lover		4.04	4.04
Environment concerned			4.45
Significance	0.588	0.751	0.454

APPENDIX 1.5C: Homogeneous of subset (Influential factor that makes you purchase LED bulb (Trusted brand))

Influential factor that makes you purchase LED bulb (Trusted brand)			
	Subset for alpha = 0.05		
Subset	1	2	3
Technology lover	3.47		
Home Lover	3.6		
Busy lifestyle	3.67	3.67	
Environment concerned and home lover	3.75	3.75	
Trend follower		4.07	4.07
Environment concerned			4.5
Significance	0.696	0.164	0.233

APPENDIX D
HOMOGENEOUS SUBSET OF INFLUENTIAL FACTOR TO STOP PEOPLE PURCHASE LED BULB

APPENDIX 1.1D: Homogeneous of subset (Influential factor that makes you stop purchase LED bulb (High price))

Influential factor that makes you not purchase LED bulb (High price)		
Subset	1	2
Trend follower	2.67	
Technology lover	2.8	
Environment concerned and home lover		4
Home Lover		4
Busy lifestyle		4
Significance	0.769	1

APPENDIX 1.2D: Homogeneous of subset (Influential factor that makes you stop purchase LED bulb (Difficult installation))

Influential factor that makes you not purchase LED bulb (Difficult installation)		
Subset	1	2
Trend follower	2.4	
Technology lover	2.8	2.8
Environment concerned and home lover	3	3
Home Lover		3.5
Busy lifestyle		3.66
Significance	0.769	1

APPENDIX 1.3D: Homogeneous of subset (Influential factor that makes you stop purchase LED bulb (the light is not as good as traditional))

Influential factor that makes you not purchase LED bulb (the light is not as good as traditional)		
Subset	1	2
Trend follower	2	
Technology lover	2.5	2.5
Environment concerned and home lover		3.33
Home Lover		3.4
Busy lifestyle		3.5
Significance	0.418	0.143

APPENDIX 1.4D: Homogeneous of subset (Influential factor that makes you stop purchase LED bulb (No knowledge))

Influential factor that makes you not purchase LED bulb (No knowledge)			
Subset	1	2	3
	1	2	3
Trend follower	1.6		
Home Lover		2.5	
Technology lover		2.6	
Environment concerned and home lover		3	3
Busy lifestyle			3.66
Significance	0.769	0.169	0.054

BIOGRAPHY

Name	MR Choltit Rattanasetyut
Date of Birth	December 8, 1989
Educational Attainment	2008: Bachelor of Business Administration Faculty of Business Administration, Assumption University
Work Position	Sales directors, AKAN Lighting. Co, Ltd.
Publications	2016
Working Experience	Private Go Teacher, Bangkok