

**CONSUMER PERSPECTIVES ON PREMIUM PRICE OF ECOLOGICALLY
FRIENDLY PRODUCT: A CASE STUDY OF OPHTHALMIC LENS IN
THAILAND**



**A THESIS SUBMITTED IN PARTIAL FULLFILLMENT
OF THE REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT
INTERNATIONAL COLLEGE
KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG
2019
KMITL-2019-IC-M-002-003**

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NIDA TUNA

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THESIS TITLE	Consumer perspectives on ecologically product: a case study of ophthalmic lens in Thailand
STUDENT NAME	Ms. Nida Tuna
STUDENT ID	58610052
DEGREE	Master of Science
PROGRAMME	Logistics and Supply Chain Management
ADVISOR	Asst. Prof. Dr. Ronnachai Tiyarattanachai

ABSTRACT

Due to the increase of public environmental awareness especially in terms of climate change and resource depletion problems, consumers tend to change their consumption preference towards sustainable development and circular economy concepts. Green and environmentally friendly products are becoming more demanded in various business sectors. Therefore, manufacturers are driven to change their products to be more eco-friendly. Theoretically, being green should save some costs; however, this business transformation requires some investment and may cause product's price to increase. Thus, it is important to understand whether or not the consumers are willing to pay more for being "green" along with other factors that influence their green purchasing decisions. The study found that approximately 90% of the respondents are willing to pay more for green ophthalmic lens products compared to typical ophthalmic lens products. There is also some relationship between green awareness and willingness to pay more for green products. The results of the study can be used to enact government sustainability policies and business strategies.

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Finally, I must express my very greatest gratitude to my family, Moowhan and Bubble Bee with unconditional love, unfailing support and continuous motivation throughout my years of study. This accomplishment would not have been possible without them.

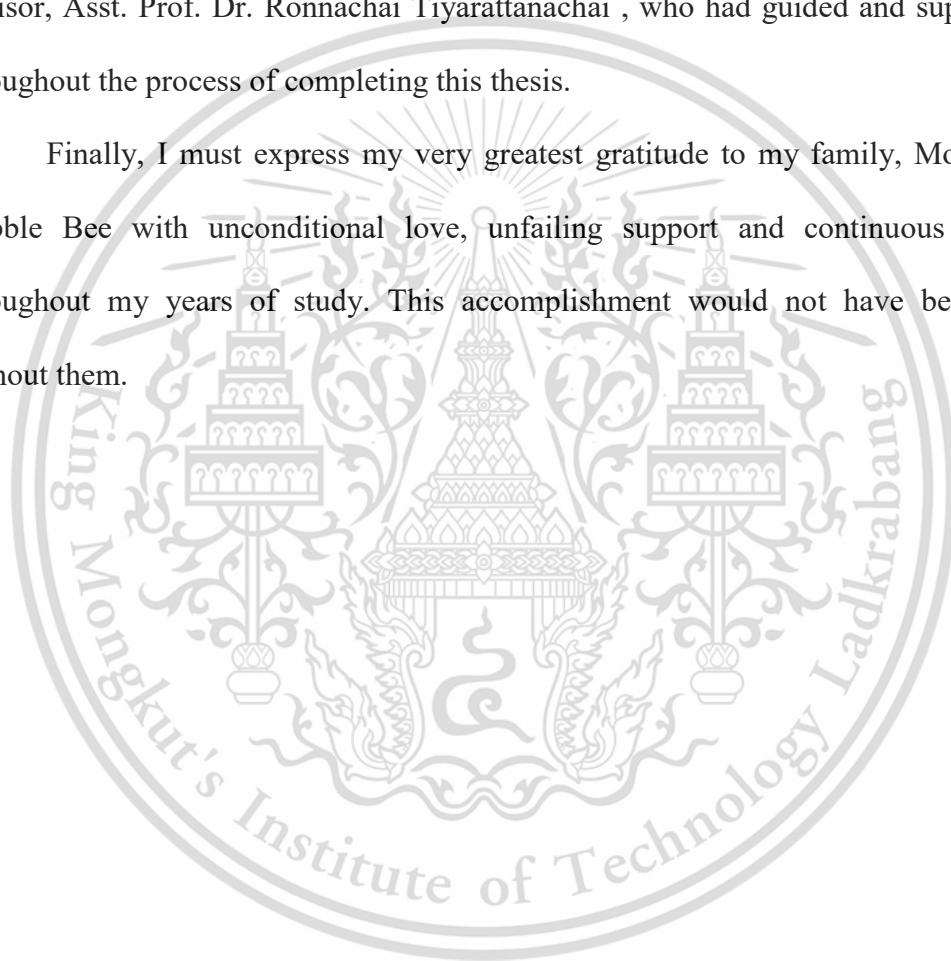


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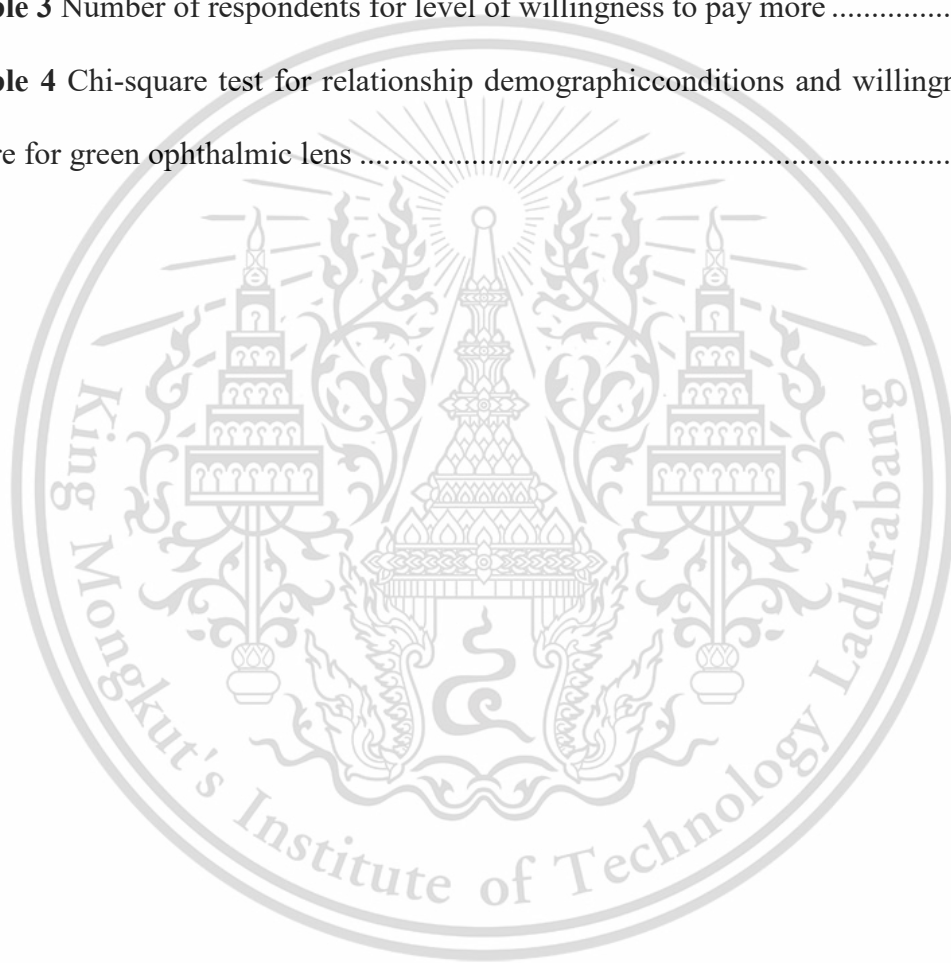
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CHAPTER 1

INTRODUCTION

1.1 Background

Green consumption has gained more interests by the public due to the increased environmental awareness. Ecologically friendly products are the key part of green consumption. In general, ecologically friendly product refers to the products that pose relatively lower environmental impacts to produce and consume compared to other products of its peer (Borchardt et al., 2015). The environmental impacts are considered throughout the product cycle including production, logistics, consumption, and disposal at the end of its lifecycle (Speer, 2011). In the market, there are many terms that imply such products such as green products, environmentally friendly products, sustainable products, planet friendly product, and organic products depending on market sectors and marketing strategies of the producers (Tan and M., 2016). Based on a survey in 2013, there have been 70% more demands for ecologically friendly products in the US (Lehman, 2015). Many companies introduced their ecologically friendly products into the market. For example, Nike introduced its sport wares produced from polyester fibre from recycled plastic bottles. Coca-cola introduced packaging materials that can be 100% recycled (Lehman, 2015).

In Thailand, Siam Cement Group (SCG), one of the biggest construction material and home decoration product producers in Thailand launched its 'SCG eco value' label for its products in 2009 (SCG, 2016). The company stated that SCG eco value is a self-declared eco-label of SCG to ensure its environmentally-friendly products and services, which is one tool that SCG uses to communicate a product's environmental friendliness to the

stakeholders that are able to choose the products and services concerning to environmental care. In some cases, however, green products are priced higher compared to the same products of their peers. This is quite ironic considering that, theoretically, green product should consume less resource to produce. Ophthalmic lens are the tools used for eye corrections such as presbyopia, hyperopia, myopia, and astigmatism. Ophthalmic lens have many varieties for example, clear lens, transitions lens, and polarized lens. Based on a survey by Essilor, the world's largest ophthalmic lens producer, approximately 4.6 billion people need vision correction. It means that there are an approximate total of 9.2 billion lens demanded globally (Essilor, 2018). Ophthalmic lens production requires considerable amount of water consumption. Their packaging materials and wastes at the end of product life cycle also generate an enormous amount of wastes. Due to limited availability of green ophthalmic lens products especially in Thailand market, there is a need for study to investigate the perception of ophthalmic lens users towards the products of this kind. Ophthalmic lens producers can use the findings of this study to make investment on production process modification and marketing strategies in response to this green consumer demands.

1.2 Statement of the Problem

Ophthalmic lens production requires two main raw materials including glass and plastic. Presently, plastic lens are more preferable by customers because of their light-weight, durability and safety. In general, there are two types of lens production: made-to-stock and made-to-order lens. This section describes the production of Rx lens, which is a kind of made-to-order lens. Production process starts with the use of Semi-finished (SF)

lens. The SF lens has eye correction values due to their polymer convex surface. A considerable amount of water is required in this polymer setting process. Water is used for lens polishing, cleaning, hard-coating, and anti-reflection coating. Production process also includes lens generating, which generates a lot of plastic wastes. Packaging material is also a large source of wastes. Due to the huge amount of lens demands based on sustainability report 2015 of Essilor company, it is approximated that this lens company consuming water and energy 4.8 million liters and 709.5 GWh and generating the industrial waste of 21kT (Sustainability, 2015).

1.3 Objectives of the Study

Based on information, supply chain is the connection between demand and supply. The Final products and services would be driven from the consumer's need. With increasing environmental awareness in the last decade, the consumers use their purchasing power to force all chains from upstream to downstream to provide better environmental performance through their product and process including on all activities from raw material until disposal (Shahriarpour and Tabriz, 2017).

The primary objective of the study is to know the relationship among environmental awareness, green habit attitude, and willingness to pay more. The study also aims to compare the relationship between demographic conditions and willingness to pay more on green ophthalmic lens.

1.4 Scope of the Study

The study focuses on the perceptions of consumers to product manufacturing. The product manufacturing is one of step on tool 'Life cycle assessment (LCA)'. LCA is the tool to use for assessing the environmental aspect and potential environmental aspects and potential aspects associated with product or service (Srinivas H.,2015). The six steps are described in LCA tool starting to assess from raw materials, product manufacturing, packing, distributing, use and disposal, see in Figure 1 showing the information of life cycle stage that is related to final product or service. By this information can be displayed on the green label which is another tool that the manufacturers communicate to consumers about how this product or service are environmental friendly in which stage.

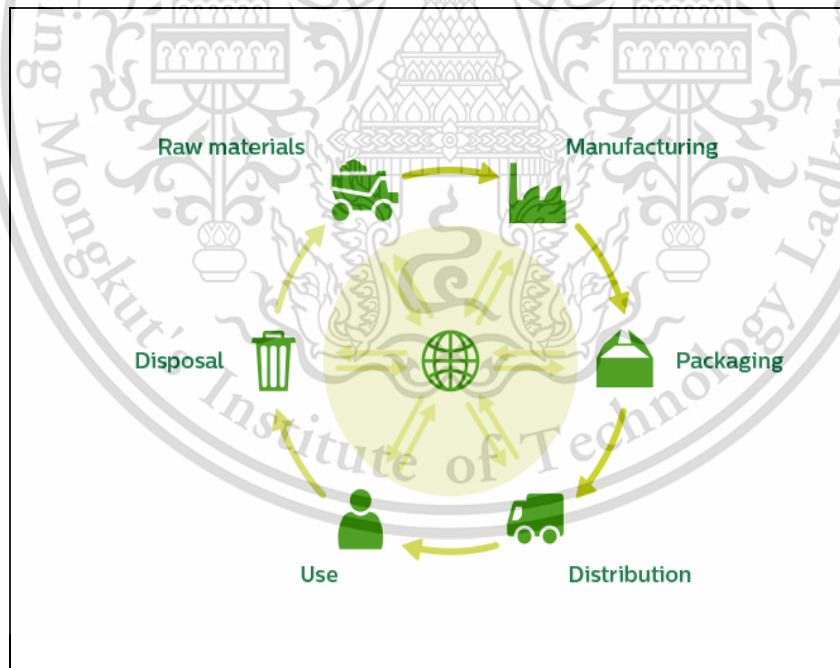


Figure1. Life cycle assessment (LCA) process

Source: www.innovation.services.philips.com (Kampen, M. V., 2015). Life cycle management.

Definitions of terms used in this study are also listed below to make certain that the terms and their meanings are consistent throughout the study.

Definition of Terms

Definition of environmental awareness knows environment problem status, what behaviour can be a cause of the environment problem and consequence. For example, knowing the world is facing global warming issue and it is caused by human generating the pollution. And definition of green habit attitude is how preference to be green in daily activities such as preferring to use the cloth bag than plastic bag.

Definition of Environmentally friendly products is “products that do not harm the environment whether in their production, use or disposal”. In other words, these products help preserve the environment by significantly reducing the pollution they could produce. Environmentally friendly products are also known as eco products or green product as they cause minimal harm to people and environment.

Definition of Eco label or green label is a voluntary method of environmental performance certificate and labeling that is practiced around the world, it identifies product or services proven environmentally friendly based on life cycle considerations, see the stages of life cycle assessment (LCA) in Figure 1.

Hypothesis

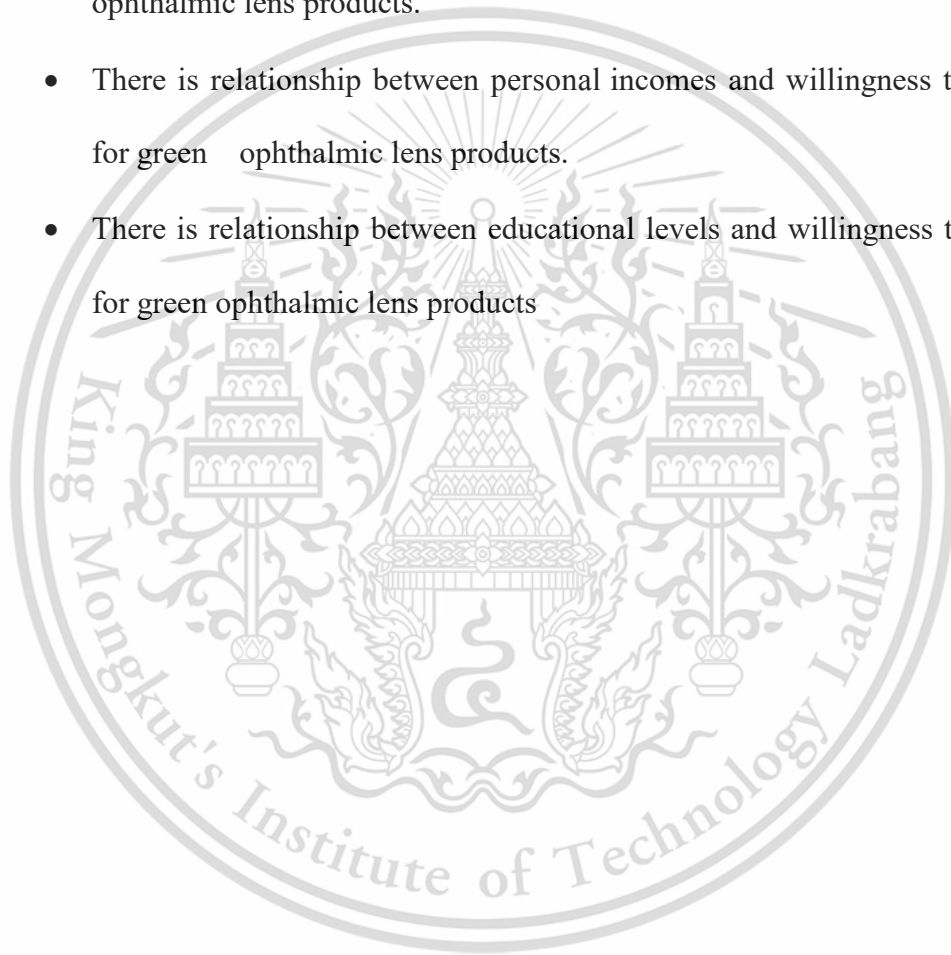
1. Relationship among environmental awareness, green habit attitude, and willingness to pay more

- There is relationship between environmental awareness and willingness to pay for green ophthalmic lens products.

- There is relationship between green habit attitude and willingness to pay for green ophthalmic lens products.

2. Relationship between demographic conditions and willingness to pay more on green ophthalmic lens.

- There is relationship between gender and willingness to pay more for green ophthalmic lens products.
- There is relationship between personal incomes and willingness to pay more for green ophthalmic lens products.
- There is relationship between educational levels and willingness to pay more for green ophthalmic lens products



CHAPTER 2

LITERATURE REVIEW

This chapter listed studies related to the profound knowledge used in the design of this study. The literatures are summarized in two (2) groups of factors influencing green consumptions

2.1 Internal factors influencing green consumption

Internal factors that influence green consumption are somewhat related to environmental awareness and attitude (Afroz et al., 2018). Environmental awareness and attitude are the key drivers to understand environmental impacts resulted from human beings (Tan and M., 2016). For example, consumers who have good environmental awareness should be aware that less agricultural product outcome is partially due to climate change impacts (Afroz et al., 2015). Some people who prefer to consume organic products because they are aware of chemicals used in non-green production processes (Santiteerakul and Veasangkomsatea, 2016). However, a survey in 1993 revealed that people who consumed ecologically friendly products were driven from allergy problems, which are sometimes related to environmental conditions. These problems make them aware the impacts of deteriorated environmental conditions (Chekima et al., 2016). However, there was no clear evidence that this awareness has significant relationship with gender and level of education (Borchardt et al., 2016).

2.2 External factors influencing green consumption

Green consumption can also be influenced by external factors (Suki, 2016). For example, consumers may be influenced by the society they live in (Biswas and Roy, 2015). Currently, there is an increasing trend of environmental awareness and conservation (Li et al., 2016). Some people may follow green consumption led by their colleagues once they have learnt the benefits of ecologically friendly products (Borchardt et al., 2016). Green label is also an important driver for green consumption since it provides information about benefits of green products such as energy saving and emission data on their packages (Swaroop and Yadav, 2016). Beside of the benefits to themselves, consumers also value producers' reputation in terms of Corporate Social Responsibility (CSR) (Zeng et al., 2012). They tend to weigh this factor in purchasing decision no less than the products themselves (Hwang et al., 2013).

CHAPTER 3

RESEARCH METHODOLOGY

This chapter presents the research methodology conducted to complete the study. It explains how the study area and study population were set. It also describes how data were collected and how results were interpreted.

3.1 Study area

The study was conducted through questions in 15 days so the population is mostly from social network of researcher living in Thailand. The background of population is mostly in mid range incomes.

3.2 Study Population

The subjects participating in this study consist of populations who had and also did not have experience in ophthalmic lens purchasing. The populations have the different demographic profiles such as personal incomes, level of education, gender, and age. The total numbers of population of Thailand year 2018 are about 69 million people (Thailand population, 2018).

3.3 Survey design

The number of sample size was calculated by a simplified formula for proportions. The simplified formula to calculate sample sizes was provided by Yamane (Yamane, 1967). The sample size is determined by level of precision and population, confidence level and proportion are designated as specific number.

The researcher has used random sampling and to select the sample, the formula of Taro Yamane has been used with the following formula.

$$\text{formula} \quad n = \frac{N}{1 + Ne^2}$$

When n = size of sample group

N = size of all population

e = the missing adjusting rate in random sampling at level 0.05

The sample size of this study was considered appropriate at 95% confidence level with a precision rate of $\pm 5\%$ and the degree of maximum variability is .5

The degree of maximum variability is 0.5, the minimum size of sample populations were set to be total 385.

3.4 Questionnaire Form Design

A questionnaire was used as the primary tool to collect data for the study. The study aimed to understand the relationship consumers' environmental awareness and willingness to pay more for ecologically friendly products using ophthalmic lens as a case study. The survey consists of 5 sections including

Section 1 Demography data

Section 2 Green awareness

Section 3 Green habit attitude

Section 4 Experience ophthalmic lens purchasing

Section 5 Willingness to pay more for green ophthalmic lens

Part 1 consists of four (4) questions, which were designed to collect general information and profiles of the respondents. The questions were aimed to ask about the age, gender, education level, and personal incomes.

Part 2 and part 3 of the questionnaire consists of 8 questions designed to ask about environmental awareness and to ask about green habit attitude. A five-point Likert scale was used in the survey. The scale ranged from 1 to 5, indicating [1] = strongly disagree, [2] = disagree, [3] = neutral agree, [4] = agree, and [5] = strongly agree. It is designed to demonstrate the respondents' perception of green awareness and green habit attitude respectively.

Part 4 of the questionnaire consists of 2 questions designed to ask about experience ophthalmic lens purchasing and price rate.

Part 5 of the questionnaire consists of 2 questions designed to ask willing to pay more on ophthalmic lens in percentage and price rate in Thai baht

(See Appendix A for the questionnaire)

3.5 Collection of data

The questionnaire was distributed using social media and email networks. A total 207 responses were received.

3.6 Analysis of Data and Statistical Procedures

From the collection of research data, statistical analysis based on descriptive and inferential methods were used to analyze data by utilizing the Statistical Package for Social Science (SPSS).

A structured questionnaire was pretested for its validity and reliability before distribution. As presented in Table 1, Cronbach's alpha ranged from 0.81 to 0.98, which are acceptable. The Kaiser-Mayer-Olkin result of 0.914 showed a sufficient sampling

adequacy of factor analysis. The hypothesis tests of the relationship among environmental awareness, green habit attitude, and willingness to pay more use regression analysis.

The hypothesis tests of the relationship between demographic conditions and willingness to pay more on green ophthalmic lens use Chi-square test.



CHAPTER 4

RESULTS AND DISCUSSIONS

This chapter presents the results of the survey from 207 respondents. Based on survey design, the sampling size should be 385 respondents considering appropriate at 95% confidence level with a precision rate of $\pm 5\%$ and the degree of maximum variability is .5 By the number of 207 respondents shows 85% confidence level approximately with the same a precision rate and the degree of maximum variability . It means the 85% of the answers are truly answer if you get exhaustively interviewed everyone in Thailand (Raosoft, 2004).

4.1. Respondents demography

Demographic information of the respondents is presented in Table 1 Approximately 79.6% of the respondents have some experience in ophthalmic lens purchasing. Approximately 63.7% and 36.3% of the respondents are female and male, respectively. The socio-economic status of respondents was surveyed based on income tax levels in Thailand. Compared to the legally required minimum salary for bachelor degree holders in Thailand of 15,000 baht, the majority of the respondents deem middle-class. Approximately 93% of the respondents earn more than 25,000 baht per month. Over 90% of the respondents have at least bachelor degree or higher.

Table 1. Demography

Experience in ophthalmic lens purchasing	
Had experience in ophthalmic lens purchasing	79.6 %
Did not have experience in ophthalmic lens purchasing	20.4 %
Gender	

Male	36.3%
Female	63.7%
Personal incomes	
Less than 25000 baht per month	7%
25,001 to 45000 baht per month	37.9%
More than 45001 baht per month	55.1%
Education	
High school	1%
Bachelor's degree	56.5%
Graduate degree or higher	42%
Others	0.5%

4.2 Relationship among environmental awareness, green habit attitude and willingness to pay

Definition of environmental awareness knows environment problem status, what behaviour can be a cause of the environment problem and consequence. For example, knowing the world is facing global warming issue and it is caused by human generating the pollution. And definition of green habit attitude is how preference to be green in daily activities such as preferring to use the cloth bag than plastic bag. This section summarizes the results of hypothesis tests using regression analysis. The null hypothesis fails if p-value is greater than 0.05. The results are presented in Table 2. In summary, the results show that:

- 1) There is relationship between environmental awareness and willingness to pay for green ophthalmic lens products.
- 2) There is no relationship between green habit attitude and willingness to pay for green ophthalmic lens products.

However, approximately 90% of the respondents indicated that would be willing to pay more for green ophthalmic lens. As presented in table 3, the majority of them are willing to pay up to 5% more for green ophthalmic lens products. From the result of regression, environmental awareness supports the willingness to pay more on green ophthalmic lens product. But green habit attitude does not support on willingness to pay more on green ophthalmic lens. It is interesting to learn that some respondents, who deny paying more, believe that making the products green should be producers' responsibility if it is going to cost more. Though, they would choose to buy general green products if they are priced the same as traditional non-green products.

Table 2. Result of regression for relationship among awareness, attitude, and willingness to pay more.

Willingness to pay more for green ophthalmic lens products			
	Estimate	S.E.	p-value
Awareness on environment problem	0.351	0.158	0.027
Attitude on green habit	0.064	0.106	0.548

Table 3. Number of respondents for level of willingness to pay more

Level of willingness to pay more for green ophthalmic lens	Number of respondents (%)
1% - 5%	47
6% - 10%	15
11% -15%	17
16% - 20%	7
21% - 25%	1
25% -30%	1
More than 30%	2

Deny willingness to pay more for green ophthalmic lens	10
--	----

4.3 Relationship between demographic conditions and willingness to pay more on green ophthalmic lens.

The results of hypothesis testing about relationship between demographic conditions and willingness to pay more on green ophthalmic lens are presented in Table

4. Key findings are summarized as follows:

- 1) There is no relationship between gender and willingness to pay more for green ophthalmic lens products.
- 2) There is no relationship between personal incomes and willingness to pay more for green ophthalmic lens products.
- 3) There is no relationship between educational levels and willingness to pay more for green ophthalmic lens products.

Table 4. Chi-square test for relationship demographic conditions and willingness to pay more for green ophthalmic lens

Demographic condition	p-value
Gender	0.984
Personal incomes	0.177
Education level	0.764

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

A survey study has been conducted to find relationship between willingness to pay more for green products and green awareness and attitude focusing on ophthalmic lens products in Thailand. The survey also attempted to find the relationship between willingness to pay and some demographic conditions such as gender, level of education and incomes level. Based on the results of the study, there was significant relationship between green awareness and willingness to pay but there was no significant relationship between attitude and any demographic conditions. This is somewhat in line with findings of other studies in the past. However, it is interesting to find that some respondents indicate that additional costs, if any, for being green should be absorbed by the producers. They would still prefer to buy green products if they cost the same as non-green products. Based on this result of this study, it can use to motivate the manufactures to implement green in their product or service in any stage of the product life cycle. The consumer's perception of green demand can be a key driving all chains in supply chains to start or maintain green implementation in their product and process.

It should also be noted that this study focused on ophthalmic lens products in Thailand. The conclusions may be different for other product sectors in Thailand or different countries.

5.2 Recommendations

This study was conducted in Thailand. It is recommended more studies be conducted in other countries in order to understand and compare the consumer's perception in different countries.

Moreover, it is interesting to study more for communication of product's environmental friendliness information to the consumers to understand whether there is any relationship or not between the communication such as green label, eco label and willingness to pay more to the green products and services. Then the result can be useful to convince some companies to apply the green system. Also, some companies can use this result of the further study to improve their communication of green products to the consumers.

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Questionnaire: Consumer perspectives on premium price of ecologically friendly product: a case study of ophthalmic lens in Thailand.

(แบบสอบถาม: มุมมองของผู้บริโภคต่อราคาที่เพิ่มขึ้นของสินค้าที่เป็นมิตรต่อสิ่งแวดล้อม กรณีศึกษาเลนส์แว่นตาในประเทศไทย)

This questionnaire is part of a research by Ms. Nida Tuna to fulfill her thesis requirements of Master Program in Logistics and Supply Chain, KMITL International College.

(แบบสัมภาษณ์นี้เป็นส่วนหนึ่งของงานวิจัยโดย น.ส. นิดา ตูนา เพื่อเป็นส่วนหนึ่งของการศึกษาตามหลักสูตรการจัดการโลจิสติกส์และซัพพลายเชนมหาบัณฑิต (หลักสูตรนานาชาติ) สถาบันเทคโนโลยีพระจอมเกล้า เจ้าคุณทหารลาดกระบัง ในหัวข้อ “มุมมองของผู้บริโภคต่อราคาที่เพิ่มขึ้นของสินค้าที่เป็นมิตรต่อสิ่งแวดล้อม กรณีศึกษาเลนส์แว่นตาในประเทศไทย”)

Contact for more information (ติดต่อเพื่อขอข้อมูลเพิ่มเติม)

Email : nida.t@essilor.co.th, rtiyarattanachai@gmail.com

Definition : Environmentally friendly products are “products that do not harm the environment whether in their production, use or disposal”. In other words, these products help preserve the environment by significantly reducing the pollution they could produce.

(คำนิยาม:ผลิตภัณฑ์ที่เป็นมิตรต่อสิ่งแวดล้อม หมายถึง ผลิตภัณฑ์ที่ส่งผลกระทบต่อสิ่งแวดล้อมจากขั้นตอนการจัดหาวัตถุดิบ, การผลิต, การขนส่ง, การใช้งานและการจัดการซากหลังการใช้งานน้อยกว่าเมื่อเทียบกับสินค้าอื่นที่ทำหน้าที่อย่างเดียวกัน)

The questionnaire is divided into three parts; (แบบสอบถามแบ่งออกเป็น 3 ส่วน)

Part One – Demographic (แบบสอบถามเกี่ยวกับปัจจัย

ส่วนบุคคล)

Part Two – Green awareness, green habit attitude and willingness to pay more for green ophthalmic lens (ข้อมูลเกี่ยวกับความตระหนักในปัญหาสิ่งแวดล้อม ทัศนคติต่อพฤติกรรมการรักษาสิ่งแวดล้อม และความต้องการจ่ายราคาเพิ่มต่อเลนส์แว่นตาที่เป็นมิตรต่อสิ่งแวดล้อม)

Part Three – Experience on ophthalmic lens purchasing (ข้อมูลการซื้อผลิตภัณฑ์เลนส์แว่นตา)

Part One: General Information

(ส่วนที่ 1: แบบสอบถามเกี่ยวกับปัจจัยส่วนบุคคล)

Please select your answer by check ☒ in the ☐ according to your information and fill in your answer on for the open-ended questions.

(โปรดทำเครื่องหมาย ☒ ลงในช่อง ☐ ที่ตรงกับความจริงของท่านมากที่สุด และกรอกข้อมูลลงใน สำหรับคำถามแบบอัตนัย กรุณาเติมคำตอบจนครบทุกข้อ)

1.1 Education level (ระดับการศึกษาสูงสุด)

- ☐ Under high school (ต่ำกว่ามัธยมศึกษาตอนปลาย)
- ☐ High school (มัธยมศึกษาตอนปลายหรือเทียบเท่า)
- ☐ Bachelor degree (ปริญญาตรี)
- ☐ Master degree (ปริญญาโท)
- ☐ Doctorial degree (ปริญญาเอก)
- ☐ Others (อื่นๆ)

1. 2 Gender (เพศ)

☐ Male (ชาย)

☐ Female (หญิง)

1.3 What is your nationality? เชื้อชาติ

☐ Thai (ไทย) ☐ others (อื่นๆ)

1.4 Personal incomes (THB) (รายรับต่อเดือน (บาท))

☐ 0 - 15,000

☐ 15,001 - 25,000

☐ 25,001 - 45,000

☐ 45,001 - 65,000

☐ 65,001 - 85,000

☐ 85,001 - 100,000

☐ More than 100,001 (มากกว่า 100,001)

Part Two – Green awareness, green habit attitude and willingness to pay more for green
Ophthalmic lens

(ส่วนที่ 2: ข้อมูลเกี่ยวกับความตระหนักในปัญหาสิ่งแวดล้อม ทักษะติดต่อพฤติกรรมความรัก
สิ่งแวดล้อม และความต้องการจ่าย ราคาเพิ่มเติมเลนส์แว่นตาเป็นมิตรต่อสิ่งแวดล้อม)

Please select your answer by check ☒ in the ☐ according to your information and fill in
your answer on for the open-ended questions.

2.1. Please select the scale rage representing your perception of green awareness (โปรด
เลือกระดับความตระหนักในปัญหาสิ่งแวดล้อมที่ตรงต่อความเป็นจริงของตัวท่านมากที่สุด)

The scale ranged from 1 to 5, indicating [1] = strongly disagree, [2] = disagree, [3] =
neutral agree, [4] = agree, and [5] = strongly agree.

(ระดับคะแนน 1 – 5, ระดับคะแนน 5 หมายถึง เห็นด้วยอย่างยิ่ง, ระดับคะแนน 4 หมายถึง
เห็นด้วย, ระดับคะแนน 3 หมายถึง ไม่แน่ใจ, ระดับคะแนน 2 หมายถึง ไม่เห็นด้วย, ระดับ
คะแนน 1 หมายถึง ไม่เห็นด้วยอย่างยิ่ง)

2.1.1. Wast is one of the environment problem (ขยะคือหนึ่งในสาเหตุของปัญหาสิ่งแวดล้อม)

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

น้อยที่สุด

มากที่สุด

2.1.2. Saving energy is importance for sustainability (การใช้พลังงานอย่างประหยัดเป็นสิ่งสำคัญ
สำหรับการพัฒนาอย่างยั่งยืนโดยไม่ทำลายสิ่งแวดล้อม)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.1.3. Saving water is importance for sustainability (การประหยัดน้ำเป็นสิ่งสำคัญสำหรับการ
พัฒนาอย่างยั่งยืนโดยไม่ทำลายสิ่งแวดล้อม)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.1.4. Incinerate generates pollution (การเผาขยะสามารถทำให้เกิดมลพิษในอากาศ)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.1.5. Global warming is problem we are facing (โลกเรากำลังประสบปัญหาโลกร้อน)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.1.6. Global warming is caused by human (ปัญหาโลกร้อนมีสาเหตุมาจากการกระทำของ
มนุษย์)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.1.7. Global warming is harmful to life (ปัญหาโลกร้อนเป็นอันตรายต่อของสุขภาพมนุษย์)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.1.8. Green habits can improve global warming (พฤติกรรมการใช้ของที่เป็นมิตรต่อสิ่งแวดล้อมของมนุษย์สามารถช่วยลดปัญหาโลกร้อนได้)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2. Please select the scale range representing your perception of green awareness (โปรดเลือกระดับทัศนคติต่อพฤติกรรมกรรักษ์สิ่งแวดล้อม ที่ตรงต่อความเป็นจริงของตัวท่านมากที่สุด)

2.2.1. I prefer cloth than plastic bag (ฉันเลือกใช้ถุงผ้ามากกว่าการใช้ถุงพลาสติก)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.2. I prefer mug than plastic cup (ฉันเลือกใช้ภาชนะที่นำกลับมาใช้ได้หลายครั้งมากกว่าการใช้แก้วพลาสติกที่ต้องเปลี่ยนใหม่ในครั้งถัดไป)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.3. I save energy in my house (ฉันมีการประหยัดพลังงานในบ้านของฉัน)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.4. I save energy in my house ฉันมีการประหยัดน้ำในบ้านของฉัน *

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.5. I prefer green products than general products (ฉันเลือกใช้ผลิตภัณฑ์ที่เป็นมิตรต่อสิ่งแวดล้อมมากกว่าผลิตภัณฑ์ทั่วไป)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.6. I prefer green transportation such as by walk, bicycle and electric car (ฉันเลือกใช้การเดินทางที่เป็นพลังงานสะอาดไม่ปล่อยมลพิษต่อสิ่งแวดล้อม ตัวอย่างเช่น การเดิน การปั่นจักรยาน การใช้รถพลังงานไฟฟ้า)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.7. I prefer using product with green label (ฉันเลือกใช้ผลิตภัณฑ์ที่มีตราสัญลักษณ์ของการเป็นมิตรต่อสิ่งแวดล้อม)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

2.2.8. I prefer product make from enviromental friendly manufaturing (ฉันเลือกใช้ผลิตภัณฑ์ที่ผลิตจากกระบวนการที่เป็นมิตรต่อสิ่งแวดล้อม)

☐ 1☐ 2☐ 3☐ 4☐ 5

น้อยที่สุด

มากที่สุด

3. Experience ophthalmic lens purchasing (ข้อมูลการซื้อผลิตภัณฑ์เลนส์แว่นตา)

3.1. Have you ever bought ophthalmic lens) ท่านเคยซื้อแว่นสายตาหรือไม่? *

☐ Yes (เคย)☐ Never(ไม่เคย)

(If you never bought the lens, skip to 3.3)

(ไม่เคยซื้อเลนส์แว่นตาข้ามไปข้อ3.3)

3.2. Price of two lenses excluding frame (ราคาของเลนส์แว่นตาของท่าน 1 คู่ ไม่รวมกรอบแว่นตา)

(For person who have experience on lens purchasing)

(สำหรับผู้ที่เคยซื้อแว่นตา)

- ☐ Less than 3000 THB (ต่ำกว่า 3000 บาท)
- ☐ 3,001 - 6,000 THB (3,001 - 6,000 บาท)
- ☐ 6,001 - 9,000 THB (6,001 - 9,000 บาท)
- ☐ 9,001 - 12,000 THB (9,001 - 12,000 บาท)
- ☐ More than 12,000 THB (มากกว่า 12,000 บาท)

3.3 Please select your price of 2 lenses if you want to buy excluding frame (for who never bough the lenses) หากท่านต้องการซื้อเลนส์แว่นตา โปรดประมาณช่วงระดับราคาของเลนส์สายตา 1 คู่ (ไม่รวมกรอบแว่นตา) ที่ท่านสนใจซื้อ * (สำหรับผู้ไม่เคยซื้อเลนส์แว่นตาเท่านั้น)

- ☐ Less than 3000 THB (ต่ำกว่า 3000 บาท)
- ☐ 3,001 - 6,000 THB (3,001 - 6,000 บาท)
- ☐ 6,001 - 9,000 THB (6,001 - 9,000 บาท)
- ☐ 9,001 - 12,000 THB (9,001 - 12,000 บาท)
- ☐ More than 12,000 THB (มากกว่า 12,000 บาท)

3.4 Select acceptable additional price for green ophthalmic lense, please declare in the percentage of price from item 3.3, 3.2 (ท่านสามารถจ่ายเพิ่มขึ้นสำหรับเลนส์แว่นตาที่เป็นมิตรต่อสิ่งแวดล้อม จากราคาเท่าไร เทียบกับราคาปกติที่ท่านซื้อ ข้อ3.3, 3.2)

☐ 1 - 5%

☐ 6 - 10%

☐ 11 - 15%

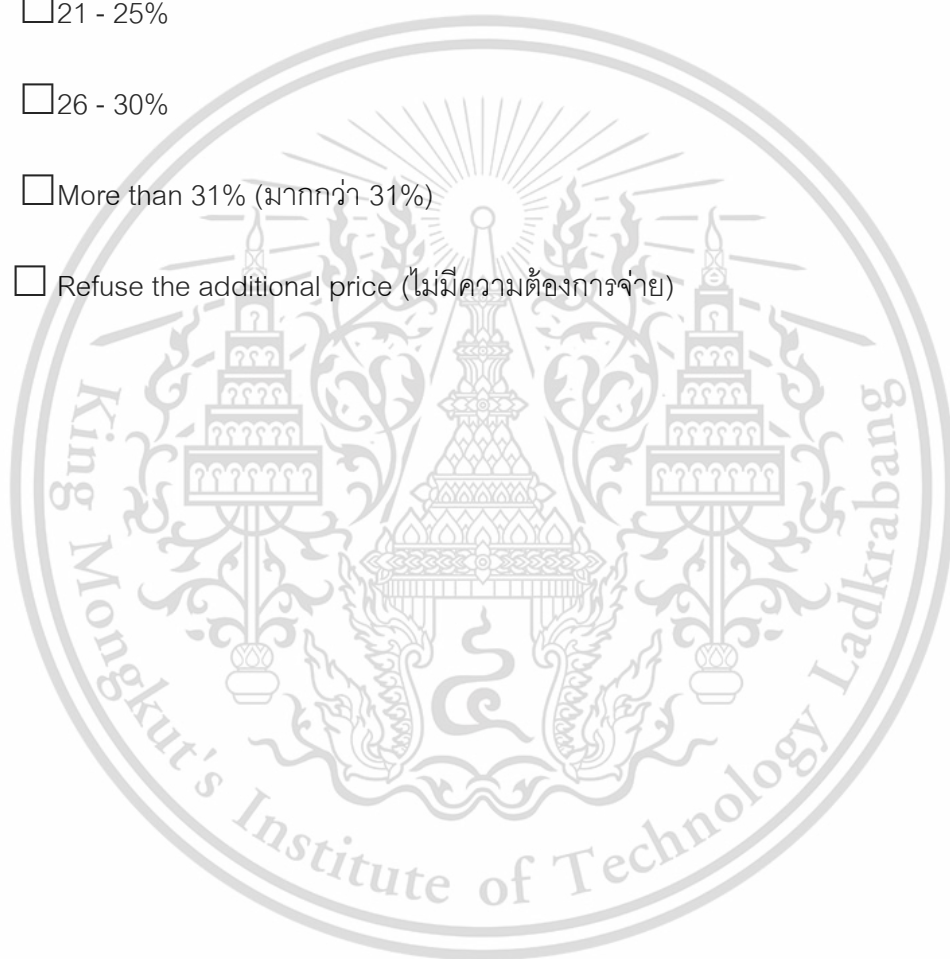
☐ 16 - 20%

☐ 21 - 25%

☐ 26 - 30%

☐ More than 31% (มากกว่า 31%)

☐ Refuse the additional price (ไม่มีความต้องการจ่าย)



Thank you very much for your cooperation in filling questionnaire perfectly.

(ขอขอบคุณทุกท่านสำหรับความร่วมมือในการตอบคำถาม)

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The logo of Mongkut's Institute of Technology Ladkrabang is a circular emblem. It features a central sunburst with rays emanating from a central point. Below the sunburst are two traditional Thai lamps (diyas) on stands, flanking a central tiered structure. The entire emblem is surrounded by a circular border containing the text 'Mongkut's Institute of Technology Ladkrabang' in a stylized font.

Appendix B:
Conference paper

Published in IOP Conf. Series: Earth and Environmental Science 265 (2019) 012013
'Consumer perspectives on premium price of ecologically friendly product: a case study
of ophthalmic lens in Thailand'

Consumer perspectives on premium price of ecologically friendly product: a case study of ophthalmic lens in Thailand

Nida Tuna* and Ronnachai Tiyarattanachai

International College, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand

* corresponding author: Nidasophon@gmail.com

Abstract. Due to the increase of public environmental awareness especially in terms of climate change and resource depletion problems, consumers tend to change their consumption preference towards sustainable development and circular economy concepts. Green and environmentally friendly products are becoming more demanded in various business sectors. Therefore, manufacturers are driven to change their products to be more eco-friendly. Theoretically, being green should save some costs; however, this business transformation requires some investment and may cause product's price to increase. Thus, it is important to understand whether or not the consumers are willing to pay more for being "green" along with other factors that influence their green purchasing decisions. The study found that approximately 90% of the respondents are willing to pay more for green ophthalmic lens products compared to typical ophthalmic lens products. There is relationship between green awareness and willingness to pay more for green products. The results of the study can be used to enact government sustainability policies and business strategies.

1. Introduction

Green consumption has gained more interests by the public due to the increased environmental awareness. Ecologically friendly products are the key part of green consumption. In general, ecologically friendly product refers to the products that pose relatively lower environmental impacts to produce and consume compared to other products of its peer. The environmental impacts are considered throughout the product cycle including production, logistics, consumption, and disposal at the end of its lifecycle [1-3]. In the market, there are many terms that imply such products such as green products, environmentally friendly products, sustainable products, planet friendly product, and organic products depending on market sectors and marketing strategies of the producers [1]. Based on a survey in 2013, there have been 70% more demands for ecologically friendly products in the US [4]. Many companies introduced their ecologically friendly products into the market. For example, Nike introduced its sport wares produced from polyester fibre from recycled plastic bottles. Coca-cola introduced packaging materials that can be 100% recycled [4].

In Thailand, Siam Cement Group (SCG), one of the biggest construction material and home decoration product producers in Thailand launched its 'SCG eco value' label for its products in 2009 [5]. The company stated that SCG eco value is a self-declared eco-label of SCG to ensure its environmentally-friendly products and services, which is one tool that SCG uses to communicate a product's environmental friendliness to the stakeholders that are able to choose the products and

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services concerning to environmental care [5]. In some cases, however, green products are priced higher compared to the same products of their peers. This is quite ironic considering that, theoretically, green product should consume less resource to produce. Ophthalmic lens are the tools used for eye corrections such as presbyopia, hyperopia, myopia, and astigmatism. Ophthalmic lens have many varieties for example, clear lens, transitions lens, and polarized lens. Based on a survey by Essilor, the world's largest ophthalmic lens producer, approximately 4.6 billion people need vision correction. It means that there are an approximate total of 9.2 billion lens demanded globally [6]. Ophthalmic lens production requires considerable amount of water consumption. Their packaging materials and wastes at the end of product life cycle also generate an enormous amount of wastes. Due to limited availability of green ophthalmic lens products especially in Thailand market, there is a need for study to investigate the perception of ophthalmic lens users towards the products of this kind. Ophthalmic lens producers can use the findings of this study to make investment on production process modification and marketing strategies in response to this green consumer demands.

2. Ophthalmic lens production and resource consumption

Ophthalmic lens production requires two main raw materials including glass and plastic. Presently, plastic lens are more preferable by customers because of their light-weight, durability and safety. In general, there are two types of lens production: made-to-stock and made-to-order lens. This section describes the production of Rx lens, which is a kind of made-to-order lens. Production process starts with the use of Semi-finished (SF) lens. The SF lens has eye correction values due to their polymer convex surface. A considerable amount of water is required in this polymer setting process. Water is used for lens polishing, cleaning, hard-coating, and anti-reflection coating. Production process also includes lens generating, which generates a lot of plastic wastes. Packaging material is also a large source of wastes. Due to the huge amount of lens demands based on sustainability report 2015, it is approximated that lens company consuming water and energy 4.8 million liters and 709.5 GWh and generating the industrial waste of 21kT [7].

3. Literature review

3.1. Internal factor influencing green consumption

Internal factors that influence green consumption are somewhat related to environmental awareness and attitude [8]. Environmental awareness and attitude are the key drivers to understand environmental impacts resulted from human beings [2]. For example, consumers who have good environmental awareness should be aware that less agricultural product outcome is partially due to climate change impacts [8]. Some people who prefer to consume organic products because they are aware of chemicals used in non-green production processes [9]. However, a survey in 1993 revealed that people who consumed ecologically friendly products were driven from allergy problems, which are sometimes related to environmental conditions. These problems make them aware the impacts of deteriorated environmental conditions. However, there was no clear evidence that this awareness has significant relationship with gender and level of education [10, 11].

3.2. External factor influencing green consumption

Green consumption can also be influenced by external factors. For example, consumers may be influenced by the society they live in [1, 12, 13]. Currently, there is an increasing trend of environmental awareness and conservation [14]. Some people may follow green consumption led by their colleagues once they have learnt the benefits of ecologically friendly products [11]. Green label is also an important driver for green consumption since it provides information about benefits of green products such as energy saving and emission data on their packages [15-17]. Beside of the benefits to themselves, consumers also value producers' reputation in terms of Corporate Social Responsibility (CSR). They tend to weigh this factor in purchasing decision no less than the products themselves [17].

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4. Research method

4.1. Measurement instrument

The study aimed to understand the relationship consumers' environmental awareness and willingness to pay more for ecologically friendly products using ophthalmic lens as a case study. This study used a survey as a data collection tool. The survey consists of 4 sections including 1) demographic characteristics; 2) environmental problem awareness; 3) green attitude; and 4) willingness to pay more for ecologically friendly products. A five-point Likert scale was used in the survey. The scale ranged from 1 to 5, indicating [1] = strongly disagree, [2] = disagree, [3] = neutral agree, [4] = agree, and [5] = strongly agree.

4.2. Data collection

A structured questionnaire was pretested for its validity and reliability before distribution. As presented in table 1, Cronbach's alpha ranged from 0.81 to 0.98, which are acceptable. The questionnaire was distributed using social media and email networks. A total of 207 responses were received. The Kaiser-Mayer-Olkin result of 0.914 showed a sufficient sampling adequacy of factor analysis.

Table 1. Reliability analysis.

	Cronbach's alpha	Mean	Std. dev.
Environmental problem awareness	0.8056	4.62	0.65
Green habit attitude	0.8905	3.65	1.00
Willingness to pay more for green ophthalmic lens	0.9752	2.86	1.14

5. Results

5.1. Respondents demography

Demographic information of the respondents is presented in table 2. Approximately 79.6% of the respondents have some experience in ophthalmic lens purchasing. Approximately 63.7% and 36.3% of the respondents are female and male, respectively. The socio-economic status of respondents was surveyed based on income tax levels in Thailand. Compared to the legally required minimum salary for bachelor degree holders in Thailand of 15,000 baht, the majority of the respondents deem middle-class. Approximately 93% of the respondents earn more than 25,000 baht per month. Over 90% of the respondents have at least bachelor degree or higher.

5.2. Relationship among environmental awareness, green habit attitude, and willingness to pay more

Definition of environmental awareness is knowing environment problem status, what behavior can be a cause of the environment problem and consequence. For example, knowing the world are facing global warming issue and it is caused by human generating the pollution. And definition of green habit attitude is how preference to be green in daily activities such as preferring to use the cloth bag than plastic bag. This section summarizes the results of hypothesis tests using regression analysis. The null hypothesis fails if p-value is greater than 0.05. The results are presented in table 3. In summary, the results show that:

- 1) There is relationship between environmental awareness and willingness to pay for green ophthalmic lens products.
- 2) There is no relationship between green habit attitude and willingness to pay for green ophthalmic lens products.

However, approximately 90% of the respondents indicated that would be willing to pay more for green ophthalmic lens. As presented in table 4, the majority of them are willing to pay up to 5% more for green ophthalmic lens products. From the result of regression, environmental awareness supports the willingness to pay more on green ophthalmic lens product. But green habit attitude does not

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support on willingness to pay more on green ophthalmic lens. It is interesting to learn that some respondents, who deny to pay more, believe that making the products green should be producers' responsibility if it is going to cost more. Though, they would choose to buy general green products if they are priced the same as traditional non-green products.

Table 2. Demography

Experience in ophthalmic lens purchasing	
Had experience in ophthalmic lens purchasing	79.6 %
Did not have experience in ophthalmic lens purchasing	20.4 %
Gender	
Male	36.3%
Female	63.7%
Personal incomes	
Less than 25000 baht per month	7%
25,001 to 45000 baht per month	37.9%
More than 45001 baht per month	55.1%
Education	
High school	1%
Bachelor's degree	56.5%
Graduate degree or higher	42%
Others	0.5%

Table 3. Result of regression for relationship among awareness, attitude, and willingness to pay more.

Willingness to pay more for green ophthalmic lens products			
	Estimate	S.E.	p-value
Awareness on environment problem	0.351	0.158	0.027
Attitude on green habit	0.064	0.106	0.548

Table 4. Number of respondents for level of willingness to pay more

Level of willingness to pay more for green ophthalmic lens	Number of respondents (%)
1% - 5%	47
6% - 10%	15
11% -15%	17
16% - 20%	7
21% - 25%	1
25% -30%	1
More than 30%	2
Deny willingness to pay more for green ophthalmic lens	10

5.3. Relationship between demographic conditions and willingness to pay more on green ophthalmic lens

The results of hypothesis testing about relationship between demographic conditions and willingness to pay more on green ophthalmic lens are presented in Table 5. Key findings are summarized as follows:

- 1) There is no relationship between gender and willingness to pay more for green ophthalmic lens products.
- 2) There is no relationship between personal incomes and willingness to pay more for green ophthalmic lens products.
- 3) There is no relationship between educational levels and willingness to pay more for green ophthalmic lens products.

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Table 5. Chi-square test for relationship demographic conditions and willingness to pay more for green ophthalmic lens.

Demographic condition	p-value
Gender	0.984
Personal incomes	0.177
Education level	0.764

6. Conclusions

A survey study was conducted to find relationship between the willingness to pay more for green products and green awareness and attitude focusing on ophthalmic lens products in Thailand. The survey also attempted to find the relationships between willingness to pay and some demographic conditions such as gender, level of education and incomes level. Based on the results of the study, there was significant relationship between green *there was but awareness and willingness to pay* no significant relationship *between attitude* and any demographic conditions. This is somewhat in line with findings of other studies in the past. However, it is interesting to find that some respondents indicate that additional costs, if any, for being green should be absorbed by the producers. They would still prefer to buy green products if they cost the same as non-green products. It should also be noted that this study focused on ophthalmic lens products in Thailand. The conclusions may be different from other product sectors in Thailand or different countries.

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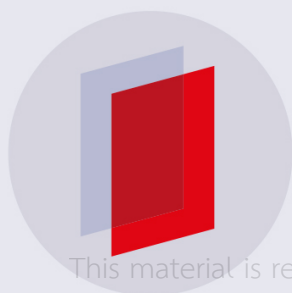


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AUTHOR BIOGRAPHY

Author: MS. Nida Tuna
Degree: Master of Science
Date: 10th July 2018
Date of Birth: 26th August 1983
Place of Birth: Suphanburi, Thailand

Undergraduate and Graduate Education:

Master of Science in Logistics and Supply Chain Management,
King Mongkut's Institute of Technology Ladkrabang, Bangkok, 2019

Bachelor degree in Engineering,
Thammasat University, Thailand, 2005

Major: Industrial Engineering

Presentations and Publications:

Nida T. and Tiyarattanachai. R. "Consumer perspectives on premium price of ecologically friendly product: a case study of ophthalmic lens in Thailand" Proceedings of the 10th International Conference on Combustion, Incineration/Pyrolysis, Emission and Climate Change, Bangkok, Thailand, pp 265. December 2018.