A hands-on Recommendation of Artificial Lighting for promoting product appeal in fresh markets

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Abstract

This descriptive study aims to help sellers in fresh markets be aware of the importance of artificial lighting in promoting the appeal of their products and apply it at their stalls. This study was conducted in three stages, with two objectives, to 1) gain insights regarding types of artificial lights used at the stalls and common product types sold at the selected fresh markets, and 2) identify the artificial lighting that suits each type of the common products. Insights from four popular markets in Bangkok were gained during the Exploration Stage. Most sellers were using fluorescents in cool white, warm white, and mixed white, and incandescents provided by the market management. Vegetables, fruits, seafood, meats, and desserts were the common food products sold. The dimensions of the stalls at the markets were in a similar range. Such information was used to design mockup stalls at the Design Stage; they were installed with each type of artificial lighting. The mockups were used during the Testing Stage when the lighting was shining on the food products. The respondents rated that mix-white fluorescents helped vegetables, fruits, and seafood look appealing, and so did the warm white fluorescents for meats and desserts. The results of this study led to a recommendation addressing the Correlated Color Temperature effects on the appeal of products and how sellers can select off-the-shelf light bulbs suiting their products.

Keywords: lighting design, lighting, sales promotion, and fresh market

1. Introduction

Lighting design for a space is important to both ambiance and the products presented within the premises. This article addresses the importance of lighting in one of the most essential spaces of communities—fresh markets—at which multiple products are sold. Initiated by the authors' observation, lighting design has not been widely used at stalls in fresh markets. It could occur that sellers were not aware that appropriate lighting can help promote their products. As a consequence, a societal question was raised: *How can lighting designers help these sellers be aware of the importance of the lighting?*

Artificial lighting design has been practiced by designers to help promote products sold especially in controllable lighting spaces, like shopping malls and supermarkets. Some preceding studies describe the appropriate artificial lighting for food products sold at supermarkets with technical properties—values of Color Rendering Index (CRI), Correlated Color Temperature (CCT), and illuminance level. However, the studies addressing the effects of the CCT on the potential customers' satisfaction with the appeal of the food products were missing. Also, the studies about the artificial lighting designed for fresh markets—semi-/open spaces that natural lights can penetrate—are limited. These limited studies infer that there is a knowledge gap in understanding what types of lighting could cause such potential customers' satisfaction.

Thus, this study was conducted to fulfill the knowledge gap that can benefit both academia and society. Since most of the light bulbs available at ordinary electric shops in Thailand are of the same CRI value, it was thereby excluded from this study. The measurement of the illuminance levels was also excluded from this study since most off-the-shelf bulbs are of the same value. The CCT, then, was focused in order to identifying which artificial lighting of what CCT would make the potential customers be satisfied with the particular product. According to the determined results, this study was designed to be qualitative research. The methods were developed to gain insights from the context. Therefore, the obtained knowledge would contribute to academia by means of the methods to which researchers, designers, and students can refer or apply. As for the societal contribution, sellers—who are not lighting designers—would be aware of the light types that can enhance the appeal of their products. The sellers can also refer to a hands-on recommendation that the authors developed for selecting the light bulbs at ordinary electric shops.

2. Literature review

Artificial lighting and lighting for markets were the keywords searched in both scientific databases and through gray literature. The importance of artificial lighting for spaces, the human perception of colors of lights, and lighting design for food were the main categories of literature found applicable to this study. However, there was a deficiency in the literature regarding artificial lighting focusing on fresh markets.

Artificial lights are lights invented by humans in order to overcome the darkness or provide visual clarity in spaces that lack natural light (European Commission, 2012; Pritchard, 1995). Artificial lighting is an essential part of interior architecture design. A selection of sufficient lights should match the space, users' requirements, and the purposes of the space (Cayless & Marsder, 1984; Gmbh, 2013; Michel, 1995; Whitehead, 1998; Whitehead, 2009). As such, designers shall select the lights that suit the psychology, context ecology, and architectural factors. The appropriately selected lights would yield a pleasant ambient light level to people in that space (Ganslandt & Hofmann, 1992; Rea, Figueiro, & Bullough, 2002).

Knowledge of human perception (Birren, 1969), colors of light (Youyuenyong, 2013), illuminating engineering (Hariyadi & Fukuda, 2018; Illuminating Engineering Society, 2011), and energy saving (Turner, 1998) shall be employed when designing lighting. Birren (1969), a renowned practitioner in the color industry, found relationships between human perceptions and lights, and also between human well-being and lighting design. He suggested that warm, cool, and artificial daylight were the light colors that could influence one's moods and cognitive performance. This principle describes why people's moods shifted in an environment with specific colors of light. Lighting and perceived color cannot be considered apart from each other. Birren's work has impacted several design guidelines for spaces and objects surrounding us, such as colors for interior design to reduce the inhabitants' visual fatigue (Kay, 1999), the use of vivid colors on machines and sufficient lights for occupation health safety (Kaufman, 1966; Kaufman, 1974), color versus psychology for fashion design (Silva, 2017), etc. However, Knez (2001) argued that the colors of lights did not have a direct effect on human moods.

In the food landscape, lighting design has been applied to the designs of restaurants (Luxsystems, 2022; Webstaurant Store, 2018) and convenience stores (Philips, 2018) for marketing reasons. Alsharhan (2013) and

Conservation Technology of Illinois (2018) describe the technical properties of the artificial lighting appropriate for presenting food products at supermarkets through the values of CRI, CCT, and illuminance level. However, literature about lighting designs for fresh markets is scarce.

Fresh markets are spaces built for serving food chains to communities as they are usually located within 500-meter proximity. Inside a market, stalls are placed in clusters according to the main selling products, e.g., fresh food, dried ingredients, household devices, etc. (Chiwakul, Watanapasuk, Thadaniti, Atibodhi, Nakeeraket, & Nakavachara, 1982; Youyuenyong, 2013). In line with Ganslandt and Hofmann's suggestion (1992), Department for Environment Food and Rural Affairs (2006) and Youyuenyong (2013) emphasized that the lighting designed based on the understanding of the architectural context of that space would potentially increase the values of both the market's architecture and the selling products.

Particularly for lighting design, designers should take the CCT (Illuminating Engineering Society, 2011) into account. CCT is what a person sees from a light bulb. The measuring unit is in Kelvin (K), with the common range of 2200 – 6500 Kelvin degrees (Ames, 2020). The needed brightness of the space, the colors of the space, the colors of furniture within that space, the room temperature, visual clarity, and the use ¬of the lighting itself are the factors affecting designers' decisions on the appropriate lighting.

The aforementioned literature has implied that the appropriate lighting design for presenting products at markets can increase the chances that potential customers would be interested in the products at that stall. However, the knowledge concerning 1) the actual situation at fresh markets in Thailand, 2) the CCT effects on the appeal of products from the customers' perspective, and 3) recommendations for the sellers in selecting the appropriate lighting for enhancing the appeal of different product types was limited. Thus, there was a need to investigate. As a consequence, the authors formulated a research question below to define the framework of this research.

How can sellers at fresh markets select the appropriate lighting that provides appealing food products to their customers?

The next section provides details of how this study was carried out.

3. Methods and research instruments

In order to contribute knowledge to academia and recommendations to society, the author planned this study based on two research objectives as follows:

Objective 1: Gain insights into the current setting and types of artificial lighting at the stalls in fresh markets, details of the stalls, and the common food types sold there.

Objective 2: Identify the lighting that makes each type of common food product look appealing according to the potential customers' perceptions.

In serving academia, this study was integrated as part of the Natural Lighting in Buildings course for Architecture students, the Faculty of Architecture, Rajamangala University of Technology Thanyaburi (RMUTT). This study was designed with three stages: Exploration, Design, and Testing. The architecture students were involved in the first stage as junior researchers. In addition, the interior architecture students joined the last stage as respondents for testing the artificial lighting.

Exploration was the first stage for the authors to gain insights according to Research Objective 1. Design was the second stage that the authors built mockup stalls, and installed each of them with each type of the common lighting. These mockups became research instruments for the last stage of this study. Testing was the last stage in which the authors asked respondents to rate their satisfaction with the light type that could make each food product look appealing. This last stage served Research Objective 2. The methods and research instruments are provided below.

3.1 Exploration Stage

The authors, including junior researchers, explored the fresh markets, their stalls, and the food products sold. Market layouts, the positions of lighting at the stalls, and the common food products were within the exploration scope. The junior researchers were 40 Architecture students who were taking the Natural Lighting in Buildings course. The author instructed them on how to collect data prior to visiting the four high-end and popular markets in Bangkok, Thailand, namely Bon Marche, Ying Charoen,

Methods	Data collectors	Instruments	Analysis methods	Results
site exploration	Six junior researchers sketched the market layout and identify the types of lights and products sold at each stall.	- stationary for sketching and documentation - A3 paper - measuring tools - camera/ smartphone camera	- mapping - frequency counting and percentage calculation per lighting type and product type	- market layout - common types of lighting used at the stands - common types of products sold at the stands
stall study	Two junior researchers measured the stalls and photographed, including documenting the lighting positions at the stalls.		technical drawing documentation	details of stalls and lighting positions
individual interview	Two people interviewed the volunteering sellers.	a semi-structured questions list regarding the lighting use behaviors and awareness of lighting design for product sales	thematic analysis	- lighting use behaviors - awareness of lighting design for product sales

Table 1. The methods, instruments, and analysis methods of the Exploration Stage

Food Villa Market Rachapruek, and Or Tor Kor. The junior researchers were divided into four groups, each group explored one market. Three methods: site exploration, stall study, and individual interview were applied. Table 1 provides descriptions of the methods, instruments, and analysis methods of the Exploration Stage.

The results regarding the common light types, the common product types sold at the stalls, and the details of stalls and lighting positions were used by the authors to design the mockups for testing.

3.2 Design Stage

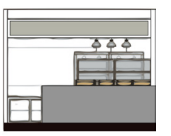
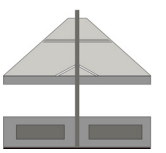
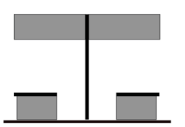
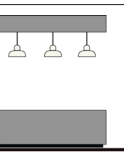
The authors built the mockup stalls and installed a lighting type for each of them. The dimensions used for designing and building the mockup stalls were the average values calculated from the dimensions of the stalls and the lighting positions measured by the junior researchers (see Table 2). By doing so, these mockup stalls could represent the stall-surface height from the floor, the depth of the stall surface, and the distance between the stall surface and the light bulbs at the fresh markets. Non-reflective materials were used for building the mockup to limit any factors that would alter the respondents' satisfaction with the appeal of the food products.

3.3 Testing Stage

The Testing Stage focused on the respondent's satisfaction with the lighting that made the products look appealing. The authors referred to the photographs taken by the junior researchers and placed the products in the positions where the lights would be shining onto.

Purposive sampling was used for recruiting the respondents from fourth-year and third-year students who enrolled for Interior Architecture, Faculty of Architecture, RMUTT. These students were purposively selected because they were trained and sufficiently practiced in aesthetics and designs, yet lighting design topic. As such, they were considered to be objective in assessing the appeal of the food products without in-depth understanding of the lighting design principle. One hundred respondents were invited to join the Testing Stage. This study did not focus on the respondents' familiarization with the markets, but their perceived satisfaction.

Table 2. Summary of the common types of food products and lights, including the patterns of the stall design

Studied markets	Common types of food products	Types of lights				Patterns of the stall design
		Cool white	Warm white	Mixed white	Incan-descent	
Bon Marche 	Meats	100%	0%	0%	0%	 - Height from floor to stall top: 0.90 m - Depth of the stall surface: 1.00 m - Height between the stall surface to the bulbs: 1.30 m
	Seafood	80%	20%	0%	0%	
	Fresh vegetables	100%	0%	0%	0%	
	Fruits	67%	22%	0%	11%	
	Desserts	68%	23%	9%	0%	
Ying Charoen 	Meats	99%	0%	0%	1%	 - Height from floor to stall top: 0.80 m - Depth of the stall surface: 0.80 m - Height between the stall surface to the bulbs: 1.40 m
	Seafood	99%	0%	0%	1%	
	Fresh vegetables	75%	0%	0%	25%	
	Fruits	76%	24%	0%	0%	
	Desserts	80%	20%	0%	0%	
Food Villa Market Rachapruek 	Meats	10%	90%	0%	0%	 - Height from floor to stall top: 0.70 m - Depth of the stall surface: 0.90 m - Height between the stall surface to the bulbs: 1.60 m
	Seafood	60%	30%	0%	10%	
	Fresh vegetables	0%	100%	0%	0%	
	Fruits	38%	59%	0%	3%	
	Desserts	40%	60%	0%	0%	
Or Tor Kor 	Meats	40%	60%	0%	0%	 - Height from floor to stall top: 0.80 m - Depth of the stall surface: 0.9 m - Height between the stall surface to the bulbs: 1.30 m
	Seafood	47%	47%	0%	6%	
	Fresh vegetables	85%	15%	0%	0%	
	Fruits	52%	45%	0%	3%	
	Desserts	52%	47%	0%	1%	

Methods	Data collectors	Instruments	Analysis methods	Results
questionnaire	The authors handed out and collected the questionnaires.	- paper-based questionnaire regarding the satisfaction with the lighting for each common types of the products - the mockup stalls - the common product samples	frequency counting	types of lighting that could best make each type of the common product look appealing

Table 3. The methods, instruments, and analysis methods of the Exploration Stage

A room with semi-natural light penetrations was selected as the testing venue. Each of the four mockup stalls was placed 5-meter away from each other so that the lighting would not interfere with each other. This stage was conducted during 17.00-18.30 hr. to mimic the time that people mostly visited the fresh markets after studying or working.

Survey was the research method used for retrieving the respondents' satisfaction. Questionnaire, mockup stalls, and samples of the common products sold at the studied fresh markets were used as the research instruments. All respondents entered the testing venue at the same time. They were allowed to circulate in the venue like the ways they could do at fresh markets. They rated their satisfaction in the questionnaire that the authors distributed.

The summary of the methods, instruments, and analysis of the Testing Stage is shown in Table 3.

The testing that was conducted with the stalls designed based on the information collected from four fresh markets, including the venues and the testing timing could yield representable results for high-end markets. Yet, the hands-on recommendation would still be generalizable for any sellers since it would deal with light bulbs that ones could buy at an electric shops.

Figure 1. A photograph captured during the test

3.4 Ethics

Students who were recruited as junior researchers of the Exploration Stage and respondents of the Testing Stage were informed of their roles and rights of participation. Their withdrawal from this study would not affect any grading in their academics. Their personal information and identity would not be disclosed. Similar protection of personal information and identity was applied to the volunteering sellers who were interviewed during the Exploration Stage.

The details provided above is illustrated in Figure 2 to recap the research framework of this study.

This study yields the results presented in the following section.

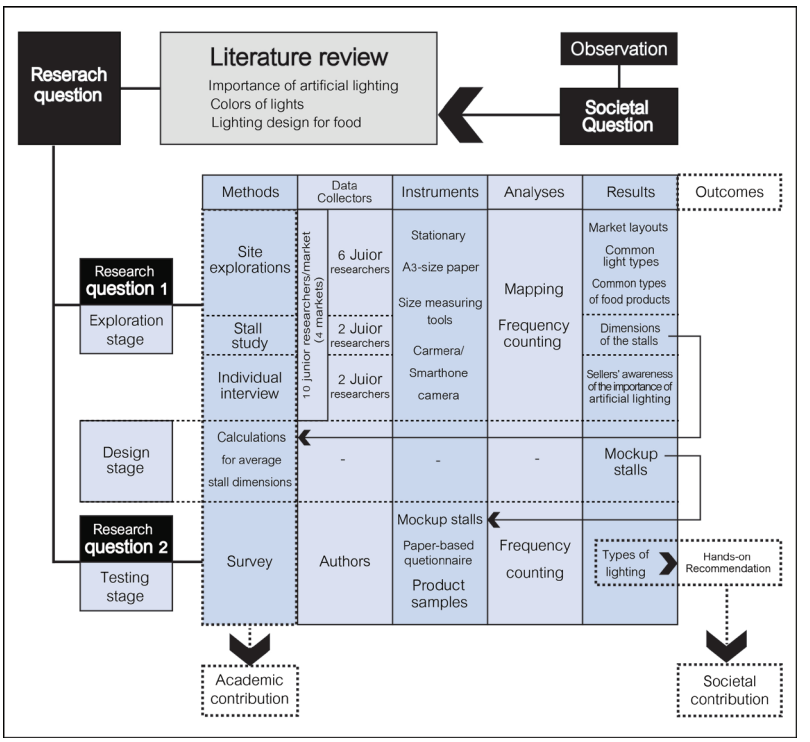


Figure 2. Research framework of this study

4. Results

The results are narrated along with the order of the Exploration, Design, and Testing Stages. The narrative starts with insights about the current setting at the markets, details of the stalls at which the common product types were sold, and the artificial lights used at the stands in the fresh markets (see Subsection 4.1). Next, the descriptions of the mockup stalls designed based on the insights are presented (see Subsection 4.2). Lastly, the identification of the lighting that makes each type of the common product look appealing is provided (see Subsection 4.3). These results show some evidence that the perceived colors—CCT—from specific light types play an important role in making customers find a particular type of the common products look appealing. These findings are essential to the determined hands-on recommendation in selecting off-the-shelf bulbs that suit the sellers' products.

4.1 Insights into the fresh markets, the stalls, and the use of artificial lighting

All of the studied markets are located approximately 500 meters away from communities. They differ in sizes and plans but are similar in terms of stall clustering. Most of the selling products are food. The common food products are meats, seafood, fresh vegetables, fruits, and desserts. Patterns of the stall design were found. Fluorescent, in the perceived colors: cool white (53.40%), warm white (24.70%), and mixed white (cool and white) (16.10%), and incandescent (5.80%) were the popular types of lights used in the studied fresh markets.

Figures 3 (a) – (d) illustrate the plans of the studied markets, the clustering of the stalls by product types, and the light types; Table 2 summarizes details of the stalls and the types of artificial lighting used. The stalls were built permanently. Sellers used the area around 1.50 x 0.90 m of the stall surface for presenting their products. The height of the stall structure was 2.20 m. Most sellers revealed that they used the lights that had been installed by the market management. They did not design the lighting to enhance the appeal of their products because they did not realize its importance. When checking the specifications of the lights installed at the stalls, most of the fluorescent lights were 12 Watt and the incandescent lights with 120 Watt.

The dimensions of the stalls and details of the lights were subsequently calculated for their averages and brought to the design of the mockups.

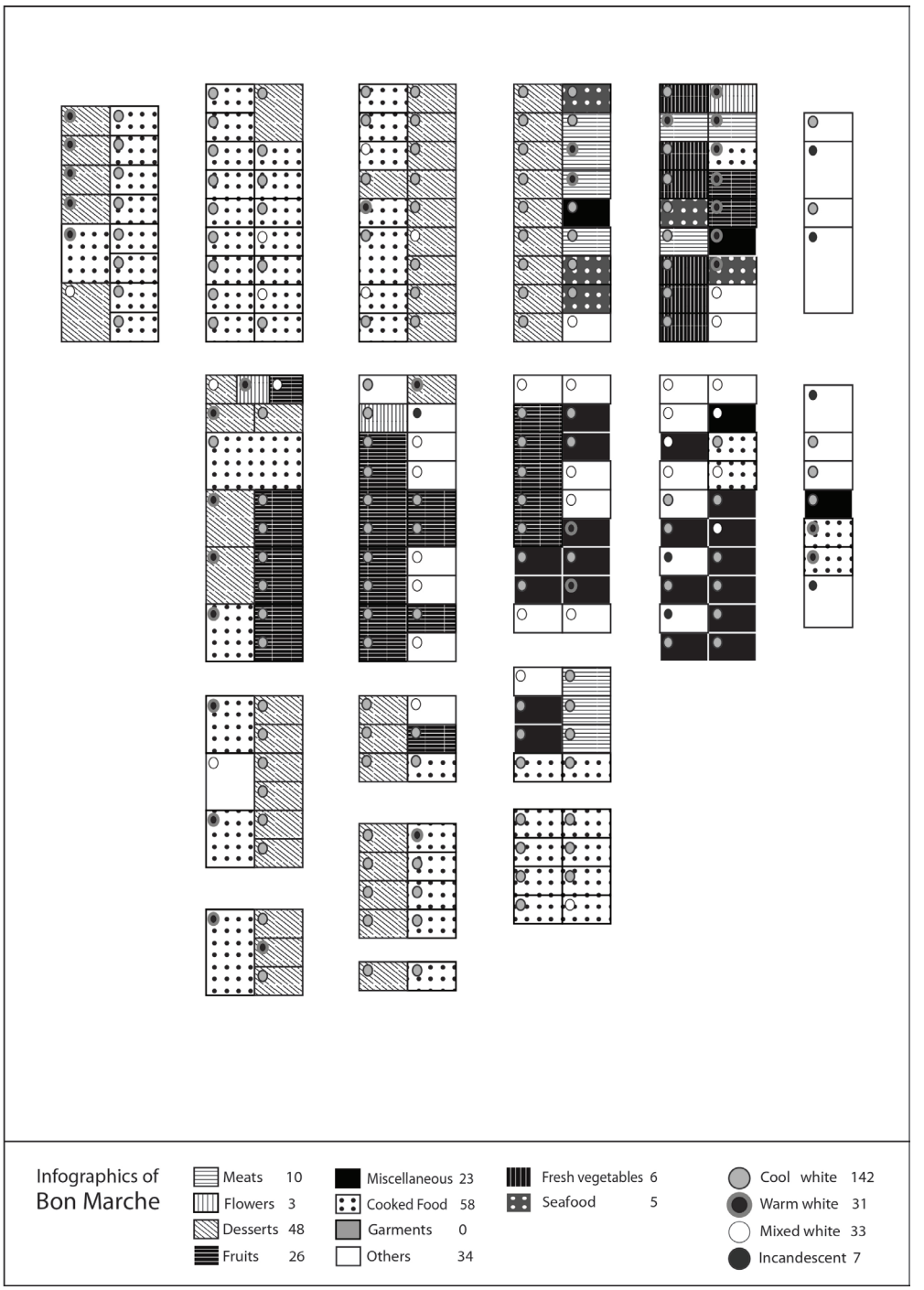


Figure 3 (a). The plan and stalls of Bon Marche

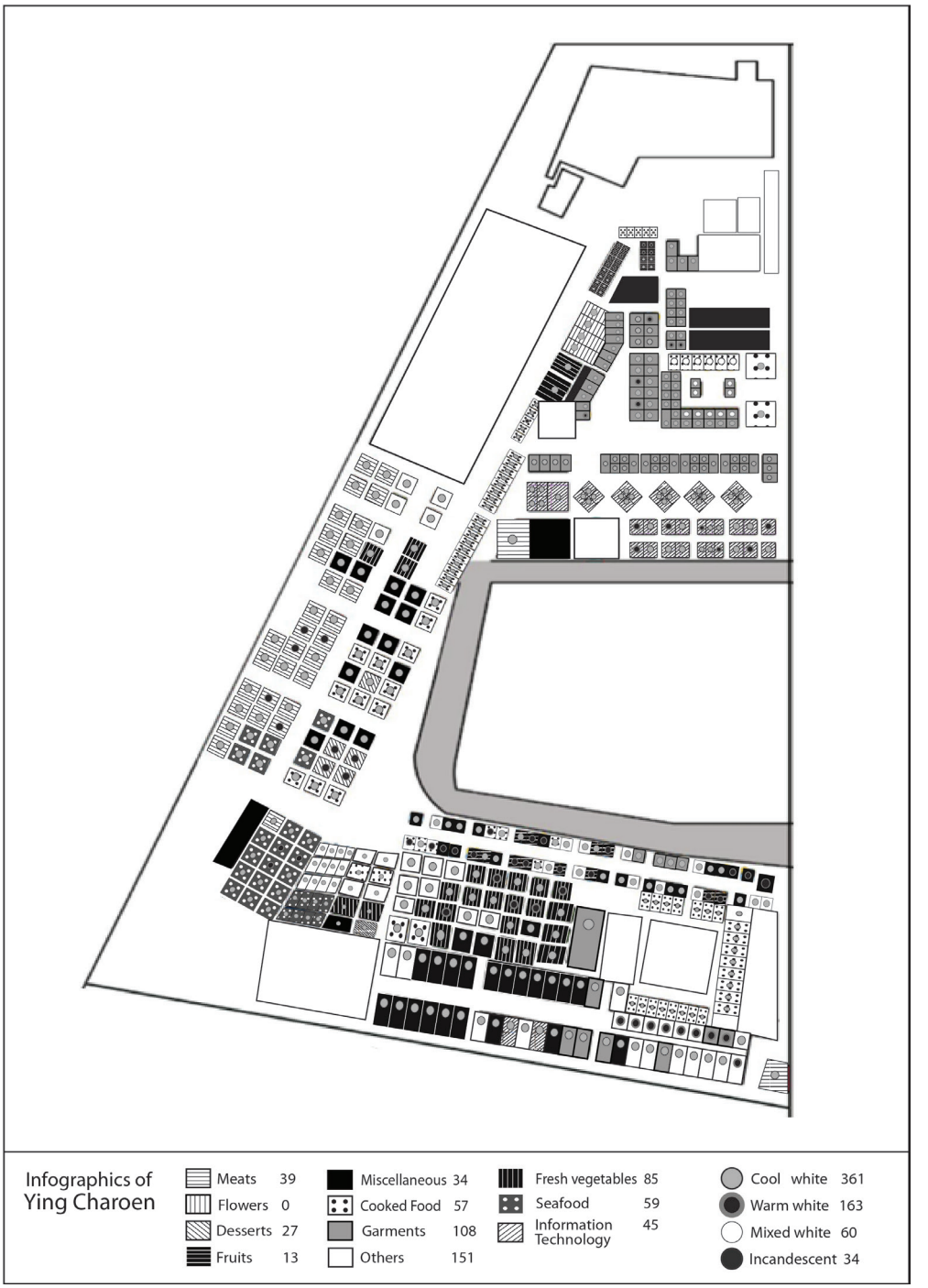


Figure 3 (b). The plan and stalls of Ying

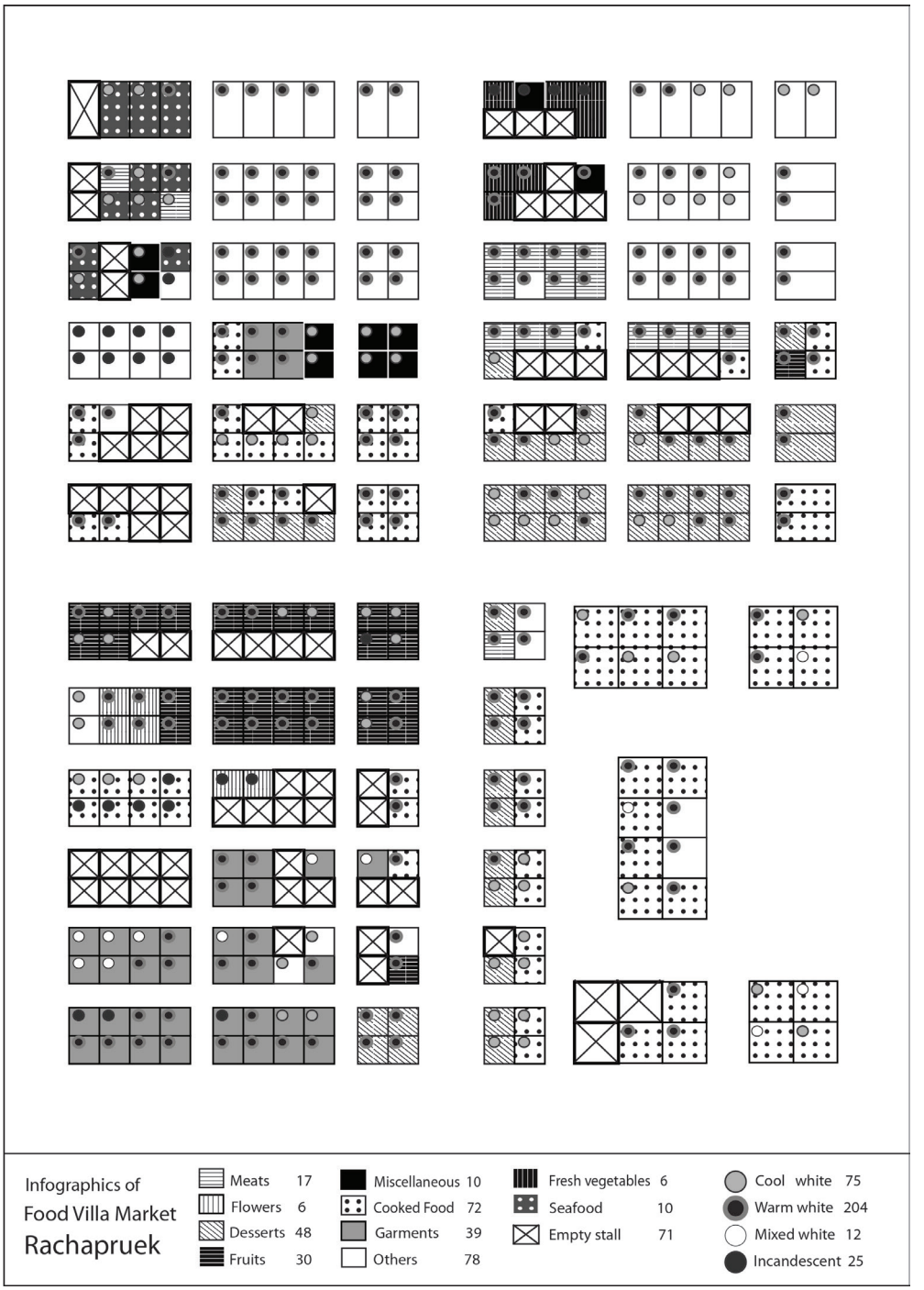


Figure 3 (c). The plan and stalls of Food Villa Market Rachapruek

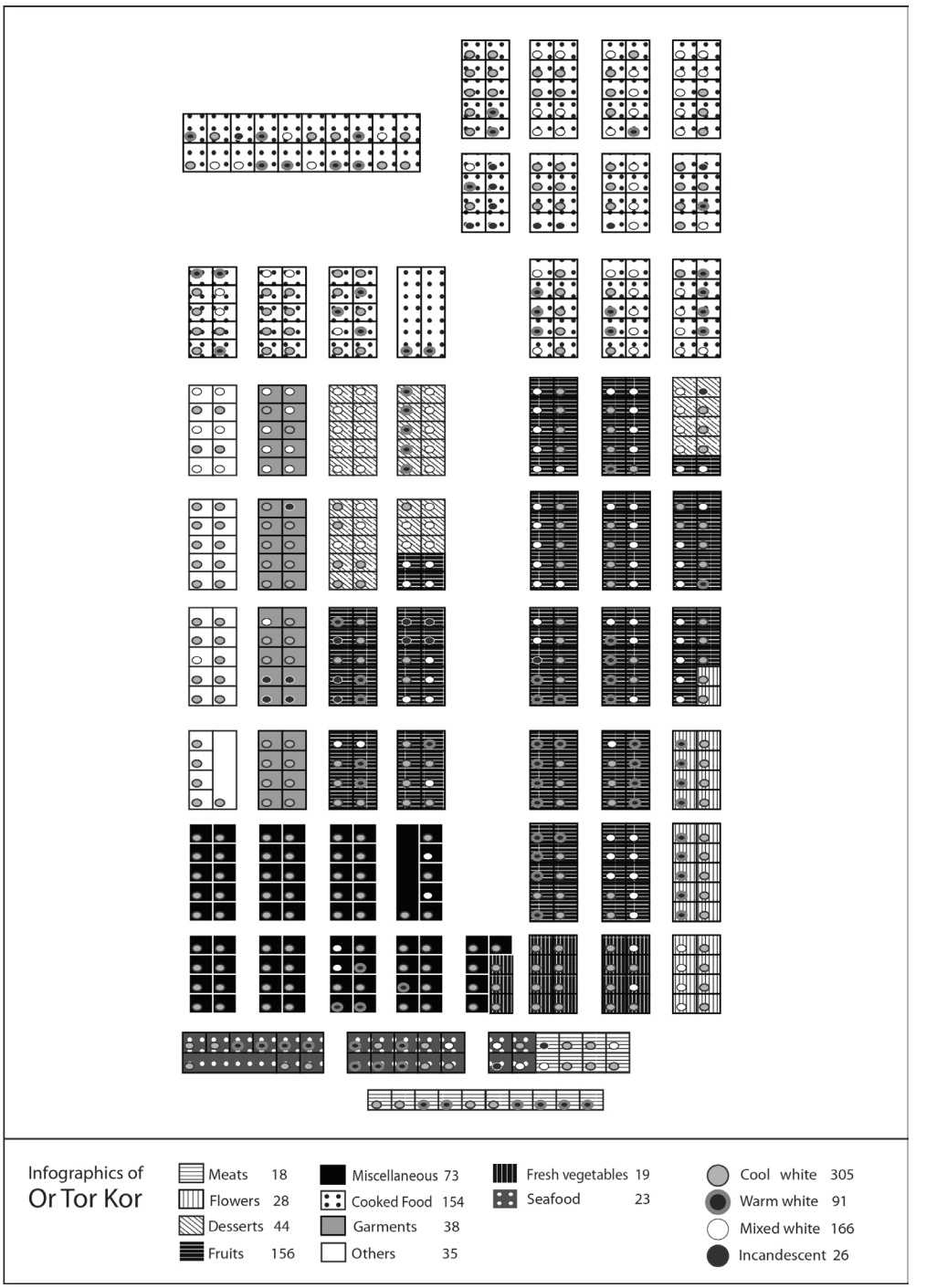


Figure 3 (d). The plan and stalls of Or Tor Kor

4.2 Design of the mockup stands

Four mockups were in the size of 1.50 m for the width and 0.90 m for the depth of the stall surface, 0.8 m for the height of the stall surface from the floor, and 1.40 m for the height between the stall surface and the bulbs. The depth of the stand, the height of the stall surface from the floor, and the height between the stall surface and the bulbs were the average values calculated from the numbers in Table 2. The width of the stall surface remained at 1.50 m. Such width can sufficiently place 5 dishes that each contained one type of the common food products. During the test, each dish was with a diameter of 25.00 cm and was placed with a space in between. A roof was placed at the top of each stall to prevent interference from the lighting of the other three stalls. Four bulbs per light type were used for each stall for equal lighting distribution all over the stall surface. The bulbs were sorted from ordinary electric shops and installed in one alignment.

As for the materials used for these mockup stalls, the structures consisted of 1 x 1-inch carbon steel square tubes and 1 x 1-inch angle bars enough to bear loads. These structures were finished with matte-black paint. Ten-millimeter medium-density fiberboard (MDF) laminated with matte-white material was used for the stall surface. The roofs were built from 6-mm transparent polycarbonate boards.

Figure 4 illustrates the design of the mockup stands, Table 4 recaps the CCT values of the lights used for the stalls, and Figure 5 presents the placing of all dishes during the testing.

The next section provides the results of testing these mockups.

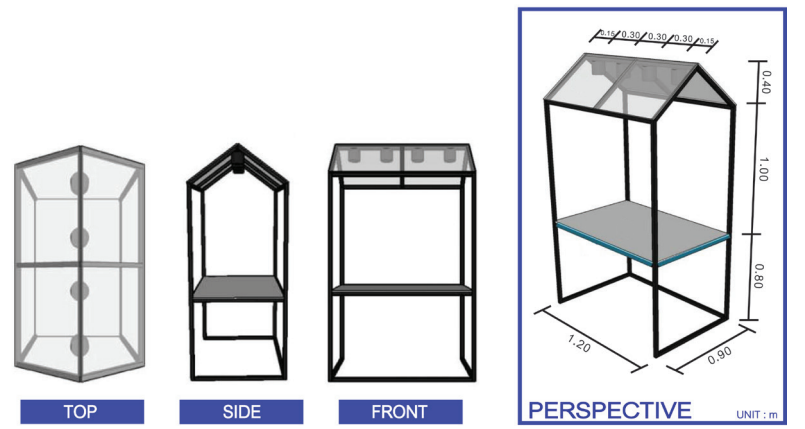


Figure 4. The mockups and light bulb positions

Figure 5(a) Warm white fluorescents

Figure 5(b) Cool white fluorescents

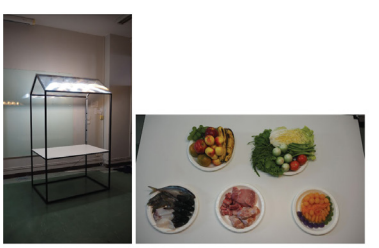


Figure 5(c) Mixed white fluorescents

Figure 5(d) Incandescents

Figure 5. The mockups and food product presentation

Table 4. Details of the lighting used for each stall

Mockups	Types of light	Perceived colors	Watts	Kelvins (K)
1	Fluorescent	Warm white	12	2,700
2		Cool white	12	6,500
3		Mixed white (2 bulbs of warm white and 2 bulbs of cool white)	12	2,700 + 6,500
4	Incandescent	The incandescent color	120	2,800

Table 5. The respondents' satisfaction with the appeal of meats

Types of the common food products: meats	Respondents	%
Cool white fluorescents	15	15.00
Warm white fluorescents	34	34.00
Mixed white fluorescents	31	31.00
Incandescents	20	20.00
Total	100	100.00

Table 6. The respondents' satisfaction with the appeal of seafood

Types of the common food products: seafood	Respondents	%
Cool white fluorescents	29	29.00
Warm white fluorescents	20	20.00
Mixed white fluorescents	40	40.00
Incandescents	11	11.00
Total	100	100.00

Table 7. The respondents' satisfaction with the appeal of fresh vegetables

Types of the common food products: fresh vegetables	Respondents	%
Cool white fluorescents	26	26.00
Warm white fluorescents	17	17.00
Mixed white fluorescents	47	47.00
Incandescents	10	10.00
Total	100	100.00

Table 8. The respondents' satisfaction with the appeal of fruits

Types of the common food products: fruits	Respondents	%
Cool white fluorescents	19	19.00
Warm white fluorescents	21	21.00
Mixed white fluorescents	46	46.00
Incandescents	14	14.00
Total	100	100.00

Table 9. The respondents' satisfaction with the appeal of desserts

Types of the common food products: desserts	Respondents	%
Cool white fluorescents	8	8.00
Warm white fluorescents	45	45.00
Mixed white fluorescents	30	30.00
Incandescents	17	17.00
Total	100	100.00

4.3 Suitable lighting for promoting food product sales

This subsection reports the results regarding the appeal of each food product that the respondent found as different lights were shining. One hundred respondents put a mark, as the rating, for the light type that could make each food product look appealing the most. The results show that warm white fluorescents could make the meat products look appealing a bit more than the mixed white fluorescent (See Table 5).

The respondents found seafood under the mixed white fluorescent looked the most appealing (see Table 6).

Around half of the respondents found fresh vegetables most appealing with the mixed white fluorescent. See Table 7 for all rated satisfaction.

The respondents also rated the mixed white fluorescents for their best effect on the appeal of fruits. See Table 8.

Differently from the aforementioned results, the warm white fluorescents earned the most satisfaction from the respondents in making the desserts appealing (see Table 9).

The results from Tables 5 – 9 were interpreted into the types of light that suit each common food product. For meat products, either warm white or mixed white fluorescents can be used since they gained nearly the same percentages. The warm white fluorescents gained just three percent more than the mixed white ones. Mixed white fluorescents suit the presentation of seafood products at the stalls, and so do for the fresh vegetables and fruits. Last but not least, warm white fluorescents could present the desserts at their best.

These findings are concluded in the next section and discussed for formulating a hands-on recommendation.

5. Conclusion and discussion

This section concludes the findings of this study by referring to its research objectives and discusses these findings by comparing them with a renowned work. After that, a hands-on recommendation is made to sellers from fresh markets. Lastly, opportunities for future work are touched upon.

This study achieved Research Objective 1 by gaining insights into the four selected markets: Bon Marche, Ying Charoen, Food Villa Market Rachapruek, and Or Tor Kor, the popular artificial lights: fluorescents (warm white, cool white, and mixed white) and incandescents, and the common food products: meats, seafood, fresh vegetables, fruits, and desserts. These findings were used for designing the testing methods that also led to the achievement of Research Objective 2. The authors learned that the mixed white fluorescents make seafood, fresh vegetables, and fruits look appealing, and so do the warm white fluorescents for desserts. Either warm white or mixed white fluorescents can be used for presenting meat products.

These findings are in line with Birren's (1969) suggestion regarding the effect of light colors on human cognitive performance. The mixed white fluorescents emit both warm and cool light temperatures (refer to CCT); vegetables, fruits, and seafood are also in warm and cool color tones. The matching between light temperatures and color tones can possibly enhance the appeal of such food products in multiple respondents' sight. A similar discussion continues for the matching between the light color of warm white fluorescents and the colors of meats and desserts. The perceived color of the warm white fluorescents is orange. The colors of the meats range from pink to red, and the colors of the common desserts are yellows. It is likely that the orange-color light can enhance the appeal of the meats and desserts that are in also a warm color tone.

Table 10. A hands-on recommendation made to sellers for selecting lights for their products

Types of the lights	CCT (Kelcins or K)	Food products		
Mixed white fluorescents	2,700 (cool) + 4,000 (warm)	 Vegetables	 Fruits	 Seafood
Warm white fluorescents	2,700	 Meats	 Desserts	

As part of answering the research question, the author has visualized a hands-on recommendation for sellers at fresh markets to select the appropriate lights for their food products (see Table 10).

Types of lights, Kelvins, and pictures of the food products are provided. However, the brands of light bulbs are not stated as part of this recommendation to avoid any conflict of interest. The sellers should read the specifications on the packages of the light bulbs and choose the ones that are in the recommended types and Kelvins. After all, choose the bulbs with the specification as closed as recommended, yet fit the budget. The appropriate selection of lights is currently defined as the selection of the light bulbs with 1) the properties that provide sufficient lighting at a stall and enhance the appeal of the products, and 2) the ones that are financially viable.

The results of this study cannot yet relate the importance of artificial lighting to the sales increase. Although there are studies about the capability of artificial lighting on increasing retail sales indoors, there are still limited studies in the context of fresh markets where natural light can penetrate. In addition, the appeal of a product may attract customers to stop at a stall, but the appeal is not the only factor stimulating the customers to buy that product. Factors, such as price, size, quality, location of the stall, together with the

customers' requirements, needs, and preferences would be the factors involved in the seconds before deciding to buy something.

There are limitations within this study. For instance, this study excluded mimicking the exact natural lighting of the fresh markets during the Testing Stage, taking the profiles of the respondents (e.g., age, visual accuracy, color preferences, mood, etc.) into account for the analysis, and testing the artificial lighting for comprehensive product types as mentioned in Figures 3 (a) – (d) Also, this study is yet to identify relationships between the respondents' profiles and the perception of the product appeals, or the relationship between the perception of products' appeal and the increase in sales.

Due to the limitations above, this study is considered as an initial step in developing the hands-on recommendations. There are opportunities for researchers to investigate and develop the recommendations. The development of the recommendations on the appropriate lighting for comprehensive product types in fresh markets, the incorporation of the CRI to refine the recommendations, and statistical analyses are examples of the future work that the interested researchers can conduct.

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