PACKAGING SELECTIVE FACTORS OF NON-ALCOHOLIC BEVERAGE MANUFACTURER

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Thesis
entitled

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ABSTRACT

The beverage market is a large market with intense competition. Companies are striving to attract customers by their uniqueness. Packaging is one of the most important factors of concern. This research has studied the packaging selective factors of a non-alcoholic beverage manufacturer. The objective is to confirm significant factors that effect packaging selection. The research is focused on Thai non-alcoholic beverage manufacturer's opinion towards primary packaging, which has direct contact with the product. Questionnaires were used to collect the data. The hypotheses were tested and supported via Structural Equation Modeling and Linear Structural Relationship.

The empirical data confirmed the hypotheses that packaging selection comprises of five important factors respectively; protection and preservation, material characteristics, containment, convenience, and communication. The research also has sub-group analysis and the results show that different types and different serving sizes of beverage effect the importance level of packaging selective factors.

KEY WORDS: PACKAGING SELECTION / BEVERAGE PACKAGING / CONFIRMATORY FACTOR ANALYSIS / LINEAR STRUCTURAL RELATIONSHIP

87 pages

องค์ประกอบในการเลือกใช้บรรจุภัณฑ์ของผู้ผลิตเครื่องดื่มที่ไม่มีแอลกอฮอล์

PACKAGING SELECTIVE FACTORS OF NON-ALCOHOLIC BEVERAGE MANUFACTURER

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บทคัดย่อ

ตลาดเครื่องดื่มเป็นตลาดที่มีขนาดใหญ่และมีการแข่งขันสูง บริษัททั้งหลายต่างพยายามดึงดูดใจลูกค้าด้วยลักษณะพิเศษของผลิตภัณฑ์ โดยบรรจุภัณฑ์นับเป็นปัจจัยสำคัญที่จะต้องมีการคำนึงถึงอย่างรอบคอบ งานวิจัยนี้ศึกษาเกี่ยวกับองค์ประกอบในการเลือกใช้บรรจุภัณฑ์ของผู้ผลิตเครื่องดื่มที่ไม่มีแอลกอฮอล์ โดยมีวัตถุประสงค์เพื่อยืนยันองค์ประกอบที่มีความสำคัญต่อการเลือกใช้ ขอบเขตของงานวิจัยนี้เน้นที่ความคิดเห็นของผู้ผลิตเครื่องดื่มที่ไม่มีแอลกอฮอล์ในประเทศไทย ซึ่งมีต่อบรรจุภัณฑ์ชั้นต้นที่ใช้บรรจุเครื่องดื่มโดยตรง เครื่องมือในการวิจัย คือ แบบสอบถาม ทั้งนี้ จากการทดสอบสมมุติฐานด้วยโมเดลสมการโครงสร้างและโปรแกรม LISREL ผลปรากฏว่าข้อมูลเชิงประจักษ์สอดคล้องกับสมมุติฐาน กล่าวคือ

การเลือกใช้บรรจุภัณฑ์มีองค์ประกอบสำคัญ 5 ด้านเรียงตามลำดับ คือ ด้านการป้องกันและรักษาสภาพ ด้านลักษณะวัสดุบรรจุภัณฑ์ ด้านการบรรจุ ด้านความสะดวก และ ด้านการสื่อสาร นอกจากนี้ ในการวิเคราะห์กลุ่มย่อยพบว่า การเลือกใช้บรรจุภัณฑ์สำหรับเครื่องดื่มแต่ละชนิดและเครื่องดื่มแต่ละขนาดการบรรจุ มีระดับความสำคัญขององค์ประกอบแตกต่างกัน

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CHAPTER I
INTRODUCTION

1.1 Background and problem statement

The market of non-alcoholic beverage in Thailand is growing continuously. From Figure 1.1, the sales volume of non-alcoholic beverage in 2011 is approximately 224.07 billion baht (Choonhavuttiyanont, 2012) and the sales volume in 2014 is forecasted to be approximately 239.40 billion baht (Jedkedkit, 2010). The growing rate of the market is around 5.4 percent per year. The competition in the market is very intense. All players are striving to be in the consumers' mind and step further than the competitors.

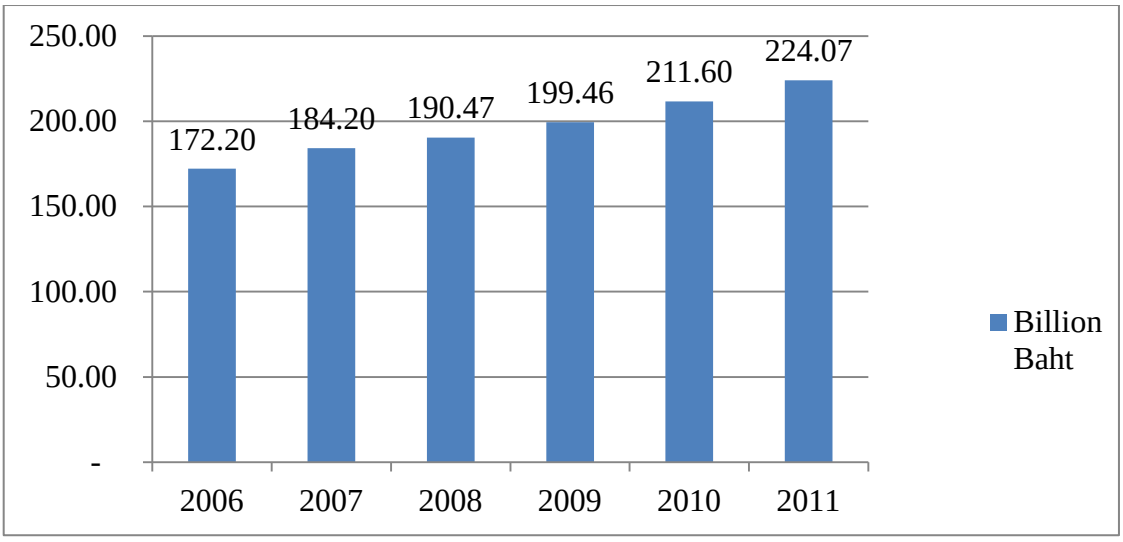


Figure 1.1 Market value of non-alcoholic beverage in Thailand in million baht (Choonhavuttiyanont, 2012)

Packaging is one of the most important factors that all beverage manufacturers have to make a careful consideration. As packaging is the first thing that will attract the eyes of customer, unattractive one may leads to failure of the

product. “A 2005 study conducted by the Paperboard Packaging Alliance showed that in the minds of consumers, product and package are one and the same” (Emerald Group Publishing Limited, 2010). Nevertheless, there are many factors to be considered in selecting the right packaging for a product. Generally, packaging plays an important role for containment, protection and preservation, convenience, and communication.

Knowing how beverage manufacturers give importance to each factor, one can have a guide for choosing his own packaging. Also, the packaging manufacturer can use this information to develop new products to meet customer’s demand.

1.2 Research objective

It is to confirm factors that involved in selecting the packaging of non-alcoholic beverage manufacturer and to compare different important level of the factors between groups.

1.3 Scope of research

This research is focused on collecting the data to confirm packaging selective factors. There are research scopes with regard to population, area, and methodology as follows.

1.3.1 Scope of population

The population in focus is non-alcoholic beverage manufacturer in Thailand.

1.3.2 Scope of research area

The packaging in focus is only the primary packaging which has direct contact with the product. The secondary packaging is excluded.

1.3.3 Scope of research methodology

The data of this research is collected via questionnaire. The model of the study is illustrated by Structural Equation Modeling. The method to analyze the data is confirmatory factor analysis and the data is analyzed via Linear Structural Relationship program.

CHAPTER II
LITERATURE REVIEW

This chapter will discuss about the background theory and literature review of the research. It is separated into 4 main topics as follows.

1. Packaging and its roles
2. Variables from beverage manufacturer that effect packaging selective factors
3. Factor analysis methods and tools
4. Related research

2.1 Packaging and its roles

2.1.1 Definition of packaging

According to the European Parliament and Council Directive 94/62/EC, “packaging shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer” (Olsson, 2004).

2.1.2 Levels of packaging

Generally, there are two levels of packaging, which are primary package and secondary package. Primary package is the package that has direct contact with the food and beverage, for example, a can of coca-cola, a carton of milk, and a bottle of green tea. Secondary package is the outer package that contains a number of primary packages for transportation, for example 30 cans of coca-cola are packed in one carton (Berk, 2008).

2.1.3 Packaging selective factors

Packaging plays an important role in delivering the product to the consumer. Different attributes are required for each type of beverage. Basically, there are four main roles of packaging as follows (Berk, 2008).

Containment is the first role of packaging as we use it to contain the product to the consumer. It is important because the product needs container for storage, transportation, distribution, and retailing (Siripatrawan, 2006a).

Protection and preservation is the second role of packaging. It is also important that the product is physically protected, chemically protected, and biologically protected from the environment (Berk, 2008).

Convenience is also an important role of packaging. As consumers are looking for the product that fit with their lifestyles, the manufacturer has to find out those preferences, for example, the package size, the package volume, and the special features of the package (Luangsa-ard, 2008). Also, the consideration should be in all the stages of the supply chain that relate to the consumer, which are consumer purchase, storage, and usage (Rundh, 2009).

The forth role of packaging is to make a communication as customers will perceive an identity and information of the product from its appearance (Silayoi, 2007).

In order to select the right packaging, a company needs to understand not only its roles, but also material characteristics. Environmental friendliness has gained much more importance in the eyes of customers. Beverage manufacturers also need to thoroughly understand laws, regulations, and benefits of each kind of packaging with respect to the sales area before making a selection (Paklamjeak, 2013).

2.1.4 Observed variables in packaging selective factors

Each packaging selective factor has several variables that can give beverage manufacturer more details and insights. For containment factor, there are four main observed variables as follows.

Storage – Packaging is used to contain the product in specific volume (Berk, 2008). With packaging, product can be stored during several processes in the supply chain.

Transport – Without packaging, transportation of the product will be difficult. Packaging is important to move the product from manufacturing place to the market (Paklamjeak, 2013).

Distribution – Packaging is important for distribution process from manufacturing source to end customers (Paklamjeak, 2013). Good packaging for distribution should use few of space, have light weight, and have good resistant (Rundh, 2009).

Retailing – Good packaging for retailing should use few shelf space and be "protective and tamper evident" (Rundh, 2009).

For protection and preservation factor, there are eight observed variables as follows.

Transport properties – Packaging can be barrier to protect the product from gases and vapors (Berk, 2008).

Optical properties – Packaging can be barrier to protect the product from light. "Many deteriorative reactions from ultraviolet light are lipid oxidation, off-flavor generation, discoloration, and destruction of nutritionally important components" (Berk, 2008).

Mechanical properties – Product can be damaged during the process of distribution and sales. Packaging is needed to protect the product from any damages, for example, deformed container by product overlay, collision, and quake (Paklamjeak, 2013).

Chemical reactivity – The packaging material must not react "with the food within and the environment without", for example, "the corrosion of tinplate and the migration of chemical substances from the package to the food" (Berk, 2008).

No product deterioration prior to expire date – Without appropriate packaging, the product can be deteriorated before expire date, which is unsafe and unacceptable for the consumers (Paklamjeak, 2013).

Health and safety issue – "The package is expected to prevent recontamination of the thermally stabilized food inside" (Berk, 2008).

Active packaging – Packaging which contains preserving substances in its material is called active packaging (Berk, 2008).

Controlled and modified atmosphere packaging – Packaging “with specific transport properties” in its material, which can help better preservation, is called controlled or modified atmosphere packaging (Berk, 2008).

For convenience factor, there are twelve observed variables as follows.

Packaging size – Packaging must be in appropriate size that suits best with its target consumers, for example, individual size, family size, and bulk size (Berk, 2008).

Packaging volume – Packaging must be in appropriate volume that suits best with its target consumers. For example, the net content of juice concentrate is usually between 360 to 500 milliliters, which can be diluted to 1.44 to 2 liters.

Convenience to use – With higher standard of living and changing lifestyle in urban area, customer does not only look for quality, but convenient product (Paklamjeak, 2013).

Machinability – The food and beverage manufacturers expect to have packaging that is suitable for automation and hot/cold filling (Rundh, 2009).

Portable and on the go packaging – The packaging should be “easy and safe to carry, and have low weight” (Rundh, 2009).

Easy to open – The packaging should be easily opening without using any other tools and there must be no spillage during its opening.

Reclosable packaging – With reclosable packaging, the remaining product can be kept well, and it is fine to be consumed later.

Spill resistant – Spill resistant is important in beverage product. Packaging needs to be stable and easy to pour without spillage (Paklamjeak, 2013).

Utensil free – “Packaging can be served as plates, cups, bowls, etc. from which the food can be eaten or drunk directly (Berk, 2008).

Clean up free or easy to dispose – After consuming the product, there is no need to clean up the package and utensils or it can all be disposed.

No time consuming – The product is ready to serve in the packaging that needs no preparation.

Microwavable – “Packaging can be served as heating utensils” (Berk, 2008).

For communication factor, there are three observed variables as follows.

Attract or motivate customer – Packaging needs to have good appearance in order to attract people's interest and motivate them to buy. Most customers buy product without preattention. It happens because of motivation in sales environment, for example, presence of product in the shelf and advertisement. Therefore, marketer uses packaging to gain customer's attention, let them read product information, and make a buying decision (Paklamjeak, 2013).

Advertise or inform – Information on packaging is very important to communicate with customers about quality, usefulness, consumption method, manufacturing source, etc. (Paklamjeak, 2013).

Identity – Packaging is a tool to create differentiation. It helps creating unique product characteristic and differentiating for specific target customers or specific net content. Appearance, color, and product logo are used to show product image and make customers remember the brand (Paklamjeak, 2013).

For material characteristics factor, there are three observed variables as follows.

Environmental friendliness – Packaging, which can be reused or recycled, is sustainable packaging. It is more preferable in the modern days. Also, it helps reducing the total cost of packaging (Paklamjeak, 2013).

Packaging material reduction – The specific packaging helps reducing the use of total packaging material, which will save resource and cost (Paklamjeak, 2013). For example, using a shrinkable film to cover the whole body of beverage container, it reduces using one label and a sealed cap.

Packaging requirement – The beverage manufacturer needs to follow the packaging requirements and rules of the market country. They are used to control safety of packaging material, information shown on the label, and environmental issues (Paklamjeak, 2013).

The literatures that mention some key packaging selective factors are summarized in the Table 2.1 and 2.2.

Table 2.1 Summary of variables in containment factor and protection & preservation factor from literatures

Author	Berk	Luangsaard	Olsson	Paklamjeak	Risch	Silayoi	Siripatrawan
Year	2008	2008	2004	2013	2009	2007	2006a
1. Containment factor							
Storage	x	x	x		x		x
Transport	x	x	x	x			x
Distribution	x	x	x	x			x
Retailing	x	x		x			x
2. Protection & preservation factor							
Transport properties	x	x		x	x		
Optical properties	x				x		
Mechanical properties	x	x	x	x		x	x
Chemical reactivity	x						
No product deterioration prior to expire date	x	x	x	x		x	x
Health / safety issue	x	x	x	x	x	x	
Active packaging	x				x		
Controlled / modified atmosphere	x		x		x		

Table 2.2 Summary of variables in convenience factor, communication factor, and material characteristics factor from literatures

Author	Berk	Luangsaard	Olsson	Paklamjeak	Risch	Silayoi	Siripatrawan
Year	2008	2008	2004	2013	2009	2007	2006a
3. Convenience factor							
Package size	x	x			x	x	x
Package volume		x		x		x	x
Convenience to use		x			x	x	x
Machinability		x	x				
Portable & on the go packaging		x	x				
Easy to open	x	x	x	x			
Reclosable packaging	x	x	x	x			
Spill resistant		x		x			
Utensil free	x	x	x				
Clean up free / easy to dispose		x	x				
No time consuming		x		x		x	
Microwavable	x			x	x		
4. Communication factor							
Attract consumer / motivation		x	x	x		x	x
Advertising / inform	x	x	x	x	x	x	x
Identity	x	x	x			x	
5. Material characteristics factor							
Environmental friendliness	x	x	x	x			x
Packaging material reduction		x	x				x
Packaging requirement		x		x			

2.2 Variables from beverage manufacturer that effect packaging selective factors

Different beverage manufacturers weight packaging selective factors differently. Important independent variables from beverage manufacturer characteristic that effect packaging selective factors are as follows.

2.2.1 Types of beverage

There are many types of beverage in the market for consumers to choose on their preferences. Beverage is categorized in many aspects according to the perspective of each organization as shown in Table 2.3.

According to the National Health and Nutrition Examination Survey of the United States of America, there are 13 types of non-alcoholic beverage which are “whole milk, reduced fat milk, skim milk, vegetable juice, 100% fruit juice (not orange / grapefruit juice), 100% orange / grapefruit juice, fruit drink (regular), fruit drink (low calorie), soda (regular), soda (low calorie), milk substitute and evaporated milk, coffee, and tea” (National cancer institute, 2013).

According to the Beverage Institute of Health and Wellness, there are 10 types of non-alcoholic beverage which are “water, milk and dairy-based beverages, soy-based beverages, 100% juice, juice drinks, coffee, tea, soft drinks, sports beverages, and energy drinks” (Koelemay, 2013).

According to the Notification of the Thai Ministry of Public Health (No. 61, 195, 196, 197, 198, 199, 350, 351, 352, 353, and 356), non-alcoholic beverage in the sealed container in Thailand is separated into 9 types which are water, mineral water, electrolyte drinks, tea, coffee, soybean milk, milk, “beverage which is containing or made from fruits / plants / vegetables”, and “beverage which is containing or made from other constituents except fruits / plants / vegetables” (Thai Ministry of Public Health, 1981, 2000, 2013).

Table 2.3 Comparison of beverage types from different organizations

National Health and Nutrition Examination Survey of USA	Beverage Institute of Health and Wellness	Ministry of Public Health in Thailand
-	Water	Water
		Mineral water
Whole milk	Milk and dairy-based beverages	Milk
Reduced fat milk		
Skim milk		
Milk substitute and evaporated milk		
-	Soy-based beverages	Soybean milk
Coffee	Coffee	Coffee
Tea	Tea	Tea
-	Sports beverages	Electrolyte drinks
	Energy drinks	
100% fruit juice (not orange / grapefruit juice)	100% juice	Beverage which is containing or made from fruits / plants / vegetables
100% orange / grapefruit juice		
Vegetable juice	Juice drinks	
Fruit drink (regular)		
Fruit drink (low calorie)		
Soda (regular)	Soft drinks	Beverage which is containing or made from other constituents except fruits / plants / vegetables
Soda (low calorie)		

This research follows the categorization of Ministry of Public Health in Thailand. The definitions of beverages according to the Notification of Public Health in Thailand are as follows in Table 2.4.

Table 2.4 Definition of each beverage type from Food and drug administration Thailand

Water (drinking water which shall be of the physical, chemical, and microbiological properties as follows in the notification of the Thai Ministry of Public Health No.61)
Mineral water (natural mineral water which is derived from underground natural water resource and contained several minerals depending on source of water)
Electrolyte drinks (drinks which are mainly consist of minerals)
Ready-to-drink tea (product of tea, which is mixed with other ingredients for ready to be consumed and is packed in the sealed containers)
Ready-to-drink coffee (product of coffee, which is mixed with other ingredients for ready to be consumed and is packed in the sealed containers)
Soybean milk (liquid which is derived from soybean, or some part of soybean, and other nutrients may be added)
Milk (products which are made from edible animal milk, such as cow's milk, flavoured milk, fermented milk, and other milk products)
Beverage which is containing or made from fruits, plants or vegetables, and may also contain dissolved carbon dioxide or oxygen gas
Beverage which is containing or made from other constituents, except fruits, plants or vegetables, and may also contain dissolved carbon dioxide or oxygen gas

2.2.2 Target market

Products, which are sold domestically and internationally, have different set of packaging consideration. Beverage manufacturer that exports its products has to consider its packaging to match with transportation condition, laws and regulations of the exported country, and trade barriers (Paklamjeak, 2013).

2.2.3 Serving size of the product

Beverage product comes in many different serving sizes. One way to classify it into groups is whether it is served for one or many people. There is no clear cut about the size of single-serve and multi-serve beverage in Thailand. However, there are indications in some other countries. A single-serve beverage in Australia is limited to 600 milliliters for a water-based beverage and 500 milliliters for fruit juice (Australian Beverages Council, 2013). In Canada, up to and including 591 milliliters of beverage is considered to be single-serve beverage and larger than 591 milliliters of beverage is considered to be multi-serve beverage (Canadian Beverage Association, 2013).

2.2.4 Size of the company

In order to separate the size of the company, turnover and employee number are widely used. However, it is suggested that “turnover is an appropriate measure for firms engaged in areas such as construction, retailing, wholesaling and a host of other areas, employee number is more appropriate for firms engaged in manufacturing” (Prendergast, 1996).

In a research of packaging with environmental issues, it found that large companies are “less likely to see a trade-off between the packaging function and the environment than those from smaller companies. It is possible that smaller companies believe they may not have the financial resources to develop packaging which meets both the marketing and environmental demands, and in such a situation the environment takes a back seat. Larger companies with a larger resource base, however, may find it more feasible to marry the environmental and marketing demands of packaging” (Prendergast, 1996).

In the ministerial regulation of Ministry of Industry in Thailand, the company is separated into three sizes, which are large, medium, and small. For the company in products and services industry, small company has employee number of not over than 50 people. Medium company has employee number between 51 to 200 people. Large company has employee number of 201 people and more.

2.3 Factor analysis methods and tools

In order to do factor analysis, we need to study and understand some important methods and tools as follows.

2.3.1 Structural equation modeling (SEM)

Structural equation modeling or SEM is a tool that is widely used in many researches. It can be used in various analysis purposes. SEM's main purpose is to analyze "the pattern of a series of inter-related dependence relationships simultaneously between a set of latent (unobserved) constructs, each measured by one or more manifest (observed) variables" (Reisinger, 1999). Moreover, it can also be used to "estimate variance and covariance, test hypotheses, conventional linear regression, and factor analysis" (Reisinger, 1999). The method of using SEM is as follows in Figure 2.1.

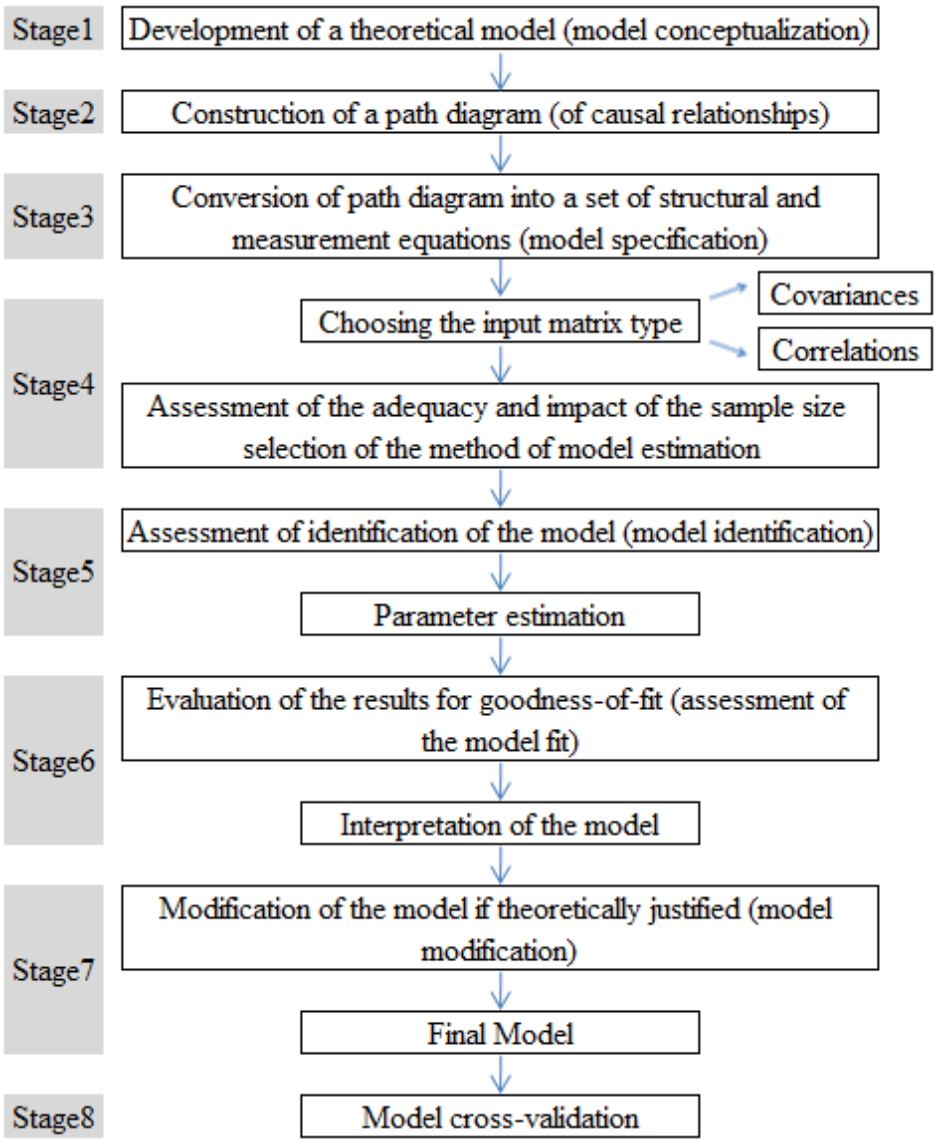


Figure 2.1 Stages in the application of structural equation modeling (Reisinger, 1999)

2.3.2 Confirmatory factor analysis (CFA)

Confirmatory factor analysis (CFA) can be used to identify and explore hypotheses about covariability pattern of the data. It can address how a latent variable model can predict the actual covariability (Burton, 2003). The measurement is justified by how the data fit with the model and how significant of the model parameter (Gatignon, 2010).

2.3.3 Linear structural relationship (LISREL)

Linear structural relationship or LISREL is a statistical program firstly introduced in 1972 “for covariance structure analysis. It is a multivariate technique which combines” (Reisinger, 1999) the measurement model of factor analysis and the structural equation model. The measurement model shows how the hypothesis or the latent variables are measured by the observed variables and the structural equation model shows the relationship of the latent variables. This program is commonly used for structural equation modeling in many applications (Pang, 1996).

2.4 Related research

2.4.1 Descriptive analysis on packaging functions

The research of Siripatrawan is titled “Packaging technology to support Thailand’s processed food export”. Its goal is to specify packaging problems of processed foods for export and state possible solutions for problem solving and quality improvement. The research method is a combination of “personal interview, survey, and sequential brainstorming conference”. The packaging problems are defined into five main categories, which are packaging materials / forms / functions, labeling, sale promotion, transportation, and return. The solutions are divided into two parts. The first one is to solve the problem by “use of environmental friendly, convenience-to-use, and innovative packaging system”. Another part is to suggest an improvement by having attractive packaging that conforms to importer’s packaging standards (Siripatrawan, 2006b).

Prendergast has research topic of “Packaging, marketing, logistics, and the environment: are there trade-offs?”. The researcher wonders if the company can go with environmental-friendly packaging without bad effect to other functions. The research is done by preliminary interviews with experts and a mail survey to marketing executives in consumer product industries. The result is that the marketers do not see environmental-friendly issues as a threat to their marketing and logistic strategy. Environmentalism will have more and more roles in the future due to

European parliament and council packaging directive, social trend, and economic perspective (Prendergast, 1996).

Both researches have one interesting topic on functions of packaging which can be summarized in Table 2.5.

Table 2.5 Importance of each packaging function

Author, year	Siripatrawan, 2006b		Prendergast, 1996	
Research paper	Packaging strategies to support processed food export		Packaging, marketing, logistics and the environment: are there trade-offs?	
Product lines of respondents	Export processed food		Food, beverage, toiletries, cleaning products, pharmaceutical products	
Function	Protection	18.20%	Containment & protection	54.26%
	Containment	16.40%		
	Process tolerance	14.50%	Attract customer	19.19%
	Motivation	12.70%		
	Identity	10.90%	Reinforce a product's image	13.41%
	Sale promotion	9.10%		
	Machinability	7.30%	Facilitate use of the product	11.92%
	Utility & convenience	5.50%		
	Communication	3.60%	Other	0.86%
	Reuse / recycle	1.80%		
Total		100.00%		100.00%

2.4.2 Inferential analysis on structural equation modeling and confirmatory factor analysis

Structural equation modeling is widely used to analyze the relationship of variables. Many industries can apply to investigate their own hypotheses.

Kim et al. (2007) develop an integrated conceptual model of internet acceptance in Korea to investigate the relationship between variables. They use structural equation modeling and LISREL for their analysis. The result shows that internet usage is not effected by subjective norm, but it is effected by experience, usefulness, and ease of use.

Suhonen et al. study to examine if individualized nursing care will have positive effect on three aspects of patient outcome, which are “patient satisfaction, patient autonomy, and perceived health-related quality of life” (Suhonen et al., 2007). Structural equation modeling and LISREL are used for the analysis and it shows supported outcome for all three aspects.

Maiga et al. study if information technology pays off an investment on three aspects, which are “return on sales, turnover on assets, and return on assets” (Maiga et al. 2013). The researchers use structural equation modeling and maximum likelihood estimation to analyze the data. The result indicates that profitability comes from customer satisfaction, cost improvement, and “the extent of managerial information technology usage” (Maiga et al., 2013).

Confirmatory factor analysis is also widely used to identify covariability pattern. It can be used in variety applications as shown in Table 2.6.

Table 2.6 Confirmatory factor analysis in variety applications

Author, year	Topic	Samples	Tools
Carrillo, 2012	Spending behavior on functional foods	Functional food consumers in Spain	SPSS
Hansen, 2005	Consumer perception of food quality (shrimps & cheese)	Graduate students in Denmark	LISREL
Hult, 2000	Valued product attributes	French and Malaysian Consumers	LISREL
Koo, 2005	Reasons of e-consumers' loyalty	Internet users with shopping experiences in Korea	SPSS & LISREL
Lee, 2009	Product quality perception	Automobile in Kazakhstan	-
Liang, 2011	Online buying behavior	Undergraduate students who purchased specialty food online	SPSS & LISREL
Punniya-moorthy, 2011	Supplier selection	Boiler in India	LISREL
Punniya-moorty, 2012	Supplier selection	Boiler in India	LISREL & fuzzy AHP
Sanzo, 2003	Attitude and satisfaction in a traditional food product	Honey consumer in Spain	EQS

CHAPTER III
RESEARCH METHODOLOGY

The research methodology adopted in this thesis consists of five main steps as shown in Figure 3.1.

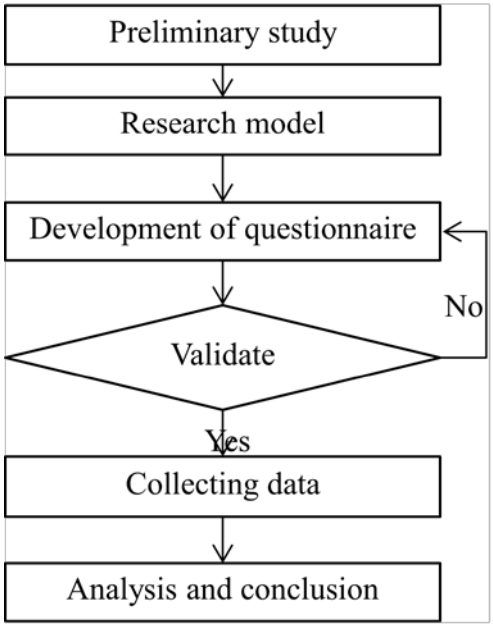


Figure 3.1 Steps in research methodology

3.1 Preliminary study

The first step is to investigate through literatures that related to the roles of packaging, especially food and beverage packaging. The theories and reviews of literatures are presented in the chapter two. It is found that knowing the roles of packaging is not enough for manufacturers to select the right packaging for their product. The material characteristics of the packaging are one important factor that a person must know also. Therefore, packaging selective factors of non-alcoholic

beverage are divided into five sub-factors. Four of them are roles of the packaging and one of them is material characteristics.

Each manufacturer also has its own characteristics, which leads to different perspective toward each packaging selective factor. From literature review, there are four important variables from either the beverage manufacturer or the product itself that effects packaging selective factors, which are the beverage type manufactured by the company, its target market, the size of manufacturing company, and current material used for the product.

Previous studies about packaging selective factors are mostly in descriptive analysis. By doing this research, the packaging selective factors will be thoroughly explored and gave useful insights to both beverage manufacturer and packaging manufacturer.

3.2 Research model

The research hypothesis is derived from the question of how non-alcoholic beverage manufacturers choose their packaging. Knowing this information could make one has an insight to the view of beverage manufacturers toward packaging. Results are expected to confirm factors that effect packaging selection of non-alcoholic beverage manufacturer.

From Figure 3.2, five hypothesis statements are derived as follows.

H1: Containment factor has positive effects on packaging selection of non-alcoholic beverage manufacturer.

H2: Protection and preservation factor have positive effects on packaging selection of non-alcoholic beverage manufacturer.

H3: Convenience factor has positive effects on packaging selection of non-alcoholic beverage manufacturer.

H4: Communication factor has positive effects on packaging selection of non-alcoholic beverage manufacturer.

H5: Material characteristics factor has positive effects on packaging selection of non-alcoholic beverage manufacturer.

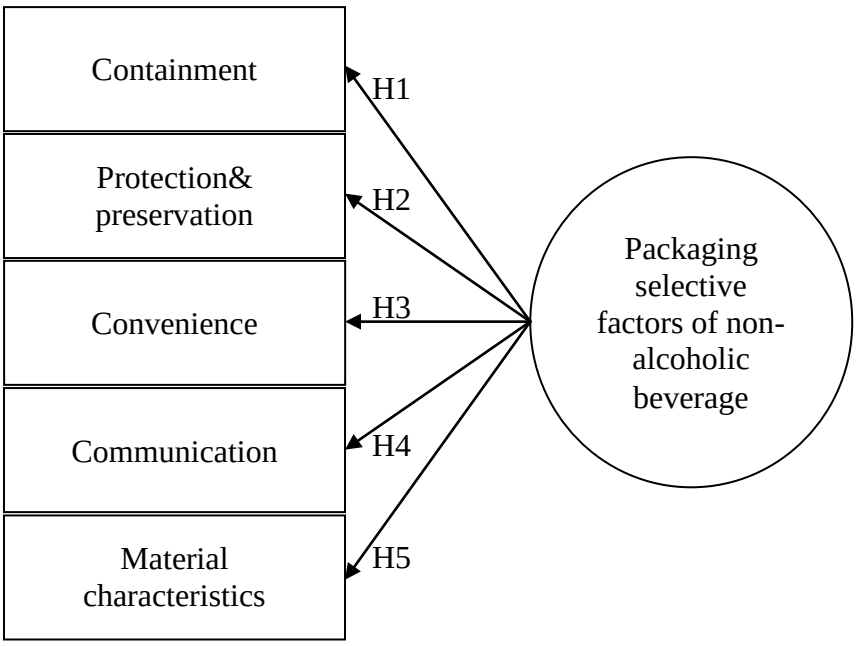


Figure 3.2 Research hypothesis H1 – H5

In addition, there will be two sub-group research hypotheses to see whether different group of respondents have different packaging selective factors for non-alcoholic beverage.

The first sub-group is categorized by type of beverage. In the literature review, non-alcoholic beverage in the sealed container in Thailand is separated into nine types. To make it simpler, the type of beverage will be separated into two groups, which are drinking water and other beverages. Therefore, there will be ten more hypotheses for this sub group. H6 and H11 stand for containment factor has positive effects on packaging selection of drinking water and other beverages as shown in Figure 3.3.

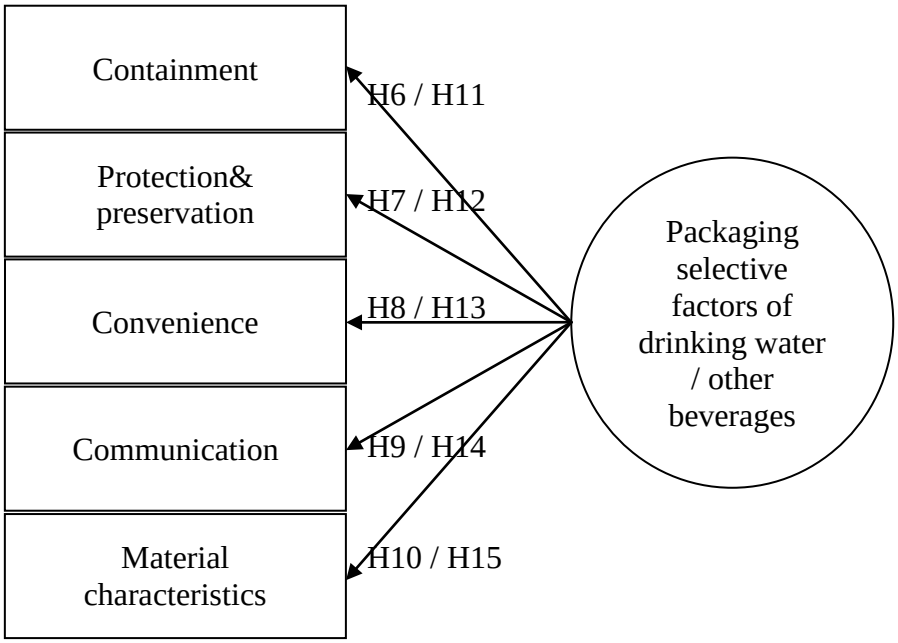


Figure 3.3 Research hypothesis H6 – H15

The next sub-group is categorized by serving size of beverage. According to the literature review about serving size of the product, in this research, the single-serve beverage will be between 1-500 milliliters and the multi-serve beverage will be 501 milliliters and more. Then, there will be ten more hypotheses for this sub group. H16 and H21 stand for containment factor has positive effects on packaging selection of single-serve and multi-serve beverage as shown in Figure 3.4.

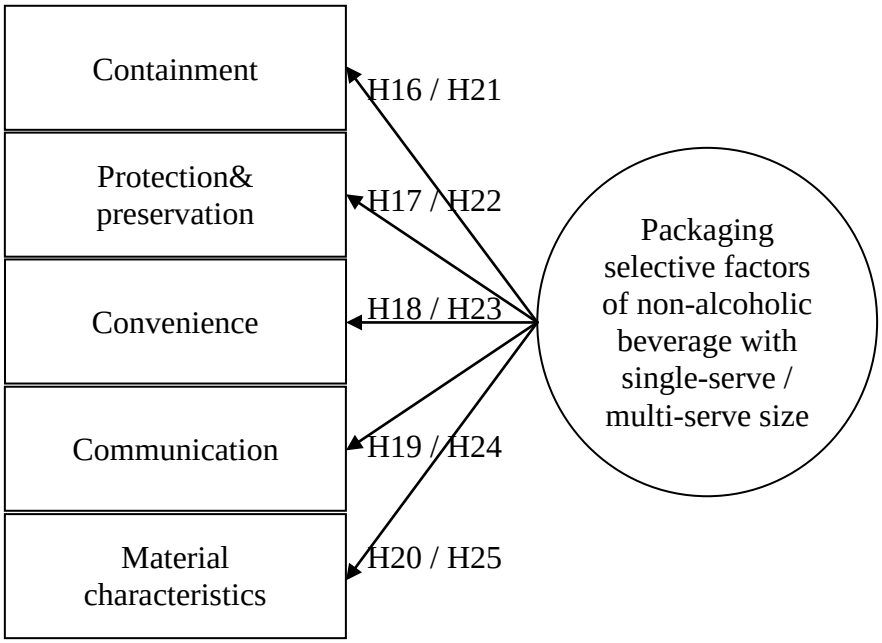


Figure 3.4 Research hypothesis H16 – H25

3.3 Development of questionnaire

The hypothesis statements are transformed into questions in the questionnaire. Then, it is reviewed for validation by three experts in the field of beverage and structural equation modeling. In this process, experts will check each question if it is appropriate for research objective. The experts' opinion for each question is in three options. If it is an appropriate question, it will score one point. If it is an inappropriate question, it will score minus one point. If the expert is not sure with that question, it will score zero point. After all experts give opinion to the questionnaire, the total scores for each question will be summed up and divided by the number of experts. This score is called Item-Objective Congruence Index or IOC. The question that scores more than 0.5 is good enough or appropriate to be used in the questionnaire. The IOC of this research is shown in Appendix A.

The final questionnaire to be used for collecting data is divided into three main parts. It is shown in Appendix B.

The first part of the questionnaire is asking if the respondents take part in packaging selection and the size of the company (question 1 and 2).

The second part is asking about details of the company product, which are type of beverage, target customers, product net content, price, and type of packaging material (question 3 to 7).

The third part is asking for an opinion related to five packaging selective factors and its sub-factors. Respondents have to give the score for the importance of each factor by numerical scale.

There are 35 questions in this section, which can be separated into 5 main factors.

The first factor is containment, which has 6 questions derived from 5 attributes of containment as shown in Table 3.1.

Table 3.1 Research questions in containment factor

Attribute	Observed variable
Pack / Unpack	Q01: Packaging can be easily packed for storage.
	Q05: Packaging can be easily unpacked for retailing.
Storage	Q02: Packaging can be stored easily.
Transport	Q03: Packaging can be transported easily.
Distribution	Q04: Packaging can be easily distributed to the wholesaler and retailer.
Retail	Q06: Packaging can be retailing easily.

The second factor is protection and preservation, which has 7 questions derived from 3 attributes of protection and preservation as shown in Table 3.2.

Table 3.2 Research questions in protection and preservation factor

Attribute	Observed variable
Preservation	Q07: The product will not be deteriorated before expired date.
	Q08: Packaging has good transport properties.
	Q11: Packaging has good chemical reactivity.
Protection	Q09: Packaging has good optical properties.
	Q10: Packaging has good mechanical properties.
Atmosphere in the package	Q12: It is active packaging.
	Q13: It is controlled / modified atmosphere packaging.

The third factor is convenience, which has 12 questions derived from 4 attributes of convenience as shown in Table 3.3.

Table 3.3 Research questions in convenience factor

Attribute	Observed variable
Figure	Q14: Packaging is in appropriate size and shape for consumer.
	Q16: Packaging is in spill resistance shape.
	Q17: It is portable packaging.
Consumption	Q15: Packaging has appropriate net content for consumer.
	Q18: Packaging can be opened easily.
	Q19: It is reclosable packaging.
	Q20: Packaging is microwavable or can be stored in freezer.
	Q23: Packaging can keep hot / cold beverage temperature for a long time.
	Q24: Consumer can drink it directly from the packaging (utensil free).
Disposal	Q25: Packaging can be disposed easily.
Manufacturing	Q21: Packaging has good machinability.
	Q22: Packaging can work well with hot-filled / cold-filled process.

The forth factor is communication, which has 5 questions derived from 2 attributes of communication as shown in Table 3.4.

Table 3.4 Research questions in communication factor

Attribute	Observed variable
Communication	Q26: Packaging can advertise or inform details of the product.
	Q27: Packaging can represent identity of the product.
Appearance	Q28: Packaging has a good appearance.
	Q29: Packaging is in modern style.
	Q30: Packaging looks different from others.

The last factor is material characteristics, which has 5 questions derived from 3 attributes of material characteristics as shown in Table 3.5.

Table 3.5 Research questions in material characteristics factor

Attribute	Observed variable
Cost	Q31: When using a particular packaging material, the total cost of material is lower than using the other packaging material.
Environmental friendliness	Q32: When using a particular packaging material, the total packaging used is less than using the other packaging material.
	Q33: It is reusable packaging.
	Q34: It is recyclable packaging.
Standard	Q35: Packaging passes the packaging laws and regulations.

Before the questionnaire can be used to collect the real data, the reliability test must be done. Therefore, the questionnaire was used to collect the data from 38 respondents and test for reliability by using the Cronbach's alpha coefficient. The reliability score of the questionnaire was good as shown in Appendix C.

3.4 Collecting data

The sample size of each research should be collected according to its research objective and methodology. According to Vongvanich, the sample size for factor analysis should be calculated by multiply the number of variable by five, and the total sample size must be at least one hundred (Vongvanich, 2007).

In this research, convenience factor has the highest number of variable. Twelve multiply by five is equal to sixty. Therefore, the sample size of this research should be at least one hundred.

Two hundred of non-alcoholic beverage manufacturers in Thailand are randomly selected. The most frequent channel is Mailing. Other channels are electronic mail, phone interview, and face-to-face interview.

3.5 Analysis and conclusion

The data was collected and analyzed with two kinds of statistic, descriptive statistic and inferential statistic.

3.5.1 Descriptive statistic

This statistic will describe quantitative data from the questionnaire. There will be divided into two sections. The first one is demographic data of the respondents from the first and second part of the questionnaire. The second one is respondents' opinion toward packaging selective factors of non-alcoholic beverage from the third part of the questionnaire. The value of mean, standard deviation, min, max, and its interpretation will be presented. All questions in the third part are asking for importance level which can be converted into five Likert scales as shown in Table 3.6.

Table 3.6 Respondents' importance level toward packaging selective factors of non-alcoholic beverage.

Importance level	The level score
Very low importance	The score is equal to 1
Low importance	The score is equal to 2
Moderate importance	The score is equal to 3
High importance	The score is equal to 4
Very high importance	The score is equal to 5

The mean score of each question can interpret its level of importance, which can be separated into 5 levels as shown in Table 3.7.

Table 3.7 Interpretation of importance level from mean score

Mean score	Interpretation
Mean of 1.00 – 1.50	Very low importance
Mean of 1.51 – 2.50	Low importance
Mean of 2.51 – 3.50	Moderate importance
Mean of 3.51 – 4.50	High importance
Mean of 4.51 – 5.00	Very high importance

3.5.2 Inferential statistic

The first step is to analyze the correlation between each question. It is used to prove that all variables are unique and different from others. The correlation analysis shows two main important results, which are the correlation value and its significance. The value shows how one variable relates to the others and the significance shows if we can believe that value. The value of higher than 0.90 shows multi-collinearity between variables and the insignificance means we have to do more analysis.

The tolerance and the variance inflation factor (VIF) are two diagnostic factors that can be used to prove if multi-collinearity is an issue.

The tolerance value is equal to $1-R^2$. Its small value indicates that the variable involves in the linear relationship with other independent variables in the equation. The variable with value of less than 0.10 is suggested not to be added to the equation.

The variance inflation factor (VIF) is equal to $1 / 1-R^2$. Its value shows the impact of collinearity among all variables in the equation. The value of more than 5.00 indicates that the variable has linear relationship with other independent variables in the equation.

Later, confirmatory factor analysis is used to test the hypothesis and confirm the existent of packaging selective factors. The model is created by using structural equation modeling and the analysis is done by an application called linear structural relationship or LISREL.

The t-value will indicate if the variable is significant and on which level. For two-tailed test, the number of 1.96 indicates significant on five percent level and the number of 2.58 indicates significant on one percent level. If such variable is significant, we can see how important it is on the value of factor loading. For easiness, it is converted into percentage by its value divided by the summation of all factor loading, multiply by one hundred. In addition, we need to look at important fit indices for model fitness, which is presented in Table 3.8.

Table 3.8 Important fit indices to be used in the data analysis

Goodness of fit statistics	Recommended value
Chi-square (χ^2)	-
Degree of freedom (df)	-
χ^2 / df	<2
P-value	>0.05
Root mean square error of approximation (RMSEA)	<0.05
Root mean square residual (RMR)	<0.05
Goodness of fit index (GFI)	>0.95
Adjusted goodness of fit index (AGFI)	>0.95
Normed fit index (NFI)	>0.95
Non-normed fit index (NNFI)	>0.95
Comparative fit index (CFI)	>0.95

3.6 Research schedule

The research is scheduled following five steps in research methodology. It is planned to be done within 12 months as follows in Table 3.9.

Table 3.9 Research's timeline

Research methodology	Month					
	1-2	3-4	5-6	7-8	9-10	11-12
Preliminary study	x					
Research model		x				
Development of questionnaire			x			
Collecting data				x	x	
Analysis and conclusion						x

CHAPTER IV
RESULTS AND DISCUSSION

4.1 Questionnaire respondents

The data is collected via questionnaire. In total, there are 130 respondents from beverage manufacturers in Thailand. The demographic of the respondents are as shown in Table 4.1.

Table 4.1 The demographic of the respondents

Participation in packaging selection	Number	Percent
Respondent is packaging selector	47	36.15
Respondent takes part in packaging selection	83	63.85
Size of the company	Number	Percent
Small enterprise (1-50 people)	89	68.46
Medium enterprise (51-200 people)	13	10.00
Large enterprise (201 people or more)	28	21.54
Types of beverage	Number	Percent
Drinking water	70	53.85
Other beverages	60	46.15
Sales	Number	Percent
Domestic	103	79.23
International	27	20.77
Product net content	Number	Percent
1-500 milliliters	74	56.92
501 milliliters or more	56	43.08

Table 4.1 (Continued) The demographic of the respondents

Packaging material used	Number	Percent
Metals	4	3.08
Glass	8	6.15
Paper	12	9.23
Polymers	106	81.54

The method of confirmatory factor analysis is used via Linear Structural Relationship application or LISREL. The data will be analyzed to confirm whether the results are according to the theory. It is used to prove that the hypothesis (H_1-H_5) cannot be rejected and to confirm that those packaging selective factors have significant positive effect on packaging selection of non-alcoholic beverage manufacturer.

4.2 Descriptive analysis

4.2.1 Containment factor

There are six containment questions in the questionnaire asking the respondents to give important scores. From the interpretation in Table 4.2, it shows that respondents give high importance in all variables, especially in question 1. It means that packaging which can be easily packed for storage is the most important for the beverage manufacturers.

Table 4.2 The observed variables that effect containment factor

Observed variable	Mean	S.D.	Min / Max	Interpre-tation
Q01: Packaging can be easily packed for storage.	4.05	0.80	2 / 5	High
Q02: Packaging can be stored easily.	3.86	0.88	1 / 5	High
Q03: Packaging can be transported easily.	3.74	0.90	2 / 5	High
Q04: Packaging can be easily distributed to the wholesaler and retailer.	3.95	0.83	2 / 5	High
Q05: Packaging can be easily unpacked for retailing.	3.72	0.89	1 / 5	High
Q06: Packaging can be retailing easily.	3.86	0.90	2 / 5	High

4.2.2 Protection and preservation factor

There are seven protection and preservation questions in the questionnaire asking the respondents to give important scores. From the interpretation in Table 4.3, it shows that respondents give high importance in five questions and medium importance in two questions. Question 7 and 11 have the highest score. It means that the beverage manufacturers give high concern on changes of their product quality.

Table 4.3 The observed variables that effect protection and preservation factor

Observed variable	Mean	S.D.	Min / Max	Interpre-tation
Q07: The product will not be deteriorated before expire date.	4.20	0.90	2 / 5	High
Q08: Packaging has good transport properties.	4.03	1.04	1 / 5	High
Q09: Packaging has good optical properties.	3.63	1.18	1 / 5	High
Q10: Packaging has good mechanical properties.	4.12	0.91	2 / 5	High
Q11: Packaging has good chemical reactivity.	4.20	1.13	1 / 5	High
Q12: It is active packaging.	3.14	1.28	1 / 5	Medium
Q13: It is controlled / modified atmosphere packaging.	3.32	1.26	1 / 5	Medium

4.2.3 Convenience factor

There are twelve convenience questions in the questionnaire asking the respondents to give important scores. From the interpretation in Table 4.4, it shows that respondents give high importance in eight questions, medium importance in three questions and low important in one question. Question 15, packaging which has appropriate net content for consumer, has the highest score. It means that the beverage manufacturers give high concern on its product volume for each group of consumer.

Table 4.4 The observed variables that effect convenience factor

Observed variable	Mean	S.D.	Min / Max	Interpre-tation
Q14: Packaging is in appropriate size and shape for consumer.	4.14	0.77	2 / 5	High
Q15: Packaging has appropriate net content for consumer.	4.26	0.69	3 / 5	High
Q16: Packaging is in spill resistance shape.	4.17	0.82	2 / 5	High
Q17: It is portable packaging.	4.02	0.94	1 / 5	High
Q18: Packaging can be opened easily.	4.11	0.95	1 / 5	High
Q19: It is reclosable packaging.	3.49	1.28	1 / 5	Medium
Q20: Packaging is microwavable or can be stored in freezer.	2.18	1.1	1 / 5	Low
Q21: Packaging has good machinability.	3.85	1.12	1 / 5	High
Q22: Packaging can work well with hot-filled / cold-filled process.	3.38	1.19	1 / 5	Medium
Q23: Packaging can keep hot / cold beverage temperature for a long time.	3.20	1.24	1 / 5	Medium
Q24: Consumer can drink it directly from the packaging (utensil free).	4.23	0.99	1 / 5	High
Q25: Packaging can be disposed easily.	3.83	1.02	1 / 5	High

4.2.4 Communication factor

There are five communication questions in the questionnaire asking the respondents to give important scores. From the interpretation in Table 4.5, it shows that respondents give high importance in all variables, especially in question 28. It means that, in beverage manufacturers' mind, appearance is the most important variable that will attract their customers.

Table 4.5 The observed variables that effect communication factor

Observed variable	Mean	S.D.	Min / Max	Interpre-tation
Q26: Packaging can advertise or inform details of the product.	4.08	0.81	2 / 5	High
Q27: Packaging can represent identity of the product.	4.18	0.80	2 / 5	High
Q28: Packaging has a good appearance.	4.23	0.72	3 / 5	High
Q29: Packaging is in modern style.	4.18	0.84	2 / 5	High
Q30: Packaging looks different from others.	3.92	0.89	1 / 5	High

4.2.5 Material characteristics factor

There are five material characteristics questions in the questionnaire asking the respondents to give important scores. From the interpretation in Table 4.6, it shows that respondents give high importance in two questions and medium importance in three questions. Question 35, packaging passes the packaging laws and regulations, has the highest score. It means that the beverage manufacturers give high concern whether the packaging material is qualified to be used.

Table 4.6 The observed variables that effect material characteristics factor

Observed variable	Mean	S.D.	Min / Max	Interpre-tation
Q31: When using a particular packaging material, the total cost of material is lower than using the other packaging material.	3.95	0.91	1 / 5	High
Q32: When using a particular packaging material, the total packaging used is less than using the other packaging material.	3.40	0.96	1 / 5	Medium
Q33: It is reusable packaging.	2.72	1.21	1 / 5	Medium
Q34: It is recyclable packaging.	3.45	1.18	1 / 5	Medium
Q35: Packaging passes the packaging laws and regulations.	4.34	0.79	2 / 5	High

4.2.6 Packaging selective factors

There are five main packaging selective factors of non-alcoholic beverage. From the interpretation in Table 4.7, it shows that respondents give high importance in all factors, especially in communication factor. This implies that the first thing to be considered for the beverage manufacturers is whether the packaging can communicate well with their customers.

Table 4.7 Packaging selective factors of non-alcoholic beverage

Packaging selective factor	Mean	S.D.	Interpretation
Containment	3.86	0.65	High
Protection and preservation	3.81	0.81	High
Convenience	3.93	0.64	High
Communication	4.12	0.68	High
Material Characteristics	3.57	0.69	High

4.3 Inferential analysis: observed variables that effect each packaging selective factor

Each packaging selective factor is latent variable that effected by observed variables. In this case, the data is collected by the questionnaire and analyzed separately for each factor via LISREL application.

4.3.1 Containment factor (factor 1)

From literatures and interviews with experts in the industry, there are six observed variables that effect containment factor.

From the correlation analysis in Table 4.8, the values are between 0.30 and 0.60. They are all lower than 0.90 and significant at the 0.01 level. This means there is no multi-collinearity between each variable with 99% confidence interval.

Table 4.8 The correlation analysis result of observed variables in containment factor

Var.	Q01	Q02	Q03	Q04	Q05	Q06
Q01	1					
Q02	0.50**	1				
Q03	0.36**	0.54**	1			
Q04	0.45**	0.46**	0.60**	1		
Q05	0.30**	0.57**	0.37**	0.42**	1	
Q06	0.36**	0.59**	0.49**	0.55**	0.57**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The result from LISREL shows in Table 4.9that the t-values of all observed variables are significant on 1 percent level. It means thatall observed variables have significant positive effect on containment factor.

Table 4.9 The data analysis shows how each observed variable has effect on containment factor

Observed variable	Factor loading	Percentage	Rank	t-value
Q01	0.45	12.60	6	6.70**
Q02	0.76	21.30	1	10.80**
Q03	0.57	16.00	4	7.41**
Q04	0.64	17.99	2	8.44**
Q05	0.54	15.00	5	7.16**
Q06	0.61	17.11	3	8.29**

(* Significant on 5 percent level, ** Significant on 1 percent level)

The top two important variables are in storage and distribution attribute. Q2 (Packaging can be stored easily) Q4 (Packaging can be easily distributed to the wholesaler and retailer)

4.3.2 Protection and preservation factor (factor 2)

From literatures and interviews with experts in the industry, there are seven observed variables that effect protection and preservation factor.

From the correlation analysis in Table 4.10, the values are between 0.18 and 0.75. They are all lower than 0.90. Most of them are significant at the 0.01 level and two of them are significant at 0.05 level. This means there is no multi-collinearity between each variable with 99% and 95% confidence interval, respectively.

Table 4.10 The correlation analysis result of observed variables in protection and preservation factor

Var.	Q07	Q08	Q09	Q10	Q11	Q12	Q13
Q07	1						
Q08	0.75**	1					
Q09	0.44**	0.39**	1				
Q10	0.63**	0.59**	0.57**	1			
Q11	0.63**	0.56**	0.49**	0.69**	1		
Q12	0.37**	0.30**	0.62**	0.27**	0.20*	1	
Q13	0.33**	0.29**	0.57**	0.28**	0.18*	0.75**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The t-values in Table 4.11are all significant on 1 percent level. It shows that all observed variables have significant positive effect on protection and preservation factor.

Table 4.11 The data analysis shows how each observed variable has effect on protection and preservation factor

Observed variable	Factor loading	Percentage	Rank	t-value
Q07	0.70	15.43	4	9.72**
Q08	0.73	16.25	3	8.51**
Q09	0.60	13.28	5	5.34**
Q10	0.76	16.77	2	10.79**
Q11	0.91	20.17	1	10.30**
Q12	0.41	9.11	6	3.50**
Q13	0.41	8.99	7	3.50**

(* Significant on 5 percent level, ** Significant on 1 percent level)

Most important variables are in preservation and protection attribute. Q11 (Packaging has good chemical reactivity) Q10 (Packaging has good mechanical properties) Thus, the beverage manufacturers give highest importance to preserve their beverage quality.

4.3.3 Convenience factor (factor 3)

From literatures and interviews with experts in the industry, there are twelve observed variables that effect convenience factor.

From the correlation analysis in Table 4.12, the values are between -0.13 and 0.76. They are all lower than 0.90. Most of them are significant at the 0.01 and 0.05 level. This means there is no multi-collinearity between each variable with 99% and 95% confidence interval, respectively. However, 17 of them are not significant and need to be proved that multi-collinearity is not an issue. The two diagnostic factors are tolerance and the variance inflation factor (VIF).

Table 4.12 The correlation analysis result of observed variables in convenience factor

Var.	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25
Q14	1											
Q15	0.76**	1										
Q16	0.46**	0.61**	1									
Q17	0.60**	0.64**	0.54**	1								
Q18	0.51**	0.55**	0.56**	0.71**	1							
Q19	0.31**	0.31**	0.41**	0.34**	0.60**	1						
Q20	-0.03	0.02	0.03	0.12	0.09	0.27**	1					
Q21	0.44**	0.30**	0.18*	0.42**	0.43**	0.24**	0.15	1				
Q22	0.01	0.18*	0.19*	0.13	0.06	-0.13	0.43**	0.17*	1			
Q23	0.17	0.18*	0.17	0.35**	0.29**	-0.03	0.36**	0.43**	0.49**	1		
Q24	0.37**	0.32**	0.35**	0.31**	0.29**	0.18*	0.10	0.16	0.25**	0.42**	1	
Q25	0.29**	0.40**	0.35**	0.46**	0.50**	0.44**	0.18*	0.14	0.08	0.38**	0.50**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The tolerance values of observed variables Q14 to Q25 are between 0.29 and 0.58 (Appendix D). The variance inflation factor values are between 1.73 and 3.51 (Appendix D). Therefore, there is no multi-collinearity between each variable.

In Table 4.13, ten out of twelve t-values are significant on l percent level. It shows that the observed variables have significant positive effect on convenience factor. However, there are two observed variables that are not significant (Q20 and Q22) and it shows that the observed variables have no effect on convenience factor.

Table 4.13 The data analysis shows how each observed variable has effect on convenience factor

Observed variable	Factor loading	Percentage	Rank	t-value
Q14	0.50	8.36	7	7.97**
Q15	0.48	8.05	8	8.67**
Q16	0.56	9.37	5	7.98**
Q17	0.85	14.24	1	12.01**
Q18	0.75	12.71	2	10.35**
Q19	0.70	11.87	3	5.95**
Q20	0.12	2.10	12	1.25
Q21	0.51	8.54	6	5.13**
Q22	0.12	2.10	11	1.13
Q23	0.43	7.18	9	3.93**
Q24	0.32	5.41	10	3.54**
Q25	0.60	10.07	4	6.63**

(* Significant on 5 percent level, ** Significant on 1 percent level)

The top two important variables are in the attribute of figure and consumption. Q17 (It is portable packaging) Q18 (Packaging can be opened easily)

4.3.4 Communication factor (factor 4)

From literatures and interviews with experts in the industry, there are five observed variables that effect convenience factor.

From the correlation analysis in Table 4.14, the values are between 0.41 and 0.81. They are all lower than 0.90 and significant at the 0.01 level. This means there is no multi-collinearity between each variable with 99% confidence interval.

Table 4.14 The correlation analysis result of observed variables in communication factor

Var.	Q26	Q27	Q28	Q29	Q30
Q26	1				
Q27	0.81**	1			
Q28	0.68**	0.70**	1		
Q29	0.55**	0.61**	0.77**	1	
Q30	0.48**	0.41**	0.64**	0.67**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In Table 4.15, the t-values are all significant on 1 percent level. It shows that all observed variables have significant positive effect on communication factor.

Table 4.15 The data analysis shows how each observed variable has effect on communication factor

Observed variable	Factor loading	Percentage	Rank	t-value
Q26	0.59	18.69	5	9.09**
Q27	0.60	19.00	3	9.50**
Q28	0.68	21.53	2	13.18**
Q29	0.69	21.89	1	10.76**
Q30	0.59	18.89	4	8.19**

(* Significant on 5 percent level, ** Significant on 1 percent level)

The top two important variables are in appearance attribute (Q29 and Q28). Thus, the beverage manufacturers give higher importance to the appearance of the packaging comparing to product communication.

4.3.5 Material characteristics factor (factor 5)

From literatures and interviews with experts in the industry, there are five observed variables that effect material characteristics factor.

From the correlation analysis in Table 4.16, the values are between 0.06 and 0.55. They are all lower than 0.90. Most of them are significant at the 0.01 and 0.05 level. This means there is no multi-collinearity between each variable with 99% and 95% confidence interval, respectively. However, one of them is not significant and need to be proved that multi-collinearity is not an issue. The tolerance values of observed variables Q31 to Q35 are between 0.57 and 0.82 (Appendix D). The variance inflation factor values are between 1.23 and 1.76 (Appendix D). Therefore, there is no multi-collinearity between each variable.

Table 4.16 The correlation analysis result of observed variables in material characteristics factor

Var.	Q31	Q32	Q33	Q34	Q35
Q31	1				
Q32	0.32**	1			
Q33	0.19*	0.47**	1		
Q34	0.06	0.28**	0.55**	1	
Q35	0.35**	0.41**	0.24**	0.43**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In Table 4.17, the t-values are all significant. Four of them are significant on 1 percent level and one of them is significant on 5 percent level. It shows that all observed variables have significant positive effect on material characteristics factor.

Table 4.17 The data analysis shows how each observed variable has effect on material characteristics factor

Observed variable	Factor loading	Percentage	Rank	t-value
Q31	0.17	5.56	5	2.09*
Q32	0.47	15.08	4	5.06**
Q33	1.17	37.70	1	7.43**
Q34	0.66	21.17	2	5.61**
Q35	0.64	20.49	3	6.19**

(* Significant on 5 percent level, ** Significant on 1 percent level)

The top two important variables are in environmental friendliness attribute (Q33 and Q34). Some beverage manufacturers might really concern about the environment. However, some beverage manufacturers may also concern about themselves as those variables give them some cost advantages.

4.3.6 Goodness of fit statistics

All sub-models have good values in all goodness of fit statistics as shown in Table 4.18.

Table 4.18 Goodness of fit statistics of the sub-models

Goodness of fit statistics	Recom-mended value	Model value				
		Containment	Protection & preservation	Convenience	Communication	Material characteristics
Chi-square (χ^2)	-	4.400	6.020	11.230	0.030	0.550
Degree of freedom (df)	-	6	7	23	1	2
χ^2/df	<2	0.733	0.860	0.488	0.030	0.275
P-value	>0.05	0.623	0.538	0.981	0.858	0.760
Root mean square error of approximation (RMSEA)	<0.05	0	0	0	0	0
Root mean square residual (RMR)	<0.05	0.017	0.046	0.033	0.001	0.014
Goodness of fit index (GFI)	>0.95	0.989	0.987	0.986	1	1
Adjusted goodness of fit index (AGFI)	>0.95	0.961	0.947	0.952	1	0.990
Normed fit index (NFI)	>0.95	0.990	0.990	0.990	1	1
Non-normed fit index (NNFI)	>0.95	1.010	1	1.030	1.020	1.050
Comparative fit index (CFI)	>0.95	1	1	1	1	1

4.4 Inferential analysis: packaging selective factors of non-alcoholic beverage manufacturer

From literatures, there are five main packaging selective factors that effect packaging selection of non-alcoholic beverage manufacture. The covariance matrix of each factor, which is used to calculate in LISREL, is the mean score of all observed variables in each factor.

4.4.1 Packaging selective factors

From the correlation analysis in Table 4.19, the values are between 0.47 and 0.75. They are all lower than 0.90 and significant at the 0.01 level. This means there is no multi-collinearity between each variable with 99% confidence interval.

Table 4.19 The correlation analysis result of packaging selective factor

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1				
Factor 2	0.61**	1			
Factor 3	0.66**	0.61**	1		
Factor 4	0.56**	0.47**	0.75**	1	
Factor 5	0.58**	0.65**	0.64**	0.57**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

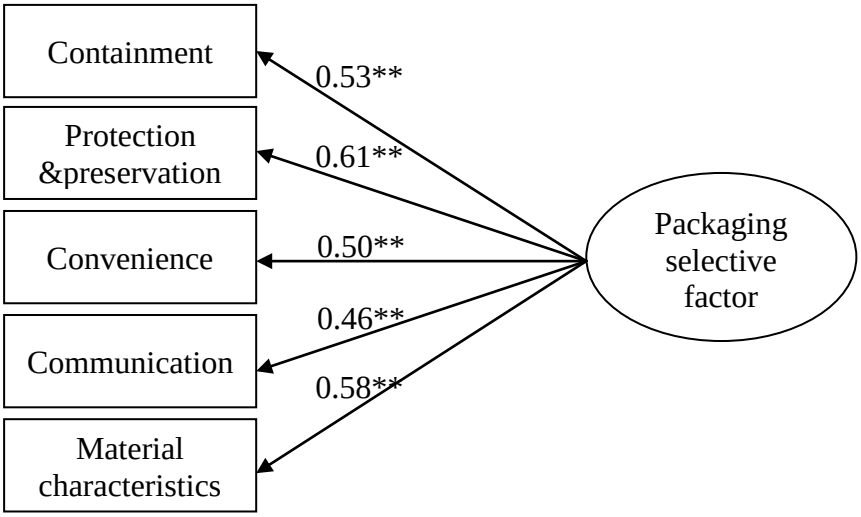
The result from LISREL shows in Table 4.20that the t-valuesof all factorsare significant on 1 percent level. Null hypothesis 1-5 are tested and supported. It means that all factors have significant positive effect on packaging selection.

Table 4.20 The percentage that each factor has positive effect on packaging selection of non-alcoholic beverage manufacturer

Packaging selective factor	Factor loading	Percentage	Rank	t-value
Containment	0.53	19.87	3	10.22**
Protection & preservation	0.61	22.81	1	9.68**
Convenience	0.50	18.63	4	9.99**
Communication	0.46	16.99	5	8.18**
Material characteristics	0.58	21.70	2	10.61**

(* Significant on 5 percent level, ** Significant on 1 percent level)

Figure 4.1 shows that protection and preservation factor has the highest effect on packaging selection with 22.81%. The next one is material characteristics factor with 21.70%, containment factor with 19.87%, convenience factor with 18.68%, and communication factor with 16.99%, respectively.



(* Significant on 5 percent level, ** Significant on 1 percent level)

Figure 4.1 The model of packaging selective factor of non-alcoholic beverage

In addition, the model has good value in all goodness of fit statistics as shown in Table 4.21.

Table 4.21 Goodness of fit statistics of the model

Goodness of fit statistics	Recommended value	Model value
Chi-square (χ^2)	-	3
Degree of freedom (df)	-	3
χ^2/df	<2	1
P-value	>0.05	0.392
Root mean square error of approximation (RMSEA)	<0.05	0
Root mean square residual (RMR)	<0.05	0.007
Goodness of fit index (GFI)	>0.95	0.990
Adjusted goodness of fit index (AGFI)	>0.95	0.950
Normed fit index (NFI)	>0.95	0.990
Non-normed fit index (NNFI)	>0.95	1
Comparative fit index (CFI)	>0.95	1

The most important factor in manufacturers' mind is the same as the food packaging theory. Berk says protection and preservation is "the most important among the functions of packaging and the barrier has a decisive effect on the shelf life of the product"(Berk, 2008).

The most important factor (protection and preservation) is the same as the research of Luangsa-ard(2008)and Prendergast (1996),if all functions in the researches are converted into packaging selective factor. The comparison is shown in Table 4.22. However, there is a difference in material characteristics factor. From research analysis, its importance is in the second rank after protection and preservation factor, while it has least important in those two researches. By looking at researches' detail, only few environmental friendly issues are raised. Therefore, result comparison between researches is different.

Table 4.22 Comparison of packaging selective factor

Packaging selective factor	This research's rank	Luangsa-ard's rank	Prendergast's rank
Containment	3	2	1
Protection & preservation	1	1	1
Convenience	4	3	4
Communication	5	4	3
Material characteristics	2	5	5

In addition, the current situation is quite changing from the past. Three main attributes of material characteristics factor gain more attention in the passing years.

The first one is about packaging cost of each material. Nowadays, there are even more packaging materials for beverage manufacturers to choose for their product. The cost of each material is different. The beverage manufacturers need to carefully choose the best that suit with their product as beverage industry is a big market with intense price competitiveness.

The second attribute is environmental friendliness. Nowadays, people have moreconcern on environment and the beverage manufacturers use an issue to promote their product. For instance, Thai Namthipcompany limited launched new packaging for its drinking water in 2012. The company claimed that its packaging is environmental friendly. Each bottle uses less plastic by one-third. It is hundred percent recyclable and can be crushed to destroy. This made a very great change in Thai beverage industry. Its brand awareness was jumping from nearly zero percent to 71 percent in a year (Matichon PLC, 2013) and the sales volume is twenty percent higher than the passing year (Piyabavornnant, 2013).

The last attribute is packaging standards which enforced by the law and regulation. There are more packaging standards that the beverage manufacturers have to follow. Those can be divided into many topics, such as material safety, label detail, and environment concern in some countries (Paklamjeak, 2013).

4.4.2 Packaging selective factors of different type of beverage

The data in questionnaire's respondents is also used to do multi-group analysis. Therefore, we can have more insights toward sub-group of beverage manufacturer. In this case, each group is separated by the type of beverage that the manufacturer uses to give opinion as shown in Table 4.23.

Table 4.23 The demographic of sub-group respondents by type of beverage

Type of beverage	Drinking water		Other beverages	
Participation in packaging selection	Number	Percent	Number	Percent
Respondent is packaging selector	39	55.71	8	13.33
Respondent takes part in packaging selection	31	44.29	52	86.67
Size of the company	Number	Percent	Number	Percent
Small enterprise (1-50 people)	61	87.14	28	46.67
Medium enterprise (51-200 people)	7	10.00	6	10.00
Large enterprise (201+ people)	2	2.86	26	43.33
Types of beverage	Number	Percent	Number	Percent
Drinking water	70	100.00	0	0.00
Other beverages	0	0.00	60	100.00
Sales	Number	Percent	Number	Percent
Domestic	61	87.14	42	70.00
International	9	12.86	18	30.00
Product net content	Number	Percent	Number	Percent
1-500 milliliters	16	22.86	58	96.67
501 milliliters (or more)	54	77.14	2	3.33

Table 4.23 (Continued) The demographic of sub-group respondents by type of beverage

Type of beverage	Drinking water		Other beverages	
Packaging material used	Number	Percent	Number	Percent
Metals	0	0.00	4	6.67
Glass	0	0.00	8	13.33
Paper	0	0.00	12	20.00
Polymers	70	70.00	36	60.00

From the correlation analysis in Table 4.24 and 4.25, the values are between 0.29 and 0.82. They are all lower than 0.90. Most of them are significant at the 0.01 level and one of them are significant at 0.05 level. This means there is no multi-collinearity between each variable with 99% and 95% confidence interval, respectively.

Table 4.24 The correlation analysis result of packaging selective factor of drinking water

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1				
Factor 2	0.58**	1			
Factor 3	0.73**	0.74**	1		
Factor 4	0.53**	0.29*	0.66**	1	
Factor 5	0.40**	0.55**	0.55**	0.51**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.25 The correlation analysis result of packaging selective factor of other beverages

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1				
Factor 2	0.71**	1			
Factor 3	0.59**	0.53**	1		
Factor 4	0.58**	0.66**	0.82**	1	
Factor 5	0.75**	0.76**	0.73**	0.63**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

From literature review, the different types of beverage might effect packaging selective factors of non-alcoholic beverage manufacturer. This can be proved by using multi-group function in LISREL. Therefore, the respondents are divided into two groups. The first group is 70 respondents who give answers for drinking water. The second group is 60 respondents who give answers for other beverages. Multi-group function is used to analyze and confirm that there are differences between each group.

The result from LISREL shows in Table 4.26 and 4.27that the t-values of all factors are significant on 1 percent level. Null hypothesis 6-15 are tested and they cannot be rejected.It means that all factors have significant positive effect on packaging selection.

Table 4.26 The percentage that each factor has positive effect on packaging selection of drinking water manufacturer

Packaging selective factor	Drinking water			
	Factor loading	Percentage	Rank	t-value
Containment	0.36	14.80	5	5.42**
Protection & preservation	0.71	29.19	1	6.73**
Convenience	0.49	20.12	2	7.08**
Communication	0.48	19.86	3	6.03**
Material characteristics	0.39	16.03	4	5.22**

(* Significant on 5 percent level, ** Significant on 1 percent level)

Table 4.27 The percentage that each factor has positive effect on packaging selection of other beverages manufacturer

Packaging selective factor	Other beverages			
	Factor loading	Percentage	Rank	t-value
Containment	0.60	19.47	3	7.59**
Protection & preservation	0.68	22.06	2	7.74**
Convenience	0.58	18.89	4	6.90**
Communication	0.54	17.42	5	5.87**
Material characteristics	0.68	22.16	1	8.48**

(* Significant on 5 percent level, ** Significant on 1 percent level)

From the analysis of drinking water in Table 4.26, it shows that protection and preservation factor has the highest effect on packaging selection with 29.19%. The next one is convenience factor with 20.12%, communication factor with 19.86%, material characteristics factor with 16.03%, and containment factor with 14.80%, respectively.

From the analysis of other beverages in Table 4.27, it shows that material characteristics factor has the highest effect on packaging selection with 22.15%. The next one is protection and preservation factor with 22.06%, containment factor with

19.47%, convenience factor with 18.89%, and communication factor with 17.42%, respectively.

The model also has good value in all goodness of fit statistics as shown in Table 4.28.

Table 4.28 Goodness of fit statistics of the model (comparing by type of beverage)

Goodness of fit statistics	Recommended value	Model value
Chi-square (χ^2)	-	0.010
Degree of freedom (df)	-	2
χ^2/df	<2	0.005
P-value	>0.05	0.996
Root mean square error of approximation (RMSEA)	<0.05	0
Root mean square residual (RMR) : drinking water	<0.05	0
Root mean square residual (RMR) : other beverages	<0.05	0.001
Goodness of fit index (GFI) : drinking water	>0.95	1
Goodness of fit index (GFI) : other beverages	>0.95	1
Normed fit index (NFI)	>0.95	1
Non-normed fit index (NNFI)	>0.95	1.040
Comparative fit index (CFI)	>0.95	1

Importance of each packaging selective factors of drinking water and other beverages are totally different. When the manufacturers develop drinking water, they give highest importance to protection and preservation factor. When it comes to non-alcoholic beverage other than drinking water, the manufacturers give almost equal importance to material characteristics and protection and preservation factor.

Important packaging selective factors of drinking water are very different from the main result. Most of drinking water respondents give their opinion toward product with net content higher than 500 milliliters and protection and preservation is the most importance factor. The next two most important factors are convenience and communication, which are customer-oriented. As the core value of drinking water is the quite similar for each brand. The manufacturers need to differentiate its product on the side function of convenience and attractiveness. In the mean time, material characteristics factor and containment factor are one that already has setting standards

in the industry. Therefore, the manufacturers just follow the norms and give them the least importance.

Important packaging selective factors of non-alcoholic beverage other than drinking water are very similar to the main result. 96.7% of beverage respondents give their opinion toward product with net content from 1-500 milliliters. Their most important packaging selective factors are material characteristics and protection and preservation. It shows that the beverage manufacturers concern on product itself before the consumer. The material characteristics is important to narrow down to specific packaging selection and protection and preservation is important to ensure the product at its best quality. Later, containment, convenience, and communication factors are what the manufacturers think about. While the first two factors are very important, the other three factors are also important for the manufacturers. We can see from the percentage that all five factors share nearly one-fifth of total score. Also, the highest and the lowest score are not more than 5 percent.

4.4.3 Packaging selective factors of different serving size

The data in questionnaire's respondents is used to do another multi-group analysis. In this case, each group is separated by the serving size of beverage that the manufacturer uses to give opinion as shown in Table 4.29.

Table 4.29 The demographic of sub-group respondents by serving size of beverage

Type of beverage	Single-serve beverage		Multi-serve beverage	
Participation in packaging selection	Number	Percent	Number	Percent
Respondent is packaging selector	22	29.73	25	44.64
Respondent takes part in packaging selection	52	70.27	31	55.36
Size of the company	Number	Percent	Number	Percent
Small enterprise (1-50 people)	42	56.76	47	83.93
Medium enterprise (51-200 people)	6	8.10	7	12.50
Large enterprise (201+ people)	26	35.14	2	3.57
Types of beverage	Number	Percent	Number	Percent
Drinking water	16	21.62	54	96.43
Other beverages	58	78.38	2	3.57
Sales	Number	Percent	Number	Percent
Domestic	54	72.97	49	87.50
International	20	27.03	7	12.50
Product net content	Number	Percent	Number	Percent
1-500 milliliters	74	100.00	0	0.00
501 milliliters (or more)	0	0.00	56	100.00
Packaging material used	Number	Percent	Number	Percent
Metals	4	5.40	0	0.00
Glass	8	10.81	0	0.00
Paper	12	16.22	0	0.00
Polymers	50	67.57	56	100.00

From the correlation analysis in Table 4.30 and 4.31, the values are between 0.32 and 0.82. They are all lower than 0.90. Most of them are significant at the 0.01 and 0.05 level. This means there is no multi-collinearity between each variable with 99% and 95% confidence interval, respectively. However, one of them is

not significant and need to be proved that multi-collinearity is not an issue. The tolerance values of factors in two groups are between 0.19 and 0.74 (Appendix D). The variance inflation factor values are between 1.35 and 5.29(Appendix D). Therefore, there is no multi-collinearity between each variable.

Table 4.30 The correlation analysis result of packaging selective factor of single-serve beverage

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1				
Factor 2	0.67**	1			
Factor 3	0.63**	0.57**	1		
Factor 4	0.59**	0.68**	0.82**	1	
Factor 5	0.68**	0.80**	0.70**	0.64**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.31 The correlation analysis result of packaging selective factor of multi-serve beverage

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1				
Factor 2	0.52**	1			
Factor 3	0.71**	0.70**	1		
Factor 4	0.48**	0.80	0.60**	1	
Factor 5	0.33*	0.32*	0.48**	0.41**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

From literature review, the different net contents of beverage might effect packaging selective factors of non-alcoholic beverage manufacturer. Therefore, the respondents are divided into two groups. The first group is 74 respondents who give

answers for single-serve beverage. The second group is 56 respondents who give answers for multi-serve beverage. Multi-group function is used toanalyze and confirm that there are differences between each group.

The result from LISREL shows in Table 4.32 and 4.33that the t-values of all factors are significant on 1 percent level. Null hypothesis 16-25 are tested and they cannot be rejected. It means that all factors have significant positive effect on packaging selection.

Table 4.32 The percentage that each factor has positive effect on packaging selection of single-serve beverage manufacturer

Packaging selective factor	Single-serve beverage			
	Factor loading	Percentage	Rank	t-value
Containment	0.52	17.33	4	7.42**
Protection & preservation	0.74	24.44	2	8.84**
Convenience	0.52	17.44	3	7.16**
Communication	0.49	16.30	5	6.13**
Material characteristics	0.74	24.49	1	10.15**

(* Significant on 5 percent level, ** Significant on 1 percent level)

Table 4.33 The percentage that each factor has positive effect on packaging selection of multi-serve beverage manufacturer

Packaging selective factor	Multi-serve beverage			
	Factor loading	Percentage	Rank	t-value
Containment	0.39	18.55	4	5.72**
Protection & preservation	0.51	24.07	2	5.71**
Convenience	0.52	24.75	1	9.06**
Communication	0.43	20.44	3	4.49**
Material characteristics	0.26	12.19	5	3.89**

(* Significant on 5 percent level, ** Significant on 1 percent level)

From the analysis of single-servebeverage in Table 4.32, it shows that material characteristics factor has the highest effect on packaging selection with 24.49%. The next one is protection and preservation factor with 24.45%, convenience factor with 17.44%, containment factor with 17.33%, and communication factor with 16.30%, respectively.

From the analysis of multi-servebeverage in Table 4.33, it shows that convenience factor has the highest effect on packaging selection with 24.75%. The next one is protection and preservation factor with 24.07%, communication factor with 20.45%, containment factor with 18.55%, and material characteristics factor with 12.19%, respectively.

The model also has good value in all goodness of fit statistics as shown in Table 4.34.

Table 4.34 Goodness of fit statistics of the model (comparing by serving size of beverage)

Goodness of fit statistics	Recommended value	Model value
Chi-square (χ^2)	-	6.580
Degree of freedom (df)	-	6
χ^2/df	<2	1.097
P-value	>0.05	0.362
Root mean square error of approximation (RMSEA)	<0.05	0.039
Root mean square residual (RMR) : single-serve beverage	<0.05	0.022
Root mean square residual (RMR) : multi-serve beverage	<0.05	0.006
Goodness of fit index (GFI) : single-serve beverage	>0.95	0.970
Goodness of fit index (GFI) : multi-serve beverage	>0.95	1
Normed fit index (NFI)	>0.95	0.980
Non-normed fit index (NNFI)	>0.95	0.990
Comparative fit index (CFI)	>0.95	1

Importance of each packaging selective factors of single-serve beverage and multi-serve beverage are totally different. When the manufacturers develop single-serve beverage, they give almost equal importance to material characteristics factor and protection and preservation factor. The summation of these two factors' percentage is almost equal to half importance of all packaging selective factor. When

it comes to multi-serve beverage, the manufacturers give almost equal importance to convenience factor and protection and preservation factor. Similarly, the summation of these two factors' percentage is almost equal to half importance of all packaging selective factor.

Important packaging selective factors of single-serve beverage are similar to the main result. From the data, 78.40% of single-serve beverage is non-alcoholic beverage other than drinking water. When the manufacturers think about their product, the first two important concerns are their product quality and their cost. After that, they will think about containment function, consumer's convenience, and product communication.

Important packaging selective factors of multi-serve beverage are very different from the main result. Most of multi-serve beverage respondents are drinking water manufacturer. As the product has high weight, the manufacturers have to consider both product quality and consumer's convenience. As drinking water is quite similar from one brand to the other, the manufacturers need to make a difference in consumers' mind toward convenience and communication factors. From the fact that drinking water is a product with price competitiveness, all manufacturers choose polymer as their packaging material as it costs less comparing to other material with similar packaging properties.

4.5 Result summary

This research is conducted to confirm factors that involved in selecting the packaging of non-alcoholic beverage manufacturer. There are five main factors to be considered, which are containment, protection and preservation, convenience, communication, and material characteristics.

From the inferential analysis, it shows that all five factors have positive effect on packaging selection of non-alcoholic beverage by the manufacturer. After they are supported, the analysis goes further to test whether those factors also have positive effect on packaging selection of specific non-alcoholic beverage and different size of non-alcoholic beverage. The analysis is shown to prove that all five factors also

have positive effect on packaging selection of different group of beverage as shown in Table 4.35. However, the importance is given to each factor differently from one group to another.

Table 4.35 Summary of hypothesis testing

Hypothesis	Factor	Description	Result
1	Containment	Positive effect on packaging selection of non-alcoholic beverage.	Supported
2	Protection & preservation		Supported
3	Convenience		Supported
4	Communication		Supported
5	Material characteristics		Supported
6	Containment	Positive effect on packaging selection of drinking water.	Supported
7	Protection & preservation		Supported
8	Convenience		Supported
9	Communication		Supported
10	Material characteristics		Supported
11	Containment	Positive effect on packaging selection of non-alcoholic beverage other than drinking water.	Supported
12	Protection & preservation		Supported
13	Convenience		Supported
14	Communication		Supported
15	Material characteristics		Supported
16	Containment	Positive effect on packaging selection of single-serve non-alcoholic beverage.	Supported
17	Protection & preservation		Supported
18	Convenience		Supported
19	Communication		Supported
20	Material characteristics		Supported
21	Containment	Positive effect on packaging selection of multi-serve non-alcoholic beverage.	Supported
22	Protection & preservation		Supported
23	Convenience		Supported
24	Communication		Supported
25	Material characteristics		Supported

CHAPTER V
MANAGERIAL IMPLICATION AND CONCLUSION

This chapter will describe the managerial implication from the data analysis in the previous chapter.

5.1 Managerial implication

By looking at the factor loading of each packaging selective factor of beverage manufacturer, it is clearly separated into two main groups. The first group is the factors that have direct effect to the beverage manufacturer. The second group is the factors that have effect to both beverage manufacturer and consumer.

5.1.1 Packaging selective factors that have direct effect to the beverage manufacturer

There are three packaging selective factors that beverage manufacturer give more importance when selecting their packaging. They are protection and preservation factor, material characteristic factor, and containment factor. It might imply that when they start developing a new product, they think about themselves before the consumer.

5.1.1.1 Protection and preservation factor - There are seven significant variables in this factor. The most important variables are in protection attribute. The beverage manufacturers give the highest importance to physical protection of their beverage as it is the most visible product condition. Different material gives different advantages toward protection and preservation of the product. Most packaging nowadays is usually developed from four kinds of materials, which is metals, glass, paperboard, and polymer. Each of them has different properties and can be tested by different standards.

5.1.1.2 Containment factor - There are six significant variables in this factor. The first two important variables are the attributes of pack/unpack and transport. The beverage manufacturer needs to have clear information on how their products are stored, transported, distributed and sold because this information needs to be used in the process of product development. Product with different methods of transportation requires different packaging condition. The required information is, for example, the shipping method, the process of transportation, the number of times needed for loading, and the storage method.

5.1.1.3 Material characteristics - There are five significant variables in this factor. The first two important variables are in environmental friendliness attribute. In 2010, the global trend of green packaging was growing around 20-30 percent (Paklamjeak, 2013). Many companies use this as their marketing strategy to attract customers. Meanwhile, the companies also gain some cost advantages from developing environmental friendly packaging. Some beverage containers are changed, for example, using plastic bottle or lamination bag instead of glass bottle, using recycled material, using soy printing ink, and using compostable bioplastic.

5.1.2 Packaging selective factors that have effect to both beverage manufacturer and consumer

There are two packaging selective factors that beverage manufacturer gives less importance when selecting their packaging. They are communication factor and convenience factor.

5.1.2.1 Communication factor - There are five significant variables in this factor. The first two important variables are in appearance attribute. Thus, the beverage manufacturers give higher importance to the appearance of the packaging comparing to product communication.

It conforms to the product shelf test which normally consists of 6 questions. “The first question is how fast or how easy can the product be seen among several brands. The second question is if the product is outstanding among several brands. The third question is if the product is unique or different from others. The forth question is if the packaging can communicate identity and details of the product.

The fifth question is how the product is satisfied. The last question is if the person has intention to buy" (Paklamjeak, 2013).

5.1.2.2 Convenience factor - There are ten significant variables in this factor. The top three important variables are in the attribute of consumption. It conforms to the trends nowadays that the consumers need product that suits their lifestyle. According to Paklamjeak (2013), convenient trends for consumption are now in three major topics. The first one is product in smaller size for consumer to bring it on-the-go. The second one is packaging which can be opened easier. The third one is packaging which is easy to hold and also reclosable.

5.1.3 Managerial implication for beverage manufacturer

When the beverage manufacturer plans to have a new product development, packaging selection is one of important thing to be considered. This research describes how others in the industry give importance to each packaging selective factors. The top three important factors that have direct effect to the manufacturer and need to be thoroughly considered are protection and preservation factor, material characteristic factor, and containment factor, respectively. The other two factors that have effect to both manufacturer and consumer are convenience factor and communication factor. In addition, different beverage type also has different priority toward factors.

5.1.4 Managerial implication for packaging supplier

When the packaging supplier plans to launch a new product, it is important to have insights about the customer needs. Knowing packaging selective factors of non-alcoholic beverage manufacturer will give the supplier a clearer focus on its product. In the competitive market, one may not be able to serve the customer needs in all aspects. With limited resource, one might choose to focus the most important aspect in customer mind. If there are 2 similar packaging products for the customer, one that can serve more important factors will definitely have higher chance of being selected.

5.2 Conclusion

This research has studied about the packaging selective factor of non-alcoholic beverage manufacturer. The objective is to confirm significant factor that effect packaging selection. Questionnaires are launched to collect data from 130 non-alcoholic beverage manufacturers in Thailand. The hypotheses are tested and supported. Therefore, packaging selection comprises of five important factors respectively, protection and preservation, material characteristic, containment, convenience, and communication. The research also has sub-group analysis. The results show that different types of beverage, which are drinking water and other beverages in this research, and different serving sizes of beverage, which are single-serve beverage and multi-serve beverage in this research, effect the important level of each packaging selective factor.

5.2.1 Recommendation for future research

This research is conducted with non-alcoholic beverage manufacturers. The sub-group analysis is done through different type of beverage (drinking water and other beverages) and different serving size (single-serve and multi-serve beverage). By conducting a research with more specific scope of respondents, the result may give better insights toward focused industry and market.

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APPENDICES

APPENDIX A

Item-objective congruence index

Observed variable	Judgement			IOC
	Ex-pert1	Ex-pert2	Ex-pert3	
Q01: Packaging can be easily packed for storage.	1	1	1	1.00
Q02: Packaging can be stored easily.	1	1	1	1.00
Q03: Packaging can be transported easily.	1	1	1	1.00
Q04: Packaging can be easily distributed to the wholesaler and retailer.	1	1	1	1.00
Q05: Packaging can be easily unpacked for retailing.	1	1	1	1.00
Q06: Packaging can be retailing easily.	1	1	1	1.00
Q07: The product will not be deteriorated before expire date.	1	1	1	1.00
Q08: Packaging has good transport properties.	1	0	1	0.67
Q09: Packaging has good optical properties.	1	1	1	1.00
Q10: Packaging has good mechanical properties.	1	0	1	0.67
Q11: Packaging has good chemical reactivity.	1	1	1	1.00
Q12: It is active packaging.	1	1	1	1.00
Q13: It is controlled / modified atmosphere packaging.	1	0	1	0.67
Q14: Packaging is in appropriate size and shape for consumer.	1	1	1	1.00
Q15: Packaging has appropriate net content for consumer.	1	0	1	0.67

Observed variable	Judgement			IOC
	Ex-pert1	Ex-pert2	Ex-pert3	
Q16: Packaging is in spill resistance shape.	1	1	1	1.00
Q17: It is portable packaging.	1	1	1	1.00
Q18: Packaging can be opened easily.	1	1	1	1.00
Q19: It is reclosable packaging.	1	1	1	1.00
Q20: Packaging is microwavable or can be stored in freezer.	1	1	1	1.00
Q21: Packaging has good machinability.	1	0	1	0.67
Q22: Packaging can work well with hot-filled / cold-filled process.	1	0	1	0.67
Q23: Packaging can keep hot / cold beverage temperature for a long time.	1	0	1	0.67
Q24: Consumer can drink it directly from the packaging (utensil free).	1	1	1	1.00
Q25: Packaging can be disposed easily.	1	1	1	1.00
Q26: Packaging can advertise or inform details of the product.	1	1	1	1.00
Q27: Packaging can represent identity of the product.	1	1	1	1.00
Q28: Packaging has a good appearance.	1	1	1	1.00
Q29: Packaging is in modern style.	1	0	1	0.67
Q30: Packaging looks different from others.	1	0	1	0.67
Q31: When using a particular packaging material, the total cost of material is lower than using the other packaging material.	1	1	1	1.00
Q32: When using a particular packaging material, the total packaging used is less than using the other packaging material.	1	1	1	1.00
Q33: It is reusable packaging.	1	0	1	0.67

Observed variable	Judgement			IOC
	Ex-pert1	Ex-pert2	Ex-pert3	
Q34: It is recyclable packaging.	1	1	1	1.00
Q35: Packaging passes the packaging laws and regulations.	1	0	1	0.67

APPENDIX B

<u>แบบสอบถามเพื่อการวิจัย</u>

องค์ประกอบด้านคุณลักษณะที่มีอิทธิพลต่อการเลือกใช้
บรรจุภัณฑ์ของอุตสาหกรรมเครื่องดื่มที่ไม่มีแอลกอฮอล์

ผู้วิจัย นางสาวศรินดา วงศ์โกศลสุข

นักศึกษาปริญญาโท คณะวิศวกรรมศาสตร์ สาขาวิศวกรรมอุตสาหการ มหาวิทยาลัยมหิดล

คำชี้แจง

แบบสอบถามชุดนี้จัดทำขึ้น เพื่อรวบรวมข้อมูลสำหรับการวิจัยเรื่อง “ องค์ประกอบด้านคุณลักษณะที่มีอิทธิพลต่อการเลือกใช้บรรจุภัณฑ์ของอุตสาหกรรมเครื่องดื่มที่ไม่มีแอลกอฮอล์ ” โดยการวิจัยครั้งนี้มีวัตถุประสงค์ เพื่อระบุองค์ประกอบด้านคุณลักษณะที่มีอิทธิพลต่อการเลือกใช้บรรจุภัณฑ์ของอุตสาหกรรมดังกล่าว

ดังนั้น จึงขอความร่วมมือของท่านในการตอบแบบสอบถามฉบับนี้ตามความเป็นจริง โดยข้อมูลที่ท่านตอบ จะถูกเก็บเป็นความลับและจะไม่ส่งผลกระทบใดๆ ต่อท่านและหน่วยงานของท่าน เนื่องจากข้อมูลที่นำเสนอในผลงาน วิจัยจะนำเสนอในภาพรวม และจะใช้ข้อมูลเพื่อประโยชน์ในการวิจัยเท่านั้น

แบบสอบถาม แบ่งออกเป็น 3 ส่วน ดังนี้ ส่วนที่ 1 ข้อมูลเกี่ยวกับผู้ตอบแบบสอบถามและข้อมูลองค์กร ส่วนที่ 2 ข้อมูลเกี่ยวกับผลิตภัณฑ์ขององค์กร ส่วนที่ 3 การให้ความสำคัญกับองค์ประกอบด้านคุณลักษณะที่มีอิทธิพลต่อการเลือกใช้บรรจุภัณฑ์

ขอความกรุณาท่านได้โปรดตอบแบบสอบถามและส่งกลับมายังผู้วิจัย ภายในวันที่ 3 พฤษภาคม 2556 ผู้วิจัย ใคร่ขอขอบพระคุณล่วงหน้ามา ณ โอกาสนี้

หากท่านมีปัญหาหรือข้อสงสัยประการใดเกี่ยวกับแบบสอบถามชุดนี้ โปรดติดต่อข้าพเจ้า นางสาวศรินดา วงศ์โกศลสุข โทรศัพท์ 086-5469369 หรือ อีเมล์ tg_sandy@yahoo.com

โปรดกรอกรายละเอียดให้ครบถ้วนและกาเครื่องหมาย X หน้าข้อที่ตรงกับท่าน

ส่วนที่ 1 ข้อมูลเกี่ยวกับผู้ตอบแบบสอบถามและข้อมูลองค์กร

1. ท่านมีส่วนเกี่ยวข้องอย่างไรบ้างกับการเลือกบรรจุภัณฑ์เครื่องดื่มขององค์กร

◯ เป็นผู้ตัดสินใจเลือกใช้ ◯ เป็นผู้มีส่วนในการตัดสินใจเลือกใช้

◯ ไม่มีส่วนในการตัดสินใจเลือกใช้

2. จำนวนพนักงานในองค์กรของท่านคือเท่าใด

◯ 1 – 50 คน ◯ 51 – 100 คน ◯ 101 – 150 คน ◯ 151 – 200 คน

◯ 201 คนขึ้นไป

ส่วนที่ 2 ข้อมูลเกี่ยวกับผลิตภัณฑ์ขององค์กร

โปรดเลือกผลิตภัณฑ์เครื่องดื่มหลักขององค์กรท่านขึ้นมา 1 รายการและตอบคำถามดังต่อไปนี้

3. โปรดระบุประเภทของผลิตภัณฑ์เครื่องดื่มดังกล่าว (เลือกเพียง 1 ข้อ)

◯ น้ำดื่ม ◯ น้ำแร่ ◯ ชา ◯ กาแฟ

◯ น้ำนมถั่วเหลือง ◯ เครื่องดื่มเกลือแร่ ◯ ผลิตภัณฑ์นมจากสัตว์

◯ เครื่องดื่มที่มีหรือทำจากผลไม้ พืช หรือผัก (โปรดระบุชนิด _____)

◯ เครื่องดื่มที่มีหรือทำจากส่วนผสมที่ไม่ใช่ผลไม้ พืช หรือผัก (โปรดระบุชนิด _____)

4. ผลิตภัณฑ์ของท่านมีการส่งออกขายต่างประเทศหรือไม่

◯ ไม่มี ◯ มี

ถ้ามี กรุณาเลือกทวีปที่มีการส่งออกผลิตภัณฑ์ (เลือกได้มากกว่า 1 ข้อ)

◯ เอเชีย ◯ ยุโรป ◯ โอเชียเนีย

◯ อเมริกาเหนือ ◯ อเมริกาใต้ ◯ แอฟริกา

5. ปริมาณบรรจุของผลิตภัณฑ์ดังกล่าวคือเท่าใด (ตอบเพียง 1 คำตอบ) _____ (หน่วยเป็น กรัม/มล./ซี.ซี.)

6. ราคาขายปลีกของผลิตภัณฑ์เครื่องดื่มดังกล่าวคือเท่าใด _____ บาท

7. ผลิตภัณฑ์ดังกล่าวถูกบรรจุอยู่ในบรรจุภัณฑ์ประเภทใด

◯ เหล็ก/อลูมิเนียม ◯ แก้ว ◯ กระดาษ ◯ พลาสติก

ส่วนที่ 3 การให้ความสำคัญกับองค์ประกอบด้านคุณลักษณะที่มีอิทธิพลต่อการเลือกใช้บรรจุภัณฑ์

องค์ประกอบด้านคุณลักษณะที่มีอิทธิพลต่อการเลือกใช้บรรจุภัณฑ์ หมายถึง ลักษณะหรือข้อดีของตัวบรรจุภัณฑ์ที่ส่งผลต่อการเลือกใช้งาน ซึ่งไม่รวมถึง การคัดเลือกผู้ผลิตบรรจุภัณฑ์

โปรดให้ระดับความสำคัญกับองค์ประกอบต่างๆ ที่มีอิทธิพลต่อการเลือกใช้บรรจุภัณฑ์สำหรับผลิตภัณฑ์ที่ท่านได้ระบุไว้ในส่วนที่ 2

หากองค์ประกอบใดไม่มีความเกี่ยวข้องกับการเลือกใช้บรรจุภัณฑ์ของท่าน ให้ถือเป็นระดับความสำคัญน้อยที่สุด

องค์ประกอบด้านการบรรจุ (เพื่อการดำเนินการในห่วงโซ่อุปทาน)			ระดับความสำคัญของแต่ละองค์ประกอบ				
			น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
1	บรรจุภัณฑ์มีลักษณะ	ที่ง่ายต่อการบรรจุรวมเป็นแพ็คเพื่อการจัดเก็บ					
2		ที่ง่ายต่อการจัดเก็บ เช่น วางซ้อนได้ ทำความสะอาดง่าย					
3		ที่ง่ายต่อการขนส่งในลักษณะต่างๆ เช่น ทางบก ทางน้ำ ทางอากาศ					
4		ที่ง่ายต่อการกระจายสินค้าไปยังผู้ขายส่งและผู้ขายปลีก					
5		ที่ง่ายต่อการแยกจากแพ็คเพื่อการขายปลีก					
6		ที่ง่ายต่อการขายปลีก เช่น วางในชั้นได้สะดวก ไม่กินที่					

องค์ประกอบด้านการป้องกันและรักษาสภาพ			ระดับความสำคัญของแต่ละองค์ประกอบ				
			น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
1	เครื่องดื่มไม่เสื่อมสภาพลงก่อนวันหมดอายุที่กำหนดไว้						
2	บรรจุภัณฑ์	สามารถป้องกันการซึมผ่านของของเหลวและก๊าซ					
3		สามารถป้องกันการสัมผัสแสง/กระทบแสง					
4		สามารถปกป้องสภาพผลิตภัณฑ์ไม่ให้เสียหาย					
5		ไม่เกิดปฏิกิริยาทางเคมีที่ไม่พึงประสงค์ เช่น สารเคมีของบรรจุภัณฑ์ปนเปื้อนลงไปในเครื่องดื่ม					
6		สามารถช่วยปรับสภาพบรรยากาศภายในบรรจุภัณฑ์ เช่น ดูดความชื้น (Active Packaging)					
7		สามารถช่วยควบคุม/ดัดแปลงส่วนประกอบของบรรยากาศภายในบรรจุภัณฑ์เพื่อยืดอายุเครื่องดื่ม (Controlled/Modified Atmosphere Packaging)					

องค์ประกอบด้านความสะดวก			ระดับความสำคัญของแต่ละองค์ประกอบ				
			น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
1	บรรจุภัณฑ์	มีขนาดและรูปทรงที่เหมาะกับการบริโภคของลูกค้า					
2		มีปริมาณบรรจุที่เหมาะกับการบริโภคของลูกค้า					
3		มีลักษณะรูปทรงที่มั่นคง/ป้องกันการหก					
4		มีขนาด รูปทรง และลักษณะที่พกพาสะดวก					
5		สามารถเปิดได้ง่าย					
6		สามารถเปิดและปิดซ้ำได้					
7		สามารถเข้าไมโครเวฟได้/เข้าช่องฟรีซได้					
8		สามารถใช้งานได้ดีกับเครื่องบรรจุอัตโนมัติ					
9		สามารถทนต่อการบรรจุเครื่องดื่มที่มีอุณหภูมิร้อน/เย็น					
10		สามารถกักเก็บอุณหภูมิร้อน/เย็นไว้ได้นาน					
11	ผู้บริโภคสามารถ	ดื่ม/ทานได้เลยจากบรรจุภัณฑ์					
12		ทิ้ง/กำจัดขยะส่วนที่เหลือหลังการบริโภคแล้วได้ง่าย					

องค์ประกอบด้านการสื่อสาร			ระดับความสำคัญของแต่ละองค์ประกอบ				
			น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
1	บรรจุภัณฑ์	สามารถโฆษณา/ให้ข้อมูลของผลิตภัณฑ์ได้					
2		สามารถบ่งบอกตัวตนของผลิตภัณฑ์ เช่น เป็นผลิตภัณฑ์ประเภทใด ยี่ห้อใด					
3		มีรูปลักษณ์ที่สวยงาม					
4		มีรูปลักษณ์ที่สื่อถึงความทันสมัย					
5		มีรูปลักษณ์ที่แปลกใหม่					

	องค์ประกอบด้านลักษณะของวัสดุบรรจุภัณฑ์	ระดับความสำคัญของแต่ละองค์ประกอบ				
		น้อยที่สุด	น้อย	ปานกลาง	มาก	มากที่สุด
1	ราคาต้นทุนที่แตกต่างกันของแต่ละวัสดุบรรจุภัณฑ์ เช่น หากเลือกใช้แก้วจะมีต้นทุนรวมในการใช้งานที่สูงกว่าพลาสติก (ต้นทุนวัสดุ, การจัดเก็บ, การขนส่ง, ฯลฯ)					
2	บรรจุภัณฑ์ดังกล่าวส่งผลให้มีการใช้ทรัพยากร/วัสดุเพื่อการบรรจุโดยรวม ในปริมาณน้อย (Reduce)					
3	บรรจุภัณฑ์สามารถนำมาใช้ซ้ำได้ เช่น นำไปทำความสะอาดและนำกลับมาใช้ใหม่ หรือ นำไปใช้ประโยชน์ในการบรรจุสิ่งอื่น (Reuse)					
4	บรรจุภัณฑ์สามารถนำกลับไปรีไซเคิลได้ เช่น นำกลับไปหลอมละลายเพื่อสร้างผลิตภัณฑ์ใหม่ (Recycle)					
5	บรรจุภัณฑ์ดังกล่าวผ่านกฎหมายและมาตรฐานด้านบรรจุภัณฑ์ เช่น อย., มอก.					
6	บรรจุภัณฑ์ดังกล่าวได้ประโยชน์ด้านภาษีบรรจุภัณฑ์ (สำหรับผลิตภัณฑ์ส่งออกเท่านั้น)					
7	บรรจุภัณฑ์ดังกล่าวได้ประโยชน์เหนือการกีดกันทางการค้าในส่วนที่ไม่ใช่ภาษี (สำหรับผลิตภัณฑ์ส่งออกเท่านั้น)					

--- จบแบบสอบถาม ---

APPENDIX C

Test of reliability by using the Cronbach's alpha coefficient

SUM ITEM VARS	29.69
TEST MEAN	138.08
TEST STD. DEV.	17.99
TEST VAR.	323.70
K (# ITEMS)	35.00
K-1	34.00
CRONBACH'S ALPHA	0.94
Standard Error of Measurement = (Std.Dev. of test)(Sq.Root of 1-Cronbach's alpha)	4.59
95% C.I. for 1st person (upper limit) =	162.99
95% C.I. for 1st person (lower limit) =	145.01
95% C.I. for 10th person (upper limit) =	138.99
95% C.I. for 10th person (lower limit) =	121.01
95% C.I. for 20th person (upper limit) =	153.99
95% C.I. for 20th person (lower limit) =	136.01
95% C.I. for a person scoring at the test mean (upper limit) =	147.07
95% C.I. for a person scoring at the test mean (lower limit) =	129.09

APPENDIX D

The tolerance values and the variance inflation factor values of observed variables Q14 to Q25

Model	Collinearity	
	Tolerance	VIF
Convenience1	0.31	3.22
Convenience2	0.28	3.51
Convenience3	0.49	2.05
Convenience4	0.35	2.86
Convenience5	0.30	3.36
Convenience6	0.38	2.66
Convenience7	0.58	1.73
Convenience8	0.57	1.76
Convenience9	0.54	1.86
Convenience10	0.42	2.39
Convenience11	0.58	1.73
Convenience12	0.47	2.12

The tolerance values and the variance inflation factor values of observed variables Q30 to Q35

Model	Collinearity	
	Tolerance	VIF
Material charactertistics1	0.82	1.23
Material charactertistics2	0.66	1.52
Material charactertistics3	0.57	1.76
Material charactertistics4	0.58	1.74
Material charactertistics5	0.65	1.55

The tolerance values and the variance inflation factor values of packaging selective factors of multi-serve beverage

Model	Collinearity	
	Tolerance	VIF
Containment	0.49	2.04
Protection and Preservation	0.32	3.11
Convenience	0.19	5.29
Communication	0.39	2.57
Material characteristics	0.74	1.35

BIOGRAPHY

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