

# Role of Green Marketing in the Adoption of Intelligent Food Containers

by

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## **Abstract**

The growing human population is causing food security concerns in many countries. As food security is the access by all people to enough food to live a healthy and productive life, the world must reduce food waste. At the consumer level, households are responsible for half of the total avoidable losses due to food becoming out-of-date, developing bad smell or taste, or having been forgotten in the fridge. This study investigates the factors leading to consumer adoption of intelligent food containers (IFC) – an emerging technology that can store food, monitor food quality and minimize food waste. In particular, the study focuses on the role of companies' green marketing in affecting consumers' willingness to adopt IFC. So doing, the study develops and tests a research model and related hypotheses by using the partial least squares structural equation modeling approach. The model was constructed based on the integration of Technology Adoption Model (TAM) with green marketing. An online survey was used to collect data from 153 households in Canada. The results suggest that improved TAM with the addition of green marketing mix is useful in explaining consumers' purchase intention toward IFC. The findings provide valuable information to marketers in the packaging technology sector to help them convince eco-friendly segment to purchase IFCs and enhance the pro-environmental purchasing behavior in Canada.

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## **Glossary**

- Food security is “access by all people to enough food to live a healthy and productive life”. Food security exists when “all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life”.
- Food quality refers to the quality characteristic of food which is acceptable to consumers. This includes “external factors such as appearance (size, shape, color, gloss, and consistency), texture, flavor, and internal (chemical, physical, microbial)”.
- Food safety is “a scientific discipline describing handling, preparation, and storage of food in ways that prevent foodborne illness”. Also, food safety can include “nutritional quality, chemical and microbiological safety and concerns regarding particular food and food processes”.
- Food waste or food loss refers to uneaten food which is discarded.
- Intelligent food container (IFC) is “science and technology that use the packaging system's communication function to facilitate decision making by monitoring changes in the internal and external environments and communicating the conditions of the packaged food product”.
- Green consumers are “those who avoid products that are likely to endanger the health of the consumer or others; cause significant damage to the environment during manufacture and use of disposal; consume a disproportionate amount of

energy; cause unnecessary waste, and use materials derived from threatened species or environments”.

- Green marketing is the marketing of products that are “presumed to be environmentally safe or process of selling goods and services based on their environmental benefits”.
- Green (ethical) consumerism is “the practice of purchasing products and services produced in a way that minimizes social and environmental damage while avoiding goods and services deemed to have an adverse impact on society or the environment”.
- Technology adoption is “the adoption or acceptance of a new technology or innovation, according to the demographic and psychological characteristics of defined adopter groups”.
- Green purchasing behavior is “the act of consuming products that are conservable, beneficial for the environment, and responding to environmental concern”.
- Behavior refers to “the manifest, observable response in a given situation concerning a given target”.
- Intention is an individual’s readiness to perform a particular action.
- Perceived Usefulness (PU) is “the degree to which a person believes that using a particular system would enhance his or her job performance”.
- Perceived Ease of Use (PEOU) is “the degree to which a person believes that using a particular system would be free of effort”.

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# 1 Chapter: Introduction

## 1.1 Background

The explosive growth in the worldwide population will require a minimum of 77 percent increase in global food preparation by 2050 (Verghese et al., 2013). Simultaneously, natural resources are becoming more and more limited, and they should be applied efficiently and sustainably. Sustainable development is commonly referred to something that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Imperatives, 2008, p.39). It means we need to produce more with less, increase productivity, and reduce waste (Clay, 2016).

In total, one-third of the globally produced food gets lost or wasted. This means 1.3 billion tons of food a year (FAO, 2013a) while at the same time 842 million people in the world suffer from undernourishment (FAO, IFAD, & WFP, 2013). Food waste is acknowledged as a problem that needs to be solved. It represents a waste of valuable production resources (e.g. land, water), it causes increased greenhouse-gas (GHG) emission through production, processing, and disposal; and it contributes to world hunger as food is wasted instead of delivered to the ones in need (Hocke, 2014).

Food packaging plays a critical role in securing food system by maintaining food quality, improving safety, and reducing food waste (Verghese et al., 2013). However, inappropriate packaging design can contribute up to 50 percent food waste, especially in developing countries (Opara, 2013). As traditional design and production methods for food packaging have become less useful and suitable, the need for novel design and production approach arises. Therefore, food packaging industry is increasingly forced by

consumers and governmental organizations to bring novel and emerging packaging technologies to revolutionize the traditional packaging limitation (Vanderrost, 2017). As a result, numerous innovative packaging technologies have been launched within the last decades. These new packaging technologies can resolve consumers demand for food quality, food safety, food waste, and package reuse and recycling (Chen et al., 2013).

Intelligent food containers (IFC) will be other outcomes of these novel packaging technologies. IFC will be developing as a response to consumers' demands or industrial production trends towards preserved, fresh, and tasty food with extended shelf-life (Biji et al., 2015). In fact, these sustainable containers will provide consumers' requirements of containing and protecting products with minimum packaging effects on the environment. IFC which involved intentional interaction with the food or its surroundings and influenced consumer's health will be a considerable innovation in the field of packaging technology compared to previous traditional packaging system.

However, not all innovative packaging concepts show steady market behavior. In spite of the benefits that the IFC technology will provide, some doubt has been cast upon the acceptance and adoption of this technology by consumers in the market (Chen et al., 2013, Dainelli et al., 2008, Ghaani et al., 2016; Aday & Yener, 2015). For example, previous research shows that in western countries active and smart packaging techniques have been adopted quite slow (Ahvenainen & Hurme, 1997)

If the success of a new technology is indicated by "acceptance" (DeLon & McLean, 1992; Prasad & Kochhar, 2014), research studies are needed both in domestic and foreign markets in order to evaluate consumer attitude and behavior toward that new technology (Ahvenainen & Hurme, 1997; Chen et al., 2013). For example, regarding intelligent

packaging, food industries have been partly reluctant to invest in a new packaging concept because of two reasons. The first reason is related to the cost of highly specialized and sophisticated technologies used in this packaging which is simply not affordable for most of the consumers. The second reason is consumer acceptance since consumers often do not perceive the substantial benefits of a new packaging technology. For instance, when some consumers believe that food with shorter shelf-life is fresher, an intelligent packaging concept (like oxygen scavengers) which would extend the shelf-life may not be seen attractive and reliable. As a result, the development and implementation of intelligent packaging will depend on the acceptance and cost-effectiveness for industry and consumers (Prasad & Kochhar, 2014). So, the conservative behavior of consumers is a key point that still needs to be addressed (Dainelli et al., 2008, Chen et al., 2013).

By having enough knowledge about the consumers' prejudices and fears, as well as expectations and the marketing requirements, food industries would be more successful in introducing new technologies (Ahvenainen & Hurme, 1997; Childers et al., 2001; Kulviwat et al., 2007). Moreover, a better demonstration and presentation of product efficacy, safety and benefits will increase consumers' awareness and consequently the number of products launched onto the market (Dainelli et al., 2008). In fact, a better understanding of consumers' purchase intention can help to minimize rejection of a novel technology (Vanderroost et al., 2017).

In the meantime, because of progressive increase in consumer environmental consciousness, their demand for more environmentally friendly packaging techniques is increased (Hartmann & Apaolaza Ibáñez, 2006). Food industries view this phenomenon as offering business opportunities and try to make their innovative packaging more

sustainable and environmental friendly (EF). However, despite evidence shows society sensitivity towards the environment, many EF products have achieved disappointingly low levels of market share (Young et al., 2010). Although some research has suggested that the higher level of environmental concerns cause the more likely to engage in EF behavior (Antil, 1984; Roberts, 1991; Sheltzer et al., 1991; Shabecoff, 1993), a number of studies do not fully support the above and there is often a gap between attitude and behavior. For example, a 1991 study by Simmons Market Research Bureau's (SMRB) demonstrated a low correlation between environmental concern and consumers' EF behavior. Furthermore, research carried out by Kleiner (1991), Schlossberg (1991), and Winski (1991) conducted that there is little evidence to support the relationship between positive attitudes towards environmental issues and actual purchase behavior. In fact, most of the consumers "will not sacrifice their needs or desires just to be green" (Ginsberg & Bloom, 2004, p. 79). As a result, figuring out the determinants which influence intention for green products for the mass market rather than just for the green consumer segment would be beneficial for firms (Boztepe, 2016).

Over the years, various explanatory theories have been used to explain consumer EF behavior. For instance, social sciences like psychology, sociology, or economics are one of the drivers. The other one is related to the effects of marketing variables as external stimuli, such as advertising, physical product differentiation, packaging, promotion, retail availability, and so on (Ehrenberg and Goodhart, 1979; Kalafatis et al, .1999; Hartmann & Apaolaza Ibáñez, 2006; Nguyen et al., 2015). While "profit-making" is still more important than "social value" for many firms (Prothero & Fitchett, 2000), some businesses believe that building social value is a way of improving their overall

performance (Porter & Kramer, 2006). As a balanced approach, these businesses combine the profit motive with social responsibility (Wymer & Polonsky, 2015). They consider green marketing as a solution for enhancing consumers' EF behavior as well as confronting the environmental problems (Prothero et al., 2010; Kharde, 2016; Singal et al., 2013). Thus, it is considered as a win-win situation—both business and the environment benefit. However, the issue becomes, then, to what extent green marketing can serve as a vehicle in consumer adoption of new EF products and solving environmental problems (Wymer & Polonsky, 2015). A successful marketing system depends on effective combination of the marketing mix components with each other, the consumer needs, and the environmental forces (Khodaparasti et al., 2015; Kiran, 2012, Kharde, 2016; Ulfah et al., 2016; Astuti et al., 2015; Alipour et al., 2012).

Research gaps that call for this study are categorized as 1) whether the technology acceptance model (TAM) which has been commonly used in studying the adoption of new technologies can explain customers' acceptance and adoption of a new packaging technology like IFC? 2) what factors do exactly promote or hinder the diffusion of an EF product such as IFC technology? (Biji et al., 2015; Majid et al., 2016; Verghese et al., 2013; Ghaani et al., 2015; Aday & Yener, 2015; Chen et al., 2013). 3) what role does companies' green marketing play in consumers' adoption of a new technology like IFC? (Souar et al., 2015; Khodaparasti et al., 2015). Finally, 4) whether the influence of green marketing varies between countries because of differentiation between customers' pro-environmental attitude? (Lazaro, 1993; Tantawi et al., 2009). So, this study combines all these research gaps in order to understand the adoption of this new technology by food consumers and to explore the factors which affect consumers' purchase intention. In

conclusion, this research is designed to test the appropriateness of the TAM within the domain of green marketing.

## **1.2 Purpose**

The overall purpose of this study is to investigate consumers' adoption of IFC by identifying marketing mix elements that influence their purchase intention and by highlighting the most important factors to determine the appropriate marketing strategy in the packaging technology sector. The specific objective of this study is to investigate what role does companies' green marketing play in consumer adoption of IFC. Therefore, this research was trying to answer to two questions come up from research gaps.

1. What factors promote or hinder consumer diffusion and adoption of a new food packaging technology like IFC?
2. How do the green marketing mix elements influence consumers' purchase intention of such technology?

To examine this purpose, the Technology Adoption Model (TAM) by Davis (1989) and its derivatives were used. TAM has been used to explain the acceptance of a variety of technologies. Examples of the technologies in past studies using TAM include mobile services (Lu et al., 2003; Wang, Lin, & Luarn, 2006), email (Huang, Lu, & Wong, 2003), t-commerce (Yu, Ha, Choi, & Rho, 2005), Internet banking (Chau & Lai, 2003; Suh & Han, 2002), banking technology (Adamson & Shine, 2003), online games (Hsu & Lu, 2004), groupware system (Li, Lou, Day & Comms, 2004), digital library (Hong, Thong, Wong, & Tam, 2001-2002), telemedicine technology (Chau & Hu, 2001), and desktop video conferencing (Townsend, Demarie, & Hendrickson, 2001; as cited in Cho, 2007). Although TAM has been applied in the study of user adoption of different technology,

there is a lack of relevant studies regarding its application in the context of new food packaging technologies. Therefore, the rationales for choosing adoption theory as the research theoretical perspective are 1) to use this theory in a sector where customers' concerns over food safety play critical role in their acceptance of a new food packaging technology. 2) to understand whether the TAM which has been commonly used in studying the adoption of new technologies can explain customers' acceptance and adoption of a new food packaging technology like IFC. 3) to determine whether two major determinants of the Technology Acceptance Model (TAM) are valid to explain consumer acceptance of novel food packaging technology like IFC. In this study TAM is considered as the base of the research model with its two key determinants (perceived usefulness and perceived ease of use).

This study adopts particularly these two determinants to examine the relationship between IFC usefulness (i.e., maintain food quality, reduce food waste, enhance food safety and increase storage knowledge) and ease of use (i.e., ease of use, ease to wash, ease to recycle, and so on) and consumers' purchase intentions toward IFC. In addition, in this study TAM integrates with new determinants (green marketing mix elements) to examine the role of green marketing (i.e., green product, green price, green place, and green promotion) and the relationship between these factors in the consumers' purchase intention toward IFC. This incorporation of green marketing into TAM is developed to provide a theoretical framework for anticipating food consumers' purchase intention toward IFC. Insight gained from the applicability of an extended TAM with green marketing can better help marketers to choose their marketing strategies based on

customers' expectations, perceptions, and acceptance of new food packaging technologies.

### **1.3 Objective**

As mentioned, the specific objective of this study is to investigate what role does companies' green marketing play in consumers' adoption of intelligent food containers. This research is conducted by using descriptive methods through survey approach. Data is collected based on questionnaires and variables measured were 4P's marketing mix factors, namely product, place, price, and promotion.

### **1.4 Deliverables**

Results of this study build knowledge related to the widely popular theory of technology adoption; in particular, the study provides the TAM with a new determinant: green marketing. By building and testing a conceptual model, the study proposes a set of constructs that explain customers' purchase intention toward intelligent food containers. Additionally, this study provides a better understanding and insight on the impacts of driver factors including concerns over food safety, environmental concerns, social norm, and financial saving as the foundations for the success of green marketing in the context of IFC. Finally, this study proposes a better understanding of the role of green marketing (the most important and effective elements) which can be utilized as practical information for innovators and marketers to accomplish success in IFC and will lead to providing novel solutions in the packaging industry and improved sales in the section. In particular, the deliverables are:

1. A conceptual framework of technology adoption for IFC.
2. Consumer interest and purchase intentions toward IFC.

3. The role of green marketing in the consumers' purchase interest and intention toward IFC.

The research contributions are:

1. The conceptual research model provides a set of constructs that explain consumers' purchase intention toward IFC.
2. A better understanding and insight on the impacts of driver factors on consumers' interest and purchase intentions toward IFC, including concerns over food safety, environmental concerns, social norm, and financial saving.
3. A better understanding of the role of green marketing (the most important and effective elements) which can be utilized to accomplish success in IFC and will lead to improved sales in this industry.

### **1.5 Structure of the Thesis**

This study is organized into six chapters with their subsections. Chapter one introduces the background, purpose, objective, and deliverables. Chapter two reviews the previous literature on food quality, food safety, food waste, technology adoption, and green marketing. The chapter focuses particularly on consumers' technology adoption and purchase intention toward IFC. Chapter three explains the development of the research model and hypotheses. Chapter four presents the method and the procedure used to prepare the questionnaire, gather required data, and analyze the data. Chapter five reports the results of the empirical study. It includes demographics of the sample and a summary of research variables. Finally, chapter six concludes the study and provides implications with respect to theory and practice, study limitations, and suggestions for future research.

## 2 Chapter: Literature review

The goal of this chapter is to provide an overview of factors which may affect consumers' purchase intention toward new technology, particularly IFC. The information gathered through relevant literature comes in three sections.

The first part is a general review of food quality, food safety, and food waste with all the environmental, economic, and ethical impacts. In this section, the importance of innovation in food packaging technologies is offered. The next part focuses on the concept of intelligent food packaging, including IFC technology and consumers' adoption and purchase intention toward such technology. The last part is presented to illustrate the role of green marketing mix (green product feature, green promotion, green price, and green place) in consumers' purchase intention toward IFC.

The conceptual framework focusing on consumers' purchase intention toward IFC is predominantly based on the popular TAM by Davis (1989). The information used for literature review in this study is gained from scholarly databases including the ScienceDirect, IEEE Explore, Carleton Digital Library, and Google Scholar with the purpose of providing a wide review of the current literature on food quality, food safety, food waste, innovation in food packaging, intelligent food containers, purchase intention toward a new technology/product, and green marketing.

At this stage, articles were sorted based on their research topic, read carefully, summarized and selected. After that, chosen literature was mapped to identify streams of research, research goal, and the future proposed research. Finally, based on the literature

review, three main streams of this research is introduced: 1) demand for food quality, food safety, and their effects on consumers' food waste, 2) new food packaging technology (IFC) and consumers' adoption and purchase intention toward this new technology, and 3) the role of green marketing mix in consumers' purchase intention toward IFC.

The first stream examines to what extent demand food quality and safety result in consumer food waste increased. The second steam deals with the question of whether consumers' perception of food quality, safety, and food waste with all its impacts (ethical, environmental, and economic) affect their demand for new food packaging technology like IFC, as well as, their adoption and purchase intention toward IFC. Finally, the last stream investigates the role of green marketing in consumers' purchase interest and intention toward IFC. As TAM essentially identifies the elements that either increase or decrease consumers' purchase intention toward new technology, the present research aims to add a new variable, namely green marketing to the model.

## **2.1 Background to the choice of literature streams**

The growth rate of global human population is around 75 million annually (1.1% per year). The worldwide population has grown from 1 billion in 1800 to 7 billion in 2012, and it is expected to reach 8.4 billion by mid-2030, and 9.6 billion by the mid-century (Wikipedia, 2017). With this high rate of growth, the key question is whether we can feed these people equitably, healthily and sustainably (Beddington, 2010).

Food security exists “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (Lundqvist et al., 2008, p. 18). Although the effort to enhance

food security is increased, there are still some people (one in seven people) who do not have access to sufficient protein and energy (Godfray et al., 2010). As a consequence, food security is becoming an emerging challenge for governments and policy makers in the food supply chain. This challenge is about producing enough food with fewer natural resources (e.g., land, water, and air), reducing food waste, and decreasing the level of greenhouse gases emitted globally (Clay, 2016).

Increasing efficiency and productivity is one of the solutions to this dilemma (Verghese et al., 2013). To do so, we need to take advantage of existent technologies and create and develop new scientific discoveries in the food industry. In fact, we need newer and greener revolutions in food science and packaging technology system to deal with this problem (Beddington, 2009). Innovation in the food packaging industry would be a useful and helpful innovation in the food supply chain in order to have sustainable food system. In fact, food packaging innovation offers new alternative ways of protecting food products from discoloration, off-flavor, off-odor, nutrient loss and texture changes (Chen et al., 2013). Although over the past decades packaging technology has undergone major changes, food producers, retailers, and consumers continuously look for more innovative, cost-effective, and sustainable food packaging which satisfies their requirements and desires such as maintaining food quality, improving food safety, reducing food waste and minimizing environmental impacts. Today packaging industry takes the advantages of the developments in sensors and information and communication technologies to produce desirable packaging which promotes better interactions between the product, package, and consumers. These new packaging technologies will enable the consumer to make

decisions about the quality and safety of the product contained in the package and to reduce their food waste (Opara, 2013).

An intelligent food container (IFC) is defined as “science and technology that use the packaging system's communication function to facilitate decision making by monitoring changes in the internal and external environments and communicating the conditions of the packaged food product” (Yam, 2012, p. 138; Ghaani et al., 2016, p. 2). This container will behave as an intelligent messenger to monitor the condition and provide quality information on prepared foods to the consumers. In fact, unlike conventional packaging, which is completely inert, IFC is designed to communicate with the contents and/or the surrounding environment with the aim of maintaining food products quality, improving food safety, reducing food waste, and increasing consumers’ storage knowledge to extend products shelf-life (Biji et al., 2015). Despite an obvious increase in consumer interest in novel food packaging technology, the success of a new technology, e.g. IFC, hinges on consumer acceptance and behavioral response in the marketplace (Chen et al., 2013).

## **2.2 Demand for food quality and food safety**

The lifestyles of food consumers who do not have enough time to spend for shopping fresh food make them more interested in novel and improved packaging concepts that extend shelf-life while maintaining and monitoring food safety and quality (Dainelli et al., 2008). Food quality is “the quality characteristics of food that is acceptable to consumers” (Wikipedia, 2017). Consumers’ opinions about food products of good quality are related to central concepts of food products such as appearance (size, shape, color, etc.), taste (and other sensory characteristics), health (chemical, physical, and microbial)

as well as convenience (Grunert, 2005). Changes in any of these characteristics are prone to result in food waste because of increase in the risk of foodborne illness.

Food poisoning or foodborne illness is any disease caused by having contaminated food. It is considered as a common, yet distressing and sometimes life-threatening problem for millions of people around the world. It has become a high concern for households when they figure out some suspected or confirmed food poisoning and contamination. Thus, rapid and accurate detection of pathogen and toxins in food is necessary to maintain consumers safe and healthy (Huff, 2008; Aday & Yener, 2015).

As a result, food quality preservation and food safety control are essential to better protect consumers against foodborne illness, to minimize food waste due to the microbial spoilage of perishable foods, and to enhance the quality of lives.

### **2.3 Food waste and its impacts**

In recent years, the impacts of food loss and food waste on food security and environment have become a global concern as the population grows fast and food production resources become even more limited (Lim et al., 2014). Food is lost or wasted throughout the supply chain – from farm to fork. While food loss is related to production, harvest, post-harvest wastage of edible food, food waste is related to consumers and retailers wastage behavior (Hower, 2014).

Wastage or discarding of food which is perfectly good to eat mostly happened in medium and high-income countries (Lundqvist et al., 2008). In a nation where the average consumers' annual household garbage comprises 40–60 per cent food waste, we need to find ways to reduce the amount of this waste and its impacts (Farr-Wharton et al., 2014).

Food waste which increasingly recognized as a problem and crisis need to be solved causes important economic, environmental, and ethical impacts (Hocke, 2014).

Economically, food waste is related to wasted investment paid for resources, production, processing, preparation, and transportation of the food plus money wasted in the home with financial constraint. A research study done on American families demonstrates that each year approximately 25 percent of the food and beverages they buy is thrown away which is about \$1,365 to \$2,275 for a household of four (Gunders, 2012).

Environmentally, producing food that will not be consumed represents a waste of the world's limited resources such as unnecessary loss of water, land, and energy with their undesirable environmental impacts. Also, food throws away by consumers ends up in landfills where food breaks down to produce CO<sub>2</sub> emissions, methane, and other greenhouse gases which contribute to climate change (Lipinski et al., 2013).

Finally, as part of its ethical impact, food waste contributes to the world hunger and poverty because it is wasted instead of delivered to the people who need it. About one in six Americans do not have access to secure supply of food year round while most people do not even understand how much food they throw away every day (Hocke, 2014). To sustain the world's limited resources and secure all humans food accessibility, we need to reduce the amount of food waste. Knowledge about the most important reasons of food waste is an essential step in meeting this goal.

The confusion over date labeling is one of the main reasons which may lead to considerable amount of food waste; misapplication of natural resources; unexpected financial problem; and potential risk of food safety (Newsome et al., 2014). Date labeling which suggests when to consume the food by for best flavor or quality is a key action

done by food manufacturers to meet consumers demand for higher food quality and safety. However, the date on the packaging may be taken very seriously by some individuals. Since the date labeling on the food packaging varies significantly with different terminology (such as sell by, best if used by, best before, freeze by and so on), it fosters confusion and misunderstanding in the marketplace and consequently food waste. Hence, it is really essential to know what these dates mean. Below are some examples for these dates' definitions (Gunders, 2012).

- Sell by. This date says “the store how long to display the product for sale while it is at its highest level of quality (freshness, taste, consistency) and it doesn't indicate product spoilage.”
- Best if used by (or before). This indicates the “last date recommended for best quality or flavor. It's not a safety or purchase date”.
- Use by. This is the “last date recommended for the use of the product at its peak quality and also doesn't pertain to safety” (Amy Campbell, 2014).

Empirical evidence shows that confusion about the concept of food date labels is one of the most common reasons resulting in removing edible food from supermarket shelves or throwing out by consumers (Verghese et al., 2015). National governments, nonprofit organizations, and even the United Nations have highlighted confusion around food date labels as one of the most important drivers of food waste. Some people believe that date labeling on food packaging is generally not regulated. They believe that their most common reasons for discarding food prematurely are dated variation, inconsistent usage, and lack of education around them. In the British households, around 20 percent of avoidable food waste is discarded because of misinterpretation of date labels (Gunders,

2012). If the same estimation were true for the U.S, it would mean about \$275-455 of food is discarded in the average household because of confusion over date labels. These people are tossing good food out because of lack of knowledge and fear of spoiled or unsafe food (Billions, 2013).

In combination with the consumer's confusion over date labeling, food gone bad, poor planning, impulse and bulk purchases, over-preparation, improper or suboptimal storage, and poor visibility in refrigerators cause large amounts of waste. In the United Kingdom, food spoilage (not being used in time) cause about two-thirds of household waste (Gunders, 2012).

Thus, while eliminating food waste is not possible, even reducing it by half would have huge impacts and benefits (Clay, 2016). To reduce consumers' food waste, it is necessary to know which strategies work best and which can be scaled more quickly. Innovation in packaging technology which may reduce consumers' confusion over date labeling is one of these strategies. IFC will be an innovation in the packaging industry which plays a critical role in protecting fresh products and processed food, improving resource efficiency and hence preventing food waste throughout consumers' everyday lives.

#### **2.4 Innovation in food packaging: Intelligent Food Containers (IFC)**

Changes in consumer preference and market trends expected development in food packaging system (Biji et al., 2015). In fact, the emerging revolution in packaging system will improve the economy by maintaining food quality, by improving food safety, and by diminishing food waste (Majid et al., 2016).

What is food packaging? Food packaging is a necessary component of the food system which is used for convenient transport, storage, and sale of a product. It is also defined as

“enclosing food to protect it from tampering or contamination from physical, chemical, and biological sources” (Prasad & Kochhar, 2014). In fact, it plays a vital role in containing and protecting foods when it moves through the supply chain (from manufacturers to the consumers) (Verghese et al., 2013). Traditional food packaging has four basic functions: protection, communication, convenience, and containment, and they use to preserve the food against attack from oxygen, water, vapor, ultraviolet light, and both chemical and microbiological contamination (Prasad & Kochhar, 2014). However, there is a need for innovation in food packaging materials, design and labeling to eliminate the weakness of the conventional packaging as well as to improve efficiency (Verghese et al., 2013).

Consumers’ expectations from new food packaging are classified into various applications such as: maintaining food quality, providing food safety, reducing food waste, extending shelf life, and addressing the environmental issues. (Opara, 2013). Despite traditional food packaging which is meant for mechanical support and protection of food from external influences, the innovative packaging is expected to achieve better food quality, higher food safety, and more consumer convenience (Ghaani et al., 2016). The interest in these new packaging characteristics has boosted the development of intelligent devices, in the form of sensors, indicators, and Radio-Frequency Indicators (RFIDs) that perform different functions. Different from conventional packaging which is totally inert, new food packaging system is expected to interact with the content and or/ the surrounding environment of food to provide all required information and applications in a better and more reliable method (Biji et al., 2015). This new packaging is expected to

be sustainable as well as completely collaborate and share the data related to food quality and safety and also food expiration with consumers (Verghese et al., 2013).

In the 20th century more innovation in packaging technology emerged as intelligent food packaging. In the European Union, intelligent food packaging systems are defined as “packaging that monitors the internal and/or external conditions of a product through its life cycle”, in other words, a package that “can communicate (i.e. indicate) the quality of the product” (De Jong et al., 2005). In fact, in addition to the basic communication function of traditional packaging, intelligent food packaging provides extra functionality. It informs consumers about the internal and external changes in the product surroundings on the basis of its ability to observe or record. Another function of intelligent food packaging is assessing the quality and safety of the packaged food item as well as predicting or measuring its safe shelf-life better than a best before -date. In the structure of this packaging, typical indicators such as gas leakage, ripeness regulators and indicators, time-temperature monitors, bio-probes, radio frequency indicators and toxin indicators are presented (Majid et al., 2016).

The IFC is an innovative concept which inspires its technology from intelligent food packaging. Unlike intelligent food packaging which is used by the manufacturers while packing the food products, IFC will be an aftermarket product presented in any retail or even online stores and will be used by food consumers and households to re-pack their food products or leftovers. If consumers have a hard time remembering when they bought a product or when they prepared a kind of food, this container has been used to inform them about the safe shelf-life or the quality and safety of leftover. Food consumers and households can put their products and also leftovers in this container to monitor the

condition of the food product or its surrounding environment. It may seem like a lot of effort, but by doing so, consumers will be reminded of when to use the food by each time they open the fridge and throw out foods when there is a chance with their health danger.

IFC will be clearly one of the newest technologies within the food packaging field. Although this technology is still growing and not completely commercially viable, it will have enormous potentials. The IFC will be considered as a sustainable and eco-friendly product (replacing artificial chemical ingredients in packaging materials with natural ingredients) since it has a less environmental impact or is less detrimental to human health than the traditional food packaging. This container will come in different shapes and sizes and use the “packaging system's communication function to facilitate decision making by monitoring changes in the internal and external environments and communicating the conditions of the packaged food product” (Yam, 2012;Ghaani et al., 2016).

IFC will communicate to the consumer based on its ability to detect, sense, and record the changes in the product's environment. This communication helps consumers to achieve a better understanding of whether food is in its good quality and safe to be consumed. It increases consumers' knowledge related to better storing and preserving the food, as well as helping them to use food before it expires and reducing food waste. In general, its concept will be based on optimizing food quality and safety, minimizing food waste, maximizing food storage knowledge, and minimizing packaging environmental impact. The development and improved packaging concepts in this new food container are provided by three intelligent systems; sensors, indicators and radio-frequency identification (RFID) systems (Kerry et al., 2006; Vanderroost et al., 2014).

1. Sensors: “a sensor can be defined as a device used to detect, locate or quantify energy or matter giving a signal for the detection or measurement of a physical or chemical property to which the device responds” (Kress-Rogers, 1998). Example: biosensors, gas sensors, chemical sensors, etc.
2. Indicators: “indicators can be defined as substances that indicate the presence, absence or concentration of another substance or the degree of reaction between two or more substance by means of a characteristic change, especially in color” (Kerry et al., 2006). Some examples of indicators are; freshness and/ or ripening indicators, time-temperature indicators (TTI), seal and leak indicators, and so on.
3. Finally, radiofrequency identification (RFID) which is "an automatic identification technology that uses wireless sensors to identify items and gather data without human intervention. A RFID is based on tags and readers" (Tajima, 2007; Hong et al., 2011).

The devices used in IFC are easily activated and are able to identify, quantify and report changes in the atmosphere within the container and the microbiological quality of food. Changes in the food container are easily visible and measurable and do not need any specific skills or knowledge. This is an advanced form of the communication function of traditional packaging.

However, although the potential benefits of IFC have been widely explained, there is still an existing gap in market acceptance. (Dainelli et al., 2008; Ghaani et al., 2016; Aday, & Yener, 2015). Since consumer acceptance toward a new technology may be different and effective, the success of IFC hinges on consumers behavioral response and purchase intention in the marketplace (Chen et al., 2013). In fact, consumer acceptance is essential

for commercial realization and future development of this new packaging technology (Prasad & Kochhar, 2014). People have heterogeneous tendency and priority toward new innovative food technologies and from their perspective, an innovation may be categorized as either receptive or resistant (Pliner & Salvy, 2007). Childers et al. (2001) proposed that “both hedonic and utilitarian motivations are relevant as consumers engage in a new product or service” (Kulviwat et al., 2007).

To investigate the factors which may affect consumer acceptance and purchase intention toward IFC, the TAM is examined and also it is integrated with one more factor: Green Marketing.

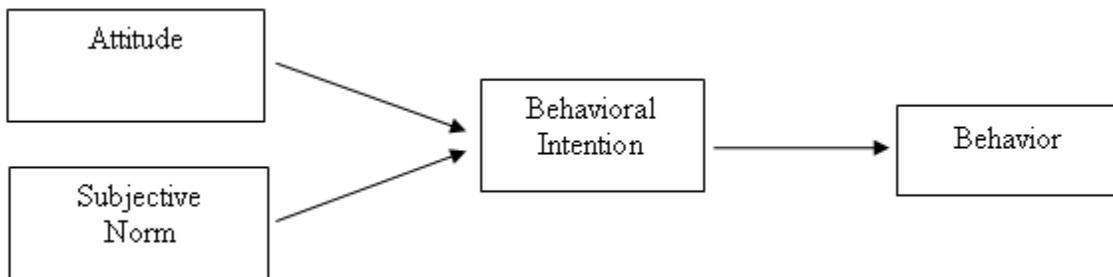
## **2.5 Technology Adoption**

Technology adoption is becoming as one of the most intriguing topics in business technology literature. In the last few decades, researchers and scholars have increasingly tried to figure out the factors which influence technology acceptance by consumers (Kulviwat et al., 2007). According to Ozaki (2011), a new service or product will be adopted by if the new innovation clearly shows characteristics such as identity, image, values, norms, functionality, usability, costs, and intended outcomes. Also, customers are willing to adopt a new product or service if it provides 1) benefits (i.e. using the product or service increases their positive consequences), 2) compatibility with what they have and their common practices, 3) enjoyable (provides some kind of fun for users), and 4) low risk. When the early adopters find an innovation as a useful tool which becomes a norm among a large group of people, the adoption rate will be increased (Ozaki, 2011).

The empirical results have proved TAM, originally proposed by Davis (1989), as the most widely used and theoretical tool for understanding users' acceptance of a new technology (Park, 2009).

## 2.6 Technology Acceptance Model (TAM)

The original TAM is inspired from the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), which proposes that attitudes and subjective norms influence intentions of behavior and subsequently cause the actual behavior (Figure 1).



**Figure 1 Theory of Reasoned Action by Ajzen & Fishbein (1980)**

The construction of the TRA was modified by Davis and his colleagues (Davis, 1989; Davis et al., 1989) to develop a new model, namely TAM. In the new model subjective norms were eliminated and a causal link between attitude and intention was provided. Moreover, in the new model, the main goal is to reveal the influence of external variables on internal beliefs, attitudes, and intentions (Lu et al., 2003). According to the suggestion by Davis (1989), two belief constructs are the core determinants of the TAM: perceived usefulness (PU) and perceived ease of use (PEOU). This model is one of the most reliable and robust models widely applied in the study of consumers' acceptance of different technologies in order to measure the success of a particular system (Figure 2) (Kim &

Park, 2012; Vijayasathy, 2004). This model theorized that individuals' behavioral intention to adopt a new technology is defined by "the person's attitude toward the use of technology. Attitude, in turn, is determined by PU and PEOU (Kulviwat et al., 2007).

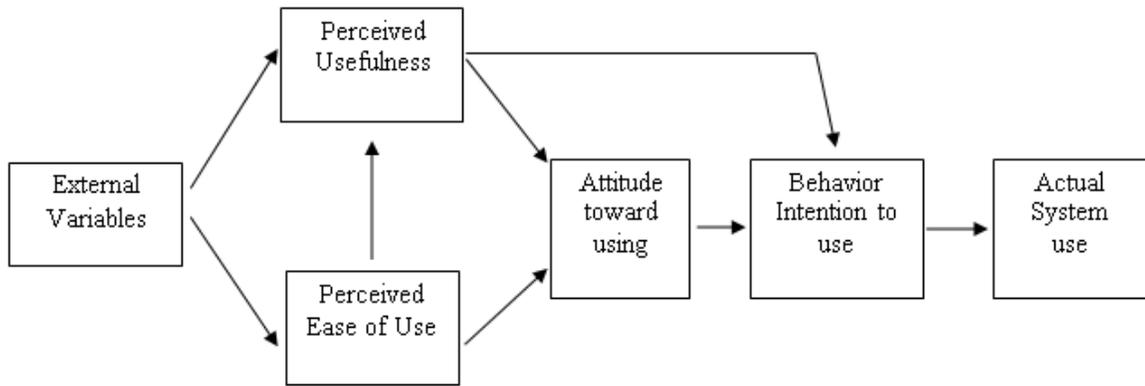


Figure 2 Technology Acceptance Model (TAM) by Davis et al. (1989, p.985)

TAM includes the following variables:

- **Behavior intention** is defined as "a person's perceived likelihood or subjective probability that he or she will engage in a given behavior" (Nguyen et al., 2015, p.98)
- **Attitude** has been characterized as "a person's inclination to exhibit a certain response toward a concept or object" (Vijayasathy, 2004, p.751). Lloyd (2002) reported a link between attitude and behavioral intention, which was statistically insignificant. As a result, some researchers have included attitude and/or behavioral intention in their research model. It is in the situation that unlike Lloyd's report, recent studies indicate a strong connection between attitude and intention and they use both attitude and behavioral intention in their application of the TAM. In this study, the model includes interest to use a new product instead

of attitude and examines its relationship with consumers' purchase intention toward a new technology.

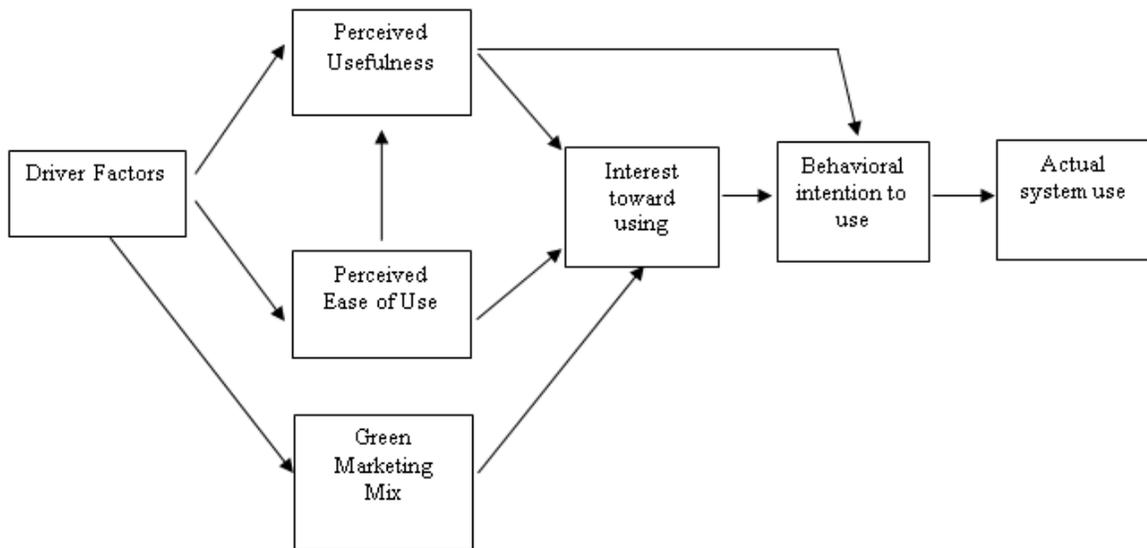
- **PU** is one of the independent constructs in the TAM. It is defined as “the degree to which a person believes that using a particular system would enhance his/her job performance” (Davis, 1989, p.320). PU has been found as a strong and most significant variable of user acceptance, adoption, and usage behavior even more important than PEOU. So, in the original model, there is a direct effect of PU on intention (Kulviwat et al., 2007).
- **PEOU** is another construct in TAM model which means “the degree to which the prospective user expects the system to be free of efforts” (Davis, 1989, p.320). The same as PU, researchers have known PEOU as another critical component of the adoption process. However, the effects of this construct within TAM are not really obvious. Sometimes it has been shown a direct effect on attitude, whereas in other cases only an indirect effect (via PU) has been found (Kulviwat et al., 2007). In this study both direct and mediated effect of PEOU on interest will be examined.
- **Actual system's use** is the TAM outcome to measure the success of a particular system (Agarwal & Prasad, 1997). The outcomes of the TAM are behavior intention and the actual use of technology. One's actual use of a new product or service is influenced directly or indirectly by the user's behavior intention, attitude, PU, and PEOU (Park, 2009). Davis et al. (1989) measured actual use by asking the frequency of the use of the technology, and the results showed a positive influence of behavior intention on actual usage and a significant

correlation between these two factors. Unlike some researchers measure both behavior intention and actual use, most researchers who apply TAM in their research model only consider behavior intention. In this research, only behavior intention is considered since the product is in the pre-design and development stage and the consumers' actual use cannot be determined.

Over time, the TAM model has been validated by many empirical studies. Many researchers have simulated the model and believed that this model is useful in predicting the success of various technologies. Studies using TAM have focused on e.g. mobile services (Lu et al., 2003; Wang, Lin, & Luarn, 2006), email (Huang, Lu, & Wong, 2003), t-commerce (Yu, Ha, Choi, & Rho, 2005), Internet banking (Chau & Lai, 2003; Suh & Han, 2002), banking technology (Adamson & Shine, 2003), online games (Hsu & Lu, 2004), groupware system (Li, Lou, Day & Comms, 2004), digital library (Hong, Thong, Wong, & Tam, 2001-2002), telemedicine technology (Chau & Hu, 2001), and desktop video conferencing (Townsend, Demarie, & Hendrickson, 2001; as Cited in Cho, 2007).

Although TAM has been widely used in many empirical studies in the contexts of different technologies, there have been some weaknesses in its constructs resulting in the model modification or extensions (Cho, 2007). As a result, researchers have extended the original TAM with added variables, including e.g. motivation (Li et al., 2004; Venkatesh, et al., 2002), subjective norm (Huang et al., 2003; Yu et al., 2005), and self-efficacy (Hong et al., 2001/2002; Wang et al., 2006), culture/social influence (Evers & Day, 1997; Malhotra & Galletta, 1999), and trust (Chiravuri & Nazareth, 2001; Dahlberg et al., 2003; Gefen et al., 2003; Ha & Stoel, 2005; as cited in Cho, 2007). The present study adds green marketing mix as a determinant to TAM model to examine its role on consumers'

purchase intention toward IFC (Figure 3). In this study, it is suggested that the new packaging system success depends on four multifaceted outcomes of marketing mix including product feature (PU, PEOU, and environmental friendliness), price (pricing), place (availability) and promotion (advertising). In this study, the reception of the IFC is examined to understand reactions of the public to this new product. It is important and critical to know which factors have influence on the acceptance of this new technology.



**Figure 3** Extended TAM with Green Marketing Mix

## 2.7 Marketing

Consumers’ perception of a new technology affects their purchase decision. According to Mowen and Minor (1999), perception is “a stage where consumers get exposure, attention, and comprehension in an information process”. Since consumer’s perception plays an important role in their purchase decision, effective marketing strategy which influences the consumers’ decision and perception will be an important element for firms and marketers to increase sales and profit. As a result, the marketing concept and strategy of firms need to be rethought based on consumers’ needs and expectations. In order to be

sustainable in the market, firms should have a long term marketing viewpoint rather than the short-term one, and they have to plan and carry out research to find out customers response toward their new marketing strategy (Kharde, 2016).

There have been numerous definitions of the marketing concept. Simple definitions such as the definition by McCarthy and Perreault (1984) have been proposed: "The marketing concept means that an organization aims all its efforts at satisfying its customers at a profit." Conversely, The American Marketing Association (AMA) has defined marketing in a slightly complex manner as "the process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services to create an exchange and satisfy individual and organizational objectives" ("AMA board approves new marketing definition", Marketing News, 1985). Nevertheless, marketing is simply the activities done by firms to figure out the target customers' needs and wants; to customize the right feature of the products; to offer the right pricing; and to choose the right distribution channels to ensure availability (Rosenbloom & Dimitrova, 2011).

## **2.8 Marketing Mix**

The controllable elements of a product's marketing plan commonly termed marketing mix which influences the purchasing decisions of consumers. According to Kotler and Armstrong (2010), the marketing mix is a combination of marketing tools used by firms to achieve their marketing objectives and to control the market. In fact, marketing mix is about putting the right product, in the right place, at the right time. There are various marketing mix models with different ingredients since each of them may be required for different objectives. The most famous and popular mix developed by E Jerome McCarthy is known as the 4Ps model (Figure 4) with the key ingredients being product, price,

promotion, and place (or distribution) (Astuti et al., 2015). The 7Ps marketing mix is another marketing mix model and it builds on the 4Ps model by composing of product, price, place, promotion, people, physical evidence, and process (Lovelock, 2011).

As consumer purchase behavior is too complex to be analyzed, knowledge about the influences of marketing mix variables on purchasing decision of consumers in determining appropriate marketing strategy would be beneficial for the firms and businesses. In fact, it is not affordable for the firm's management to wait "years" to have the value of the long-term marketing effects. They are looking for the way to have more immediate and tangible effects (Brooks & Simkin, 2012). So, capturing customers' voice during the new product development process and having the knowledge of ranking marketing mix elements based on their influence on consumers purchase decision help firms to prioritize their marketing strategies and budgets based on these elements, improve their performance in the market environment, and a greater probability of commercial success (Ciappei & Simoni, 2005). For example, a survey done in the city of Bogor to analyze the influence of marketing mix factors on consumers' desire to purchase fruit beverages showed that price and physical evidence were two factors that discriminate consumer behavior (Ulfah et al., 2016). Another study on consumers purchase decision of Malang Apples at Giant Olympic Garden Mall (MOG) demonstrated that except people and physical evidence all other factors partially and significantly influenced the purchasing decision and the most influential marketing mix variable was price (Astuti et al., 2015). Also, based on Alipour et al. (2012) research aiming at ranking the effect of marketing mix elements on consumers purchase

behaviors, high quality goods and powerful distribution system are the main factors to attract and maintain more customers (Khodaparasti et al., 2015).

In short, to effectively market and advertise a new product, marketers should understand customer needs, consider the behavior or nature of customers, and respond to their demand.



**Figure 4 The 4Ps Marketing Mix Model**

### **2.8.1 Marketing Mix – Product**

Anything which is offered to the market to attract customers' attention, acquisition, and consumption as well as to satisfy their want or need is defined as a product (Kotler, 2011). This product can be tangible in the form of good or intangible in the form of

services (Kushwaha et al., 2015). The acceptability of a product may depend on different features such as product variety, quality, design, features, brand name, packaging, size, etc (Doyle, 2011). When a product is produced base on consumers' pessimistic, ambiguous, and optimistic attitude, it can be more successful in the market compare to the other products. (Vandermoere et al., 2011). Thus, marketers must do extensive researches on the acceptance and purchase intention toward a new product during the product development phase if they want to be sustainable in the market. All in all, marketers should make sure that they are going to offer a better product to the consumers compared to their competitors”.

### **2.8.2 Marketing Mix – Price**

Price is considered as an attribute which should be sacrificed to receive specific kind of product or service (Zeithaml, 1988) Pricing always plays a critical role in the perception of a new product in consumers' eyes. From consumers' point of view, price is an extrinsic cue which indicates the quality or benefits of the product (Yoo et al., 2000). It means that customer perceptions of price have a direct impact on their satisfaction and loyalty (Martin-Consuegra et al., 2007). Consumers are willing to pay for the price demanded in the shop base on the product's attributes (Grunert, 2005). If firms do not define prices with fairness and competitiveness, it would be possible that customer switching immediately from one brand to other one (Colgate & Hedge, 2001). Therefore, the pricing should be affordable and convenient for the customer's ability. Thus, marketers should consider the value that a product offers carefully and examine competitors pricing and price accordingly if they want to be successful in the market and treat their profitable customers well (Kotler, 2011).

There are three major pricing strategies: 1) Market penetration pricing, 2) Market-skimming pricing, 3) Neutral pricing. (Market) penetration pricing is a strategy used by firms in order to quickly penetrate into the market and secure their market share by their relatively low price. In contrast, (market-)skimming pricing is a strategy used to skim off consumers who are willing to pay more while the price is relatively high in the beginning and becomes lower over time. Finally, neutral pricing is the most common strategy used by firms. In this strategy both product price and value are similar to competitors (LIU, 2010).

### **2.8.3 Marketing Mix – Place**

Place is defined as the process of distributing product by interdependent organizations to make it available for consumers (Kotler & Armstrong, 2006). Also, place is any way that the customer can obtain a product or service in the proper time and place (Jones (2007; Owomoyela & Oyeniya, 2013). In order to be successful in the market, the product has to be positioned by distribution channels and many companies activate to deliver the product in a place which is accessible to potential buyers. In fact, efficient positioning and distribution channels which are based on a comprehensive knowledge about the target market play a critical role in the consumers' perception of a new product and their purchase intention toward that product (Peter et al., 1999). Moreover, since certain types of distribution fit certain types of products, marketers should have enough knowledge about the market requests and demands and choose their distribution strategies based on that (Yoo et al., 2000). Intensive distribution, exclusive distribution, and selective distribution are some of the distribution strategies followed by companies.

Distribution is intensive when the product exists in all available stores to provide saturation coverage of the market. This form of distribution is usually used for the product which comes in a range of acceptable brands to choose from such as cigarettes, beer, etc. However, nowadays firms use exclusive and selective distribution in order to enhance the product's image and get substantial retailer support. Distribution is selective when a limited number of retailers or outlets in a specific geographical area are used to sell a product. while, distribution is exclusive when one wholesaler, retailer or distributor is used in a specific geographical area to distribute a product or brands with a high prestigious image (Yoo et al., 2000).

#### **2.8.4 Marketing Mix – Promotion**

Zeithaml et al. (1995) described promotion as part of a specific effort to get people inform about a product or service and to encourage them to tell others about them. (Owomoyela & Oyeniyi, 2013). Promotion is viewed as a tool to decrease the gap between sellers and buyers and to enhance brand recognition and sales. Promotion is comprised of different forms and procedures such as personal sales, TV advertisement, coupon shops, billboards, magazine proclamation, direct marketing, digital marketing, and word-of-mouth (Souar et al., 2015). Word of mouth is recognized as a valuable asset which a company can have in order to boost its profits. Company's promotional strategies will depend on its budget, the message it wants to communicate, and its target market. Preparing an efficient message requires comprehensive understanding and correct knowledge of the target consumers and their perceiving process (Alipour & Moniri, 2012). Cooper (2003) found that lack of communication with customers in the early process of product development cause delay and/or failures in business success.

As the face of the world consumer has truly changed, companies' marketing strategy is more important now than ever before. As a result, marketers need to identify most important marketing mix variables that either promote or inhibit consumers purchase intention toward a new product in order to rethink their marketing strategy (Min & Galle, 2001).

## **2.9 Green consumerism**

Numerous surveys have been conducted in both developing and developed countries illustrate high levels of environmental concern among the majority of population (Hartmann & Apaolaza Ibáñez, 2006). A research in the USA shows that the majority (about 70 percent) of the consumers are sensitive to the environmental concerns (Min & Galle, 2001). These groups of people are becoming more aware of their everyday purchase impacts on the natural resources and the environment and they are trying to change their purchasing behavior regarding these issues. As a result, their buying habits are being strangely influenced by green and other environmental issues. They know that their environmentally friendly action and inaction will certainly affect their environment, so they have begun to modify their purchase behavior in an attempt to preserve their environment. In fact, these groups of people are becoming more interested in sustainable, eco-friendly, and green products which have less destructive effects on the environment.

A green consumer is defined as an individual whose environmental concerns and social behavior influence his/her purchase behavior (Kharde, 2016), as well as individual who avoids purchasing products which may be dangerous for the health of other people. (Singal et al., 2013). At product level "Green" has been defined in different meaning in literatures. The Commission of the European Communities (2001) defines green products

as products which have fewer impacts on the environment by using less resource and generating lower waste (Dangelico & Pontrandolfo, 2010). Also, a product is defined as green when compared to conventional products its production, use, and disposal is highly improved to have less impacts on the environment (Peattie, 1995). Ottman et al. (2006) believe that there is not any kind of product with zero impacts on the environment; however, green product is the one which may have fewer impacts by protecting natural environment and reducing waste.

However, the positive attitude toward a green product does not always bring actual purchase intention toward the product. For example, roughly 30% of consumers report that they are very concerned about environmental issues and they are interested in the green products; however, they are struggling to translate these into purchases (Young et al., 2010). Moreover, according to the Simmons market research bureau's (SMRB) study in 1991, there is low correlation among consumer's environmental concern and their willingness to purchase environmentally friendly products. Finally, studies by Kleiner (1991), Schlossberg (1991) and Winski (1991) showed a weak relationship between consumers' positive attitudes toward environmental issues and the actual green purchase behavior (Boztepe, 2016). A general effort to change social and cultural attitudes with respect to the environment is needed in our lives (Hartmann & Apaolaza Ibáñez, 2006).

## **2.10 Green Purchase Intention**

Continuous industrialization and urbanization, shortage in the natural resources, and increase in environmental pollution lead to a great reaction of both consumers and firms. Consumers become concerns about the future of the world and as results; they mostly prefer environmentally-friendly products. In return, firms have started to manufacture

eco-friendly products (e.g., energy-efficient, recyclable, natural or organic) and support these attitudes of the consumers (Boztepe, 2016). In fact, both firms and consumers are becoming gradually more sensitive to the environmental concerns and feel more need for switching into green products and services.

However, although majority of consumers are getting behind the idea of being greener and considering environmental issues while they are shopping, this mindset does not necessarily translate into pro-environmental behavior and green purchase intention (Royne et al., 2011). In fact, when it comes to actually buying, their words and manners often look different. Follows and Jabber (2000) argue that consumers consider both environmental and individual consequences when they shape their attitudes toward green purchase behavior. For example, organic food made less than 3 percent of all food sold in 2006; Green laundry detergents and household cleaners represented less than 2 percent of sales in their product categories; and hybrid cars made up little more than 2 percent of the U.S. auto market in 2007 (Bonini & Oppenheim, 2008).

In general, in the context of purchasing green products, consumers may identify that their behavior is beneficial to the environment; however, they may also perceive the associated inconvenience relating to factors such as product feature, place (availability), promotion (advertising), and price (pricing). These inconvenient aspects of green products may affect their green purchase intention (Nguyen et al., 2015). As a result, companies have started to form their marketing strategies base on increasing knowledge of their green consumers. These marketing strategies, known as green marketing, have encourage companies to adopt green policies in their pricing, promotion, product features and distribution activities (Boztepe, 2016). Thus, it is important to understand whether green

marketing can influence consumers' attitude toward green products and also to examine the role of green marketing on the consumers' purchase intention.

### **2.11 Green Marketing**

Despite evidence that shows consumers are becoming strongly conscious about the environment and that firms are developing new products and services with environmental input, still, there are a lot of environmentally friendly products which are not successful in the market and that achieve disappointingly low level of market share. Companies and organizations who have seen environmental concerns in their consumers' manner and behavior are trying to compete with the competitive market by exploring the concept of green marketing (Kharde, 2016). Green marketing – a phenomenon developed in this recent market – is an essential strategy for producers and companies to promote their sustainable and eco-friendly products in order to gain consumers satisfaction. In fact, if an organization wants to be successful in this modern era of globalization, it has to keep in the mind the value of environment and its safety. The concept of green marketing became more prominence in the late 1980s and early 1990s (Singal et al., 2013). It is developing in many parts of the world to deliver product to the green consumers in order to keep the earth safe (Hartmann & Apaolaza Ibáñez, 2006).

There are various definitions for the green marketing in the literatures. As Polonsky states, green marketing can be defined as “all activities designed to generate and facilitate any exchange intended to satisfy human needs and wants such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment” (Kharde, 2016, p. 5; Kiran, 2012, p. 7). Charter and Polonsky (1999) also defined green marketing as “marketing or promotion of a product based on its

environmental performance or an improvement thereof” (Lee, 2008). In addition, according to the American Marketing Association (AMA), green marketing is defined in three ways: “1) Retailing: the marketing of products that are presumed to be environmentally safe. 2) Socially: the development and marketing of products designed to minimize negative effects on the physical environment or to improve its quality. And 3) Environment: the effort by organization to produce, promote, package & reclaim products in a manner that is sensitive or responsive to ecological concern” (Singal et al., 2013, p. 5). Green marketing is a new concept which has been widely adopted by firms worldwide because of various reasons such as:

1. Opportunities: As consumers become more interested in green products, many companies see this change as an opportunity to exploit and compete over firms which are not environmentally responsible. In fact, they use green marketing as an opportunity to achieve their objectives.
2. Government pressure: As governments all around the world want to “protect” consumer and society; this protection has significant impact on the implementation of green marketing by firms. In fact, governments are forcing companies to be more responsible.
3. Competitive Pressure: In order to be flourishing in the market, firms need to compete with competitors by promoting their environmental products. In fact, this competitive pressure has encouraged companies to change their detrimental environmental behavior.
4. Social Responsibility: Firms are members of a bigger community and they believe they should be as social responsible as other people. In fact, they should not only

try to achieve their profit objectives but also try to gain environmental objectives as well. So the environmental issues are integrating into the companies' culture (Singal et al., 2013).

Green marketing faces some challenges as well:

- A green product requires renewable and recyclable material which is expensive.
- A green product technology up gradation needs huge investment in R & D.
- Consumers do not have enough awareness of green products.
- Consumers' willingness to pay premium price for green products (Kharde, 2016).

Although green marketing is still in its early stage, it can be a very powerful marketing strategy through when it is done right. In fact, while green marketing can be so helpful for both businesses and consumers, it can be dangerous when businesses made false claims about their products and services. False claim means that companies are presenting themselves as environmentally responsible and their products or services as green when they are not. This action is called green washing and may affect firms' reputation as well as consumers' trust and reliance (Kiran, 2012). As a result, the first rule of green marketing is to focus on consumers' benefit and make sure that consumers feel they can make a difference which is called "empowerment" (Kiran, 2012). Actually, green marketing's fundamental role is increasing consumers' tendency to buy green products.

To sum up, while the threat of environmental issues looming large, it is extremely important for firms to select "Green Marketing" as their norm marketing strategy rather than an expectation (Singal et al., 2013). Companies which develop pro-environmental

products and services and use green marketing as their marketing strategy can have access to new markets, increase their profit sustainability, and enhance their reputation over the companies which are not concerned about environment (Kharde, 2016). When individuals decide to adopt new sustainable lifestyles, they engage with an increasingly complex decision-making process regarding their purchase behavior (Young et al., 2010). Firms need to investigate the role of green marketing on green consumers' adoption of a new product. As the green marketing mix (4Ps) is a little bit different with the traditional marketing strategy, it is essential for the firms to examine the role of each of this 4Ps on the consumers' adoption of a new green product.

## **2.12 Green Marketing Mix**

### **2.12.1 Green product and green purchase intention**

Increasing concern about environmental and social issues has been highlighted in recent years. People are trying to be more environmentally responsible. They intend to reduce their negative impacts on environment with purchasing green product. These consumers have recognized that their green purchasing behavior has direct effects on many ecological problems (Laroche et al., 2001). A green product is a new product or formulation that is being launched to replace conventional product which causes environmental damages. It is defined as products which reduce resource consumption and pollution by increasing effective utilization of natural resources. The performance of this green product is much better than conventional products since it has less economic and environmental effects (Pickett-Baker & Ozaki, 2008). In general, there are some specific characteristics for green products such as:

- A green product contains little or no toxic chemical or material.

- A green product is manufactured as efficiently as possible, using the fewest material.
- A green product is built with highly recyclable materials.
- A green product is recyclable, reusable, and biodegradable.
- A green product does not harm or pollute the environment. (Kharde, 2016).

However, researches on the consumers' purchase intention toward green product have demonstrated that perceived product performance and feature is a significant barrier to its selection. So it is important to look at what features of a green product influence the consumer's selection process (Pickett-Baker & Ozaki, 2008). It means that for having a sustainable world, making an environmentally friendly product is not sufficient by itself. For enhancing consumers' purchase intention toward a new product, firms need to increase their consumers' awareness regarding the product's benefits (Boztepe, 2016).

The majority of the people do not have enough knowledge about the features of green products and their usage, or they are usually confused about buying green products—and with good reason (Kiran, 2012). Communicating with them to put stress on environmental aspect of a green product may increase their knowledge of green product and their green purchase intention (Laroche et al., 2001). Therefore, the first rule of green marketing is focusing on product features and its benefits for customer. By doing this in the right time, companies can motivate consumers to switch brands or even pay a premium for the greener alternative (Kiran, 2012).

### **2.12.2 Green pricing and green purchase intention**

Although consumers' environmental concerns have influenced their purchase decision for eco-friendly products, price is a barrier which affects consumers green purchase behavior. The higher quality of ingredients in green products causes a little bit higher price compared to conventional one. So, consumers usually complain of high price of green products which often reduce the influence of consumers' green values in their decision-making process. In self-report behavior surveys, consumers report that they are ready to pay extra money for green products; however, their purchasing data demonstrated that "green" matters are very little compared to price (Bui, 2005). Also, according to Grail' research on 520 US Green consumers in 2009, high price of green products is one of the reasons which deters consumers from purchasing (Boztepe, 2016).

Price is defined by the AMA as "the formal ratio that indicates the amount of money needed to acquire a given quantity of goods or service" (Tabachnick et al., 2007). However, price premium is the extra amount of money paid for a specific product compare to a usual price (Karatu & Mat, 2015). Since consumers are price sensitive, their actual green purchase decision may be affected by the high price of the products (Karatu & Mat, 2015). They are willing to pay more for a green product if the price of the green product be affordable for the customer and if it maintains a cleaner and greener environment. If the products are priced very high, it may lose its market acceptability (Lee, 2009). In 1989, 67 percent of Americans stated that they are willing to pay only 5-10% more for ecologically compatible products. By 1991, environmentalism individuals were willing to pay between 15-20% for green products.

An important challenge facing new technologies development is to identify whether consumers are willing to pay premium price for the green products, and if yes which

consumers are willing to pay more. The effort to identify environmentally friendly consumers backs to early 1970s. Berkowitz and Lutterman's (1968) study showed that females, pre-middle age and high level of education (finished high school) are high socially conscious person who is willing to pay more for green products. While Reizenstein et al. (1974) illustrated that men are more ecologically conscious than women. This kind of inconsistency and conflict is also showed in related to age, education, and income.

In all, pricing is one of the most important elements of the green marketing mix since it is the only element of the marketing mix which generates revenue for the organizations. So, organization should pay more attention to the pricing of the green product if they want to be successful in the market. Also, it is essential for them to understand the role of this element in the consumers' purchase intention of a new technology.

### **2.12.3 Green place and green purchase intention**

Another potential determinant of consumer decision-making pertains to the availability of sustainable products. Green availability means making the green product available or accessible. How easily a consumers can have access to a green product is considered as consumer's perceived green availability (Karatu & Mat, 2015). Although the motivation to purchase green products is high among green consumers, it may be impossible to do so because of low availability. As the expenses to produce green products are high, they often have less availability, are not really visible, and are not sufficiently promoted (Vermeir & Verbeke, 2006). Research done by Robinson and Smith (2002) shows that 52% of consumers were interested in buying "earth-sustainable" foods; however, they

did not purchase those foods because of some limitations such as availability, inconvenience and price.

While some researchers argue that easy availability of green products can positively affect the intention to buy green products, others have the opposite opinion and they believe that availability was not strongly affect green purchase intention (Karatu & Mat, 2015). The question is whether availability of green products affects consumer green purchase intention.

#### **2.12.4 Green promotion and green purchase intention**

Some personal characteristics (such as acceptance, understanding and harm avoidance) are found to be important factors in predicting individual's environmentally responsible behaviors. In other words, individuals who are concerned about the environmental issues (harm avoidance) will accept a new idea more easily (acceptance) with a strong perception about its advantages (understanding) (Gupta & Ogden, 2006). However, even individuals demonstrate positive attitudes towards the environment; they are not successful in executing these attitudes. The closer manufacturers move to an understanding of what variables affect individuals green purchase intention, the better they will be able to produce green products. In fact, understanding consumers' environmental requirements and targeting this green segment of population will be a business opportunity for the companies (Karna et al., 2001). Sometimes knowing that a brand is green will make consumers felt better while using it (Hartmann & Apaolaza Ibáñez, 2006). Communication with the market which put stress on environmental aspects of a green product and improve its image in the eye of consumers may affect consumers' purchase intention. In fact, advertisement and sales promotions are essential

for the firms which produce eco-friendly products and spend expenditures on environmental protection (Kharde, 2016). Companies can influence the green purchase behavior of their customers by promoting their products in two ways: external influence and interpersonal (social) influence.

External influence includes communication methods that are paid for such as television, radio, and social media advertisements and other non-interpersonal influences. In fact, companies' advertisement is a form of external influence which affects consumers' product awareness and behavior intention. In general, the advertisement must consider the belief of target market, deliver appropriate messages, and attract consumers' attention to buy a green product (Karna et al., 2001). If the company's advertisement reflects its commitment to environment, it can be more effective and valuable. Green advertising is part of green communication and reflected the company's level of greenness. It is a useful way to inform consumers about pro-environmental aspects of products and should create a connection between the product attribute and consumers' goals and values (Kharde, 2016).

Social influence is another variable influencing consumers' social behavior and their decision to adopt a new technology. In fact, it includes the external impressions that consumers are subjected to, with consequences on individuals' awareness of the advantages of using a particular technical innovation. Also through this influence (i.e. through word of mouth), consumers attitude and their purchase intention towards the usage of a new system will easily be changed. In recent years, word of mouth has become the primary source of information about environmental issues and green products for consumers (Grailresearch, 2010). Today consumers get more information about

environmental concerns and the ways to tackle it by their reference people such as family, friends, partner, etc. As a result, these people become worried about the future of the world, they have started to think about their negative habits on environment, and they have tried to decrease these negativities by purchasing green products (Garg, 2016).

In particular, social influence represents to what extent an individual should use an innovation from others point of view (Chong et al., 2010), as well as, people perception of whether or not other people should engage in a certain behavior (Pai & Tu, 2011). Indeed, it has been suggested as a critical factor in understanding innovation diffusion, as well as a critical motivator of perceived usefulness (Venkatesh et al. 2003; Yq et al. 2011). Thus, it is vital to understand and explain to what extent a person behavior is influenced by reference people (Pantano & Di Pietro, 2012). According to previous studies, in addition to external influence, internal influence may affect the consumer's purchase intention toward a new technology and companies can take the advantages of this form of influence in order to promote their products. In general, advertisement and social influence are two effective factors increasing consumers' awareness and are shifting consumers more toward eco-friendly products. Hence, it is fundamental for marketers of green products to understand the role of green promotion in consumers' attitudes and green purchase intention toward a new technology. The question is to what extent a person is influenced by the marketing promotion.

Although the importance of green values and green marketing on the decision-making process and actual purchase is obvious, the importance of each variable of marketing mix differs by variation exist in cultural, socio- demographic, geographical setting,

complexity of consumer behavior, and also differences on the basis of market forces, product, and industry.

The purpose of this study is to examine the role of green marketing mix (green product features, green product prices, green product places, and green product promotions) on the consumers purchase intention toward a new technology and to determine if there is a significant relationship between these factors and the consumer's purchase intention. TAM is integrated with green marketing to form the conceptual framework of this paper and to predict consumer's intention and demand of a new technology. The study's findings are practical value to marketers in order to identify green marketing influence on consumer ecological intention. Also, it provides useful source of information for them to know what works and what does not in appealing consumers.

### **3 Chapter: Research model and hypotheses**

The purpose of this chapter is to describe the proposed research model and hypotheses. The first part illustrates the research model. The next sections explain the definitions of constructs and driver' factors of the research model. Finally, the later part elaborates the hypotheses based on the proposed research model.

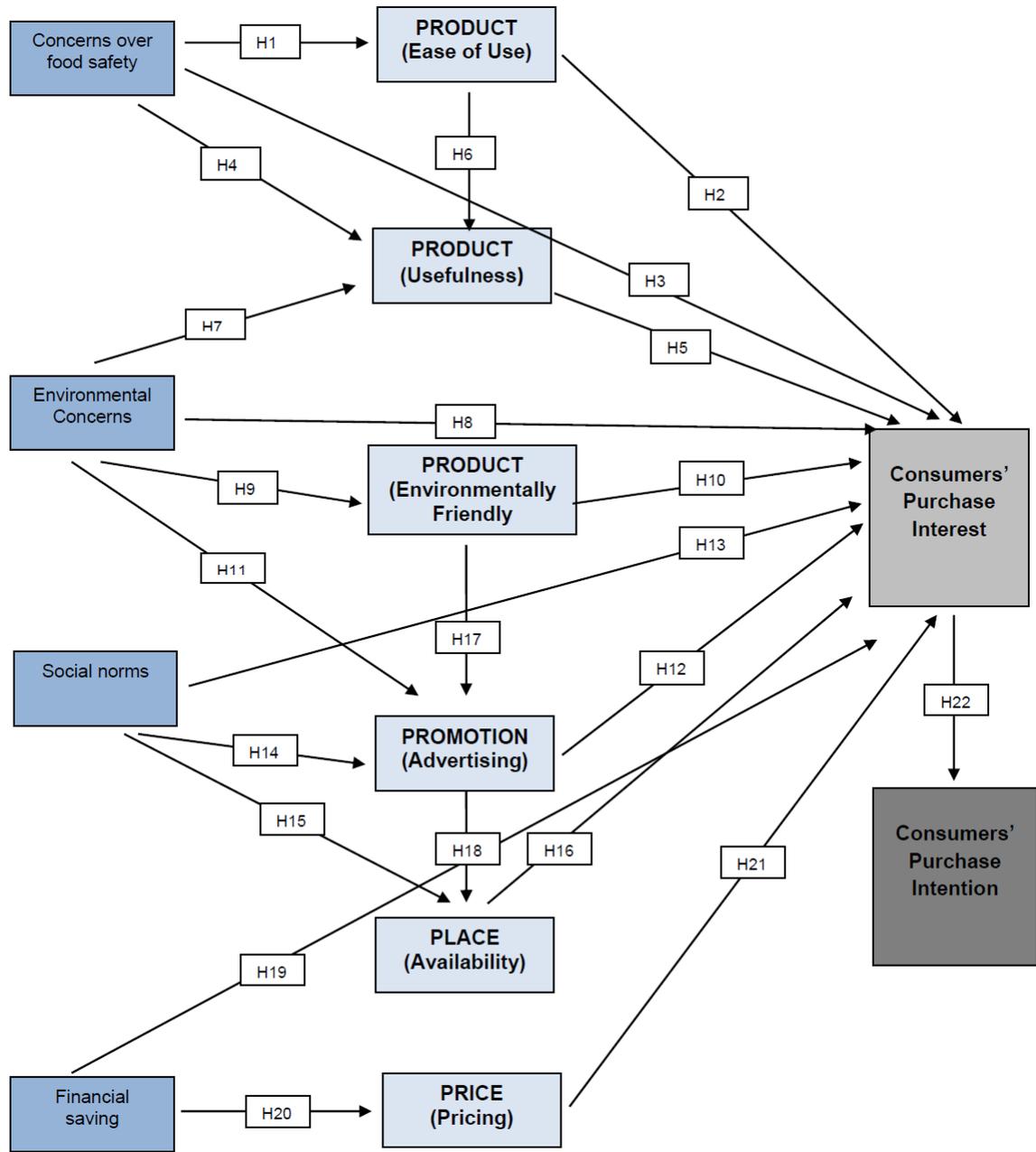
#### **3.1 Research Model**

Recently, firms have proposed a new sustainable packaging technology, known as IFC to meet consumers demand for increase in food quality and decrease in food waste. In fact, this food container is in its early stage of design and development and is still quite innovative in the marketplace, so the success of this technology depends on consumers' acceptance and voluntary behavioral intention to buy and use it.

The aim of this study is to investigate what role companies' green marketing plays in consumers' adoption of IFC. The closer firms move to an understanding of consumers' intention, the better marketers will be able to develop marketing strategies targeted green consumers (Von der Heide & Firmin, 2009). Based on the literature review and the existent gap related to what affects consumers purchase intention toward a green technology, this study used a model that has integrated the concept of green marketing with the TAM (see Figure 5).

Due to the lack of relevant studies regarding two major determinants of TAM within the packaging technology, in this study, the consumers' PU and PEOU is explained. In addition, this study adopts variables from green marketing mix in order to examine the role of green marketing (green product features, green price, green place, and green

promotion activities) on consumers' purchase intentions toward IFC. Green Marketing is defined as the marketing or promotion of an environmentally friendly product based on its performance and its improvement thereof (Lee, 2008). Marketers should always keep in mind that some traditional product attributes, such as convenience, availability, price, quality, and performance may be important for the green products as well. In other words, if they want to compete in this competitive market, they need to know what attributes of green products should match up against non-green products and how they should earn consideration from the vast majority of consumers (Ginsberg & Bloom, 2004). Including green marketing in the research model is justified by the fact that marketing is one of the most critical factors to the success of any businesses.



**Figure 5 Research Model**

In this research model, PU and PEOU are directly related to consumers' interest toward IFC. Also, there is an indirect effect of PEOU on consumers interest mediated through PU. In addition, the 4Ps of the green marketing mix are incorporated into this model and

they have directly related to consumers' interest toward IFC. To examine whether consumers interest leads to purchase intention, there is a direct relationship between these two variables in this research model.

This research model proposes concerns over food safety, environmental concerns, social norm, and financial savings as driver factors that influences consumers' motivation to use a new technology. Also, demographic characteristics (age, gender, education, income, and household size) are examined to investigate whether they have any effect on the consumers' interest and purchase intention toward intelligent food containers.

## **3.2 Definitions of Constructs**

### **3.2.1 Perceived Usefulness (PU)**

Perceived usefulness is defined as "The degree to which a person believes that using a particular system would enhance his or her job performance," (Davis, 1989, p.320). In the context of IFC, usefulness is defined as the extent to which a food consumers believe that using IFC will help them to enhance food safety, decrease food waste, and increase food storage knowledge.

### **3.2.2 Perceived Ease of Use (PEOU)**

Perceived ease of use is defined as "The degree to which a person believes that using a particular system would be free of effort." (Davis, 1989, p. 320). In the context of IFC, ease of use is defined as the extent to which food consumers believe that using IFC is free of effort, easy to learn, and easy to wash/clean.

### **3.2.3 Green marketing-Product**

In this research the two determinants of TAM model are considered as the product's features from the marketing perspective. In addition, environmental friendliness of IFC is combined with these two variables to examine its role in the consumers' purchase intention toward this new technology. In the context of IFC, environmentally friendly is defined as the extent to which food consumers believe that IFC is made of eco-friendly materials which are recyclable and reusable.

#### **3.2.4 Green marketing-Promotion**

In the context of green marketing, promotion means relationship with customers in order to help them to make a purchase decision of a product or service. The cost associated with promotion is often remarkable, so it is fundamental for the marketers to understand to what extent promotion is important for consumers and can affect their purchase intention toward a new product. In the context of IFC, promotion is defined as the extent to which food consumers believe that advertisement would affect their purchase interest and intention toward IFC.

#### **3.2.5 Green marketing-Place**

In the context of green marketing, place means taking the advantages of various methods of transporting and storing products in order to make them available for customers. In fact, a comprehensive distribution system helps a company to get the right product to the right place at the right time. As a result, it would be really helpful to understand consumers' perception about product's availability and accessibility. In the context of IFC, availability is defined as the extent to which food consumers believe that this technology is available easily and in any stores.

### **3.2.6 Green marketing- Price**

In the context of green marketing, compare to the other 4Ps which are cost, 'Price' is the one which creates sales revenue. However, because of the technology used in production of a green product, the price is usually higher than non-green products. The Research about consumers' opinions regarding product's pricing is important as it indicates how they value a product and what they want to pay. In the context of IFC, price is defined as the extent to which food consumers believe that IFC is a good value for the money, is reasonably priced, and will save them money by reducing food waste (Didier et al., 2017).

### **3.2.7 Consumers' interest**

In the research finding consumers' interest is defined as consumers' attention to a new product which meets their needs and requirements. In the context of IFC, consumers' interest is defined as the extent to which food consumers believe that using IFC will help them to monitor food quality and prevent foodborne illness.

### **3.2.8 Behavioral intention**

Research studies define behavioral intention as "a person's perceived likelihood or subjective probability that he or she will engage in a given behavior". In the context of IFC, consumers' behavioral intention is defined as the extent to which food consumers believe that using IFC will help them to monitor their food quality, enhance food safety, and reduce food waste.

## **3.3 Definition of Driver' Factors**

### **3.3.1 Concerns over food safety**

Concerns over food safety are related to consumers' concerns about foodborne illnesses (commonly known as food poisoning) which happened when people eat food that contains pathogens or toxins. As a result, consumers need to know whether their food is safe to eat and does not cause any health concerns. In this research model, consumers' concerns over food safety is defined as a factor which influences their perception of usefulness and ease of use of IFC, and purchase intention toward this new technology.

### **3.3.2 Environmental concerns**

According to research studies environmental concerns are related to consumers' concerns about the negative impacts of food packaging and food waste on the environment. As a result, they become more interested in the eco-friendly products. In this research model, customers' environmental concerns is defined as another factor which influences their perception of companies' green marketing mix elements (product's environmental friendliness and promotion) as well as consumers' interest toward IFC.

### **3.3.3 Social norm**

The social norm is defined as the rules of behavior that are considered acceptable in a group or society. As food consumers have become more aware of the negative effects of their food waste on the environment, they may feel more responsible and they decide to change their negative wastage habit. In this situation, their friends/ family request or the demand of people whose opinions are important to them plays critical role. . In this research model, social norm is defined as a factor which influences their perception of companies' green marketing mix elements (promotion and place) as well as consumers' interest toward IFC.

### **3.3.4 Financial saving**

As food waste is waste of money for the households, financial saving is a reason for them to reduce their wastage habit. In this research model, financial saving is defined as a factor which influences their perception of companies' green marketing mix element (price) as well as consumers' interest toward IFC.

## **3.4 Hypotheses in Research Model**

### **3.4.1 Relationships between Variables from Technology Acceptance Model**

Empirical research has shown that intention to buy a new product is influenced by consumer's perception, mental effort, and physical attempt. Based on reliable literature review, this research model illustrates the proposed relationships between PU, PEOU, interest to use, and purchase intention toward IFC. In addition, as consumers' concern over food safety is one of the most important reasons of household food waste, its effect on both PU and PEOU is examined. This research model will test the relationship between these variables with the following hypotheses.

- Hypothesis 1. Consumers' concerns over food safety positively influence consumers' perception of IFC ease of use.
- Hypothesis 2. PEOU positively influences consumers' purchase interest toward IFC.
- Hypothesis 3. Consumers' concerns over food safety positively influence consumers' purchase interest toward IFC.
- Hypothesis 4. Consumers' concerns over food safety positively influence consumers' perception of IFC usefulness.

- Hypothesis 5. PU positively influences consumers' purchase interest toward IFC.
- Hypothesis 6. PEOU positively influences consumers' perceived usefulness of IFC.

### **3.4.2 Relationships between 4Ps from green marketing mix**

The next hypotheses are based on the independent variables added to the original TAM model. In order to examine whether companies green marketing strategy positively influences consumers' interest, tendency, and purchase intention toward IFC, the 4Ps of green marketing are incorporated in the proposed model of this study to examine their influence in consumers' adoption of a new technology. In addition some external factors such as environmental concerns, social norms, and financial saving is added to the model to examine their affect as well. Thus, the following hypotheses are proposed.

- Hypothesis 7. Consumers' environmental concerns positively influence consumers' perception of IFC usefulness.
- Hypothesis 8. Consumers' environmental concerns positively influence consumers' purchase interest toward IFC.
- Hypothesis 9. Consumers' environmental concerns positively influence their perception of companies' green product marketing (IFC environmental friendliness).
- Hypothesis 10. Product environmental friendliness positively influences consumers' purchase interest toward IFC.
- Hypothesis 11. Consumers' environmental concerns positively influence their perception of companies' green promotion marketing (advertising).

- Hypothesis 12. Companies' green marketing promotion (advertising) positively influence consumers' purchase interest toward IFC.

Social influence is another variable influencing consumers' decision to adopt a new technology. Indeed, several studies have suggested that this influence is a critical element in understanding innovation diffusion (Venkatesh et al. 2003; Yq et al. 2011). Social norm includes the external impressions from peers, family, and friends which might influence consumers to employ a certain technology. In this research model, social influence has been included as an important factor which influences consumers' purchase interest. Thus, the following hypotheses are proposed.

- Hypothesis 13. Social norm positively influences consumers' purchase interest toward IFC.
- Hypothesis 14. Social norm positively influences customers' perception of companies' green promotion marketing (advertising).
- Hypothesis 15. Social norm positively influences customers' perception of companies' green place marketing (availability).
- Hypothesis 16. Places (availability) positively influence consumers' purchase interest toward IFC.

In this research model, it is assumed that products' environmental friendliness may influence companies' promotions. In addition, companies' green marketing promotion influence product availability. Thus, the following hypotheses are proposed.

- Hypothesis 17. Product environmental friendliness positively influences customers' perception of companies' green promotion marketing (advertising).

- Hypothesis 18. Customers' perception of companies' green promotion marketing (advertising) positively influence their perception of companies' green place marketing (availability).

Finally, in this study financial saving is considered as another factor which influences consumers' interest and purchase intention toward IFC. In addition, it influences their perception of companies' marketing strategy related to price and pricing. By understanding the importance of price and financial saving on consumers' purchase intention, companies can apply a better and practical marketing strategy related to price. Thus, the following hypotheses are proposed.

- Hypothesis 19. Financial saving positively influences consumers' purchase interest toward IFC.
- Hypothesis 20. Financial saving positively influences customers' perception of companies' green price marketing (pricing).
- Hypothesis 21. Customers' perception of companies' green price marketing positively influence their' purchase interest toward IFC.

At the end, in this study consumers' interest to IFC is expected to influence their purchase intention.

- Hypothesis 22. Consumers' interest to use IFC positively influence consumers' purchase intention toward this technology.

Demographic factors such as age, gender, education, income, and household size were considered in this research model to figure out their effects on customers' interest and purchase intention toward IFC (Table 1).

**Table 1 Hypotheses of the study**

Hypothesis	Dependent variable	Independent variable	Explanation
H1	Perceived Ease of Use	Consumers' concerns over food safety	Consumers' concerns over food safety has a positive effect on their perception of IFC ease of use
H2	Purchase interest	Perceived Ease of Use	Perceived ease of use (PEOU) has a positive effect on consumers' purchase interest.
H3	Purchase interest	Consumers' concerns over food safety	Consumers' concern over food safety has a positive effect on consumers purchase interest.
H4	Perceived Usefulness	Consumers' concerns over food safety	Consumers' concern over food safety has a positive effect on perceived usefulness.
H5	Purchase interest	Perceived Usefulness	Perceived usefulness (PU) has a positive effect on consumers' purchase interest.
H6	Perceived Usefulness	Perceived Ease of Use	Perceived ease of use (PEOU) has a positive effect on consumers' perceived usefulness.
H7	Perceived Usefulness	Environmental concerns	Consumers' environmental concern has a positive effect on perceived usefulness.
H8	Purchase interest	Environmental concerns	Consumers' environmental concern has a positive effect on consumers' purchase interest.
H9	Perceived environmentally friendliness	Environmental concerns	Consumers' environmental concern has a positive effect on perceived environmental friendliness.
H10	Purchase interest	Perceived environmental friendliness	Perceived environmentally friendliness has a positive effect on consumers' purchase interest.
H11	Promotion (Advertising)	Environmental concerns	Consumers' environmental concern has a positive effect on their perception of companies green promotion marketing.
H12	Purchase interest	Promotion (Advertising)	Customers' perception of companies' green promotion marketing has a positive effect on consumers' purchase interest.
H13	Purchase interest	Social norm	Social norm has a positive effect on consumers' purchase interest.
H14	Promotion (Advertising)	Social norm	Social norm has a positive effect on customers' perception of companies green promotion marketing.

Hypothesis	Dependent variable	Independent variable	Explanation
H15	Place (availability)	Social norm	Social norm has a positive effect on customers' perception of companies green place marketing.
H16	Purchase interest	Place (availability)	Customers' perception of companies' green place marketing has a positive effect on their purchase interest.
H17	Promotion (Advertising)	Perceived environmentally friendliness	Perceived environmental friendliness has a positive effect on customers' perception of companies green promotion marketing.
H18	Place (availability)	Promotion (Advertising)	Customers' perception of companies' green promotion marketing positively influence their perception of companies green place marketing.
H19	Purchase interest	Financial savings	Financial saving has a positive effect on consumers' purchase interest.
H20	Price (pricing)	Financial savings	Financial saving has a positive effect on customers' perception of companies' green price marketing.
H21	Purchase interest	Price (pricing)	Customers' perception of companies green price marketing has a positive effect on their' purchase interest.
H22	Purchase intention	Purchase interest	Consumers' purchase interest has a positive effect on their purchase interest.

## **4 Chapter: Methods**

This chapter describes the methods used to test the research model for this study. The first part of this chapter illustrates the process of developing research questionnaire in order to collect empirical survey data. The later parts explain the pre-test, sample, data collection, and data analysis. Data were collected through online survey from food consumers representing different socio-demographic sections in Canada. The approach used email and social media platforms to invite respondents to participate in the survey.

### **4.1 Research design**

This research is based on five steps including:

- Literature review focused on consumers' demand for food quality and food safety, adoption of a new packaging technology, and green marketing.
- Semi-structured interviews with food consumers, households, and environmental engineers.
- Formation of a research model and hypotheses based on the literature review and semi-structured interviews.
- Online questionnaire addressed to consumers/households in Canada
- Analysis of the collected survey data to test the hypotheses and the established research model.

#### **4.1.1 Literature review**

Literature review was done in related topics in order to get a better understanding of subjects, potential area, similar work, and research gaps. At this stage, selected articles were read and summarized carefully in order to identify streams of research, research goal, and the future proposed research. Based on the literature review, three main streams of this research is introduced: 1) Food quality, food safety, and their effects on consumers' food waste, 2) new food packaging technology (IFC) and consumers' adoption and purchase intention toward this new technology, and 3) the role of green marketing mix in consumers' purchase intention toward IFC.

#### **4.1.2 Semi-structured interviews**

Semi-structured interviews with a group of chosen Canadian households and environmental engineers. The idea of this open, semi-structured discussion with interviewees was to gather general information about their concern over food quality and food safety, their opinion about food waste, their knowledge about environmental issues, their intention to use new technologies, and their perceptions about the role of marketing in their purchase decision.

#### **4.1.3 Research model and hypotheses**

Research model and hypotheses were constructed based on the literature review and feedback from semi-structured interviews. The research model is established based on the integration of TAM variables with green marketing for the purpose of empirical testing through Structural Equation Modeling (SEM). The conceptual model compounds 22 hypotheses and determines whether two major determinants of TAM are valid to explain consumer acceptance of IFC. In order, the model investigates the role of companies green marketing in consumers' acceptance of IFC as well. In this research model, usefulness is

related to the features of IFC in order to increase food storage knowledge and reduce food waste. Ease of use is related to features such as washable, easy to learn, and ease of use. Green marketing is related to companies' marketing strategy and its potential effects on consumers' interest to use IFC. Finally, consumers' intention is related to customers' demand for monitoring food quality, getting informed of food conditions, and preventing food illness.

#### **4.1.4 Online questionnaire**

Online questionnaire was launched in June 2017 to understand the acceptance of IFC among consumers and households. The target group of respondents is consumers/households in Canada. Respondents were asked to fill an online questionnaire that included 72 questions. Apart from categorical background questions, all variables were measured on a five-point Likert scale (1=" Strongly disagree" to 5=" Strongly agree"). Like other methods, the Likert-type scale has several advantages and disadvantages. In terms of advantages, the scale is simple to be completed, easy to be analyzed, and comprehensive to be compared. However, the Likert scale is uni-dimensional which gives only five options of choice. The intervals between choices do not necessarily present equal changes in individuals' attitude. It may also be unsuccessful to measure the true attitudes of respondents because sometimes individuals want to present a false impression of their attitudes; on the other hand, this type of error is common to many forms of data collection (Bryman & Bell, 2011).

The survey resulted in a useful response from 153 respondents. The questions are categorized into several groups, namely general background questions, consumers' opinion about best by date, their concerns about food waste, interest in using IFC, beliefs

about IFC technology (i.e. perceived usefulness), beliefs about perceived ease of use of IFC, green marketing of IFC (companies' green marketing mix), consumers' environmental thinking, and, lastly, their intention to adopt IFC. The questionnaire is attached as Appendix A.

#### **4.1.5 Data analysis**

Data analysis was done to examine in detail the results of the study. The collected data were used to identify factors that influence consumers' purchase intention toward IFC. The data were analyzed using the IBM SPSS v23 and Smart PLS 3.2 software to test the research model and validate the established hypotheses.

## **4.2 Questionnaire Development**

### **4.2.1 Background questions**

The first section of questionnaire considers general background questions including the respondent's gender, age, highest completed level of education, household size, household annual income (before tax), and their household's most common reason for throwing out food.

### **4.2.2 Opinion about best by date**

The second section is related to consumers' demand over food quality, their concerns about food safety, and their perceptions over date labeling. These questions were added to the questionnaire in order to get a general idea about consumers' perception of date labeling and its importance in their purchase decision, as well as their concerns over food safety and its effects on their perceptions of IFC usefulness. Thus, respondents were asked to indicate their opinions about concerns over food safety on five-point Likert scale

questions (1 = strongly disagree; 5 = strongly agree). Survey questions measuring latent variables were taken from various sources (Table 2).

**Table 2 Questionnaire Items Measuring Opinion about Best by Date**

Questions	Source/adopted from
1. Food quality (color, texture, flavor, etc.) is very important to me.	(Biji et al., 2015)
2. I believe that date labeling (best before, use before, best by, and use by) on the food packaging is reliable information.	(Broad, 2014)
3. I always check the dates on the food packaging before purchasing the product.	(Newsome et al., 2014)
4. I always check the dates on the food packaging before consuming the product.	(Newsome et al., 2014)
5. I follow the date on the packaging to decide whether or not it is okay to consume the product.	(Broad, 2014)
6. I always rely on the date labels on the food packaging to make sure the food is safe to eat.	(Newsome et al., 2014)
7. I would dispose of unused food if its use by date were past because of health concerns.	(Broad, 2014)
8. I always take additional factors (e.g. appearance, odor, taste) into consideration along with the best by date in deciding if the food is safe to consume.	(Newsome et al., (2014)
9. If an item of food is coming close to its best before date, I will discard it.	(Verghese et al., 2013)
10. I believe that food past their “best before” or “use by” date are usually safe to eat.	(Verghese et al., 2013)

### **4.2.3 Concerns about food waste**

The third section of the questionnaire is about the investigation of reasons of discarding food, perceptions about consumers’ food waste, and their intention to reduce food waste

for financial savings. In this section of the questionnaire, some questions were added to get a general idea about consumers' food waste habits, their reasons, and their efforts to reduce it. Thus, respondents were asked to indicate their response on five-point Likert scale questions (1 = strongly disagree; 5 = strongly agree) (Table 3).

**Table 3 Questionnaire Items Measuring Concern about Food Waste**

Questions	Source/adopted from
1. I am always afraid of food-borne illness (e.g. food poisoning).	(Neff et al., 2015)
2. I usually dispose of leftover food because I am afraid of possibility of food poisoning.	(Neff et al., 2015)
3. I always do my best to minimize the amount of food thrown away in my household.	(Neff et al., 2015)
4. My most significant concern about food waste is waste of unused expired food.	(Verghese et al., 2013)
5. I am really interested in taking action to reduce the amount of food discarded in my household.	(Graham-Rowen et al., 2014)
6. Saving money is a major reason for me to reduce food waste.	(Neff et al., 2015)
7. I would reduce my household's food waste because of financial savings.	(Graham-Rowen et al., 2014)

#### **4.2.4 Interest in using intelligent food containers**

This section of the questionnaire is allocated to the investigation of the reasons that can influence consumers' interest in adopting and using IFC (Table 4). Thus, respondents were asked to answer ten questions on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).

**Table 4 Questionnaire Items Measuring Interest in Using IFC**

<b>Questions</b>	<b>Source/adopted from</b>
1. I am interested in an intelligent food container that will provide information about food quality.	(Yam et al., 2005)
2. I am interested in an intelligent food container that will potentially help in extending food shelf life by monitoring food quality.	(Realini & Marcos, 2014)
3. I am interested in an intelligent food container that will prevent foodborne illness.	(Aday & Yener, 2015)
4. I am interested in an intelligent food container that will monitor food quality.	(Ghaani et al., 2016).
5. I am interested in an intelligent food container that will inform me about food conditions.	(Ghaani et al., 2016).
6. I am interested in an intelligent food container that will provide real use-by date.	(Raymana et al., n.a)
7. I am interested in an intelligent food container that gives instructions about how to store food.	(Biji et al., 2015)
8. I am interested to get informed about my refrigerator/pantry/cupboard contents by notification through mobile or desktop application.	based on semi-structured interviews
9. I am interested to get informed about my refrigerator/pantry/cupboard contents by notification through the indicator on the container.	based on semi-structured interviews
10. I am interested in an intelligent food container that alerts me if a product is not being stored at the correct temperature.	(Ghaani et al., 2016).

#### **4.2.5 Beliefs about intelligent food containers**

This section is related to consumers' perception of IFC usefulness (and is thus based on the TAM). PU was assessed using seven questions. In this section, the usefulness of IFC

is related to its ability in maintaining food quality, enhancing food safety, reducing food waste, and increasing food storage knowledge. Thus, respondents were asked to indicate their perception of the usefulness of IFC on five-point Likert scale questions (1 = strongly disagree; 5 = strongly agree) (Table 5).

**Table 5 Questionnaire Items Measuring Perceived Usefulness**

Questions	Source/adopted from
1. I believe that an intelligent food container that is safe to use is beneficial for my health.	(Jay Polonsky, 2008)
2. I believe that an intelligent food container would reduce my confusion about date labeling.	(Broad,(2014)
3. I believe that an intelligent food container would help me to reduce food waste.	(Opara, 2013)
4. I believe that an intelligent food container would help me prevent foodborne illness.	(Opara, 2013)
5. I believe that an intelligent food container will help me store the product correctly.	(Quested & Parry, 2013)
6. I believe that an intelligent food container is beneficial for my household.	(Kalafatis et al., 1999)
7. I believe that an intelligent food container is a pleasant idea for my household use.	(Jay Polonsky, 2008)

#### 4.2.6 Ease of use of intelligent food container

This section is related to consumers' perception of IFC ease of use (and is thus based on the TAM). In specific, the questions addressed whether intelligent food container solution should be easy to use, sustainable, washable, and eco-friendly. Respondents were asked to indicate their perception of the ease of use of IFC on five-point Likert scale questions (1 = strongly disagree; 5 = strongly agree) (Table 6).

**Table 6 Questionnaire Items Measuring Perceived Ease of Use of**

Questions	Source/adopted from
1. I am interested in an intelligent food container that will be easy to use.	(Vijayasathy, 2004)
2. I am interested in an intelligent food container that is easy to clean/wash.	(Realini & Marcos, 2014)
3. I am interested in an intelligent food container that is easy to learn to use.	(Vijayasathy, 2004)
4. I am interested in an intelligent food container that will be environmental friendly.	(Ahvenainen & Hurme, 1997; Kalafatis et al., 1999)
5. I am interested in an intelligent food container if it's made of eco-friendly materials.	(Ahvenainen & Hurme, 1997; Kalafatis et al., 1999)
6. I am interested in an intelligent food container if it will be recyclable.	(Ahvenainen & Hurme, 1997; Kalafatis et al., 1999)
7. I am not interested in an intelligent food container if it will be environmentally harmful.	(Ahvenainen & Hurme, 1997; Kalafatis et al., 1999)

#### **4.2.7 Green Marketing of intelligent food containers**

This section is related to the role of green marketing in the adoption of IFC. In particular, respondents were asked to indicate whether companies' green marketing mix (reflecting product, price, place, and promotion) affects their adoption of IFC. Respondents' perceptions on the influence of green marketing were measured on five-point Likert scale questions (1 = strongly disagree; 5 = strongly agree) (Table 7).

**Table 7 Questionnaire Items Marketing of IFC**

Questions	Source/adopted from
1. I am interested in intelligent food containers that will be available in all stores.	(Kharde, 2016; based on semi-structured interviews)
2. I will use an intelligent food container for my products if it will be easily available.	(Kharde, 2016; based on semi-structured interviews)
3. I would prefer spending money on an intelligent food container instead of wasting edible food.	(Kiran, 2012)
4. I am willing to pay more for an intelligent food container compared to a regular container to have safe food.	(Aday & Yener, 2015)
5. I am interested in an intelligent food container that will save me money by reducing food waste.	(Neff et al., 2015)
6. I am interested in an intelligent food container if it is a good value for the money.	(Kiran, 2012)
7. I am interested in an intelligent food container if it is reasonably priced.	(Kiran, 2012)
8. I believe that an intelligent food container would pay itself back quickly.	(Kiran, 2012)
9. I believe that advertisements would affect my adoption of an intelligent food container.	(Kalafatis et al., 1999)
10. I believe that advertisements would affect my intention to use an intelligent food container.	(Kalafatis et al., 1999)

#### **4.2.8 Environmental thinking**

This section is allocated to investigate consumers' knowledge about food waste and its' economical, environmental, and ethical effects. Respondents were asked to indicate the importance of the environment for them, their attempt to reduce the negative impacts of their own behavior on the environment, and also the effects of the environmental opinions of their peers (close friends, classmates, etc.) on their environmental thinking. Respondents' environmental thinking was measured on five-point Likert scale (1 = strongly disagree; 5 = strongly agree) (Table 8).

**Table 8 Questionnaire Items Measuring Environmental Thinking**

<b>Questions</b>	<b>Source</b>
1. I have high level of knowledge about negative environmental impact of the food waste.	Graham-Rowe et al., (2014)
2. I would reduce my household's food waste to protect the environment.	Graham-Rowe et al., (2014)
3. I am likely to adopt new technologies (e.g. intelligent food container and related applications).	Matin et al., (2012)
4. I would reduce my household's food waste because of people whose opinions are important to me.	Lee, K. (2008).
5. I am interested to reduce my food waste mostly because of my family/friends request.	Lee, K. (2008).

#### **4.2.9 Intention to use intelligent food containers**

The last section of the questionnaire focuses on behavioral intention. It is categorized into using IFC as an opportunity for maintaining food quality, reducing food waste, enhancing food safety, and increasing food storage knowledge. The goal is to understand whether using IFC technology is a wise idea for consumers, is more affordable and easier than traditional packaging, corresponds well with consumers' demand and expectations, and is pleasant for the household. Respondents were asked to indicate their behavioral intention on five-point Likert scale questions (1= strongly disagree; 5 = strongly agree) (Table 9).

**Table 9 Questionnaire Items Measuring Intention to Use IFC**

Questions	Source/adopted from
1. I believe that an intelligent food container will improve my quality of life.	based on semi-structured interviews
2. An intelligent food container with sensors that monitor environmental conditions of the product will help me reduce food waste.	(Wang et al., 2015)
3. I am interested to use an intelligent food container.	(Park, 2009)
4. I intend to use an intelligent food container to enhance my food safety.	(Grunert, 2005; Biji et al., 2015)
5. I intend to use an intelligent food container to monitor my food quality.	(Grunert, 2005; Biji et al., 2015)
6. I intend to use an intelligent food container to reduce my food waste.	(Wikström et al., 2014)
7. I intend to use an intelligent food container to save money by reducing my food waste.	(Graham-Rowe et al., (2014)
8. I intend to use an intelligent food container to become more environmentally friendly.	(Kharde, (2016; Royne et al., 2011)
9. I intend to use an intelligent food container even if it will be quite expensive compared to a regular container.	(Kharde, (2016; Royne et al., 2011)
10. I intend to buy an intelligent food container whenever it becomes available.	(Kharde, 2016)

### **4.3 Pre-test**

Before data collection for the main survey, a pre-test was conducted with 7 Canadian households in order to obtain feedback and recommendation for improvements regarding the questionnaire. These 7 Canadian households consisted of 3 female and 4 male food consumers with a variety of age, education, and income (Table 10). In this stage, participants were asked to answer only background questions and provide their feedbacks and comments on the rest of the questionnaire. So, there is not any data available for this stage of the study. These pre-testers proposed their comments about the questionnaire designed on the SurveyMonkey website and generally the feedback was positive (e.g. the survey was well constructed; survey was very easy to understand and fill; and survey was comfortable to use).

While conducting a pre-test, some problems in the questions were identified, and thus the survey was modified based on the pre-test respondents' comments in order to improve the questionnaire used for the main study. In specific, all suggestions from the pre-tests were used to refine and revise the questionnaire to improve accuracy, reliability and validity (Table 10).

**Table 10 Pre-test respondents' demographic characteristic**

<b>Item</b>	<b>Category</b>	<b>Results</b>
<b>Gender</b>	Female	3
	Male	4
	<b>Total</b>	<b>7</b>
<b>Age</b>	18-25	-
	26-33	1
	34-41	3
	42-49	2
	50-57	1
	58-65	-
	Over 65	-
	<b>Total</b>	<b>7</b>
<b>Education</b>	High school	-
	Certificate holder	-
	Bachelor's degree	1
	Master's degree	2
	Doctoral degree	3
	Other	1
	Missing	-
	<b>Total</b>	<b>7</b>
<b>Household size</b>	1 person	1
	2 persons	4
	3 persons	2
	4 persons	-
	5 or more	-
	<b>Total</b>	<b>7</b>
<b>Household annual income( before tax)</b>	less than \$9,999	-
	\$10,000-\$14,999	-
	\$15,000-\$24,999	-
	\$25,000-\$34,999	1
	\$35,000-\$49,999	2

Item	Category	Results
	\$50,000-\$74,999	-
	\$75,000-\$99,999	2
	\$100,000-\$149,999	1
	\$ 150,000 or more	1
	Total	7
<b>Most common reason for throwing out food</b>	Past food date (best before/best by date)	3
	leftover	1
	Didn't like it	-
	Needed space	-
	Food gone bad	3
	Other	-
	Total	7

#### 4.4 Sample selection

Data were collected from volunteer food consumers and households in Canada. Since everyone buys and consumes food, the participants for survey could be anyone in Canada. The invitation email/message was sent to a list of 40 potential respondents. These respondents consist of classmates at Carleton University, friends who are working for government and non-governmental organizations, and current and previous colleagues at work. These prospective participants were approached through LinkedIn, Facebook, and Social Apps such as Telegram, WhatsApp, Yahoo Messenger etc. An invitation email was sent to individuals with email address and invitation message was sent to the ones with phone numbers. Soon after having their permission, the questionnaire link was sent to them. Also, in order to broaden the scope of the research, respondents were asked to forward and share the survey with those who may be interested in this area through their own social networks. This method is generally called the snowball sampling.

Snowball or chain referral sampling is a well suited method for different kind of research purposes. Although the method is known to be effective, the downside is that it is impossible to tell how many people actually received an invitation, what percentage of the respondents represented the original network of invitees and what percentage came from their connections (Biernacki & Waldorf, 1981).

A subscribed internet survey tool (surveymonkey.com) was used and the survey was conducted online during the May-June 2017. Some available template options and settings in surveymonkey.com were applied to design the survey in order to secure high-quality responses. For example: 'include all respondent information in the survey results' function was used to have respondents' IP address and to make sure the respondents are from Canada. Like other methods using for survey research, the Internet method has its strengths and limitations. The Internet helps to efficiently and quickly recruit a large number of respondents, recruit specialized samples, and easily replicate studies (Birnbaum, 2004). In terms of challenges, there is a potential bias because participants in Internet-based surveys are most likely individuals who have access to computer networks, who have the skills to use the survey tools, and who accept and feel comfortable with Internet surveys (Zhang, 2000). On the other hand, this may be not an issue – rather strength – in this research that focuses on the adoption of a novel high-technology product.

Similar to the other studies, this study might experience further sampling bias which means that a sample is collected in a way that some members of the intended population are less likely to be included than others. According to Bryman & Bell (2011), there are three different types of bias such as undercoverage bias, nonresponse bias, and voluntary

response bias. Undercoverage bias occurs when respondents aren't from the population which is hoped for or some members of the population are inadequately represented in the sample. Nonresponse bias sometimes occurs when people chosen for the sample refuse to answer or lack the time or inclination to answer. Voluntary response bias occurs when people chosen for the sample are very opinionated people. These types of voluntary responses lead to an under-representation of the general population in favor of strong opinions. In the case of snowball sampling, these biases remain and are difficult to address.

In addition, demographic factors such as age, education, and income may cause bias within the sample as well. Thus, the questionnaire included a section focused on background questions. As explained later in the study, apparently, there may be a bias emerging regarding participants' education and income. The sample included a significant portion of high-educated, high-income people that are in their mid-thirties. It is perhaps for this reason that middle age respondents having higher education and higher income seem to be more interested in the adoption of a new technology compared to others. This will be further discussed in the results section.

#### **4.5 Data collection and preparation for analyses**

The population under consideration includes all Canadian households over 18 years old since individuals less than 18 years old are dependents and not considered to live on their own and make purchase decision independently apart from minor purchases of daily goods and services. Potential research participants were approached by email/message and asked if they are willing to participate in the study. Those who agreed to participate received an invitation email/message, including the link to the questionnaire website in

Survey Monkey. Participants who completed the questionnaire submitted their responses anonymously. Thus, no participants could be associated with their answers in the data. However, email addresses/telephone number had been recorded for the purpose of sending a reminder email which sent to the participants' two times after the questionnaire was distributed.

As explained previously, snowball method was used to distribute the questionnaire. That is, all initial participants were asked to forward the questionnaire's link to their friends, families, and colleagues whom they deemed appropriate respondents for the survey. The data collection was conducted in two steps since the collected data in the first step was considered insufficient. Hair et al. (1998) suggest that the minimum sample size of 100 to 150 ensures an appropriate use of maximum likelihood estimation in SEM (Cho, 2007). Thus, the second step of data collection comprised sending reminder emails and approaching new potential participants. As a result, total number of the participants equaled 153.

#### **4.6 T-Test for bias examination**

Because the data collection span over one month and a second round was initiated to get more data, there was a probability of bias, i.e. statistical difference between the early and late data. Thus, the early responders were compared with late responders by using T-Test to find out if there are any significant differences between early and late respondents (Appendix B). For the purpose, the data was split into half based on the date of their submission; group 0 is early respondents and group 1 is late respondents. The results show that none of the variables seem to have differences significant at  $p < 0.05$  and, as a consequence, there are no statistically significant differences in the survey responses

between early responders and late responders. The data is free from bias in that sense, and the characteristics and attitudes of respondents remained similar over the second effort, thus enabling us to use early and late data as one data set for the analyses.

#### **4.7 Missing Value Analysis (MVA)**

As the impact of missing data can be serious on a quantitative research, in this study the missing data were examined as well. Missing data occur at two levels: at the unit level or at the item level; and can cause several problems such as 1) potential bias in parameter estimation, 2) weakness in generalization of the results, 3) decrease in statistical power, and 4) increase in standard errors (Dong & Peng, 2013). In this study, only missing data at the item level was tackled. An item non-response means a respondent may miss a few questions while he/she answered the questionnaire. Based on the literature review, there is no established border regarding an acceptable percentage of missing (Dong & Peng, 2013). For example, according to Schafer (1999), a missing rate of 5% or less is inconsequential. However, Bennett (2001) believed that statistical analysis is likely to be biased when more than 10% of data are missing. In this study, the missing value analysis (MVA) shows that there is not a significant missing value problem, because variables typically are missing less than 4%. The highest missing value proportion (4.6%) is related to one of the questions related to intention to use IFC (J08) which is unlikely to cause issue since it is less than 5%. Appendix C shows missing values and their percentage for each item. As B-questions are categorical background questions; thus, the table doesn't show means for them unlike all the others that are scaled questions.

#### **4.8 Data Analysis**

The collected data were used to identify factors that influence consumers' purchase intention toward IFC. In this study, the structural equation modeling (SEM) is used to test the conceptual model. As the conceptual model is in an early stage of development and relatively complex, partial least squares (PLS) approach is used (Teo et al., 2003). The PLS path modeling technique was chosen since it includes the ability to model multiple constructs with the minimum requirements on measurement levels and the maximum robustness in the face of missing data, and it does not depend on having a large sample size (Chin et al., 2003; Tenenhaus et al., 2005; cf. Westerlund et al., 2014). The PLS path modeling technique provides multiple regression analyses in which direct or moderated effects of multiple constructs is expected. In this research PLS 3.2 software was applied as an appropriate tool for testing the validity of model. It is one of the most popular software tools for PLS modeling of constructs with latent variables. The data analysis was done in different steps.

#### **4.8.1 SPSS data entry**

The first step was using SPSS software for analyses after importing the recorded data from SurveyMonkey to Excel sheet, and further into SPSS. The questionnaire was composed of categorical demographic questions and scaled main questions. The main questions were measured with five-point Likert scales (from 1= strongly disagree to 5 = strongly agree). The data were analyzed to understand the frequencies of each variable. The results on background questions indicate slightly more female respondents compared to male counterparts, significant proportion of people in their early- and middle adulthood (about 50% between 34-41), significant portion of highly educated people (approximately 87% with a university degree, and over 25% with a doctoral degree).

Moreover, respondents are mostly 1- or 2-person households and, finally, the sample is quite high-income population (as much as 38.4% of households make a combined annual income of more than \$100k). The results also show that food gone bad is clearly the main reason to throw out food, followed by past best by date. Appendix D shows the frequencies in regard to background questions.

#### **4.8.2 Setting up a new project in SmartPLS**

The partial least squares (PLS) path modeling technique performs multiple regression analyses in which there are multiple constructs expected to have direct or moderated effects on other constructs. This is also called PLS-SEM, i.e. structural equation modeling based on PLS. The software is used in empirical research to analyze collected data and test hypothesized relationships simultaneously as a total model. In this study, SmartPLS 3.2 (Ringle et al., 2015) was used to estimate the parameters tension to determine composite data. This software is one of the most popular and appropriate tools with a graphical user interface for testing the validity of model with latent variables. In this step, the data set was imported from SPSS file to a format accepted by SmartPLS (.csv file) and a path model was created using the program's tools.

#### **4.8.3 Exploratory Factor Analysis (EFA) with Varimax rotation in SPSS**

In this step, exploratory factor analysis was run in order to identify the underlying relationships between measured variables and to test the reliability of each factor. The statistical reason to do this step is to figure out which factors group together and which construct they are related to. In other words, factor analysis was run to make it easier to find feasible items/variables for constructs in the path analysis (i.e. PLS-SEM analysis) and in order to assure the validity of the loadings' questions on the appropriate factors.

In this stage, communalities (sometimes marked as  $h^2$ ) are used to look for variables which are less than 0.70 to remove from the analysis, since these variables cause disorder in factor analysis. In this study, all scaled items were used to perform factor analysis. Appendix E shows the communalities of this study. After running principle components analysis with the requirement for Eigenvalue > 1.0 and Varimax rotation method (a commonly used rotation method for factor analysis), just the strongest factors were kept in order to keep the model valid. The results illustrate that from the 72 principle components selected for the factor analysis, only 18 factors resulted in the Eigenvalue > 1 and together these factors explained 76.44% of the variance in the data. Table 11 shows the KMO and Bartlett's Test results. According to Kaiser (1974), acceptable KMO value must be above 0.50 (value smaller than this cause to rethink about collecting more data or deciding which variables to include). Based on his measurement, values between 0.50 and 0.70 are mediocre, 0.70 and 0.80 are good, 0.80 and 0.90 are great, and values above 0.90 are superb (Kaiser, 1974). In this study, KMO is 0.776 (df=2556,  $p < 0.001$ ), so the result is statistically significant and factor analysis suits well for the data (Table 11).

**Table 11 KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.776
Bartlett's Test of Sphericity	Approx. Chi-Square	7116.102
	df	2556
	Sig.	.000

#### **4.8.4 Run PLS algorithm**

PLS-SEM analysis using SmartPLS software package includes two steps. The first step runs PLS algorithm to provide beta values (i.e. path coefficients between the constructs), R<sup>2</sup> values (the numbers that tell how much independent variables explain variance in each dependent construct), and item loadings (individual variable loadings to constructs) for the full model. The analysis used 300 maximum iterations (a default setting in SmartPLS), and showed whether the values are co-efficient and significant. Moreover, PLS algorithm provides values relevant to complete reliability and validity analyses.

#### **4.8.5 Reliability analysis**

As explained, the reliability analysis tools integrated in SmartPLS were utilized to calculate reliability and validity of the constructs in terms of composite reliability values (CR) and average variance extracted values (AVE). Internal consistency reliability analysis indicated how consistently each individual item and all together measure the construct. In structural equation models the composite reliability must be greater than 0.70 (Hair Jr et al., 2014), and AVE should be more than 0.50 (Chou & Chang, 2008).

#### **4.8.6 Bootstrapped model**

In order to test coefficients in outer loadings and paths, bootstrapping procedure was applied. In this study, the second step run a bootstrapping with 1,000 resample procedure to drive t-values and illustrate whether the co-efficiencies from step 1 are actually statistically significant. For this, a two-tailed t-test with a significance level of 5% was used. In this step, beta values were replaced by t-values, and the path coefficient will be significant if the t-value will be larger than 1.96. In addition, the procedure provides the

standard p-values where it should be  $p < 0.05$ . On the other hand, t-values and p-values are tightly knitted and are typically aligned in a sense that a statistically significant t-value always has a statistically significant p-value; thus, reporting the t-value for each path is considered sufficient (Kushwaha et al., 2015).

## **5 Chapter: Results**

This chapter reports the results of the main study described in the previous chapter. In so doing, it includes a demographic description of the sample and a summary of research variables. The hypotheses were tested by analyzing the collected data from the survey.

### **5.1 Description of sample**

In order to test the hypotheses illustrated in the research model, a sample of volunteer food consumers and households in Canada was selected. Since the participants for a food-related research could be nearly anyone in Canada, the data were collected through a survey from 155 individuals using the snowball method. Out of 155 responses collected, 153 were usable and were employed for the data analyses. Upon cleaning the data set two respondents were removed; one of them was under 18 years old (considered not adult in the legal sense and thus unable to make independently purchase decisions in regard to potentially expensive technology products) and the other only completed six background questions. Descriptive statistics of the sample consist of respondents' demographic profiles reported in Table 12.

**Table 12 Demographics of respondents**

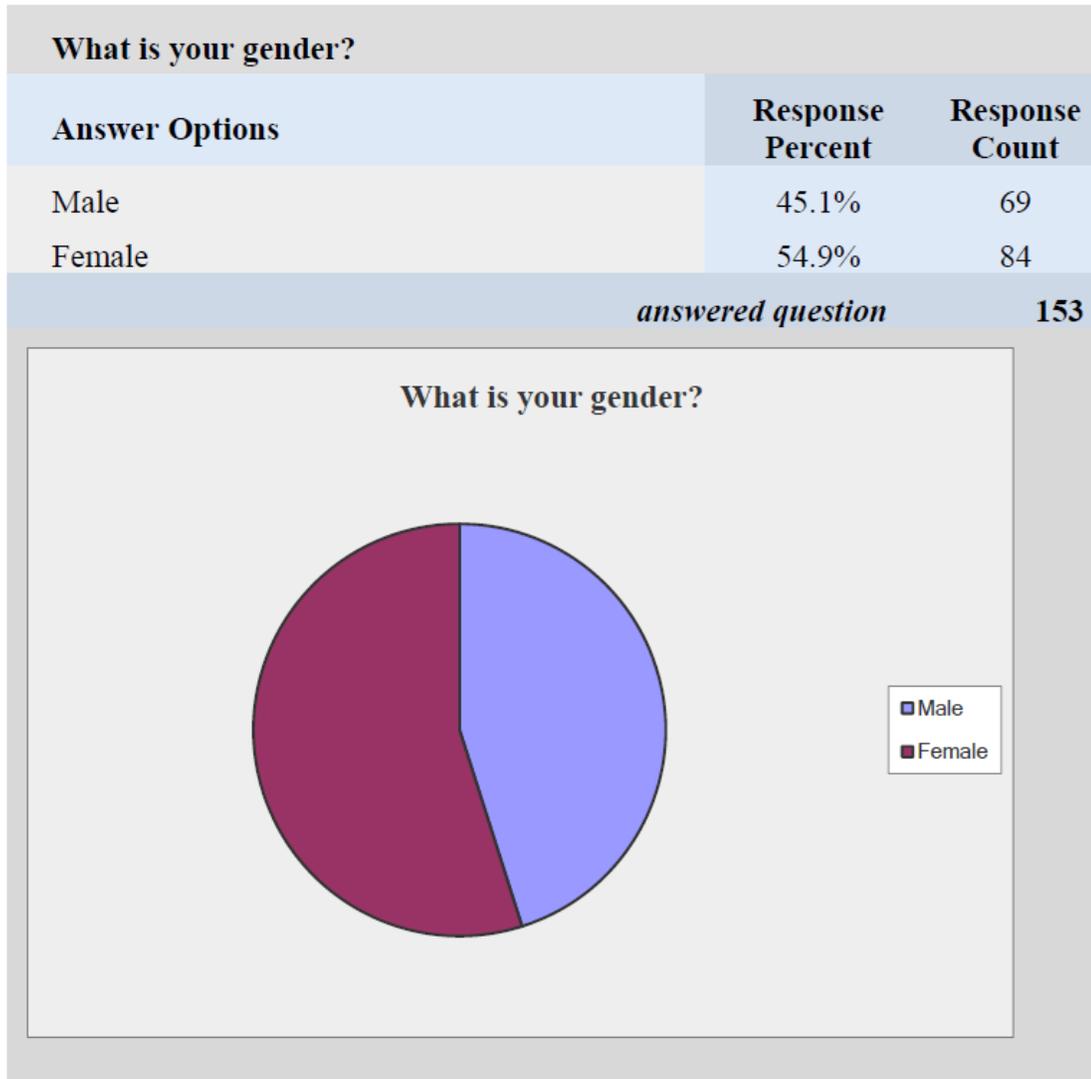
<b>Item</b>	<b>Category</b>	<b>Frequency</b>	<b>Percent<sup>a</sup></b>
Gender	Female	84	54.9
	Male	69	45.1
	Total	153	100.0
Age	18-25	18	11.8
	26-33	33	21.6
	34-41	76	49.7
	42-49	18	11.8
	50-57	6	3.9
	58-65	1	0.7
	Over 65	1	0.7
	Total	153	100.0
Education	High school	9	5.9
	Certificate holder	6	3.9
	Bachelor's degree	42	27.6
	Master's degree	52	34.2
	Doctoral degree	39	25.7
	Other	4	2.6
	Missing	1	0.7
Total	153	100.0	
Household size	1 person	33	21.6
	2 persons	55	35.9
	3 persons	31	20.3
	4 persons	27	17.6
	5 or more	6	3.9
	Missing	1	0.7
	Total	153	100.0
Household	less than \$9,999	7	4.6

Item	Category	Frequency	Percent <sup>a</sup>
annual income( before tax)	\$10,000-\$14,999	7	4.6
	\$15,000-\$24,999	13	8.5
	\$25,000-\$34,999	10	6.5
	\$35,000-\$49,999	11	7.2
	\$50,000-\$74,999	23	15.0
	\$75,000-\$99,999	22	14.4
	\$100,000-\$149,999	24	15.7
	\$ 150,000 or more	34	22.2
	Missing	2	1.3
	Total	153	100.0
Most common reason for throwing out food	Past food date (best before/best by date)	36	23.5
	leftover	23	15.0
	Didn't like it	6	3.9
	Needed space	1	0.7
	Food gone bad	85	55.6
	Other	1	0.7
	Missing	1	0.7
	Total	153	100.0

Sum of percents may not be equal to 100 because of rounding data.

### 5.1.1 Participants' gender

Figure 6 shows that 45.1% of respondents were male and 54.9% female. Thus, there were slightly more female respondents compared to male counterparts. This distribution may be due to the fact that higher percentage of female in a household are responsible for food purchasing and preparation and they are more interested in new food related technology.

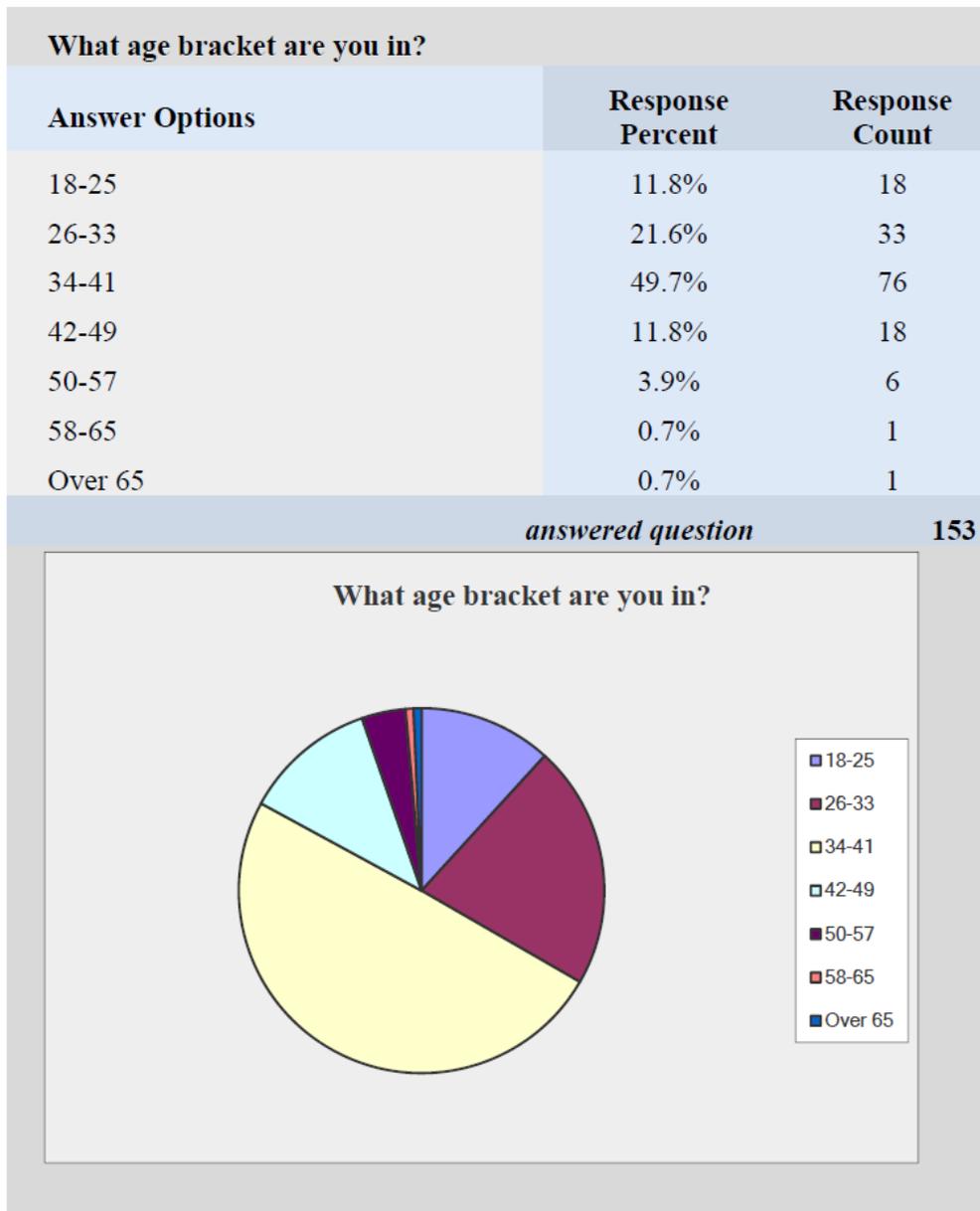


**Figure 6** Participants' gender

### **5.1.2** Participants' age

The respondents varied widely in terms of age (Figure 7). The highest percentage of the respondents (49.7%) were between 34 and 41, followed by 26-33 years old (21.6%), 42-49 years old (11.8%), 18-25 years old (11.8%), 50-57 years old (3.9%), 58-65 years old (0.7%), and over 65 years old (0.7%). Therefore, the data set has a strong representation of 34-41 years old (about 50%), and altogether people between 26-49 years old make

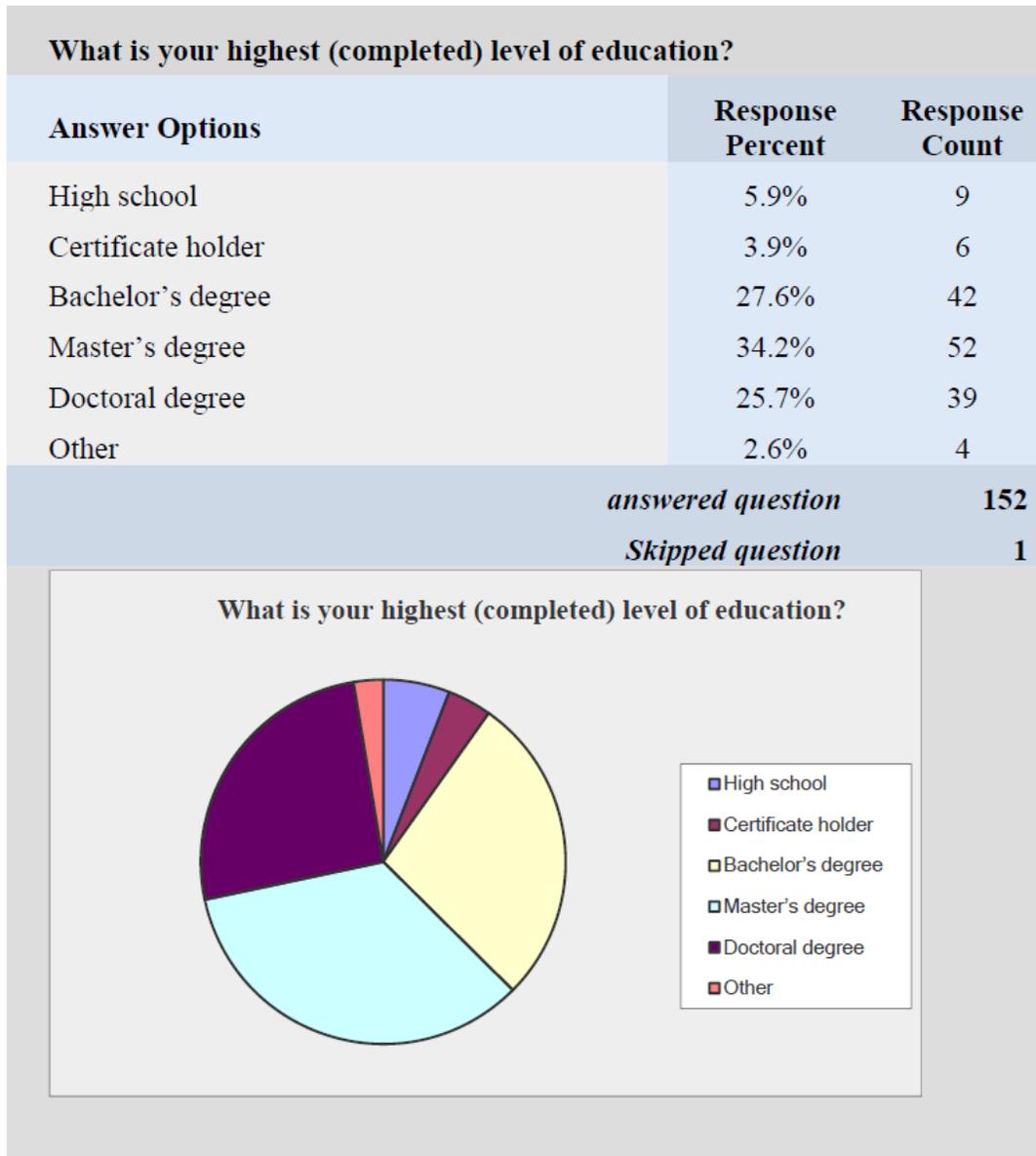
83.1%. In other word, the data set has a significant proportion of people in their early- and middle adulthood. This might be because such participants are most likely individuals who have access to computer networks, who have the skills to use the survey tools, and who accept and feel comfortable with Internet surveys.



**Figure 7** Participants' age

### **5.1.3 Participants' education**

This study categorized education into six categories. Figure 8 shows that the majority of respondents have a Master's degree (34.2%), followed by Bachelor's degree (27.6%), Doctoral degree (25.7%), High school (5.9%), Certificate holder (3.9%) and Other (2.6%). In this vein, the sample has a significant portion of highly educated people (around 87% of respondents have a university degree, and over 25% have a doctoral degree). It is obvious that the participants' level of education in this research was higher than the average community; this distribution was likely due to the fact that snowball method was used for data collection. For example, those with a graduate degree can be more likely to forward the invitation to participate in the survey to people who have similar educational background.

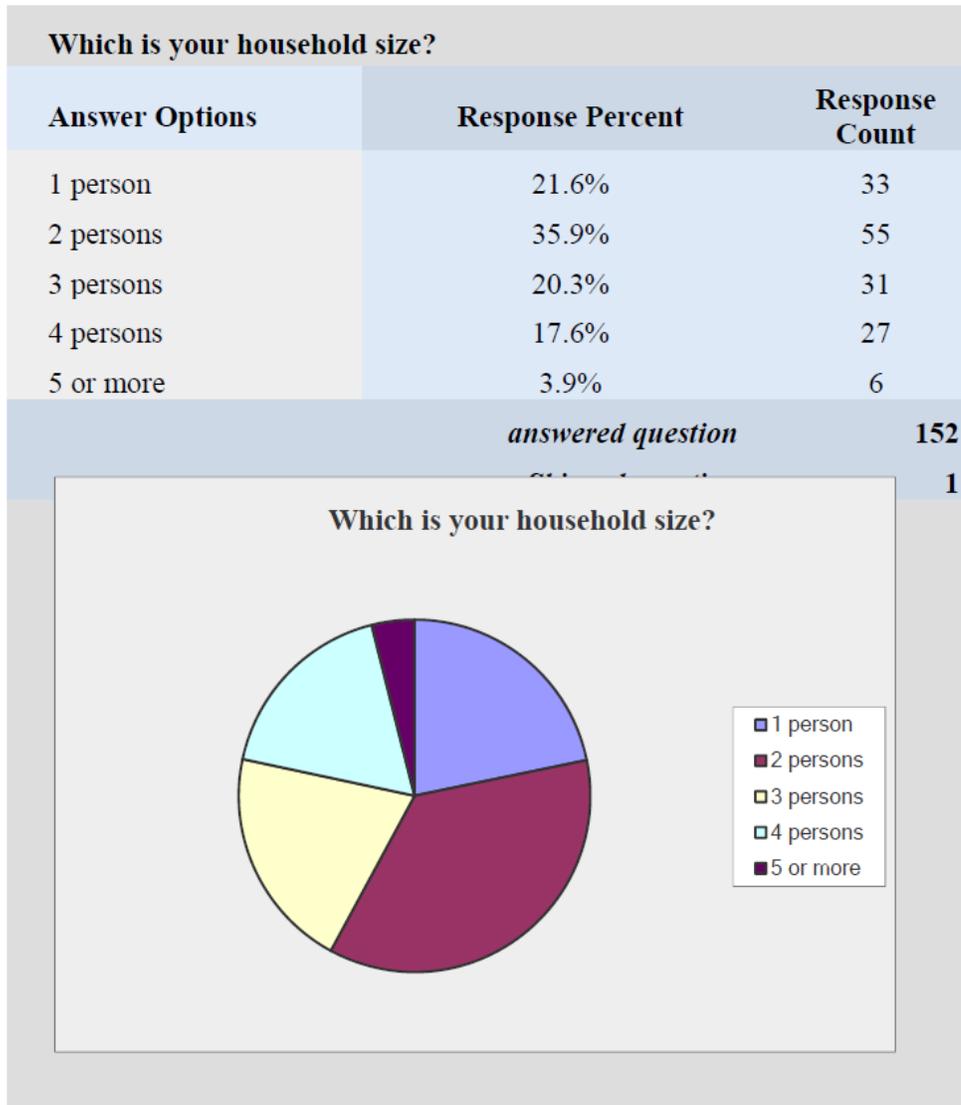


**Figure 8** Participants' education

#### 5.1.4 Participants' household size

The majority of respondent have a household with two persons (35.9%). In fact, two person households made the largest group and one person households were the second largest group (21.6%), followed by three persons (20.3%), four persons (17.6%), and five or more (3.9%). This distribution illustrates that the majority of respondents represented

1- or 2-person households (almost 58% in total), i.e. most commonly they were singles and dingles (Figure 9).



**Figure 9** Participants' household size

### 5.1.5 Participants' combined annual household income (before tax)

In terms of annual household income, the largest group (22.2%) was households earning \$150,000 or more before tax, followed by \$100,000-\$149,999 (15.7%), \$50,000-\$74,999 (15.0%), \$75,000-\$99,999 (14.4%), \$15,000-\$24,999 (8.5%), \$35,000-\$49,999 (7.2%),

\$25,000-\$34,999 (6.5%), \$10,000-\$14,999 (4.6%) and, finally, those making less than \$9,999 (4.6%) (Figure 10). Overall, the sample consists of higher income population, as 38.4% of households make a combined annual income of more than \$100,000. The high level of income in this research could be justified as the majority of the participants were highly educated and, consequently, had better paid jobs requiring a university degree.

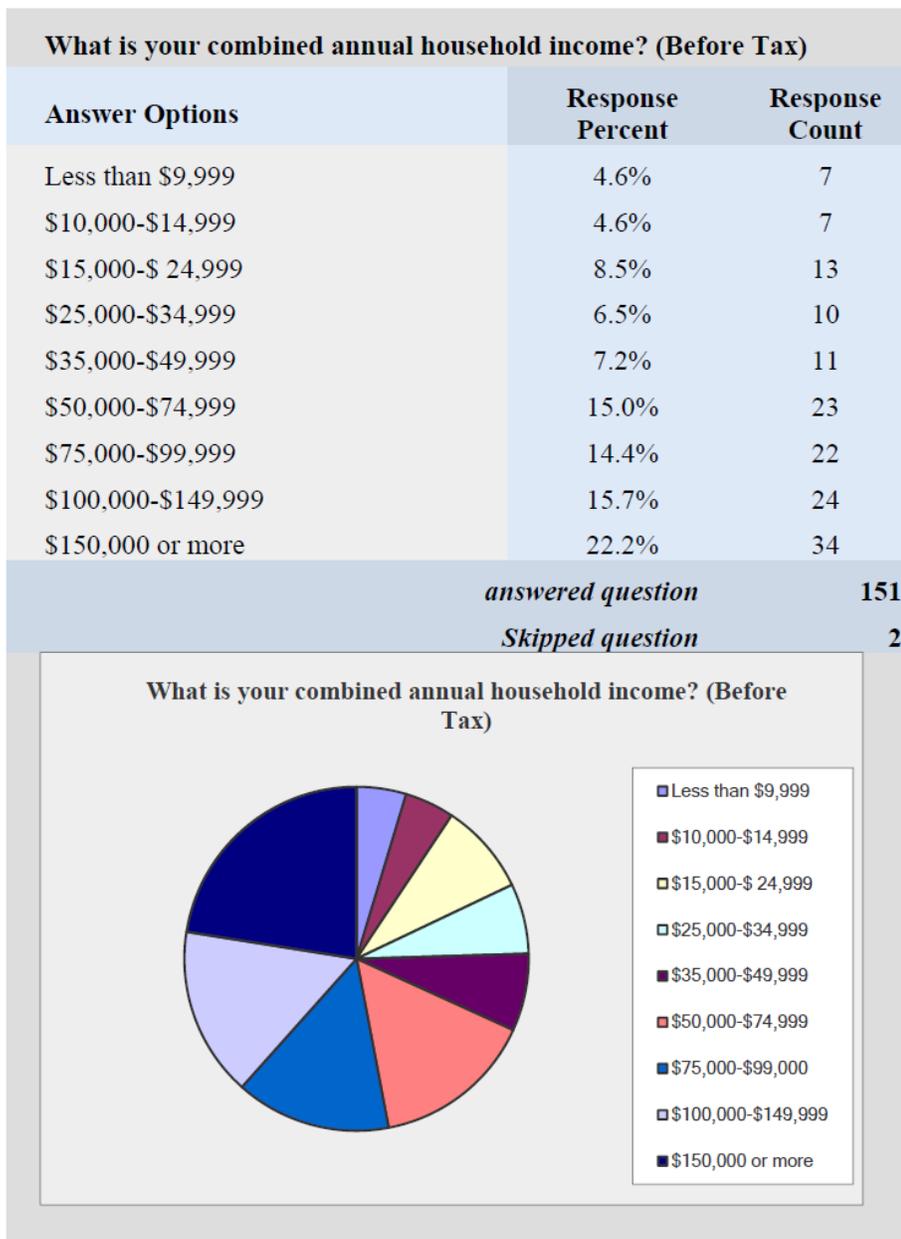
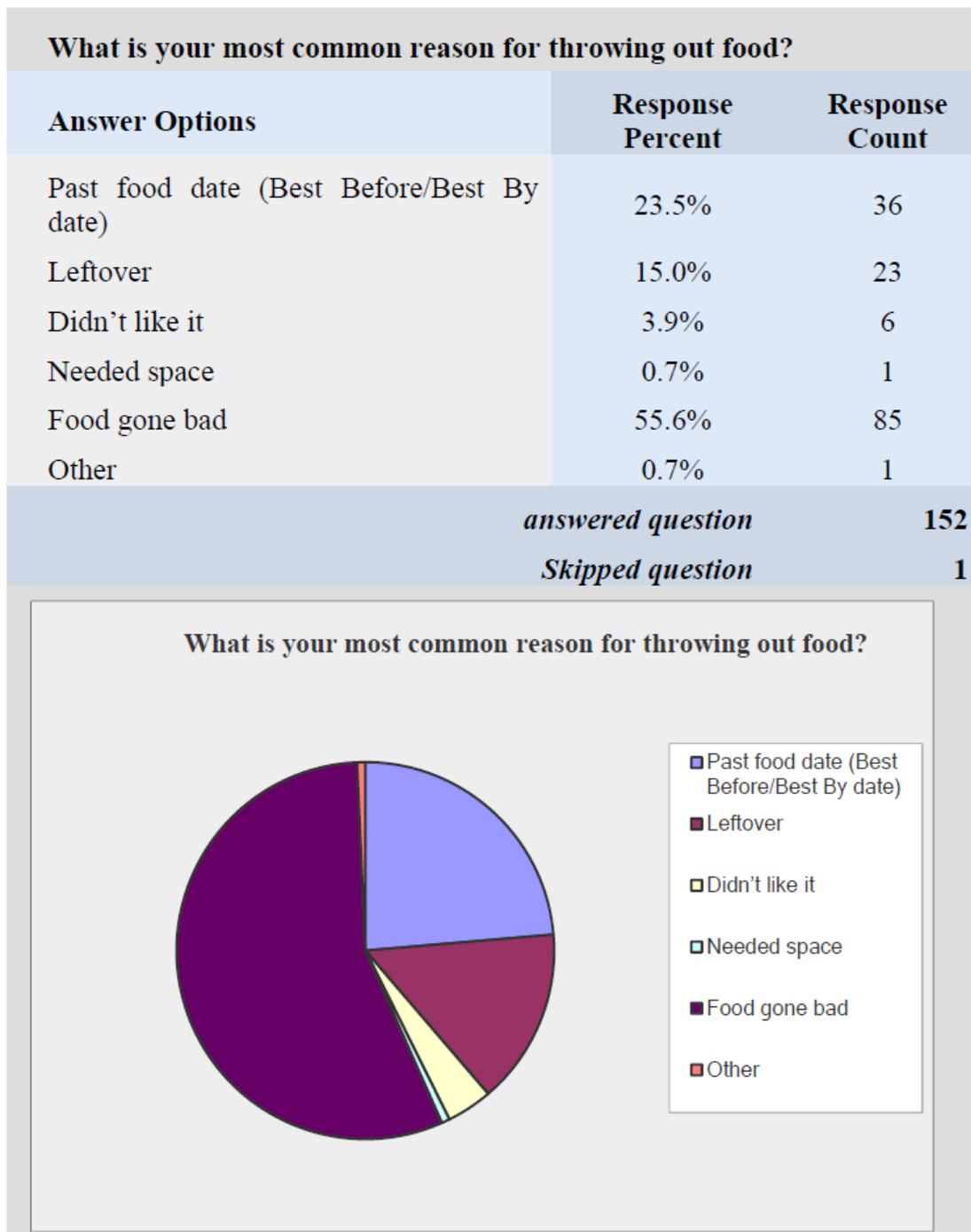


Figure 10 Participants' combined annual income (before tax)

### **5.1.6 Participants' most common reason for throwing out food**

In this research, frequency of most common reason for throwing out food was surveyed (Figure 11). In total, “food gone bad” had the highest overall percentage (55.6%), followed by “past food date (best before/best by date)” (23.5 %), “leftover” (15.0%), “didn’t like it” (3.9%), “needed space” (0.7), and “other” (0.7%). Although asked in the background section, this question is not part of demographic characteristics. Thus, it is not considered as a control factor and is excluded from further analyses of the survey.



**Figure 11** Participants' most common reason for throwing out food

## 5.2 Overall Means versus respondent background

The idea of means versus respondent background was to spot any potential biases related to respondent background. In this section, the tables were shrunk and only those rows and/or columns which had statistically significant results ( $p < 0.05$ ) were included because otherwise the tables would not fit as they were too large. In general, the Report table for each variable shows the differences and the ANOVA tables in Appendix F show the differences are statistically significant. In order to make it easier for the reader to follow, significant numbers in the tables are highlighted in yellow. Moreover, appendix G shows a table with all the coded questions used for analyses in SPSS and SmartPLS.

### 5.2.1 Respondent Gender

Table 13 shows that females agreed more on questions C10 and D03 than males. In other words, females are more prone to believe that food past their best before date is safe to eat and they are more likely to make effort to minimize the amount of food thrown away in their household.

**Table 13 Means versus respondent background – B01 (gender)**

B01 (gender)		C10	D03
1 (male)	Mean	2.28	2.94
	N	68	69
	Std. Deviation	1.183	1.327
2 (female)	Mean	2.50	3.04
	N	84	84
	Std. Deviation	1.146	1.275
Total	Mean	2.40	2.99
	N	152	153
	Std. Deviation	1.164	1.295

### **5.2.2 Respondent Age**

Results from Table 14 show that compared to their younger and older counterparts, individuals between 26-33 years are significantly less concerned about the date on the packaging when deciding whether or not it is safe to consume the food. On the other hand, people over 58 years old have the same attitude toward this date labeling as well (C05). Moreover, Table 14 illustrates that people between 34-49 years old along with those over 58 are least interested to pay premium for IFC compared to regular food containers (J09).

**Table 14 Means versus respondent background – B02 (age)**

B02		C05	J09
18-25	Mean	4.00	3.41
	N	18	17
	Std. Deviation	1.085	1.228
26-33	Mean	3.58	3.25
	N	33	32
	Std. Deviation	1.001	1.270
34-41	Mean	3.82	2.67
	N	76	75
	Std. Deviation	1.042	1.070
42-49	Mean	4.06	2.59
	N	18	17
	Std. Deviation	.873	1.121
50-57	Mean	4.00	3.20
	N	6	5
	Std. Deviation	1.095	1.304
58-65	Mean	2.00	2.00
	N	1	1
	Std. Deviation	.	.
Over 65	Mean	1.00	1.00
	N	1	1
	Std. Deviation	.	.
Total	Mean	3.79	2.87
	N	153	148
	Std. Deviation	1.049	1.180

### **5.2.3 Respondent Education**

The results show that respondent with Bachelor degrees pay more attention to the date labeling on the food packaging and their health compared to other participants. This group of individuals always checks the date on the food packaging before purchasing and before consuming the product. They also follow the date in order to decide whether or not it is safe to consume the product (C03, C04, and C05). Consequently, they are interested in IFC that give instructions about how to store food (E07). The results also show that financial saving is not a major reason for Doctoral degrees holders to reduce food waste. Conversely, certificate holders and individuals with other education level would reduce their household's food waste because of financial savings (D06 and D07). Finally, results illustrate that certificate holders are less more interested in IFC even though it monitor food quality & safety, prevent foodborne illness, provide real use-by-date, easy to clean, reduce food waste, and bring good value for the money (E01,E03, E04, E05,E06, E010, G02, G03, H05, and H08) . Table 15 details all the results.

**Table 15 . Means versus respondent background – B03 (education)**

B03		C03	C04	C05	D06	D07	E01	E03	E04	E05	E06	E07	E08	E10	G02	G03	H05	H08
1	Mean	4.00	4.00	3.89	3.78	3.67	3.78	4.22	3.78	3.89	3.89	3.67	3.11	3.89	4.33	4.44	4.11	3.89
	N	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	Std. Deviation	1.000	1.000	.928	.972	1.000	1.093	.441	.972	.928	.928	1.118	.928	.928	.500	.527	.928	.782
2	Mean	4.17	3.00	3.33	4.50	4.00	3.67	3.50	3.33	3.50	3.67	3.50	3.67	3.33	3.50	3.67	3.50	2.80
	N	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5
	Std. Deviation	.753	1.000	1.211	.548	.000	.816	1.378	1.211	.837	1.033	1.225	1.366	1.211	1.378	1.366	1.225	1.643
3	Mean	4.76	4.43	4.29	3.79	3.86	4.39	4.53	4.37	4.41	4.56	4.51	4.10	4.29	4.56	4.54	4.25	3.90
	N	41	42	42	42	42	41	40	41	41	41	41	41	41	41	41	40	40
	Std. Deviation	.489	.770	.835	1.116	.977	.666	.640	.799	.836	.594	.597	1.091	.782	.594	.636	.670	.955
4	Mean	4.19	3.90	3.65	3.63	3.63	4.39	4.37	4.33	4.37	4.38	4.27	4.19	4.31	4.50	4.35	4.10	3.62
	N	52	51	52	52	52	51	52	52	52	52	52	52	52	52	52	51	50
	Std. Deviation	.971	1.063	1.153	1.067	1.085	.666	.687	.648	.658	.796	.843	.768	.643	.700	.789	.539	.780
5	Mean	4.03	3.68	3.56	2.92	2.95	4.03	4.13	4.03	3.95	4.05	3.82	3.67	3.90	4.31	4.08	3.76	3.38
	N	39	38	39	39	39	39	39	39	38	39	39	39	39	39	39	38	39
	Std. Deviation	1.013	.933	.882	1.085	.999	.959	.923	.959	.985	.944	1.048	1.243	1.119	.731	.807	.852	.907
6	Mean	4.50	4.00	3.00	4.50	4.00	4.00	4.25	4.00	4.25	4.75	3.50	2.75	4.00	4.25	4.50	4.25	3.25
	N	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Std. Deviation	.577	1.414	1.826	.577	.000	.000	.500	.000	.500	.500	1.000	1.500	.000	.500	.577	.500	.500
Total	Mean	4.30	3.97	3.79	3.56	3.55	4.22	4.30	4.18	4.21	4.30	4.13	3.91	4.13	4.41	4.31	4.03	3.61
	N	151	149	152	152	152	150	150	151	150	151	151	151	151	151	151	148	147
	Std. Deviation	.900	1.000	1.052	1.126	1.047	.802	.784	.841	.846	.831	.929	1.091	.882	.724	.785	.742	.917

### 5.2.4 Respondents' Household

Table 16 shows that individuals who are living alone are less interested to reduce food waste because of financial saving or even because of their friends/family request (D06 and I05). The results also illustrate that a family of five are less concerned about wastage

of unused expired food (D04), while they pay more attention to the financial saving of food waste reduction (D06).

**Table 16 Means versus respondent background – B04 (household size)**

B04		C09	D04	D06	I05
1	Mean	2.03	3.39	3.09	2.38
	N	33	33	33	32
	Std. Deviation	.810	1.029	1.071	.942
2	Mean	2.18	3.91	3.85	2.95
	N	55	55	55	55
	Std. Deviation	1.249	.967	1.096	1.239
3	Mean	2.65	3.90	3.45	3.32
	N	31	31	31	31
	Std. Deviation	1.199	.978	1.060	.945
4	Mean	3.08	3.52	3.48	3.28
	N	26	27	27	25
	Std. Deviation	1.164	.935	1.189	.980
5	Mean	2.17	3.17	4.33	2.67
	N	6	6	6	6
	Std. Deviation	.408	.753	.816	.816
Total	Mean	2.40	3.70	3.56	2.95
	N	151	152	152	149
	Std. Deviation	1.167	.990	1.126	1.108

### 5.2.5 Respondents' Income

Table 17 shows interesting results. In particular, those respondents with a modest \$10-15k income are the most willing to buy an IFC, whereas those with an income of \$25-35k are the least willing to buy when compared to others (J10).

**Table 17 Means versus respondent background – B05 (income)**

B05		J10
1	Mean	3.86
	N	7
	Std. Deviation	.690
2	Mean	4.14
	N	7
	Std. Deviation	.690
3	Mean	3.92
	N	12
	Std. Deviation	.669
4	Mean	2.80
	N	10
	Std. Deviation	1.135
5	Mean	3.36
	N	11
	Std. Deviation	.505
6	Mean	3.48
	N	23
	Std. Deviation	.730
7	Mean	3.91
	N	22
	Std. Deviation	.610
8	Mean	3.64
	N	22
	Std. Deviation	.902
9	Mean	3.56
	N	32
	Std. Deviation	1.045
Total	Mean	3.62
	N	146
	Std. Deviation	.865

### **5.2.6 Respondents' most common reason for throwing out food**

Table 18 shows that those whose most common reason for throwing out food is “past food date” always check the dates before consuming, follow the date to decide whether or not the food is safe to consume, rely on the date labels, dispose unused food if its use by date was past; moreover, they always afraid of food-borne illness. In contrast, those who mostly throw away food because of “food gone bad” pay less attention to date labeling on the package and are not concerned about date labeling (C02, C04, C05, C06,C07, D01, and D02). The results also show that individuals who mostly throw out their leftover always rely on date labels and dispose past date food because of health concerns, so this group are willing to pay more for IFC to have safe food (C06, C07, and H04).

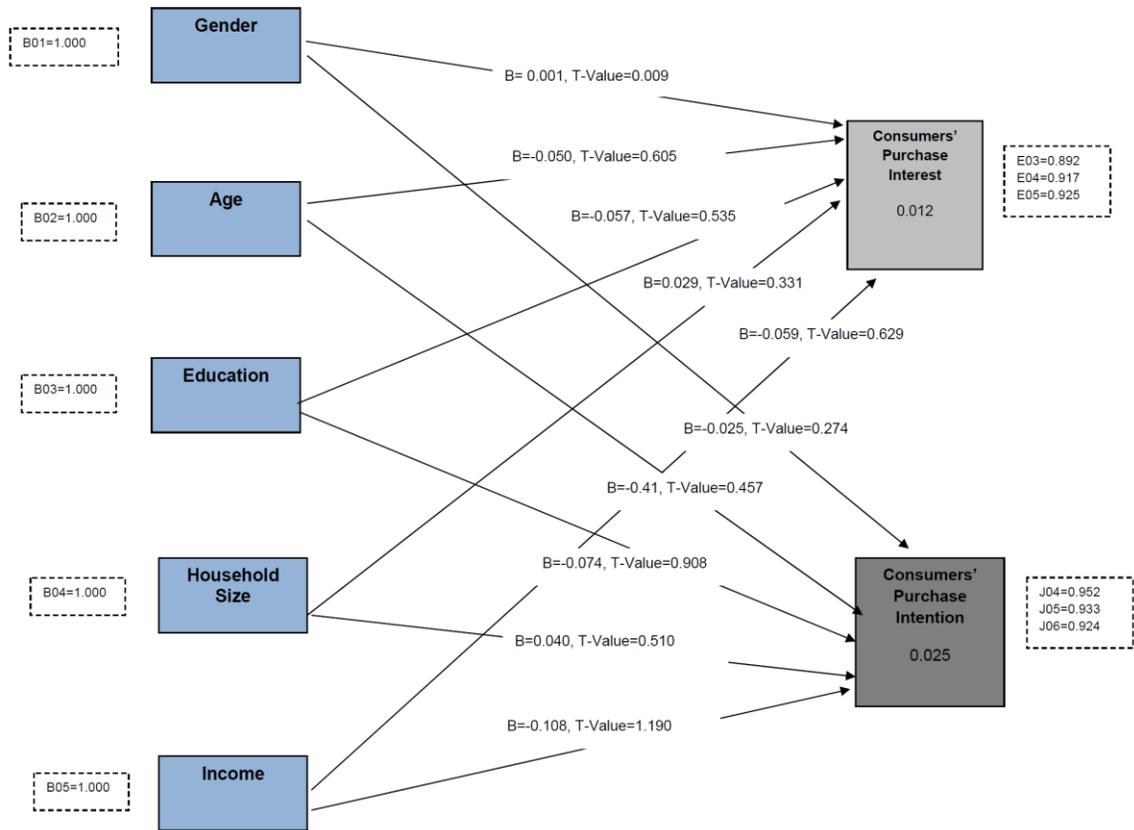
**Table 18 Means versus respondent background – B06 (reason to discard food)**

B06		C02	C04	C05	C06	C07	C08	C09	C10	D01	D02	D03	H04	I05
1	Mean	4.11	4.42	4.17	4.03	4.19	3.94	2.61	3.08	3.97	3.58	4.44	3.72	3.00
	N	36	36	36	36	36	36	36	36	36	36	36	36	36
	Std. Deviation	.747	.692	.878	.941	.951	.955	1.225	1.079	1.028	1.131	.504	.914	1.069
2	Mean	4.30	3.91	4.22	4.35	4.30	4.09	2.96	2.78	3.77	3.43	4.27	4.09	3.17
	N	23	22	23	23	23	23	23	23	22	23	22	23	23
	Std. Deviation	.703	1.109	.671	.832	.765	.596	1.261	1.043	1.020	1.121	.883	.668	1.230
3	Mean	4.00	4.50	4.50	4.00	4.17	4.83	2.67	4.00	3.50	2.83	4.83	3.67	4.17
	N	6	6	6	6	6	6	6	6	6	6	6	6	6
	Std. Deviation	.632	1.225	.837	1.265	1.169	.408	1.366	.632	1.378	.983	.408	1.211	.753
4	Mean	5.00	5.00	4.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	2.00	5.00	5.00
	N	1	1	1	1	1	1	1	1	1	1	1	1	1
	Std. Deviation	.	.	.	.	.	.	.	.	.	.	.	.	.
5	Mean	3.56	3.75	3.46	3.42	3.40	4.47	2.12	3.14	3.31	2.60	4.34	3.38	2.76
	N	85	83	85	85	85	85	84	85	84	85	85	82	82
	Std. Deviation	1.017	1.010	1.119	1.106	1.217	.683	1.034	.990	1.119	1.284	.733	1.129	1.037
6	Mean	4.00	4.00	4.00	3.00	4.00	4.00	2.00	4.00	3.00	2.00	5.00	3.00	2.00
	N	1	1	1	1	1	1	1	1	1	1	1	1	1
	Std. Deviation	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	Mean	3.84	3.97	3.79	3.74	3.77	4.30	2.40	3.13	3.55	2.98	4.36	3.59	2.95
	N	152	149	152	152	152	152	151	152	150	152	151	149	149
	Std. Deviation	.945	1.000	1.052	1.090	1.159	.772	1.167	1.031	1.121	1.289	.726	1.046	1.108

### 5.3 Run PLS algorithm and bootstrapping on control factors

In this study, five background questions were used as demographic and sociographic information on respondents; these variables were considered as control factors. Therefore, PLS algorithm and bootstrapping procedure were first run to check if these control factors have statistically significant relationships with the two dependent variables (interest to use and purchase intention). If this step reveals statistically

significant relationships, a more sophisticated method in the full model will need to be used; for example, moderation, etc. (Figure 12).



**Figure 12 Results after running PLS algorithm and bootstrapping procedure on the control factors model**

Based on the results shown in Figure 12, there are no statistically significant relationships between the control factors and the two dependent variables. While there are no statistically significant effects here in the simple model, there also should not be ones in the full model. Therefore, there is no need to utilize more sophisticated control mechanisms in the next steps, and the potential role of demographical characteristics in consumers' purchase interest and purchase intention can be excluded.

## **5.4 Portion of elements**

After the background questions (Questions 1-5), the rest of the questionnaire focused on the effects of TAM and green marketing elements (i.e. product, price, place, and promotion). Figure 13 shows the full model without any moderating effects.

### **5.4.1 Run PLS algorithm and bootstrapping procedure on full model**

Next, the SmartPLS was used to demonstrate related links between independent variables and consumers' purchase interest and intention as dependent variables. The examination of the full model was to test the hypothesized causal relationships in the research model. This analysis was conducted with twelve latent variables (four driver factors, six independent variables, and two dependent variables) and 31 indicators defined from the Factor Analysis in the previous procedure.

To start with, PLS algorithm with 300 maximum iterations (default setting in SmartPLS software) was used for path analysis and for examining the possible causal linkage between statistical variables in the model. The output values include e.g. beta values (i.e. Path coefficients), R<sup>2</sup> values, and item loadings for the full model. Nunnally (1978) indicates that the acceptable loading of a variable is >0.70; however, lower values are sometimes used which typically result in lower internal validity (Hair Jr et al., 2014). In this study, all item loadings are >0.70 (the lowest being 0.737) and considered as significant.

The next step was PLS bootstrapping procedure using 1,000 subsamples (Hedges, 1992). The bootstrapping procedure was applied to test coefficients in outer loadings, paths, and

their standard errors. This step illustrated whether the co-efficiencies produced in the previous step are actually statistically significant. Here, beta values are replaced by t-values, which have to be equal or more than  $>1.96$  to be considered as significant (Machlis et al., 2010). In Figure 13 all the statistically significant values are bolded in order to easily spot relevant relationships.

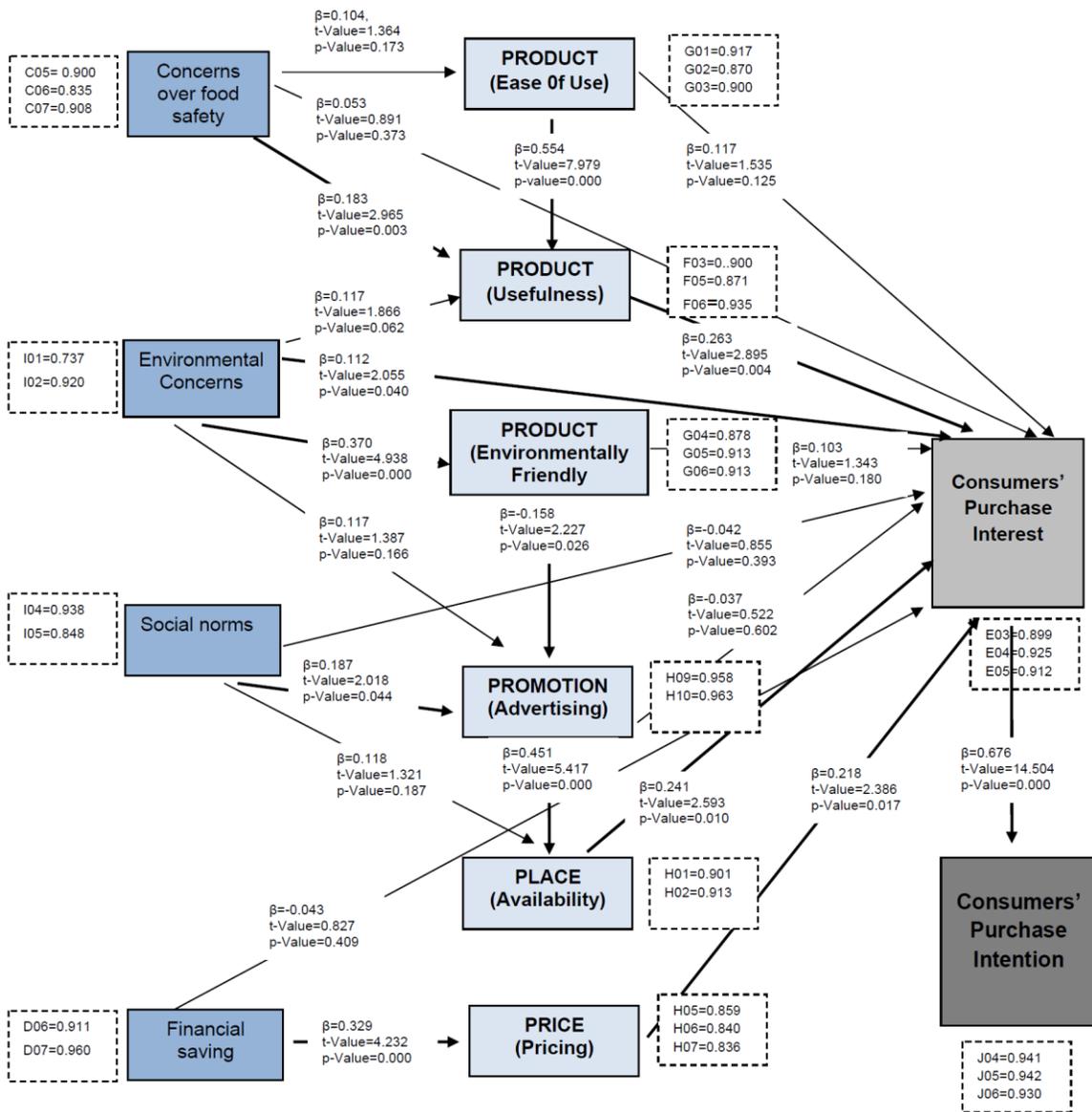


Figure 13 Full model results after running PLS algorithm and bootstrapping procedure

## 5.5 Summary of Research Analysis

### 5.5.1 Composite Reliability (CR)

Composite Reliability was used to calculate internal consistency of the indicators for each constructs. The present data evaluate reliability and validity of the constructs in terms of composite reliability values (CR) and average variance extracted values (AVE). In order to provide a feasible solution, CR should each be more than 0.70 (Hair Jr et al., 2014), and AVE should be more than 0.50 (Chou & Chang, 2008). Table 19 shows that all constructs exceed these threshold values and, thus, they are strong and meaningful for this research. Appendix H shows the Composite Reliability and AVE charts as well.

**Table 19 Construct reliability and validity**

	Composite Reliability	Average Variance Extracted (AVE)
Concern over food safety	0.913	0.777
Environmental concerns	0.818	0.695
Financial Savings	0.934	0.876
Intention to use	0.956	0.879
Interest to use	0.937	0.832
Place (Availability)	0.903	0.823
Price (Pricing)	0.882	0.714
Product (Ease of use)	0.924	0.802
Product (Environmentally friendly)	0.928	0.812
Product ( Usefulness)	0.929	0.814
Promotion (Advertising)	0.960	0.923
Social norm	0.888	0.800

### **5.5.2 Correlations among Research Variables**

Table 20 shows the correlations among research variables. The PLS technique is resistant to bias which means that data does not need to be pre-processed and standardized before the analysis. A correlation of more than 0.60 is a sign of possible bias, and 0.70 is usually considered to show an undesirably strong correlation. In this study, there are positive correlations between variables; however, none of the construct correlations exceed 0.70. Moreover, all correlations are below square AVE and there is not any validity issues. The strongest correlation, which could be considered a large effect size, is between product (usefulness) and product interest and intention ( $r=0.681$ ,  $p<0.001$ ). This means that respondents who had relatively positive attitudes toward product usefulness are likely to have high purchase interest and intention. However, this correlation is acceptable in terms of above discussion on thresholds for undesirable high correlations.

**Table 20 Correlations among research variables**

Construct	AVE	CR	COFS	EC	FS	ITP	ITU	PA	PP	PEOU	PEF	PU	PA	SN
<b>Concerns over food safety</b>	0.777	0.913	0.882											
<b>Environmental concerns</b>	0.695	0.818	0.228	0.834										
<b>Financial savings</b>	0.876	0.934	0.064	0.124	0.936									
<b>Intention to purchase</b>	0.879	0.956	0.257	0.402	0.330	0.937								
<b>Interest to use</b>	0.832	0.937	0.218	0.345	0.240	0.676	0.912							
<b>PLACE (Availability)</b>	0.823	0.903	0.102	0.258	0.285	0.495	0.664	0.907						
<b>PRICE (Pricing)</b>	0.714	0.882	0.167	0.277	0.329	0.584	0.654	0.570	0.845					
<b>PRODUCT (Ease of use)</b>	0.802	0.924	0.104	0.161	0.219	0.455	0.604	0.676	0.558	0.896				
<b>PRODUCT (Environmentally friendly)</b>	0.812	0.928	0.184	0.370	0.155	0.424	0.574	0.554	0.538	0.508	0.901			
<b>PRODUCT (Usefulness)</b>	0.814	0.929	0.267	0.248	0.367	0.681	0.681	0.638	0.662	0.592	0.505	0.902		
<b>PROMOTION (Advertising)</b>	0.923	0.960	0.284	0.220	0.147	0.408	0.380	0.480	0.421	0.360	0.234	0.457	0.961	
<b>Social norm</b>	0.800	0.888	0.216	0.242	0.178	0.273	0.169	0.227	0.141	0.165	0.179	0.250	0.243	0.894

### 5.5.3 R-square (coefficient of determination)

R-squared value (R<sup>2</sup>) shows the coefficient of multiple determinations (i.e. variance explained). This coefficient demonstrates the amount of change in the dependent variable for a unit change in the independent variable. Table 21 shows the R<sup>2</sup> for the constructs.

**Table 21 R Square**

	R Square
Intention to use	0.457
Interest to use	0.630
Place( Availability)	0.244
Price (Pricing)	0.108
Product ( Ease of use)	0.011
Product (Environmentally friendly)	0.137
Product (Usefulness)	0.406
Promotion (Advertising)	0.108

Summary of the key regression statistics, which contain R Square, R Square adjusted, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted are demonstrated in Table 22. The R<sup>2</sup> values indicated that approximately 60% of the variance in purchase interest and 45% in purchase intention were explained by the model, and it can be considered acceptable.

**Table 22 Regression statistics**

	Interest To Use	Intention To use
R Square	0.630	0.457
R square Adjusted	0.604	0.454
Cronbach's Alpha	0.899	0.931
Composite Reliability	0.937	0.956
Average Variance Extracted	0.832	0.879

### **5.6 Research model: Hypotheses Tests**

Multiple regression was used to test the hypotheses with purchase interest and intention toward IFC as the dependent variables and six predictors as independent variables. In order to answer the research question proposed for this study, 22 hypotheses were developed and tested. In this part, the implications of the data analysis for these hypotheses were presented. According to a 95% ( $p < 0.05$ ) significance rate, the hypotheses were supported or rejected.

The first hypothesis postulated that consumers' concerns over food safety positively influence their perceptions of IFC ease of use. The result indicates that respondents' concerns over food safety did not have statistically significant influence on their perception of ease of use when the effects of other predicting variables were considered ( $t = 1.364$ ,  $p = 0.173$ ). Therefore, hypothesis 1 was not supported.

The second hypothesis postulated that PEOU positively influences consumers' purchase interest toward IFC. The result shows that PEOU had a positive influence on

respondents' purchase interest; however, it was not statistically significant ( $t=1.535$ ,  $p=0.125$ ). Therefore, hypothesis 2 was not supported.

The third hypothesis postulated that consumers' concerns over food safety positively influence consumers purchase interest toward IFC. The result shows positive influence but not statistically significant ( $t=0.891$ ,  $p=0.373$ ). In fact, respondents' concerns did not strongly affect their purchase interest toward IFC. Therefore, hypothesis 3 was not supported.

The fourth hypothesis postulated that consumers' concerns over food safety positively influence consumers' perception of IFC usefulness. Concerns over food safety had a positive influence on perceived usefulness of IFC and the result was statistically significant ( $t=2.965$ ,  $p=0.003$ ). The result indicates that when customers had more concerns over their food safety, there was a higher possibility they believe that using IFC technology would enhance their food safety, reduce their food waste, and increase the storing knowledge. Therefore, hypothesis 4 was supported.

The fifth hypothesis postulated that PU positively influences consumers' purchase interest toward IFC. Base on the result, PU had a positively influence on consumer purchase interest, and the result was statistically significantly ( $t=2.895$ ,  $p=0.004$ ). Therefore, hypothesis 5 was supported.

The sixth hypothesis postulated that PEOU positively influences consumers' perceived usefulness of IFC. The result shows that consumers perception of product ease of use had a positive influence on their perceptions of product usefulness and the result was statistically significantly ( $t=7.979$ ,  $p=0.000$ ). Therefore, hypothesis 6 was supported.

The seventh hypothesis postulated that consumers' environmental concerns positively influence consumers' perception of IFC usefulness. The result shows that consumers concerns had a positively influence on their perceptions of IFC usefulness, but it was not statistically significantly ( $t=1.866$ ,  $p=0.062$ ). Therefore, hypothesis 7 was not supported.

The eighth hypothesis postulated that consumers' environmental concerns positively influence consumers' purchase interest toward IFC. In fact, the higher concern, the greater interest. The result shows that consumers concerns had statistically significant influence on their purchase interest ( $t=2.055$ ,  $p=0.040$ ); thus, hypothesis 8 was supported.

The ninth hypothesis postulated that consumers' environmental concerns positively influence their perception of companies' green product marketing (IFC environmental friendliness). The result shows customers environmental concerns had a positive influence on their perception of companies' green marketing strategy related to EF product, and the result was statistically significant ( $t=4.938$ ,  $p=0.000$ ). The result indicates that the higher customers' concerns over environmental issues, the greater opportunities for firms to present EF product base on market demand for environmentally friendly products. Therefore, hypothesis 9 was supported.

The tenth hypothesis postulated that product environmental friendliness positively influences consumers' purchase interest toward IFC. In this study, the result shows that although consumers' environmental concerns affected their perception of companies' green marketing related to presenting EF products, these EF products were not always adopted by customers and perception of companies' green making did not have any influence on customers' interest toward a new technology like IFC. The result shows

positive influence but is not statistically significant ( $t=1.343$ ,  $p=0.180$ ). Therefore, hypothesis 10 was not supported.

The eleventh hypothesis postulated that consumers' environmental concerns positively influence their perception of companies green promotion marketing (advertising). It means consumers' environmental concerns effectively provide more opportunities for companies to promote their EF products and influence consumers' purchase interest. However, the result shows that consumers' concerns positively influence perception of companies green promotion marketing but not statistically significant ( $t=1.387$ ,  $p=0.166$ ). Therefore, hypothesis 11 was not supported.

The twelfth hypothesis postulated that customers' perception of companies green promotion marketing (advertising) positively influence consumers' purchase interest toward IFC. In fact, it was hypothesized that companies which promote their green product more than the competitors will be more successful to increase customers purchase interest and consequently their sales. However, the result shows that perception of companies' promotion did not have any influence on consumers' purchase interest and not statistically significantly ( $t=0.522$ ,  $p=0.602$ ). Therefore, hypothesis twelfth was not supported.

The thirteenth hypothesis postulated that social norm positively influences consumers' purchase interest toward IFC. Individuals' behaviors may be affected by their friends, family, and peers. Thus, it was hypothesized that this social influence may increase the consumers' purchase interest toward IFC. However, the result shows consumers purchase interest was not influence by those whose opinion is important to them and social norms

did not have any influence on their purchase interest ( $t=0.855$ ,  $p=0.393$ ). Therefore, hypothesis 13 was not supported.

The fourteenth hypothesis postulated that social norm positively influences customers' perception of companies green promotion marketing (advertising). It was hypothesized that companies can take the advantages of social norms in order to promote their green products. The result of this study confirmed the positive influence of social norm on product promotion which is statistically significant ( $t=2.018$ ,  $p=0.044$ ). Therefore, hypothesis 14 was supported.

The fifteenth hypothesis postulated that social norm positively influences customers' perception of companies green place marketing (availability). It was hypothesized that social behavior influences customers' perception of companies' action in order to actively distribute their green products. The result shows positive influence but it is not statistically significant ( $t=1.321$ ,  $p=0.187$ ). Therefore, hypothesis 15 was not supported.

The sixteenth hypothesis postulated that customers' perception of companies' green place marketing positively influence their purchase interest toward IFC. It was hypothesized that when customers have easy access to a product, their interest to buy it would be higher. In sum, the higher green product availability, the more people will be interested to buy it. The result of this study confirmed the statistically significant influence of availability on purchase interest ( $t=2.593$ ,  $p=0.010$ ). Therefore, hypothesis 16 was supported.

The seventeenth hypothesis postulated that customers' perception of product environmental friendliness positively influences their perception of companies green promotion marketing (advertising). It was hypothesized that for a company which

produces EF products there is a higher necessity to promote their products in order to be sustainable in the market, compete with the competitors, and increase customers' interest. The result confirms the statistically significant influence of product environmental friendliness on companies' promotion ( $t=2.227$ ,  $p=0.026$ ). Therefore, hypothesis 17 was supported.

The eighteenth hypothesis postulated that customers' perception of companies green promotion marketing positively influence their perception of companies green place marketing (availability). It was hypothesized that when companies use promotion to increase their customer's awareness about a green product, the customers' expectation to have easy access to that product will increase. It means that the more promotion of a green product, the higher expectation for its available. The result confirms the statistically significant influence of product promotion on product availability ( $t=5.417$ ,  $p=0.000$ ). Therefore, hypothesis 18 was supported.

The nineteenth hypothesis postulated that financial saving positively influences consumers' purchase interest toward IFC. It was hypothesized that people who are concern about financial saving are more interested in IFC since it reduces their food waste which is equal to wasting money. However, the result is not statistically significant ( $t=0.827$ ,  $p=0.409$ ). Therefore, hypothesis 19 was not supported.

The twentieth hypothesis postulated that financial saving positively influences customers' perception of companies green price marketing (pricing). It was hypothesized that when customers are more concerned about financial savings, there is more responsibility for companies to price their products base on market demand and expectation. The result

confirmed co-efficient relationship between these two variables which is statistically significant ( $t=4.232$ ,  $p=0.000$ ). Therefore, hypothesis 20 was supported.

The twenty-first hypothesis postulated that customers' perception of companies green price marketing positively influence consumers' purchase interest toward IFC. It was hypothesized that the more affordable product pricing, the more consumers interest on it. Consumers are looking for the product which is reasonably pricing. The result confirmed co-efficient relationship between these two variables which is statistically significant ( $t=2.396$ ,  $p=0.017$ ). Therefore, hypothesis 21 was supported.

Finally, the twenty-second hypothesis postulated that consumers' interest to use IFC positively influence consumers' purchase intention toward this technology. The more customers become interested, the more they will buy it. The result confirmed co-efficient relationship between these two variables which is statistically significant ( $t=14.504$ ,  $p=0.000$ ). Therefore, hypothesis 22 was supported. (Table 23)

**Table 23 hypothesis testing (n=153)**

<b>Hypotheses</b>	<b><math>\beta</math></b>	<b>t-value</b>	<b>Support</b>
H1	0.104	1.364	No
H2	0.117	1.535	No
H3	0.053	0.891	No
H4	0.183	2.965	Yes
H5	0.263	2.895	Yes
H6	0.554	7.979	Yes
H7	0.117	1.866	No
H8	0.112	2.055	Yes
H9	0.370	4.938	Yes
H10	0.103	1.343	No
H11	0.117	1.387	No
H12	-0.037	0.522	No
H13	-0.42	0.855	No
H14	0.187	2.018	Yes
H15	0.118	1.321	No
H16	0.241	2.593	Yes
H17	0.158	2.227	Yes
H18	0.451	5.417	Yes
H19	-0.43	0.827	No
H20	0.329	4.232	Yes
H21	0.218	2.386	Yes
H22	0.676	14.504	Yes

## **6 Chapter: Discussion**

### **6.1 Summary of research**

The overall purpose of this study was to investigate consumers' adoption of IFC by identifying green marketing mix elements that influence their purchase intention and by highlighting the most important factors to determine the appropriate marketing strategy in the packaging technology sector. Green marketing is the marketing of products that are "presumed to be environmentally safe or process of selling goods and services based on their environmental benefits". It can be a very powerful marketing strategy when it is done right. In fact, while green marketing can be so helpful for both businesses and consumers, it can be dangerous when businesses made false claims about their products and services. False claim means that companies are presenting themselves as environmentally responsible and their products or services as green when they are not. This action is called "green washing" and may affect firms' reputation as well as consumers' trust and reliance. Therefore, the specific objective of this study was to investigate what role does companies' green marketing play in consumer adoption of IFC. In doing so, the study reviewed literatures on food quality and safety, technology acceptance, and green marketing and tried to answer to two questions come up from research gaps.

1. What factors promote or hinder consumer diffusion and adoption of a new food packaging technology like IFC?
2. How do the green marketing mix elements influence consumers' purchase intention of such technology?

To answer these questions, the Technology Acceptance Model (TAM) (Davis, 1989) was used as the base of the research model to predict consumers' purchase intention. TAM was modified to examine the role of green marketing (understood through product, price, place, and promotion) on consumers' purchase intention toward IFC. The research model and its 22 hypotheses were tested through structural equation modeling by using the PLS method. Data analysis consisted of descriptions of the sample, the summary of research variables, and research model hypothesis testing. The findings and recommendations can be used as a guideline for researchers and businesses.

## **6.2 Description of sample**

Data were collected from 153 volunteer food consumers for statistical analysis. Based on the background questions analysis, males were 45.1% of the respondents, and females were 54.9%. The highest percentage of the respondents (49.7%) was between 34 and 41, and the highest completed level of education (34.0%) was related to individuals with Master's degree. Most of the respondents were in the household size of 2 persons (35.9%) and the largest group for income before tax was (22.2%) with 150,000 or more. Finally, among five different reasons for throwing out the food, food gone bad (55.6%) was the most likely common reason and didn't like it (3.9%) was the last one.

## **6.3 Effect of control factors on research model**

In this study, demographic characteristics (age, gender, education, income, and household size) had been examined as control factors in a separate model to check if they have any statistically significant relationships between these factors and two dependent variables. The result illustrates that there were no statistically significant relationships; therefore, there was no need to utilize more sophisticated control mechanisms in the full research

model. In other words, as there was no effect in the simple model, it is assumed that there would not be one in the full model.

#### **6.4 Summary of research variables**

The study proposed that several factors, such as product ease of use, usefulness, and environmental friendliness, as well as companies' promotion, place, and price are the key determinants of consumer purchase interest toward IFC. Moreover, some factors such as concerns over food safety, environmental concerns, social norms, and financial saving also influence consumers' perception of companies' green marketing. Identification of the relationships between variables of the model presented how consumers positively respond toward IFC technology.

#### **6.5 Hypothesis testing**

The effects of marketing mix elements on customer purchase intention toward different products were examined in previous studies; however, they did not show the same results. The aim of this study is to investigate whether companies green marketing can affect consumers' adoption of a new packaging technology like IFC and to highlight the most important elements of the marketing mix to determine the appropriate marketing strategies. The results of this study illustrated that product feature (usefulness), place (availability), and price have positive and significant effects on consumers' interest and purchase intention toward IFC, which further imply the acceptance of hypotheses H5, H16, H21, and H22.

In this study, product usefulness was demonstrated as a key feature of IFC which influence consumers' interest and purchase intention toward it. The more customers believe that using IFC will help them to enhance food safety, decrease food waste, and

increase food storage knowledge, the more they will be interested in using this technology. As a result, firms should pay attention to all this uniqueness to enhance their profit and success.

Place (availability) was confirmed as another important element which influences consumers' purchase interest. Product availability means it will be in the right place at the right time. Thus, when a product is easily available, and consumers can have access without any difficulty, their interest to purchase that product is likely to increase.

Finally, price (pricing) was found a significant predictor that influences consumers' interest and purchase intention toward IFC. Price is determined by the value of the item on sale. It is important to research users' opinions about pricing since it varies by time and circumstances. For example, the price of a product cannot be the same in developed and developing countries. The more correct a product price, the higher interest to purchase it. To sum up, the higher product usefulness, greater product availability, and lower product price, the higher interest, and intention toward purchasing it.

Moreover, this study illustrates that although product environmental friendliness, as well as promotion (advertising), do not have a significant direct effect on customers purchase interest, they have indirect effects via place (availability). In fact, the results show that product environmental friendliness effects promotion followed by price (pricing) to have a positive and significant impact on customers' interest and intention. It means that companies should not only provide EF products to support the customers' needs and expectation but also they have to promote their product correctly to increase customers' information and enhance their brand recognition. Finally, an efficient and practical

distribution channel is needed to make it easily available and accessible and increase customers purchase intention.

Unlike previous research which just examines the impact of marketing mix elements on consumers' purchase intention, this study shows that there are some external factors which affect customers' perception of companies' green marketing mix followed by customers purchase interest and intention. These factors are categorized as concern over food safety, environmental concerns, social norms and financial saving. Except for place, all other marketing mix elements are significantly influenced by these factors. For example product usefulness is influenced by consumers' concerns over food safety; product environmental friendliness is influenced by environmental concerns; promotion is effected with social norms; and price is influenced by financial saving (confirmed hypotheses H4, H9, H14, and H20).

Concerns over food safety significantly affects perceived IFC usefulness. Since food consumers become increasingly concerned of foodborne illnesses, they are prone to look for new packaging technologies which enhance their food safety. Thus, the higher their concerns over food safety, the higher possibility they believe that using IFC technology would enhance their food safety by increasing the storing knowledge. Thus, hypothesis H4 is confirmed.

The second factor is environmental concerns which affect customers' perception of companies' green marketing strategy related to providing EF products like IFC. It means that when environmental impacts of non-green products become more visible to customers, they prefer to change their purchase habit and switch to green products which have less environmental damages. These people believe that if they change their

consumption habits, this would have an extreme effect on the environmental footprint. The higher customers concerns over environmental issues, the business opportunities for firms to have EF products and compete with non-green competitors. Thus, hypothesis H9 is confirmed.

Social norm is another factor which significantly influences customers' perception of companies' green marketing strategy related to advertising EF products like IFC. Word-of-mouth marketing is defined as "giving people a reason to talk about the products and services, and making it easier for that conversation to take place" (Word of Mouth Marketing Association, 2006). As Gordon (2006) notes, "most people agree that there is no better advertising than word of mouth." As a result, firms should develop positive word-of-mouth strategies, should use more buzz marketing to encourage consumers, and should also convey the message that "each of us is responsible for saving our earth." These companies could increase the consumers' awareness by working with social networks or important communities and creating tools or blogs to make it easier to communicate and share information (WOMMA, 2006). This finding indicated that consumers' motivation to comply with their close friends and other important people around them would be a chance for business to promote their products. As a result, the higher social norms' influence and motivation to comply with close friends, the higher customers' perception of companies advertisement regarding the advantages of a new food packaging technology. . Thus, hypothesis H14 is confirmed.

Finally, financial saving was the last factor which affects customers' perception of companies' green marketing strategy related to product pricing. This result indicated that for a product which has the more logical pricing for financial saving, there was more

chance to be accepted by consumers and to be purchased. Therefore, the higher customers' tendency to save money by using an eco-friendly technical innovation in food packaging, the higher their expectation of companies' affordable pricing. Also, the more reasonable and affordable pricing by companies, the higher customers' purchase interest

Thus, hypothesis H20 and H21 are confirmed.

## 7 Chapter: Conclusion

This chapter offers a conclusion of the findings as well as provides implications to firms, marketers, and researchers. Finally, it addresses limitations and suggestions for future research.

### 7.1 Research conclusion

- 1) This study investigates the factors leading to consumer adoption of intelligent food containers (IFC) – an emerging technology that can store food, monitor food quality and minimize food waste. In particular, the study focuses on the role of companies' green marketing in affecting consumers' willingness to adopt IFC by integrating TAM model with green marketing mix elements. The Research findings illustrate: The TAM model validated by many empirical studies is useful in predicting the acceptance and success of new food packaging technology like IFC and its two major determinants are valid to explain consumer acceptance and adoption.
- 2) In this study, usefulness was defined as the extent to which a food consumers believe that using a new food packaging technology like IFC will help them to enhance food safety, decrease food waste, and increase food storage knowledge. Therefore, PU was found as a strong variable of user acceptance, adoption, and usage behavior even more important than PEOU and it shows a direct significant relationship with customers' interest.
- 3) In this research, ease of use was defined as the extent to which food consumers believe that using IFC is free of effort, easy to learn, easy to wash/clean and easy to recycle. In contrast to the original TAM model which shows the direct significant

relationship between perceived ease of use and customers purchase intention, there is not any direct significant relationship between these two variables in this study and their relationship is via perceived usefulness. It is concluded that in the context of food packaging where consumers are more worried about their safety and health, the technology's ease of use does not play a critical role in their purchase interest may be due to food safety concerns. Concerns over food safety are related to consumers' concerns about foodborne illnesses (commonly known as food poisoning) which happened when people eat food that contains pathogens or toxins. Therefore, in this research consumers' concerns over food safety is defined as a factor which influences their perception of usefulness and ease of use of IFC, and consequently purchase intention toward this new technology. It means that the more customers have concerns over food safety, the higher their belief about new food packaging technology's usefulness in securing their food safety, and the higher customers' perception of new food packaging usefulness, the higher their interest and purchase intention toward this technology.

- 4) Marketing mix or marketing strategy is a combination of elements necessary to plan and implement the entire marketing campaign. The research results illustrate that there exists a need for a different view of every single dimension of the green marketing mix in the food packaging sector. The research results show that consumers are becoming more concerns about the environment issues caused by their food waste as well as food packaging and they are more interested in products that are unlikely to endanger the environment. In fact, the more customers have concerns over environmental issues, the higher their incentive and motivation toward sustainable

and eco-friendly products which have less destructive effects on the environment. Therefore, firms and businesses take the advantages of these concerns in producing desirable food packaging which promotes better interactions between the product, package, and consumers. They have started to form their marketing strategies based on increasing knowledge of their green consumers. These marketing strategies, known as green marketing, have encouraged companies to adopt green policies in their pricing, promotion, product features and distribution activities. The research results show that

- a) The higher customers' tendency toward eco-friendly products, the higher their expectation for companies' promotion and advertisement which show the products' greenness and advantages.
- b) The higher customers' perception of companies' promotion and advertisement, the higher their expectation for product availability and accessibility.
- c) The better product availability, the higher customers' interest and intention to purchase a new product.
- d) The more reasonable and affordable pricing by companies, the higher customers' purchase interest.
- e) Finally, the higher customers' purchase interest toward a new technology, the higher their intention to buy it.

## **7.2 Implications**

This study examines consumers' purchase intention toward IFC. The implications of the results to theory and practice could be used by firms, marketers, and researchers as in food packaging industry.

### **7.2.1 Implications for theory**

The major implication of the results for theory is the applicability of the TAM in the food packaging industry. The TAM has been widely applied in many areas; however, applications for food packaging in general and specifically for IFC are rare to predict consumers' purchase interest and intention. In this study, the same as the original TAM, there is a direct significant relationship between PU and customers' purchase interest (H5). However, in contrast to original TAM which suggests that PEOU have a direct significant effect on customers' acceptance of innovation (Davis, 1989; Kulviwat et al., 2007), the results of this study did not support the notion directly (H2). Rather, the results indicated an indirect effect of PEOU via PU on customers' acceptance of innovation like IFC (H6). In fact, the indirect effect of PEOU suggests that perceived ease of use could not affect interest to use IFC regardless of the product's usefulness. This may reflect the fact that IFC technology is perceived to be complex and is expected to require a lot of effort. So, customers would not like to put more effort if they were not sure about the usefulness of this technology. Also, although compared with previous studies the direct role of PEOU was found pale, and it did not have a direct statistically significant influence on purchase interest, it is still one of the important determinants in predicting consumers' purchase interest.

The second important implication of the results to theory is related to the need for extending variables for the TAM. Although TAM has been widely used in many empirical studies in the contexts of different technologies, there have been some weaknesses in its constructs resulting in the model modification or extensions (Cho, 2007). As a result, researchers have extended the original TAM with added variables,

including e.g. motivation (Li et al., 2004; Venkatesh, et al., 2002), subjective norm (Huang et al., 2003; Yu et al., 2005), and self-efficacy (Hong et al., 2001/2002; Wang et al., 2006), culture/social influence (Evers & Day, 1997; Malhotra & Galetta, 1999), and trust (Chiravuri & Nazareth, 2001; Dahlberg et al., 2003; Gefen et al., 2003; Ha & Stoel, 2005; as cited in Cho, 2007). However, research on the integration of TAM with green marketing is sparse. Therefore, the present study adds green marketing mix as a determinant to TAM model to examine its role on consumers' purchase intention toward IFC..

Green marketing was identified as a potential factor which influences the acceptance of new technology. Therefore, current research model included variables of the green marketing mix to support their role in the consumers' purchase interest. The results illustrate that there are direct significant relationships between companies' green place (availability) and price (pricing) and customers' purchase interest (H16 and H21). It means greater product availability, and lower product price, the higher interest and intention toward purchasing it. In addition, the results show that there are indirect relationships between customers' perception of product environmentally friendly, companies' green advertising, companies' green availability and customers' purchase interest (H16, H17, and H18). This means that businesses should consider product greenness, truthful green marketing promotion (versus "green washing"), and a viable distribution strategy while they are developing and producing the new product or technology.

Third, in contrast to some researches which show low correlation between environmental concern and consumers EF behavior and low customers tendency to sacrifice their needs

or desires just to be green, the results of this study support the statistically significant relationship between customers' environmental concerns and their interest to use a green technology like IFC (H8) as well as the relationship between their concerns over environmental issues and their perception of product environmental friendliness (H9) (Ginsberg & Bloom, 2004; Boztepe, 2016).

Fourth, although some studies approve the effect of social norms on consumers' behavior and purchase intention toward a new technology ((Pantano & Di Pietro, 2012; Pai & Tu, 2011;; Yq et al., 2011), the results of the present study will contribute to the fact that social norm is not an effective factor increasing consumers' awareness and shifting consumers more toward eco-friendly products (H 19). Instead the result shows that there is a significant relationship between this variable and customers' perception of companies' green promotion (H 14). It means the higher social norms' influence and motivation to comply with close friends, the higher customers' perception of companies' advertisement regarding the advantages of a new food packaging technology. Finally, in some articles advertisement and sales promotions which put stress on environmental aspects of a green product and improve its image in the eye of consumers were considered as effective elements which may affect consumers' purchase intention (Kharde, 2016; Hartmann & Apaolaza Ibáñez, 2006; Souar et al., 2015). However, the finding of this study does not support the direct effect of promotion on customers' purchase interest toward IFC(H12). Instead, the results demonstrate the promotion will be more useful if it comes with product availability and accessibility (H 16 and H18). These results may be because that the degree of the effect of green marketing varies

considerably between developed and developing countries (Lazaro, 1993) and the value of technology is perceived differently by the individual in different demographic areas.

### **7.2.2 Implications for practice**

As analyzing consumer purchase behavior is too complex, knowledge about the influences of marketing mix variables on purchasing decision of consumers in determining appropriate marketing strategy would be beneficial for the firms and businesses. So, capturing customers' voice during the new product development and knowing the influence of each marketing mix element on consumers' purchase decision help firms to prioritize their marketing strategies and budgets, improve market performance, and a greater probability of commercial success.. For example, a survey done in the city of Bogor to analyze the influence of marketing mix factors on consumers' desire to purchase fruit beverages showed that price and physical evidence were two factors that discriminate consumer behavior (Ulfah et al., 2016). Another study on consumers purchase decision of Malang Apples at Giant Olympic Garden Mall (MOG) demonstrated that except people and physical evidence all other factors partially and significantly influenced the purchasing decision and the most influential marketing mix variable was price (Astuti et al., 2015). Also, based on Alipour et al. (2012) research aiming at ranking the effect of marketing mix elements on consumers purchase behaviors, high quality goods and powerful distribution system are the main factors to attract and maintain more customers (Khodaparasti et al., 2015). Findings of this study explain factors which influence consumers' interest in purchasing IFC as a novel and EF food packaging technology. The results of this study demonstrate that firms and marketers should focus more on consumers' demands and desires for food quality as well

as their concerns over food safety while they are thinking about developing and producing new packaging technology (H4). Moreover, the results show that packaging usefulness in maintaining food quality, enhancing food safety and reducing food waste are become more critical for customers. Therefore, firms and businesses should also consider these features of the food packaging if they want to increase their customers' purchase interest and intention and compete in this competitive market..

Firms should also know that consumers' satisfaction leads to an increase in consumers' purchase intention and finally to an increase in companies' sales and profits. Therefore, they have to put more effort to introduce new useful products to the market; to distribute them widely and extensively, and to pricing them logically (H5, H16 and H21).

In addition, based on the results of this study, new corporate marketing strategies which focus on the fulfillment of consumers' concerns about environmental issues and their desire for green products are needed to increase consumers' tendency to these unique products. In fact, these marketing strategies play a fundamental role in enhancing consumers' purchase interest, companies' access to new markets, increase profit sustainability, and enhance their reputation (H8).

In the situation where individuals are more concerned about the environmental issues, green marketing which is advertising or promoting a product based on its environmental performance should be actively conducted in order to widely diffuse the concept of a green product and its benefits and greenwashing should be avoided. This study indicated that the more companies move toward providing EF products, the more marketing and advertising efforts are needed from them. Marketers should develop effective promotion and advertising through various advertisements on the Internet and media, in health

magazines, and other environmental journals. In addition, they should develop effective distribution channel to make the product available and accessible. Marketers should encourage consumers to become familiar with advantages of an EF product and persuade them to buy and use this technology which is easily available (H9,H16,H17, and H18).

The unique model which was developed in this study and validated by obtaining survey data from Canadian households confirms that product price would affect consumers' purchase intention. As eco-friendly products need specific technology in their production process, their price logically is a little bit higher than conventional and non-green products. From consumers' point of view, the price is usually an important concern in purchasing products (Norum, 2003). Consumers will pay more for green products if there will be some financial saving and financial value for them. In fact, they prefer to spend their money on a product which brings a good value for the money. Thus, in the case of green products, consumers will pay more for green products not only because of their EF feature and availability but also because of their role in saving money. This situation is an opportunity for the businesses and marketers to determine their product price in the way that increases their consumers' satisfaction regarding financial saving. By proposing a suitable and logical pricing strategy for target markets, companies would be able to convince consumers' to pay more for eco-friendly products, enhance their purchase intention toward those products, and increase their sales and profits (H20 and H21).

Social norm could have an impressive role in companies green marketing promotion. This study indicated that social norm might act as boosters for increasing marketing promotion effectiveness. Suggestions and recommendations made by consumers' close friends or those whose opinion is important to people had a significant effect on

companies product advertising. Thus, this study recommends positive green consumerism including social norms as important strategies to encourage customers toward green products as well as non-green ones (H14).

### **7.3 Limitations**

Investigating the relationship between independent variables and purchase intention toward IFC is attempted in this research. However, as with any kind of research, the proposed study should be evaluated by considering some certain limitations.

First, in this study, the generalization of the findings is limited because of the use of a sample in one geographical location, i.e. Canadian households as the target participants. In fact, demand and attitudes for environmentally friendly products are likely different across the world (Ottman, 1992a; 1992b; Peattie, 1992). Since Canada is a developed country where individuals have a high standard of living such as health care, excellent medical, transportation, communication, income, educational facilities, and internet access, the result may not be the same as developing countries where individuals do not enjoy healthy and safe environment to live and they have poor educational, transportation, communication and medical facilities, unequal distribution of income, and poor living conditions with high level of unemployment and poverty (Says, 2017). In addition, the degree of the effect of green marketing also varies considerably between developed and developing countries (Lazaro, 1993). Therefore, future research using a representative sample of consumers with varying geographic and psychographic factors is highly recommended in order to obtain a more reliable and accurate research result.

Second, the sample was drawn from a virtual group contacted through social media. Although the snowball method enabled access to individuals that the researcher does not

know personally, the people were principally those who had access to the internet, were more familiar with social media and similar advanced information technology, and were more interested in online surveys compared to the general population. In other words, this study did not use a fully random selection of participants, which may impact the research findings. Therefore, a more random sample of the population is needed to generalize the finding of this research to the people from different levels of living.

Third, in this study, the conceptual framework was largely built on beneficial aspects of using IFC (usefulness, ease of use, and EF) and customers' perceptions. However, variables such as perceived security, perceived risk, and trust were not tested in this study. This means that the results of this study may not cover all aspects of the consumer conception toward IFC. Therefore, it is wise to further investigate more in this area.

#### **7.4 Suggestions for future research**

This study was conducted with some limitations. As a result, based on the present research, several suggestions for future research are made. First, the results of this study indicated that respondent' concerns over environmental issues influenced their purchase intention toward IFC. Therefore, as future research, it would be fruitful to examine to what extent consumers' food safety demands and environmental impacts of waste consciousness influence their attitudes and purchase intention toward IFC.

Second, perceived risk and perceived security, as attributes for consumers' intention toward IFC were not examined in this study. Perceptions of risk and security have been shown to play key roles in the adoption of a new technology in the food industry (Pikkarainen et al., 2004). Perceived risk has been defined as "the consumer's perceptions of the uncertainty and the possible undesirable consequences of using the

system”, whereas perceived security has been defined as “The degree to which a consumer believes that using a certain technology will be secure” (Pantano & Di Pietro, 2012). In the consumer’s point of view, risk and security are generally important concerns in purchasing most products. Therefore, as future research, it would be beneficial to examine to what extent consumers’ risk and security consciousness influence their attitudes and purchase intentions toward IFC.

Third, the result and implication of this study were from a small sample size just in one geographic region (Canada). As a result, it would be useful to test the research model in different countries with large demographic characteristics.

Fourth, in this study snowball method was used to gather the data. Although snowball sampling is a form of simple, cheap and cost-efficient sampling, dispersion of the sample is not guaranteed. In fact, there is not any evidence which support the true distribution of the population and of the sample. Further studies using probability sampling will allow better statistical analysis to verify the results of this exploratory study.

Finally, investigating which factors affect consumer hesitation in purchasing IFC would be helpful. Future research could address why consumers may be uncertain about IFC and avoid purchasing this technology. Understanding the weak points or barriers in purchasing IFC could be helpful to increase acceptance and diffusion of this technology.

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## Appendices

### Appendix A Original Questionnaire

Background Questions:

1. What is your gender?

Male                  Female

2. What age bracket are you in?

Below 18                  18-25                  26-33                  34-41                  42-49                  50-57  
58-65                  Over 65

3. What is your highest (completed) level of education?

High school degree                  Certificate holder  
Doctoral degree                  Bachelor's degree                  Other                  Master's

4. Which is your household size?

1 person more                  2 persons                  3 persons                  4 persons                  5 or more

5. What is your combined annual household income? (Before Tax)

Less than \$9,999                  \$10,000-\$14,999                  \$15,000-\$ 24,999                  \$25,000-\$34,999  
\$35,000-\$49,999                  \$50,000-\$74,999                  \$75,000-\$99,000                  \$100,000-\$149,999                  \$150,000 or more

6. What is your most common reason for throwing out food?

Past food date (Best Before/Best By date)                  Leftover                  Didn't like it  
Needed space                  Food gone bad                  Other

Opinion about best by dates:

7. Food quality (color, texture, flavor, etc.) is very important to me.

Strongly disagree                  Disagree                  Neutral                  Agree  
Strongly agree

8. I believe that date labeling (best before, use before, best by, and use by) on the food packaging is reliable information.

9. I always check the dates on the food packaging before purchasing the product.

10. I always check the dates on the food packaging before consuming the product.

11. I follow the date on the packaging to decide whether or not it is okay to consume the product.

12. I always rely on the date labels on the food packaging to make sure the food is safe to eat.

13. I would dispose of unused food if its use by date were past because of health concerns.

14. I always take additional factors (e.g. appearance, odor, taste) into consideration along with the best by date in deciding if the food is safe to consume.

15. If an item of food is coming close to its best before date, I will discard it.

16. I believe that food past their “best before” or “use by” date are usually safe to eat.

Concerns about food waste:

17. I am always afraid of food-borne illness (e.g. food poisoning).

18. I usually dispose of leftover food because I am afraid of possibility of food poisoning.

19. I always do my best to minimize the amount of food thrown away in my household.

20. My most significant concern about food waste is waste of unused expired food.

21. I am really interested in taking action to reduce the amount of food discarded in my household.

22. Saving money is a major reason for me to reduce food waste.

23. I would reduce my household’s food waste because of financial savings.

Interest in using intelligent food container:

24. I am interested in an intelligent food container that will provide information about food quality.

25. I am interested in an intelligent food container that will potentially help in extending food shelf life by monitoring food quality.

26. I am interested in an intelligent food container that will prevent foodborne illness.

27. I am interested in an intelligent food container that will monitor food quality.

28. I am interested in an intelligent food container that will inform me about food conditions.

29. I am interested in an intelligent food container that will provide real use-by date.

30. I am interested in an intelligent food container that gives instructions about how to store food.

31. I am interested to get informed about my refrigerator/pantry/cupboard contents by notification through mobile or desktop application.

32. I am interested to get informed about my refrigerator/pantry/cupboard contents by notification through indicator on the container.

33. I am interested in an intelligent food container that alerts me if a product is not being stored at the correct temperature.

Beliefs about intelligent food containers:

34. I believe that an intelligent food container that is safe to use is beneficial for my health.

35. I believe that an intelligent food container would reduce my confusion about date labeling.

36. I believe that an intelligent food container would help me to reduce food waste.

37. I believe that an intelligent food container would help bring me prevent foodborne illness.

- 38. I believe that an intelligent food container will help me store the product correctly.
- 39. I believe that an intelligent food container is beneficial for my household.
- 40. I believe that an intelligent food container is a pleasant idea for my household use.

Ease of use of intelligent food container:

- 41. I am interested in an intelligent food container that will be easy to use.
- 42. I am interested in an intelligent food container that is easy to clean/wash.
- 43. I am interested in an intelligent food container that is easy to learn to use.
- 44. I am interested in an intelligent food container that will be environmental friendly.
- 45. I am interested in an intelligent food container if it's made of environmentally friendly materials.
- 46. I am interested in an intelligent food container if it will be recyclable.
- 47. I am not interested in an intelligent food container if it will be environmentally harmful.

Marketing of intelligent food containers:

- 48. I am interested in an intelligent food container that will be available in all stores.
- 49. I will use an intelligent food container for my products if it will be easily available.
- 50. I would prefer spending money on an intelligent food container instead of wasting edible food.
- 51. I am willing to pay more for an intelligent food container compared to regular container to have safe food.
- 52. I am interested in an intelligent food container that will save me money by reducing food waste.
- 53. I am interested in an intelligent food container if it is a good value for the money.
- 54. I am interested in an intelligent food container if it is reasonably priced.
- 55. I believe that an intelligent food container would pay itself back quickly.
- 56. I believe that advertisements would affect my adoption of an intelligent food container.
- 57. I believe that advertisements would affect my intention to use an intelligent food container.

Environmental thinking:

- 58. I have high level of knowledge about negative environmental impact of the food waste.
- 59. I would reduce my household's food waste to protect the environment.
- 60. I am likely to adopt new technologies (e.g. an intelligent food container and related applications).
- 61. I would reduce my household's food waste because of people whose opinions are important to me.
- 62. I am interested to reduce my food waste mostly because of my family/friends request.

Intention to use intelligent food containers:

- 63. I believe that intelligent food container will improve my quality of life.
- 64. An intelligent food container with sensors that monitor environmental conditions of the product will help me reduce food waste.
- 65. I am interested to use an intelligent food container.
- 66. I intend to use an intelligent food container to enhance my food safety.
- 67. I intend to use an intelligent food container to monitor my food quality.
- 68. I intend to use an intelligent food container to reduce my food waste.
- 69. I intend to use an intelligent food container to save money by reducing my food waste.
- 70. I intend to use an intelligent food container to become more environmentally friendly.
- 71. I intend to use an intelligent food container even if it will be quite expensive compared to a regular container.
- 72. I intend to buy an intelligent food container whenever it becomes available.

## Appendix B T-Test

### Statistics

DateRange

N	Valid	153
	Missing	0

DateRange

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 (early)	76	49.7	49.7	49.7
	1 (late)	77	50.3	50.3	100.0
	Total	153	100.0	100.0	

### Group Statistics

	DateRange	N	Mean	Std. Deviation	Std. Error Mean
B01	0	76	1.47	.503	.058
	1	77	1.62	.488	.056
B02	0	76	3.75	1.201	.138
	1	77	3.83	.865	.099
B03	0	75	3.79	1.200	.139
	1	77	3.77	1.075	.122
B04	0	75	2.43	1.093	.126
	1	77	2.49	1.177	.134
B05	0	74	6.16	2.543	.296
	1	77	6.35	2.281	.260
B06	0	75	3.43	1.817	.210
	1	77	3.61	1.741	.198
C01	0	76	4.54	.682	.078
	1	77	4.61	.652	.074
C02	0	76	3.79	.928	.106
	1	77	3.90	.968	.110
C03	0	76	4.28	.873	.100
	1	76	4.33	.929	.107
C04	0	74	3.93	.956	.111
	1	76	4.03	1.045	.120
C05	0	76	3.75	1.008	.116
	1	77	3.83	1.093	.125
C06	0	76	3.79	.984	.113
	1	77	3.70	1.193	.136
C07	0	76	3.74	1.215	.139
	1	77	3.82	1.109	.126
C08	0	76	4.32	.716	.082
	1	77	4.30	.828	.094
C09	0	75	2.27	1.143	.132
	1	77	2.53	1.176	.134
C10	0	76	3.21	.970	.111
	1	77	3.03	1.088	.124
D01	0	75	3.56	1.142	.132
	1	76	3.54	1.101	.126
D02	0	76	2.83	1.279	.147
	1	77	3.16	1.298	.148
D03	0	75	4.48	.644	.074
	1	77	4.26	.785	.089
D04	0	76	3.76	.964	.111
	1	77	3.65	1.023	.117
D05	0	76	4.47	.683	.078
	1	77	4.38	.629	.072
D06	0	76	3.46	1.148	.132
	1	77	3.66	1.096	.125
D07	0	76	3.54	1.038	.119
	1	77	3.57	1.069	.122

E01	0	75	4.19	800	.092
	1	75	4.25	807	.093
E02	0	76	4.12	864	.099
	1	76	4.30	749	.086
E03	0	76	4.22	810	.093
	1	75	4.39	751	.087
E04	0	76	4.09	912	.105
	1	76	4.28	759	.087
E05	0	76	4.12	909	.104
	1	75	4.31	771	.089
E06	0	76	4.20	864	.099
	1	76	4.41	786	.090
E07	0	76	4.04	972	.112
	1	76	4.24	877	.101
E08	0	76	3.95	1.106	.127
	1	76	3.88	1.083	.124
E09	0	75	4.01	979	.113
	1	75	4.08	866	.100
E10	0	76	4.13	900	.103
	1	76	4.13	869	.100
F01	0	76	4.09	696	.080
	1	76	4.13	772	.089
F02	0	76	3.92	891	.102
	1	75	3.91	932	.108
F03	0	76	4.01	825	.095
	1	76	4.14	795	.091
F04	0	76	3.79	914	.105
	1	75	4.00	788	.091
F05	0	76	3.93	789	.090
	1	76	4.03	800	.092
F06	0	76	3.82	934	.107
	1	75	3.93	794	.092
F07	0	76	3.89	960	.110
	1	76	3.96	916	.105
G01	0	76	4.28	826	.095
	1	76	4.29	727	.083
G02	0	76	4.38	765	.088
	1	76	4.45	681	.078
G03	0	76	4.34	809	.093
	1	76	4.29	763	.087
G04	0	75	4.37	818	.094
	1	74	4.28	836	.097
G05	0	76	4.25	866	.099
	1	75	4.19	896	.103
G06	0	76	4.33	806	.093
	1	75	4.23	847	.098
-G07	0	76	4.29	921	.106
	1	74	4.22	815	.095
H01	0	75	3.96	892	.103
	1	76	4.03	832	.095
H02	0	76	4.17	790	.091
	1	76	4.29	670	.077
H03	0	76	4.03	938	.108
	1	76	3.95	878	.101
H04	0	75	3.57	1.153	.133
	1	75	3.63	941	.109
H05	0	74	4.04	784	.091

	1	75	4.04	.706	.082
H06	0	74	4.08	.736	.086
	1	74	4.19	.655	.076
H07	0	75	4.28	.648	.075
	1	75	4.31	.657	.076
H08	0	74	3.50	1.010	.117
	1	74	3.73	.799	.093
H09	0	75	3.73	.859	.099
	1	75	3.77	.847	.098
H10	0	74	3.69	.964	.112
	1	75	3.84	.823	.095
I01	0	73	3.51	.915	.107
	1	76	3.37	1.005	.115
I02	0	74	4.11	.674	.078
	1	76	4.13	.660	.076
I03	0	74	4.00	.828	.096
	1	76	3.97	.765	.088
I04	0	72	3.46	1.020	.120
	1	76	3.24	1.094	.125
I05	0	73	2.88	1.066	.125
	1	76	3.01	1.149	.132
J01	0	74	3.61	.857	.100
	1	75	3.49	.844	.097
J02	0	74	3.93	.764	.089
	1	75	3.88	.753	.087
J03	0	73	3.97	.849	.099
	1	75	3.89	.815	.094
J04	0	74	3.77	.900	.105
	1	75	3.87	.777	.090
J05	0	74	3.88	.875	.102
	1	73	3.89	.774	.091
J06	0	74	3.97	.827	.096
	1	74	3.91	.762	.089
J07	0	74	3.88	.921	.107
	1	73	3.78	.768	.090
J08	0	74	3.99	.819	.095
	1	72	3.93	.757	.089
J09	0	74	2.92	1.258	.146
	1	74	2.82	1.102	.128
J10	0	74	3.64	.885	.103
	1	73	3.60	.846	.099

**Independent Samples Test**

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
B01 Equal variances assumed	4.229	.041	-1.870	151	.063	-.150	.080	-.308	.009
			-1.869	150.718	.064	-.150	.080	-.308	.009
B02 Equal variances assumed	7.552	.007	-4.480	151	.632	-.081	.169	-.415	.253
			-4.479	136.159	.633	-.081	.169	-.416	.254
B03 Equal variances assumed	.714	.400	.111	150	.912	.020	.185	-.344	.385
			.110	147.268	.912	.020	.185	-.345	.386
B04 Equal variances assumed	.750	.388	-.363	150	.717	-.067	.184	-.431	.297
			-.363	149.661	.717	-.067	.184	-.431	.297
B05 Equal variances assumed	.981	.323	-4.480	149	.632	-.188	.393	-.965	.588
			-4.479	145.810	.633	-.188	.394	-.967	.590
B06 Equal variances assumed	1.798	.182	-.637	150	.525	-.184	.289	-.754	.387
			-.636	149.282	.526	-.184	.289	-.754	.387
C01 Equal variances assumed	.512	.475	-.657	151	.512	-.071	.108	-.284	.142
			-.657	150.494	.512	-.071	.108	-.284	.142

C02	Equal variances assumed	.141	.707	-.695	151	.488	-.107	.153	-.410	.196
	Equal variances not assumed			-.696	150.878	.488	-.107	.153	-.410	.196
C03	Equal variances assumed	.422	.517	-.360	150	.720	-.053	.146	-.342	.236
	Equal variances not assumed			-.360	149.423	.720	-.053	.146	-.342	.236
C04	Equal variances assumed	.933	.336	-.574	148	.567	-.094	.164	-.417	.230
	Equal variances not assumed			-.574	147.420	.567	-.094	.163	-.417	.229
C05	Equal variances assumed	1.256	.264	-.477	151	.634	-.081	.170	-.417	.255
	Equal variances not assumed			-.478	150.316	.634	-.081	.170	-.417	.255
C06	Equal variances assumed	10.154	.002	.498	151	.619	.088	.177	-.261	.438
	Equal variances not assumed			.499	146.409	.619	.088	.177	-.261	.437
C07	Equal variances assumed	1.192	.277	-.433	151	.666	-.081	.188	-.453	.290
	Equal variances not assumed			-.432	149.375	.666	-.081	.188	-.453	.290
C08	Equal variances assumed	1.279	.260	.136	151	.892	.017	.125	-.230	.264
	Equal variances not assumed			.137	148.418	.892	.017	.125	-.230	.264
C09	Equal variances assumed	.488	.486	-1.412	150	.160	-.266	.188	-.638	.106
	Equal variances not assumed			-1.413	149.999	.160	-.266	.188	-.638	.106
C10	Equal variances assumed	.886	.348	1.107	151	.270	.185	.167	-.145	.514

	Equal variances not assumed			1.108	149.485	.270	.185	.167	-.145	.514
D01	Equal variances assumed	.025	.875	.112	149	.911	.021	.183	-.340	.381
	Equal variances not assumed			.112	148.630	.911	.021	.183	-.340	.381
D02	Equal variances assumed	.099	.754	-1.568	151	.119	-.327	.208	-.739	.085
	Equal variances not assumed			-1.569	151.000	.119	-.327	.208	-.739	.085
D03	Equal variances assumed	1.113	.293	1.888	150	.061	.220	.117	-.010	.451
	Equal variances not assumed			1.893	145.850	.060	.220	.116	-.010	.450
D04	Equal variances assumed	.499	.481	.708	151	.480	.114	.161	-.204	.431
	Equal variances not assumed			.708	150.683	.480	.114	.161	-.204	.431
D05	Equal variances assumed	.361	.549	.915	151	.362	.097	.106	-.113	.307
	Equal variances not assumed			.914	149.661	.362	.097	.106	-.113	.307
D06	Equal variances assumed	.418	.519	-1.112	151	.268	-.202	.181	-.560	.157
	Equal variances not assumed			-1.112	150.457	.268	-.202	.181	-.560	.157
D07	Equal variances assumed	.286	.594	-.188	151	.852	-.032	.170	-.369	.305
	Equal variances not assumed			-.188	150.962	.851	-.032	.170	-.369	.305
E01	Equal variances assumed	1.224	.270	-.508	148	.612	-.067	.131	-.326	.193
	Equal variances not assumed			-.508	147.990	.612	-.067	.131	-.326	.193

E02 Equal variances assumed	.001	.978	-1.405	150	.162	-.184	.131	-.443	.075
Equal variances not assumed			-1.405	147.043	.162	-.184	.131	-.443	.075
E03 Equal variances assumed	.004	.950	-1.281	149	.202	-.163	.127	-.414	.088
Equal variances not assumed			-1.282	148.439	.202	-.163	.127	-.414	.088
E04 Equal variances assumed	.016	.898	-1.354	150	.178	-.184	.136	-.453	.085
Equal variances not assumed			-1.354	145.216	.178	-.184	.136	-.453	.085
E05 Equal variances assumed	.262	.609	-1.372	149	.172	-.188	.137	-.459	.083
Equal variances not assumed			-1.374	145.713	.172	-.188	.137	-.459	.083
E06 Equal variances assumed	.075	.785	-1.571	150	.118	-.211	.134	-.475	.054
Equal variances not assumed			-1.571	148.670	.118	-.211	.134	-.475	.054
E07 Equal variances assumed	.037	.848	-1.314	150	.191	-.197	.150	-.494	.099
Equal variances not assumed			-1.314	148.449	.191	-.197	.150	-.494	.099
E08 Equal variances assumed	.104	.748	.371	150	.712	.066	.178	-.285	.417
Equal variances not assumed			.371	149.931	.712	.066	.178	-.285	.417
E09 Equal variances assumed	.195	.660	-.442	148	.659	-.067	.151	-.365	.232
Equal variances not assumed			-.442	145.820	.659	-.067	.151	-.365	.232
E10 Equal variances assumed	.000	1.000	.000	150	1.000	.000	.143	-.284	.284

	Equal variances not assumed			.000	149.826	1.000	.000	.143	-.284	.284
F01	Equal variances assumed	2.093	.150	-.331	150	.741	-.039	.119	-.275	.196
	Equal variances not assumed			-.331	148.432	.741	-.039	.119	-.275	.196
F02	Equal variances assumed	.573	.450	.097	149	.923	.014	.148	-.279	.308
	Equal variances not assumed			.097	148.484	.923	.014	.148	-.279	.308
F03	Equal variances assumed	.166	.685	-1.001	150	.318	-.132	.131	-.391	.128
	Equal variances not assumed			-1.001	149.802	.318	-.132	.131	-.391	.128
F04	Equal variances assumed	2.442	.120	-1.515	149	.132	-.211	.139	-.485	.064
	Equal variances not assumed			-1.516	146.397	.132	-.211	.139	-.485	.064
F05	Equal variances assumed	.173	.678	-.715	150	.476	-.092	.129	-.347	.162
	Equal variances not assumed			-.715	149.973	.476	-.092	.129	-.347	.162
F06	Equal variances assumed	1.724	.191	-.833	149	.406	-.118	.141	-.396	.161
	Equal variances not assumed			-.834	145.822	.406	-.118	.141	-.396	.161
F07	Equal variances assumed	.001	.972	-.432	150	.666	-.066	.152	-.367	.235
	Equal variances not assumed			-.432	149.662	.666	-.066	.152	-.367	.235
G01	Equal variances assumed	.888	.347	-.104	150	.917	-.013	.126	-.263	.236
	Equal variances not assumed			-.104	147.607	.917	-.013	.126	-.263	.236

G02Equal variances assumed	.016	.901	-.560	150	.576	-.066	.118	-.298	.166
Equal variances not assumed			-.560	148.003	.576	-.066	.118	-.298	.166
G03Equal variances assumed	.096	.757	.413	150	.680	.053	.128	-.199	.305
Equal variances not assumed			.413	149.479	.680	.053	.128	-.199	.305
G04Equal variances assumed	.142	.707	.661	147	.510	.090	.136	-.178	.357
Equal variances not assumed			.661	146.818	.510	.090	.136	-.178	.357
G05Equal variances assumed	1.627	.204	.442	149	.659	.063	.143	-.220	.347
Equal variances not assumed			.442	148.669	.659	.063	.143	-.220	.347
G06Equal variances assumed	1.078	.301	.760	149	.449	.102	.135	-.164	.368
Equal variances not assumed			.760	148.413	.449	.102	.135	-.164	.368
G07Equal variances assumed	.164	.686	.515	148	.607	.073	.142	-.208	.354
Equal variances not assumed			.516	146.688	.607	.073	.142	-.207	.354
H01Equal variances assumed	.218	.641	-.472	149	.637	-.066	.140	-.344	.211
Equal variances not assumed			-.472	147.992	.637	-.066	.140	-.344	.211
H02Equal variances assumed	.149	.700	-.997	150	.320	-.118	.119	-.353	.116
Equal variances not assumed			-.997	146.096	.320	-.118	.119	-.353	.116
H03Equal variances assumed	.024	.876	.536	150	.593	.079	.147	-.212	.370

	Equal variances not assumed			.536	149.351	.593	.079	.147	-.212	.370
H04	Equal variances assumed	3.441	.066	-.310	148	.757	-.053	.172	-.393	.286
	Equal variances not assumed			-.310	142.301	.757	-.053	.172	-.393	.286
H05	Equal variances assumed	.738	.392	.004	147	.996	.001	.122	-.241	.242
	Equal variances not assumed			.004	144.981	.996	.001	.122	-.241	.242
H06	Equal variances assumed	.080	.778	-.944	146	.347	-.108	.115	-.334	.118
	Equal variances not assumed			-.944	144.088	.347	-.108	.115	-.334	.118
H07	Equal variances assumed	.088	.767	-.250	148	.803	-.027	.107	-.237	.184
	Equal variances not assumed			-.250	147.975	.803	-.027	.107	-.237	.184
H08	Equal variances assumed	3.659	.058	-1.534	146	.127	-.230	.150	-.526	.066
	Equal variances not assumed			-1.534	138.638	.127	-.230	.150	-.526	.066
H09	Equal variances assumed	.087	.769	-.287	148	.775	-.040	.139	-.315	.235
	Equal variances not assumed			-.287	147.971	.775	-.040	.139	-.315	.235
H10	Equal variances assumed	2.694	.103	-1.028	147	.306	-.151	.147	-.441	.139
	Equal variances not assumed			-1.027	142.839	.306	-.151	.147	-.441	.140
I01	Equal variances assumed	1.271	.261	.878	147	.381	.138	.158	-.173	.450
	Equal variances not assumed			.880	146.588	.380	.138	.157	-.172	.449

I02	Equal variances assumed	.358	.551	-.216	148	.830	-.023	.109	-.239	.192
	Equal variances not assumed			-.215	147.671	.830	-.023	.109	-.239	.192
I03	Equal variances assumed	.072	.789	.202	148	.840	.026	.130	-.231	.283
	Equal variances not assumed			.202	146.397	.840	.026	.130	-.231	.284
I04	Equal variances assumed	.838	.361	1.272	146	.205	.221	.174	-.123	.566
	Equal variances not assumed			1.275	145.965	.204	.221	.174	-.122	.565
I05	Equal variances assumed	.418	.519	-.751	147	.454	-.136	.182	-.496	.223
	Equal variances not assumed			-.752	146.832	.453	-.136	.182	-.495	.222
J01	Equal variances assumed	.004	.950	.823	147	.412	.115	.139	-.161	.390
	Equal variances not assumed			.823	146.879	.412	.115	.139	-.161	.390
J02	Equal variances assumed	.029	.866	.422	147	.674	.052	.124	-.193	.298
	Equal variances not assumed			.422	146.876	.674	.052	.124	-.193	.298
J03	Equal variances assumed	.542	.463	.579	146	.563	.079	.137	-.191	.350
	Equal variances not assumed			.579	145.317	.563	.079	.137	-.191	.350
J04	Equal variances assumed	3.475	.064	-.700	147	.485	-.096	.138	-.368	.176
	Equal variances not assumed			-.700	143.372	.485	-.096	.138	-.369	.176
J05	Equal variances assumed	.906	.343	-.088	145	.930	-.012	.136	-.281	.257

	Equal variances not assumed			-.088	143.307	.930	-.012	.136	-.281	.257
J06	Equal variances assumed	.111	.739	.517	146	.606	.068	.131	-.191	.326
	Equal variances not assumed			.517	145.014	.606	.068	.131	-.191	.326
J07	Equal variances assumed	.999	.319	.697	145	.487	.098	.140	-.179	.374
	Equal variances not assumed			.698	141.121	.486	.098	.140	-.179	.374
J08	Equal variances assumed	.025	.874	.428	144	.669	.056	.131	-.202	.314
	Equal variances not assumed			.429	143.617	.669	.056	.130	-.202	.314
J09	Equal variances assumed	2.429	.121	.487	146	.627	.095	.194	-.290	.479
	Equal variances not assumed			.487	143.529	.627	.095	.194	-.290	.479
J10	Equal variances assumed	.011	.916	.227	145	.821	.032	.143	-.250	.315
	Equal variances not assumed			.227	144.855	.821	.032	.143	-.250	.315

## Appendix C Missing Value Analysis (MVA)

### Univariate Statistics

	N	Mean	Std. Deviation	Missing		No. of Extremes <sup>a</sup>	
				Count	Percent	Low	High
C01	153	4.58	.666	0	.0	4	0
C02	153	3.84	.947	0	.0	2	0
C03	152	4.30	.899	1	.7	9	0
C04	150	3.98	1.000	3	2.0	0	0
C05	153	3.79	1.049	0	.0	4	0
C06	153	3.75	1.091	0	.0	0	0
C07	153	3.78	1.160	0	.0	0	0
C08	153	4.31	.772	0	.0	6	0
C09	152	2.40	1.164	1	.7	0	10
C10	153	3.12	1.032	0	.0	0	0

D01	151	3.55	1.118	2	1.3	4	0
D02	153	2.99	1.295	0	.0	0	0
D03	152	4.37	.725	1	.7	4	0
D04	153	3.71	.993	0	.0	1	0
D05	153	4.42	.656	0	.0	1	0
D06	153	3.56	1.123	0	.0	4	0
D07	153	3.56	1.051	0	.0	3	0
E01	150	4.22	.802	3	2.0	7	0
E02	152	4.21	.811	1	.7	8	0
E03	151	4.30	.783	2	1.3	4	0
E04	152	4.18	.841	1	.7	8	0
E05	151	4.21	.845	2	1.3	8	0
E06	152	4.30	.830	1	.7	8	0
E07	152	4.14	.928	1	.7	11	0
E08	152	3.91	1.091	1	.7	0	0
E09	150	4.05	.922	3	2.0	11	0
E10	152	4.13	.882	1	.7	10	0
F01	152	4.11	.733	1	.7	4	0
F02	151	3.91	.909	2	1.3	0	0
F03	152	4.08	.810	1	.7	7	0
F04	151	3.89	.858	2	1.3	2	0
F05	152	3.98	.793	1	.7	8	0
F06	151	3.87	.866	2	1.3	3	0
F07	152	3.93	.936	1	.7	13	0
G01	152	4.28	.776	1	.7	4	0
G02	152	4.41	.723	1	.7	2	0
G03	152	4.32	.784	1	.7	4	0
G04	149	4.33	.826	4	2.6	3	0
G05	151	4.22	.879	2	1.3	4	0
G06	151	4.28	.826	2	1.3	3	0
G07	150	4.25	.868	3	2.0	6	0
H01	151	3.99	.860	2	1.3	0	0
H02	152	4.23	.732	1	.7	3	0
H03	152	3.99	.906	1	.7	12	0
H04	150	3.60	1.049	3	2.0	6	0
H05	149	4.04	.743	4	2.6	.	0
H06	148	4.14	.696	5	3.3	1	0
H07	150	4.29	.651	3	2.0	2	0
H08	148	3.61	.915	5	3.3	3	0
H09	150	3.75	.851	3	2.0	3	0
H10	149	3.77	.896	4	2.6	4	0
I01	149	3.44	.961	4	2.6	1	0
I02	150	4.12	.665	3	2.0	2	0
I03	150	3.99	.794	3	2.0	8	0
I04	148	3.34	1.061	5	3.3	7	0
I05	149	2.95	1.108	4	2.6	0	0
J01	149	3.55	.850	4	2.6	0	0
J02	149	3.91	.756	4	2.6	0	0
J03	148	3.93	.830	5	3.3	.	0
J04	149	3.82	.839	4	2.6	0	0
J05	147	3.88	.824	6	3.9	.	0
J06	148	3.94	.793	5	3.3	.	0
J07	147	3.83	.847	6	3.9	0	0
J08	146	3.96	.787	7	4.6	.	0
J09	148	2.87	1.180	5	3.3	0	0
J10	147	3.62	.863	6	3.9	3	0
B01	153			0	.0		
B02	153			0	.0		
B03	152			1	.7		
B04	152			1	.7		

B05	151			2	1.3		
B06	152			1	.7		

a. Number of cases outside the range (Q1 - 1.5\*IQR, Q3 + 1.5\*IQR).

## Appendix D Frequencies

### Statistics

		B01	B02	B03	B04	B05	B06
N	Valid	153	153	152	152	151	152
	Missing	0	0	1	1	2	1

### B01- Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	69	45.1	45.1	45.1
	2	84	54.9	54.9	100.0
Total		153	100.0	100.0	

### B02- Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	18	11.8	11.8	11.8
	3	33	21.6	21.6	33.3
	4	76	49.7	49.7	83.0
	5	18	11.8	11.8	94.8
	6	6	3.9	3.9	98.7
	7	1	.7	.7	99.3
	8	1	.7	.7	100.0
	Total		153	100.0	100.0

### B03- Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	9	5.9	5.9	5.9
	2	6	3.9	3.9	9.9
	3	42	27.5	27.6	37.5
	4	52	34.0	34.2	71.7
	5	39	25.5	25.7	97.4
	6	4	2.6	2.6	100.0
Total		152	99.3	100.0	
Missing	System	1	.7		
Total		153	100.0		

**B04- Household size**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	33	21.6	21.7	21.7
	2	55	35.9	36.2	57.9
	3	31	20.3	20.4	78.3
	4	27	17.6	17.8	96.1
	5	6	3.9	3.9	100.0
	Total	152	99.3	100.0	
Missing	System	1	.7		
Total		153	100.0		

**B05- Annual household income**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	4.6	4.6	4.6
	2	7	4.6	4.6	9.3
	3	13	8.5	8.6	17.9
	4	10	6.5	6.6	24.5
	5	11	7.2	7.3	31.8
	6	23	15.0	15.2	47.0
	7	22	14.4	14.6	61.6
	8	24	15.7	15.9	77.5
	9	34	22.2	22.5	100.0
	Total	151	98.7	100.0	
Missing	System	2	1.3		
Total		153	100.0		

**B06- Reason to discard food**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	36	23.5	23.7	23.7
	2	23	15.0	15.1	38.8
	3	6	3.9	3.9	42.8
	4	1	.7	.7	43.4
	5	85	55.6	55.9	99.3
	6	1	.7	.7	100.0
	Total	152	99.3	100.0	
Missing	System	1	.7		
Total		153	100.0		

## Appendix E Factor Analysis

### Communalities

	Initial	Extraction
B01	1.000	.797
B02	1.000	.776
B03	1.000	.733
B04	1.000	.684
B05	1.000	.711
B06	1.000	.613
C01	1.000	.741
C02	1.000	.711
C03	1.000	.702
C04	1.000	.705
C05	1.000	.843
C06	1.000	.821
C07	1.000	.773
C08	1.000	.742
C09	1.000	.644
C10	1.000	.734
D01	1.000	.779
D02	1.000	.818
D03	1.000	.671
D04	1.000	.784
D05	1.000	.690
D06	1.000	.795
D07	1.000	.824
E01	1.000	.813
E02	1.000	.773
E03	1.000	.765
E04	1.000	.887
E05	1.000	.745
E06	1.000	.787
E07	1.000	.764
E08	1.000	.632
E09	1.000	.810
E10	1.000	.780
F01	1.000	.676
F02	1.000	.694
F03	1.000	.744
F04	1.000	.707
F05	1.000	.810
F06	1.000	.859
F07	1.000	.835
G01	1.000	.870
G02	1.000	.813
G03	1.000	.826
G04	1.000	.802
G05	1.000	.785
G06	1.000	.807
G07	1.000	.600
H01	1.000	.741
H02	1.000	.747
H03	1.000	.711
H04	1.000	.743
H05	1.000	.782
H06	1.000	.758
H07	1.000	.756
H08	1.000	.716
H09	1.000	.847

H10	1.000	.891
I01	1.000	.720
I02	1.000	.695
I03	1.000	.686
I04	1.000	.738
I05	1.000	.818
J01	1.000	.711
J02	1.000	.801
J03	1.000	.825
J04	1.000	.858
J05	1.000	.872
J06	1.000	.859
J07	1.000	.826
J08	1.000	.796
J09	1.000	.722
J10	1.000	.746

Extraction Method: Principal Component Analysis.

**Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	22.710	31.542	31.542	22.710	31.542	31.542	9.429	13.096	13.096
2	4.732	6.572	38.114	4.732	6.572	38.114	8.773	12.184	25.280
3	3.658	5.080	43.194	3.658	5.080	43.194	4.376	6.078	31.358
4	2.836	3.939	47.132	2.836	3.939	47.132	3.980	5.528	36.886
5	2.400	3.333	50.465	2.400	3.333	50.465	3.516	4.883	41.769
6	2.194	3.048	53.513	2.194	3.048	53.513	3.035	4.216	45.985
7	1.833	2.546	56.059	1.833	2.546	56.059	2.635	3.659	49.644
8	1.719	2.388	58.447	1.719	2.388	58.447	2.480	3.444	53.088
9	1.653	2.295	60.742	1.653	2.295	60.742	2.207	3.065	56.153
10	1.512	2.100	62.843	1.512	2.100	62.843	1.931	2.682	58.834
11	1.424	1.978	64.821	1.424	1.978	64.821	1.897	2.635	61.469
12	1.360	1.889	66.710	1.360	1.889	66.710	1.841	2.557	64.026
13	1.303	1.810	68.520	1.303	1.810	68.520	1.754	2.436	66.463
14	1.279	1.776	70.296	1.279	1.776	70.296	1.608	2.233	68.695
15	1.200	1.667	71.963	1.200	1.667	71.963	1.478	2.053	70.748
16	1.158	1.608	73.571	1.158	1.608	73.571	1.404	1.950	72.698
17	1.048	1.456	75.027	1.048	1.456	75.027	1.356	1.883	74.581
18	1.021	1.418	76.445	1.021	1.418	76.445	1.342	1.864	76.445
19	.954	1.325	77.769						
20	.931	1.293	79.063						
21	.876	1.217	80.279						
22	.781	1.085	81.365						
23	.753	1.046	82.411						
24	.745	1.035	83.446						
25	.699	.971	84.417						
26	.647	.899	85.316						
27	.625	.867	86.184						
28	.576	.801	86.984						
29	.556	.772	87.757						
30	.532	.738	88.495						
31	.512	.711	89.206						

32	.498	.691	89.897					
33	.459	.638	90.535					
34	.437	.607	91.142					
35	.417	.579	91.721					
36	.382	.530	92.252					
37	.373	.518	92.770					
38	.356	.495	93.265					
39	.335	.465	93.730					
40	.329	.457	94.187					
41	.322	.447	94.634					
42	.293	.408	95.042					
43	.258	.359	95.400					
44	.247	.342	95.743					
45	.229	.319	96.061					
46	.227	.315	96.376					
47	.218	.303	96.679					
48	.201	.279	96.958					
49	.196	.272	97.230					
50	.187	.259	97.490					
51	.169	.234	97.724					
52	.162	.225	97.949					
53	.152	.211	98.160					
54	.145	.201	98.361					
55	.124	.172	98.533					
56	.114	.159	98.692					
57	.109	.152	98.844					
58	.099	.137	98.981					
59	.092	.128	99.108					
60	.090	.125	99.233					
61	.077	.107	99.340					
62	.073	.102	99.442					
63	.070	.097	99.539					
64	.058	.081	99.620					
65	.055	.076	99.696					
66	.049	.068	99.764					
67	.044	.061	99.825					
68	.040	.055	99.880					
69	.029	.040	99.920					
70	.024	.033	99.953					
71	.020	.028	99.981					
72	.014	.019	100.000					

Extraction Method: Principal Component Analysis.

Rotated Component Matrix<sup>a</sup>

	Component																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
J06	.807																	
J03	.804																	
J05	.788																	
J04	.769																	
J07	.728																	
J09	.722																	
J01	.680																	
J08	.673																	
J02	.671																	
J10	.667																	
I03																		
H04																		
H03																		
H05																		
E04		.802																
E05		.763																
E06		.758																
E07		.733																
E01		.727																
E09		.727																
E03		.702																
E02		.685																
E10		.638																
E08																		
H02																		
H01																		
C05			.888															
C06			.865															
C07			.764															
C02			.692															
C04			.602															
C03																		
G06				.826														
G05				.782														
G04				.666														
G07				.614														
F05					.717													
F01																		
F06																		
F03																		
F02																		
F07																		
B05																		
F04																		
G02						.793												
G01						.735												
G03						.701												
H10							.842											
H09							.789											
H08																		
D07								.834										
D06								.829										
I05									.866									
I04									.769									
H06										.670								
H07										.665								
C08											.812							
I01																		
I02																		
B06																		
D02												.782						
D01												.632						
C09																		
D04													.750					
D05													.639					
D03																		



	Total		189.385	142			
D06 * B03	Between Groups (Combined)		27.056	4	6.764	5.968	.000
	Within Groups		156.398	138	1.133		
	Total		183.455	142			
D07 * B03	Between Groups (Combined)		20.440	4	5.110	5.144	.001
	Within Groups		137.098	138	.993		
	Total		157.538	142			
E01 * B03	Between Groups (Combined)		6.091	4	1.523	2.648	.036
	Within Groups		78.221	136	.575		
	Total		84.312	140			
E02 * B03	Between Groups (Combined)		6.353	4	1.588	2.534	.043
	Within Groups		85.880	137	.627		
	Total		92.232	141			
E03 * B03	Between Groups (Combined)		7.245	4	1.811	2.981	.021
	Within Groups		82.642	136	.608		
	Total		89.887	140			
E04 * B03	Between Groups (Combined)		7.815	4	1.954	2.999	.021
	Within Groups		89.262	137	.652		
	Total		97.077	141			
E05 * B03	Between Groups (Combined)		8.584	4	2.146	3.237	.014
	Within Groups		90.154	136	.663		
	Total		98.738	140			
E06 * B03	Between Groups (Combined)		8.713	4	2.178	3.454	.010
	Within Groups		86.386	137	.631		
	Total		95.099	141			
E07 * B03	Between Groups (Combined)		14.556	4	3.639	4.854	.001
	Within Groups		102.718	137	.750		
	Total		117.275	141			
E08 * B03	Between Groups (Combined)		13.310	4	3.327	2.990	.021
	Within Groups		152.437	137	1.113		
	Total		165.746	141			
E10 * B03	Between Groups (Combined)		8.695	4	2.174	2.964	.022
	Within Groups		100.488	137	.733		
	Total		109.183	141			
F06 * B03	Between Groups (Combined)		7.067	4	1.767	2.524	.044
	Within Groups		95.898	137	.700		
	Total		102.965	141			
G02 * B03	Between Groups (Combined)		6.831	4	1.708	3.359	.012
	Within Groups		69.655	137	.508		
	Total		76.486	141			
G03 * B03	Between Groups (Combined)		6.912	4	1.728	2.850	.026
	Within Groups		83.067	137	.606		
	Total		89.979	141			
H02 * B03	Between Groups (Combined)		5.316	4	1.329	2.497	.046
	Within Groups		72.917	137	.532		

	Total		78.232	141			
H04 * B03	Between Groups (Combined)		9.884	4	2.471	2.503	.045
	Within Groups		133.288	135	.987		
	Total		143.171	139			
H05 * B03	Between Groups (Combined)		6.757	4	1.689	3.372	.012
	Within Groups		67.128	134	.501		
	Total		73.885	138			
H08 * B03	Between Groups (Combined)		9.115	4	2.279	2.802	.028
	Within Groups		108.161	133	.813		
	Total		117.275	137			
H09 * B03	Between Groups (Combined)		7.071	4	1.768	2.548	.042
	Within Groups		93.672	135	.694		
	Total		100.743	139			

**ANOVA Table – B04 (household size)**

		Sum of Squares	df	Mean Square	F	Sig.
C09 * B04	Between Groups (Combined)	21.231	4	5.308	4.236	.003
	Within Groups	182.928	146	1.253		
	Total	204.159	150			
D04 * B04	Between Groups (Combined)	9.371	4	2.343	2.483	.046
	Within Groups	138.708	147	.944		
	Total	148.079	151			
D06 * B04	Between Groups (Combined)	16.152	4	4.038	3.386	.011
	Within Groups	175.315	147	1.193		
	Total	191.467	151			
I05 * B04	Between Groups (Combined)	18.087	4	4.522	3.983	.004
	Within Groups	163.484	144	1.135		
	Total	181.570	148			

**ANOVA Table – B05 (income)**

		Sum of Squares	df	Mean Square	F	Sig.
J10 * B05	Between Groups (Combined)	13.221	8	1.653	2.376	.020
	Within Groups	95.300	137	.696		
	Total	108.521	145			

ANOVA Table – B06 (reason to discard food)

			Sum of Squares	df	Mean Square	F	Sig.
C02 * B06	Between Groups	(Combined)	15.569	5	3.114	3.810	.003
	Within Groups		119.319	146	.817		
	Total		134.888	151			
C04 * B06	Between Groups	(Combined)	14.138	5	2.828	3.023	.013
	Within Groups		133.755	143	.935		
	Total		147.893	148			
C05 * B06	Between Groups	(Combined)	21.744	5	4.349	4.363	.001
	Within Groups		145.519	146	.997		
	Total		167.263	151			
C06 * B06	Between Groups	(Combined)	22.531	5	4.506	4.192	.001
	Within Groups		156.943	146	1.075		
	Total		179.474	151			
C07 * B06	Between Groups	(Combined)	27.199	5	5.440	4.519	.001
	Within Groups		175.742	146	1.204		
	Total		202.941	151			
C08 * B06	Between Groups	(Combined)	10.354	5	2.071	3.792	.003
	Within Groups		79.725	146	.546		
	Total		90.079	151			
C09 * B06	Between Groups	(Combined)	18.504	5	3.701	2.890	.016
	Within Groups		185.655	145	1.280		
	Total		204.159	150			
C10 * B06	Between Groups	(Combined)	11.656	5	2.331	2.285	.049
	Within Groups		148.969	146	1.020		
	Total		160.625	151			
D01 * B06	Between Groups	(Combined)	14.785	5	2.957	2.472	.035
	Within Groups		172.288	144	1.196		
	Total		187.073	149			
D02 * B06	Between Groups	(Combined)	35.305	5	7.061	4.781	.000
	Within Groups		215.636	146	1.477		
	Total		250.941	151			
D03 * B06	Between Groups	(Combined)	7.775	5	1.555	3.167	.010
	Within Groups		71.192	145	.491		
	Total		78.967	150			
H04 * B06	Between Groups	(Combined)	12.365	5	2.473	2.363	.043
	Within Groups		149.662	143	1.047		
	Total		162.027	148			
I05 * B06	Between Groups	(Combined)	18.311	5	3.662	3.208	.009
	Within Groups		163.260	143	1.142		
	Total		181.570	148			

## Appendix G Coded questions in SPSS and SmartPLS

Code	Question
<b>B01</b>	What is your gender?
<b>B02</b>	What age bracket are you in?
<b>B03</b>	What is your highest (completed) level of education?
<b>B04</b>	Which is your household size?
<b>B05</b>	What is your combined annual household income? (Before Tax)
<b>B06</b>	What is your most common reason for throwing out food?
<b>Opinion about best by dates</b>	
<b>C01</b>	Food quality ( color, texture, flavor, etc.) is very important to me.
<b>C02</b>	I believe that date labeling (best before, use before, best by, and use by) on the food packaging is reliable information.
<b>C03</b>	I always check the dates on the food packaging before purchasing the product.
<b>C04</b>	I always check the dates on the food packaging before consuming the product.
<b>C05</b>	I follow the date on the packaging to decide whether or not it is okay to consume the product.
<b>C06</b>	I would dispose of unused food if its use by date were past because of health concerns.
<b>C07</b>	I would dispose of unused food if its use by date were past because of health concerns.
<b>C08</b>	I always take additional factors (e.g. appearance, odor, taste) into consideration along with the best by date in deciding if the food is safe to consume.
<b>C09</b>	If an item of food is coming close to its best before date, I will discard it.
<b>C10</b>	I believe that food's past their "best before" or "use by" date are usually safe to eat.
<b>Concerns about food waste</b>	
<b>D01</b>	I am always afraid of food-borne illness (e.g. food poisoning).
<b>D02</b>	I usually dispose of leftover food because I am afraid of possibility of food poisoning.
<b>D03</b>	I always do my best to minimize the amount of food thrown away in my household.
<b>D04</b>	My most significant concern about food waste is waste of unused expired food.
<b>D05</b>	I am really interested in taking action to reduce the amount of food discarded in my household.
<b>D06</b>	Saving money is a major reason for me to reduce food waste.
<b>D07</b>	I would reduce my household's food waste because of financial savings.
<b>Interest in using intelligent food containers</b>	
<b>E01</b>	I would reduce my household's food waste because of financial savings.
<b>E02</b>	I am interested in an intelligent food container that will potentially help in extending food shelf life by monitoring food quality.
<b>E03</b>	I am interested in an intelligent food container that will prevent foodborne illness.
<b>E04</b>	I am interested in an intelligent food container that will monitor food quality.
<b>E05</b>	I am interested in an intelligent food container that will inform me about food conditions.
<b>E06</b>	I am interested in an intelligent food container that will provide real use-by date.

<b>Code</b>	<b>Question</b>
<b>E07</b>	I am interested in an intelligent food container that gives instructions about how to store food.
<b>E08</b>	I am interested to get informed about my refrigerator/pantry/cupboard contents by notification through mobile or desktop application.
<b>E09</b>	I am interested to get informed about my refrigerator/pantry/cupboard contents by notification through indicator on the container.
<b>E10</b>	I am interested in an intelligent food container that alerts me if a product is not being stored at the correct temperature.
<b>Beliefs about intelligent food containers</b>	
<b>F01</b>	I believe that an intelligent food container that is safe to use is beneficial for my health.
<b>F02</b>	I believe that an intelligent food container would reduce my confusion about date labeling.
<b>F03</b>	I believe that an intelligent food container would help me to reduce food waste.
<b>F04</b>	I believe that an intelligent food container would help bring me prevent foodborne illness.
<b>F05</b>	I believe that an intelligent food container will help me store the product correctly.
<b>F06</b>	I believe that an intelligent food container is beneficial for my household.
<b>F07</b>	I believe that an intelligent food container is a pleasant idea for my household use.
<b>Ease of use of intelligent food containers</b>	
<b>G01</b>	I am interested in an intelligent food container that will be easy to use.
<b>G02</b>	I am interested in an intelligent food container that is easy to clean/wash.
<b>G03</b>	I am interested in an intelligent food container that is easy to learn to use.
<b>G04</b>	I am interested in an intelligent food container that will be environmental friendly.
<b>G05</b>	I am interested in an intelligent food container if it's made of environmentally friendly materials.
<b>G06</b>	I am interested in an intelligent food container if it will be recyclable.
<b>G07</b>	I am not interested in an intelligent food container if it will be environmentally harmful.
<b>Marketing of intelligent food containers</b>	
<b>H01</b>	I am interested in an intelligent food container that will be available in all stores.
<b>H02</b>	I will use an intelligent food container for my products if it will be easily available.
<b>H03</b>	I would prefer spending money on an intelligent food container instead of wasting edible food.
<b>H04</b>	I am willing to pay more for an intelligent food container compared to regular container to have safe food.
<b>H05</b>	I am interested in an intelligent food container that will save me money by reducing food waste.
<b>H06</b>	I am interested in an intelligent food container if it is a good value for the money.
<b>H07</b>	I am interested in an intelligent food container if it is reasonably priced.
<b>H08</b>	I believe that an intelligent food container would pay itself back quickly.
<b>H09</b>	I believe that advertisements would affect my adoption of an intelligent food container.
<b>H10</b>	I believe that advertisements would affect my intention to use an intelligent food container.
<b>Environmental thinking:</b>	
<b>I01</b>	I have high level of knowledge about negative environmental impact of the food waste.

Code	Question
I02	I would reduce my household's food waste to protect the environment.
I03	I am likely to adopt new technologies (e.g. an intelligent food container and related applications).
I04	I would reduce my household's food waste because of people whose opinions are important to me.
I05	I am interested to reduce my food waste mostly because of my family/friends request.
<b>Intention to use intelligent food containers:</b>	
J01	I believe that intelligent food container will improve my quality of life.
J02	An intelligent food container with sensors that monitor environmental conditions of the product will help me reduce food waste.
J03	I am interested to use an intelligent food container.
J04	I intend to use an intelligent food container to enhance my food safety.
J05	I intend to use an intelligent food container to monitor my food quality.
J06	I intend to use an intelligent food container to reduce my food waste.
J07	I intend to use an intelligent food container to save money by reducing my food waste.
J08	I intend to use an intelligent food container to become more environmentally friendly.
J09	I intend to use an intelligent food container even if it will be quite expensive compared to a regular container.
J10	I intend to buy an intelligent food container whenever it becomes available.

## Appendix H Composite Reliability and AVE charts

