

# 產品過時恐懼與消費者產品升級意願

## Fear of Product Obsolescence and Intention to Upgrade

陳建維 *Chien-Wei Chen*

國立政治大學國際經營與貿易學系

Department of International Business, College of Commerce,  
National Chengchi University

練乃華\* *Nai-Hwa Lien*

國立臺灣大學工商管理學系

Department of Business Administration,  
National Taiwan University

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\* Corresponding Author: Nai-Hwa Lien, Associate Professor, Department of Business Administration, National Taiwan University. Address: No. 1, Sec. 4, Roosevelt Rd., Taipei 106, Taiwan. Tel: 02-33661056, Fax: 02-23695882, Email: jlien@ntu.edu.tw

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## 摘要

本研究探討消費者對產品過時恐懼如何因前次購買時間之遠近而改變，同時檢視在前次購買時間與升級產品購買意願之關係中，不同類型的產品過時恐懼所扮演的中介角色，以及消費者年齡的調節作用。對 341 位臺灣智慧型手機使用者所做的線上問卷調查分析結果顯示，消費者前次購買時間距離現在越久，購買升級產品之意願越強。心理過時恐懼與科技過時恐懼部分中介前次購買時間對升級意願之效果。消費者年齡對心理過時恐懼影響升級意願之效果有負向調節作用。相較於憂慮經濟過時的年輕人，年長者的經濟過時恐懼越高，升級意願越強。科技過時恐懼對經濟過時恐懼有直接正向效果，而且透過心理過時恐懼對經濟過時恐懼有間接效果。

**關鍵詞：**前次購買時間、心理過時恐懼、科技過時恐懼、經濟過時恐懼、年齡

## Abstract

This research empirically explores how consumers' fear of product obsolescence changes with the time elapsed since last purchase. The mediating roles of product obsolescence fears in the relationship between recency and consumers' intention to purchase high-tech upgrades, along with the moderating role of consumer's age on the mechanism underlying the fear-intention to upgrade causality, are also examined. Results of an online survey of 341 smartphone users in Taiwan show that recency, i.e., the time elapsed since last purchase, has both direct and indirect effects on consumers' intention to upgrade. Fears of both psychological and technological obsolescence partially mediate the relationship between recency and intention to upgrade. The positive impact of fear of psychological obsolescence on upgrading intention is weakened by consumer's age. Older consumers who fear economic obsolescence have stronger intention to upgrade their smartphones than younger consumers who are concerned about economic obsolescence. The three types of obsolescence fears are inter-correlated, with psychological obsolescence partially mediating the relationship between fear of technological obsolescence and economic obsolescence.

**Keywords:** Recency, Fear of Psychological Obsolescence, Fear of Technological Obsolescence, Fear of Economic Obsolescence, Age

## 1. Introduction

Product obsolescence, referred to as the relative value loss of a product due to the style change or quality improvement caused by the launch of subsequent product versions (Levinthal & Purohit, 1989; Cooper, 2004), is a feature of pervasive technoculture. Most often, the value of a durable product quickly decreases not because the product becomes useless or less productive, but simply because newer or superior products are introduced. In durable markets, consumers with higher expectations for the next product generation are reluctant to invest in a product that can soon be superseded. Rosenberg (1976) indicates that uncertainty over future improvements may lead to delay in purchasing existing goods or decreases in product valuation.

When buying high-tech products, consumers, even the most educated people, can feel uncomfortable and fearful about products and experience regret over past purchases, hesitation over upgrading, and anxiety about the future due to the frequent introduction of enhanced products (Dhebar, 1996). The continuous launches of ever-changing, superior versions or models, mainly in forms of technological improvements and style modifications, heighten consumers' anxiety about the right time to buy and the right price to pay for any new durable product (Lee & Lee, 1998). Purchases of high-technology durable goods are rarely one-time affairs because such purchases often involve a series of decisions of whether to retain an incumbent model or replace it with a new one that better meets a decision maker's evolving needs and tastes (Cripps & Meyer, 1994). In consumers' product replacement decisions, upgrade refers to a consumer's second or later time purchase of an improved version of a product, which implies product performance improvement (Kim & Srinivasan, 2009). An investigation into the global communications market indicates that smartphones have emerged to become the biggest volume and sales driver within consumer electronics and that with volume sales almost entirely dependent on replacement purchases, shortening the

replacement cycles has become the biggest opportunity to increase volume sales (Euromonitor, 2018).

Previous field studies of consumers' product replacement decisions find that perceived product obsolescence is indeed a major explanatory factor in replacement timing (Bayus, 1991; Raymond et al., 1993). A thorough understanding of how and when consumers replace their smartphones is thus too important to be over-emphasized not only from a theoretical perspective but also from a practical viewpoint, given the fact that the pool of first time buyers across many of the largest emerging markets has become smaller. According to a pooling of Fluent in 2016, a strong majority of smartphone users wait two years or longer for replacement, with nearly half wait at least three years between upgrades (eMarketer, 2016). Another survey from Gallup in 2015 explored how often US smartphone owners upgraded and surprisingly found that just a tiny 2% of respondents upgraded when a new model was released (eMarketer, 2016).

The consumer behavior literature suggests that recency, defined as the elapsed time since the last time the customer purchased from a firm (Blattberg et al., 2008), can be used to predict whether the customer will respond to a current marketing effort (Hughes, 1996; Gupta et al., 2006). Recency-based models are usually employed to predict the association between recency and purchase likelihood (Bult & Wansbeek, 1995; Bitran & Mondschein, 1996; Fader et al., 2005; Rhee & McIntyre, 2008). Comparatively little attention has been directed toward understanding how buyers make repeated purchase decisions over time and rarely has any study discussed the likelihood of replacement in terms of consumer fear of product obsolescence as the time since the last replacement increases. Fear of product obsolescence reflects appreciation about making a purchase today because the product will be outdated tomorrow (Higgins & Shanklin, 1992). As affect may determine the information processing route as well as the inter-purchase interval (Grewal et al., 2004), a model that incorporates such time-inherent fear may help to develop a better understanding of the timing of high-tech durable replacement purchases (Bayus, 1991). In line with an emerging research stream that suggests to incorporate affective processes into cognition-centered models of persuasion (Cohen & Areni, 1991; Mick & Fournier, 1998), this research probes different fears

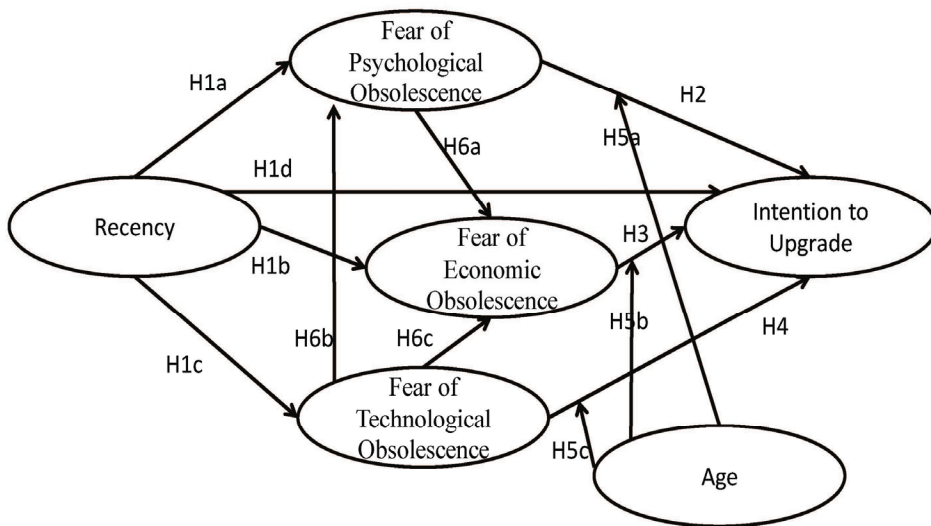
of product obsolescence in consumers' upgrading purchases of high-tech durables like smartphones from a temporal perspective. The purpose of this research is thus fourfold: (1) to determine the effect of recency on the intention to upgrade high-tech durables, mainly through the affective mechanism governed by consumers' fears specific to product obsolescence and, (2) to analyze and investigate the effects of different obsolescence fears on consumers' intention to purchase high-tech upgrades, (3) to understand how the consumer's age moderates the mechanism that underlies the fear-intention to upgrade causality, and (4) to investigate the inter-relationships among different fears of product obsolescence, i.e., fear of psychological obsolescence, fear of economic obsolescence, and fear of technological obsolescence (Cooper, 2004).

## 2. CONCEPTUAL FRAMEWORK

This research is intended to bridge a gap in our understanding of how different fears of product obsolescence shape consumers' upgrade decisions over time. A conceptual framework for the research, illustrated in Figure 1, posits a moderated mediation model that outlines the relationships between recency and intention to upgrade, mediated by fear of psychological obsolescence, fear of economic obsolescence, and fear of technological obsolescence. Recency can be defined as the time elapsed since the last time the customer purchased from a firm (Blattberg et al., 2008). In a replacement decision, recency shapes uncertainty about the future level of utility likely to be derived from both a currently owned product as well as potentially new products (Cripps & Meyer, 1994). By nature, fear of product obsolescence is a time-specific construct that can be regarded as a valenced emotional state in response to potentially outdated products. Such fear may impel changes in attitude or behavior intentions and consumer actions over time (LaTour & Rotfeld, 1997). Partial mediation is thus proposed in the sense that recency influences intention to upgrade either in a direct (cognitive) way (Fader et al., 2005; Rhee & McIntyre, 2008) or through the affective mechanism of product obsolescence fear.

The impacts of different fears of product obsolescence on intention to upgrade

are moderated by consumers' ages. Cooper (2004) distinguishes three forms of product obsolescence: psychological, economic, and technological. Psychological obsolescence originates from subjective changes in perceptions of a product with respect to status achievement, fashion, and aesthetic quality. Economic obsolescence occurs because of financial factors that cause existing products to be considered as no longer worth keeping. Technological obsolescence is caused when the functional qualities of a product are inferior to newer models. As fear could be aroused by using consumer durables (Chandon et al., 2000), fear of obsolescence reflects apprehension about making a purchase today because the product will be outdated tomorrow (Higgins & Shanklin, 1992). The rationale for the moderating effects is theoretically rooted in existing research findings that the relationship between recency and purchase likelihood may differ by consumer heterogeneity (Gönül & Shi, 1998; Gönül et al., 2000; Blattberg et al., 2008; Khan et al., 2009).



**Figure 1 : Conceptual Framework**

**Source: This study**

### 3. RESEARCH HYPOTHESES

The measure of recency is often calculated with respect to how recently the customer has purchased from a firm (Blattberg et al., 2008). Repurchasing durable products typically involves the length of time the current products can last and the length of time they function properly (Brucks et al., 2000). The stream of costs and benefits associated with either keeping the currently owned model and accepting the current period's performance or replacing it changes over a time horizon (Cripps & Meyer, 1994). In a keep/replace decision context, the length of time since the consumer's previous purchase, i.e., recency, tends to lower the uncertainty of future performance levels governed by the rate of improvements in new technologies and the rate of deterioration in the currently owned model (Cripps & Meyer, 1994). Consumers' fears specific to psychological, economic, and technological obsolescence may heighten as time passes by due to the larger size of the improvement in the new product, as opposed to the old model (Levinthal & Purohit, 1989). It is also logical to predict that recency imposes a directly positive effect on consumers' intention to upgrade durable goods simple because the longer elapsed time means cognitively approaching to consumers' respective replacement cycles.

H1a: If the recency is higher for consumers, they would have greater psychological fear of product obsolescence;

H1b: If the recency is higher for consumers, they would have greater economic fear of product obsolescence;

H1c: If the recency is higher for consumers, they would have greater technological fear of product obsolescence.

H1d: If the recency is higher for consumers, they would have greater intention to upgrade.

Psychological obsolescence occurs when people are no longer attracted to or satisfied by a product, mainly due to changes in perceived need, trends in style or fashion, desire for social status, and marketing (Cooper, 2004). In women's clothing, the utility is more psychological than physical and frequent changes in fashion clearly result in obsolescence for last year's styles (Gregory, 1947). The effect of

obsolescence is stronger when consumers perceive old products to be unfashionable (Guiltinan, 2009). Fear of obsolescence may shape or change consumer attitude. People who have a greater fear of psychological obsolescence respond more to aesthetic reasons or symbolic value than to functionality appeals (Cooper, 2004). It is therefore argued that fear of psychological obsolescence may trigger consumers to upgrade their products that can serve social adjustive, value-expressive, and/or ego-defensive functions.

H2: As consumers' fear of psychological obsolescence increases, they are more likely to upgrade their high-technology durable products.

Upgrade decisions differ from new purchase decisions because they are hindered by the psychological costs associated with the purchase price spent on the existing product (Okada, 2006). No consumer likes to render his/her own possessions obsolete and then cause loss to him/herself (Gregory, 1947). Economic obsolescence occurs when a new generation of durable goods causes an older generation to become less useful compared with the state-of-the-art technology even if its physical productivity remains the same (Lee & Lee, 1998). An old durable product becomes economically obsolete when consumers attribute little or no value to an existing version or model, based on the cost of new replacements or the expense of repair work, and conclude that it is no longer worth keeping in use (Cooper, 2004). When consumers are motivated to replace by deterioration in the performance of the incumbent, their purchase decisions might be framed as a gain above the current level of utility or as an attempt to avert a loss in per-period utility (Cripps & Meyer, 1994). Consumers who fear of economic obsolescence are inclined to hold attitudes that serve a utilitarian or instrumental function of seeking and maximizing tangible rewards and/or minimizing punishments from the environment (LeBoeuf & Simmons, 2010). As such, consumers with economic concerns tend to upgrade the incumbent models or versions of their high-technology products.

H3: As consumers' fear of economic obsolescence increases, they are more likely to upgrade their high-technology durable products.

The rapidly evolving technological environment makes even the most educated people feel uncomfortable and fearful about products due to their rapid obsolescence.



Technological obsolescence arises when people are attracted to functions in newer models added or changed as a result of advances in knowledge (Cooper, 2004). For technologically-knowledgeable consumers or aficionados, the fear of technological obsolescence can function to stimulate purchase because keeping pace with technological developments is often more satisfying than waiting for possible price reductions (Higgins & Shanklin, 1992). Consumers who are anxious about technological obsolescence may have a penchant for always owning the newest and/or the best and resort to the state-of-the-art level of performance of a product as the point of reference when judging utility (Cripps & Meyer, 1994). Consumers with greater technological obsolescence tend to adopt attitudes serving a knowledge function in that they felt forced to keep up with technological changes. Not being able to own the state-of-the-art good would be seen as imposing a loss, which even favors over-replacement (Cripps & Meyer, 1994). It is therefore hypothesized that an increase in fear of technological obsolescence may result in an increase in consumers' intentions to upgrade their products.

H4: As consumers' fear of technological obsolescence increases, they are more likely to upgrade their high-technology durable products.

Age differences can be observed in consumer needs and wants and their processing of marketing communications. The application of information processing theory in the influence of age on consumer responses is mainly concerned with the identification of differences between older and younger people in marketing information processing (Cole & Gaeth, 1990; Cole & Balasubramanian, 1993; Yoon, 1997). Age has proven to be an important demographic variable of interest not only in consumer decision contexts (Homburg & Giering, 2001) but also in organizational settings (Morris et al., 2005). It is found that older consumers are less likely to seek new information (Moscovitch, 1982) and rely more on heuristic and schema-based forms of processing (Yoon, 1997). Furthermore, Wakefield & Baker (1998) recommends the use of age as a moderator for the link of satisfaction with loyalty.

The low propensity by older consumers to adapt to new technologies would be largely related to a lack of information. They tend to suffer from the deficiencies in learning and problem-solving as well (Gregoire, 2003). Limited information sources and declines in cognitive abilities may prevent them from keeping abreast of latest

technological development, which in turn weakens the positive impact of fear of technological obsolescence on intention to upgrade.

There are other age-related declines, especially emotional and social ones, besides declines in cognitive abilities. Age changes lead to relational changes, in terms of a decrease in the number and the variety of interpersonal relationships (Gregoire, 2003). Anxiety about status achievement, fashion, and aesthetic quality in the eyes of reference groups lessens given that older consumers interact with a decreasing number of people. It is logical to expect that an increase in age will weaken the positive causality between fear of psychological obsolescence and intention to upgrade.

Older consumers rely on fewer criteria in their decision-making (Walsh et al., 2008). Heuristics like price may serve as a cue for product quality evaluation. A decrease in the availability of time may lead older consumers to shopping for utilitarian reasons (Bloch et al., 1994). When older consumer are concerned about economic obsolescence, it is therefore highly likely that their upgrade decisions might be further framed as a gain above the current level of utility or as an attempt to avert a loss in per-period utility (Cripps & Meyer, 1994), which may strengthen the influence of consumers' fear of economic obsolescence on the intention to upgrade their products.

H5a: Consumers' ages weaken the positive relationship between fear of psychological obsolescence and intention to upgrade.

H5b: Consumers' ages strengthen the positive relationship between fear of economic obsolescence and intention to upgrade.

H5c: Consumers' ages weaken the positive relationship between fear of technological obsolescence and intention to upgrade.

Cooper (2004) contends that fear of psychological obsolescence, fear of economic obsolescence, and fear of technological obsolescence respectively occur in the domains of mind, money, and matter. It is argued that what occurs in the domain of matter will influence what occurs in the domains of mind and money. Fear of psychological obsolescence exerts social pressure on consumers, making them emphasize symbolic value of being smart shoppers and/or market mavens. In

order to look clever and secure opinion leadership, consumers with psychological obsolescence fear tend to lower life-cycle costs, i.e., purchase price and service or maintenance costs, to maximize the value gained from a durable product. In other words, psychological obsolescence fear may stimulate fear of economic obsolescence.

People often feel uncomfortable and fearful about technology adoption due to rapid technological obsolescence of durable products, which arises when they are attracted to functions in newer models added or changed as a result of advances in knowledge (Cooper, 2004). The fear of technological obsolescence can stimulate consumers to keep pace with technological developments (Higgins & Shanklin, 1992). To look knowledgeable, they will pay special attention to the benefits specific to aesthetic appeals or symbolic value as well (Cooper, 2004). Buying a new product can enhance their self-perception of being smart or good shoppers and increase shoppers' prestige and achieving higher social status or group affiliation, e.g., becoming a recognized smart shopper or a market maven (Chandon et al., 2000). It is therefore hypothesized that consumers' fear of technological obsolescence will lead to fear of psychological obsolescence.

Since People with greater technological obsolescence tend to feel anxious and stressed to keep abreast of latest technological development, they are more likely to experience fear of economic obsolescence. This is because economic obsolescence arises when consumers attribute little or no value to old versions or models, as opposed to the newest or updated product. Wise product knowledge enables consumers to conclude that existing products are no longer worth keeping in use, according to the cost of new replacements or the expense of repair work (Cooper, 2004). It is therefore natural to predict that fear of technological obsolescence may trigger fear of economic obsolescence.

H6a: Fear of psychological obsolescence leads to fear of economic obsolescence

H6b: Fear of technological obsolescence leads to fear of psychological obsolescence

H6c: Fear of technological obsolescence leads to fear of economic obsolescence

## **4. RESEARCH METHOD**

### ***4.1 Data Collection***

An online survey was employed to acquire the data needed for testing the hypothesized model. Respondents were solicited to complete a questionnaire consisting the measurement items of five constructs, along with their experience in using mobile phones, and the reasons for replacing their current models. Online survey is used because of its low cost advantage, quick response, and reliable data quality (Deutskens et al., 2006; Braunsberger et al., 2007). Data collection was executed through a series of online surveys via two very popular web media in Taiwan: face book and PTT. A total of 341 usable questionnaires (78 from Facebook and 263 from PTT) were collected for the subsequent data analysis. The use of social media platform for data collection can be well-justified because mobile and social media are intricately linked. The demographic and lifestyle profiles of online respondents match the characteristics of smartphone users for their user status as lead and heavy users. According to Nielsen data, U.S. smartphone users spend about 14 times more minutes using social media apps like Facebook than they do using news apps. Facebook mobile users spend more than 15 hours a month on mobile usage. A 2014 survey conducted by the MIC, Institute for Information Industry, shows that smartphone uses in Taiwan are roughly equal to the users of social media like Facebook in terms of population distribution. It is also found that there are substantial differences in social media use by age. The final sample covered a variety of consumers. 73.6% of our respondents are 21-45 years old, which shows a seemingly good match to the proportion of 12-49 year old smartphone owners in Taiwan (78.5%) according to the MIC survey. Most of their education is above college. Although their disposable income is around NT\$ 15,000, the most used brand is Apple iPhone. The average time of smartphone replacement is around two years.

### ***4.2 Measures***

The final instrument consisted of six measures of interest. Recency is measured in terms of month and calculated as time elapsed since last purchase, as

opposed to purchase cycle (Neslin et al., 2013). The construct of intention to upgrade was adopted from Okada (2006). Fear of psychological obsolescence was measured in terms of aesthetic, symbolic value, and desire for social status (Cooper, 2004). Adopted from Cooper (2004), the construct of fear of economic obsolescence was operationalized as a 3-item scale, which captures financial outlay, value, depreciation. The scale of technological obsolescence reflects functional change, quality, effectiveness (Cooper, 2004). These measures were fine-tuned such in a way that specific questions pertaining to each of the types of fear were intentionally worded to avoid the explicit question, “Are you afraid of...” According to Higgins & Shanklin (1992), the word “concern” was substituted for the more provocative “fear.” All the multi-item constructs in this study were measured on 5-point Likert scales, responses to favourable statements were scored from 1 for “strongly disagree” and the like to 5 for “strongly agree” and the like. Finally, consumer age is measured in terms of chronological age, divided into seven categories (under 20; 21-25; 26-30; 31-35; 36-40; 41-45; over 46).

## **5. ANALYSIS AND RESULTS**

### ***5.1 Construct Validation***

We tested the moderated mediation model using the two-step approach to structural equation modeling (Mathieu et al., 1992; Ping, 1995; Cortina et al., 2001). The approach enables us to secure more reliable measures in that the interaction of measurement and structural models was avoided. The structural model was estimated using the constructs identified after validation. The construct validation produced four finalized reflective scales, each of which was established using a composite score calculated as an unweighted average of scores on the measurement items (Bollen & Lennox, 1991). The use of summated scores may reduce model complexity and achieve an acceptable variable-to-sample-size ratio in the model estimation (Cavusgil & Zou, 1994; Calantone et al., 1996; Li & Calantone, 1998; MacKenzie et al., 1998), resulting in a more parsimonious model. The four multi-item measures, along with two single-item ones, were incorporated into the

operational model for subsequent hypothesis testing.

We validated the measures in light of a scale development paradigm recommended by Gerbing & Anderson (1988). A series of confirmatory factor analyses (CFAs) established convergent validity, reliability, and discriminant validity. The CFAs used LISREL 8.51 to purify the reflective scales. We also assessed discriminant validity by constraining the estimated correlation between pairs of constructs to unity for chi-square difference tests between the constrained and unconstrained models (Bagozzi et al., 1991). We further tested for common method bias attributable to the measurement method by following Harman's single-factor test (Podsakoff et al., 2003). As shown in Table 1, the CFA model for the four reflective measures, i.e., fear of psychological obsolescence, fear of economic obsolescence, fear of technological obsolescence, and intention to upgrade, is acceptable in terms of  $\chi^2/df$  (4.732;  $p < .001$ ) and goodness-of-fit statistics (CFI = .91; IFI = .91; standardized RMR = .06) (Bollen, 1989). Cronbach's coefficient alphas for all multi-item measure are greater than .70, implying acceptable reliability and unidimensionality (Nunnally, 1978). Specifically, Cronbach's alpha is .911 for fear of psychological obsolescence. The measure of fear of economic obsolescence has an alpha value of .845. The alpha for fear of technological obsolescence is .858. Finally, intention to upgrade has an alpha value of .819.

**Table 1 : Multi-Item Measures of This Research**

Construct	Measurement Item	Standardized Loading (t-value)	$\alpha$	Composite Reliability	Variance Extracted
<b>Reflective Measurement Model<sup>a</sup></b>					
Fear of Psychological Obsolescence	“I am concerned that my smartphone will be out of fashion very soon.”	.66 (16.93)	.911	.801	.446
	“I am concerned that the design of my smartphone won’t be in style very soon.”	.69 (20.31)			
	“I am concerned that, in no time, my smartphone will fail to express my personal style.”	.64 (20.52)			
	“I am concerned that, in a short time, my smartphone cannot match my social status.”	.69 (21.70)			
	“I am concerned that my smartphone will no longer attract any attention in a short period of time.”	.66 (19.17)			
Fear of Economic Obsolescence	“I am concerned about the depreciation of my smartphone.”	.94 (20.91)	.845	.889	.731
	“I am concerned about a decrease in the performance/cost ratio of my smartphone.”	.92 (19.62)			
	I am concerned about the excess cost of repair for my smartphone relative to replacement.”	.68 (15.49)			
Fear of Technological Obsolescence	“I am concerned about the outdatedness of my smartphone in term of function.”	.84 (19.98)	.858	.917	.735
	“I am concerned about the outdatedness of my smartphone’s specs.”	.94 (20.38)			
	“I am concerned about the quickly outdated effectiveness of my smartphone.”	.87 (17.18)			
	“I am concerned that the quality of my smartphone will soon become obsolete.”	.77 (13.40)			
Intention to Upgrade	“I regard a new generation smartphone that have superior attributes and functions as more valuable, as opposed to the current available smart phones.”	.60 (13.36)	.819	.778	.468
	“I prefer a new version of smartphone that have better attributes and more functions to the currently available ones in the market.”	.71 (17.64)			
	“I am inclined to upgrade to a new generation smart phone with better attributes and more functions, rather than to stick with the current one.”	.68 (18.14)			
	“It is highly likely for me to upgrade to a new generation smartphone equipped with better attributes and more functions.”	.74 (14.91)			

<sup>a</sup> $\chi^2 = 462.76$  (df = 98); CFI = .91; NFI = .89; IFI = .91; standardized RMR = .06.

Source: This study

## ***5.2 Hypothesis Testing***

Table 2 provides the descriptive statistics and correlation matrix for all variables. The means of coping with the measurement errors involved constraining the factor loading, theta delta matrix, and theta epsilon matrix to predetermined values (Hair et al., 1998). In model specification, the measurement model was a priori; the measurement parameters of the six constructs were fixed at certain derived or specified values. The associated factor loading ( $\lambda$ ) of each reflective construct was set at the square root of its Cronbach's alpha value (Niehoff & Moorman, 1993). A conservative value of .85 was chosen as a proxy for the reliability of each single-item construct (Williams & Hazer, 1986). The error term of each construct, i.e., each of the diagonal elements in the theta delta and theta epsilon matrices, was fixed at 1 minus reliability times the observed variance of the construct  $[(1 - \alpha)\sigma^2]$  (Jöreskog & Sörbom, 1996). For the product terms, their reliabilities were computed using the formula from Bohnstedt & Marwell (1978). The three values value can then be used to fix the  $\lambda$  value for the path from the latent product to its indicator in the analysis of the structural model (Mathieu et al., 1992; Cortina et al., 2001). The paths showing the structural equation modeling were converted into a model of structural equations. The structural equation modeling was conducted using the maximum likelihood estimation method. Each of the six constructs and the three product terms was represented by only one single score.



**Table 2 : Descriptive Statistics and Correlation Matrix**

Variable	Mean (S.D.)	Coefficients of Pearson correlations					
		Recency	FPO	FEO	FTO	ITU	Age
Recency	0.49 (.40)	1.000					
Fear of Psychological Obsolescence (FPO)	2.42 (.76)	.177***	1.000				
Fear of Economic Obsolescence (FEO)	2.84 (.93)	.151***	.578***	1.000			
Fear of Technological Obsolescence (FTO)	3.32 (.83)	.151***	.341***	.609***	1.000		
Intention to Upgrade (ITU)	3.48 (.68)	.181***	.310***	.260***	.259***	1.000	
Age	1.99 (.92)	-.031	-.003	-.033	.003	-.104	1.00 0

\*p < .1; \*\*p < .05; \*\*\*p < .01

Source: This study

The structural equation modeling was conducted using the maximum likelihood estimation method. The resulting model has a chi-square value of 18.62 with 12 degrees of freedom ( $p = .098$ ), CFI = .99, NFI = .97, IFI = .99, and standardized RMR = .021. The research hypotheses were examined by testing the structural coefficient estimates. Table 3 presents the assessment of the proposed hypotheses 1-6. All the parameter estimates were transformed into a completely standardized form by removing scaling information. The results show that Hypothesis 1a, 1c, and 1d are supported respectively at significance levels of .01, .01, and .05, while Hypothesis 2 is not supported. The analytical result concerning the test of Hypothesis 2 confirms the positive relationship between fear of psychological obsolescence and intention to upgrade, significant at the .01 level. The t-value of the coefficient for the fear of economic obsolescence-intention to upgrade link (Hypothesis 3) is nevertheless insignificant. Hypothesis 4 is supported at the .1 significance level. Two of the coefficient estimates for moderating effects

(Hypotheses 5a and 5b) are significant at the .01 and .1 levels respectively. Surprisingly, Hypotheses 5b is not supported, showing that the moderation of age on the technological obsolescence fear-intention to upgrade relationship does not exist. Finally, all the hypotheses concerning the inter-relationships (H6a~H6c) among the three product obsolescence fears are supported at the .01 level.

**Table 3 : Summarized Results of Hypothesis Testing**

Causal Path	Hypothesis (Expected Sign)	Path Coefficient (Standardized)	Result
Recency → Fear of Psychological Obsolescence	H <sub>1a</sub> (+)	.26***	Supported
Recency → Fear of Economic Obsolescence	H <sub>1b</sub> (+)	-.03	Not Supported
Recency → Fear of Technological Obsolescence	H <sub>1c</sub> (+)	.37***	Supported
Recency → Intention to Upgrade	H <sub>1d</sub> (+)	.19**	Supported
Fear of Psychological Obsolescence → Intention to Upgrade	H <sub>2</sub> (+)	.32***	Supported
Fear of Economic Obsolescence → Intention to Upgrade	H <sub>3</sub> (+)	-.09	Not Supported
Fear of Technological Obsolescence → Intention to Upgrade	H <sub>4</sub> (+)	.20***	Supported
Fear of Psychological Obsolescence × Age → Intention to Upgrade	H <sub>5a</sub> (-)	-.25***	Supported
Fear of Economic Obsolescence × Age → Intention to Upgrade	H <sub>5b</sub> (+)	.22*	Supported
Fear of Technological Obsolescence × Age → Intention to Upgrade	H <sub>5c</sub> (-)	-.08	Not Supported
Fear of Psychological Obsolescence → Fear of Economic Obsolescence	H <sub>6a</sub> (+)	.60***	Supported
Fear of Technological Obsolescence → Fear of Psychological Obsolescence	H <sub>6b</sub> (+)	.33***	Supported
Fear of Technological Obsolescence → Fear of Economic Obsolescence	H <sub>6c</sub> (+)	.59***	Supported
Age → Intention to Upgrade	Moderator Variable	-.05	

\*p < .1; \*\*p < .05; \*\*\*p < .01

Source: This study

Table 4 presents the indirect and total effects of respective determinants on responsiveness to intention to upgrade. The total effects are the sum of the direct effects and all indirect effects (Jöreskog & Sörbom, 1996). As shown in this table, the total effect of recency on intention to upgrade consists of both direct and indirect influences. The indirect effect of recency stems from its direct effects on fears of psychological, economic, and technological obsolescence, which in turn exerts impacts on consumers' intention to upgrade. Partial mediation is proven.

**Table 4 : Indirect and Total Effects on Intention to Upgrade**

Causal Path From	Standardized Path Coefficient
Recency	
Indirect Effect	.16***
Total Effect	.35***
Fear of Psychological Obsolescence	
Indirect Effect	-.06
Total Effect	.26***
Fear of Economic Obsolescence	
Indirect Effect	--
Total Effect	-.09
Fear of Technological Obsolescence	
Indirect Effect	.03
Total Effect	.26***
Age	
Indirect Effect	--
Total Effect	-.05
Age × Fear of Psychological Obsolescence	
Indirect Effect	--
Total Effect	-.25***
Age × Fear of Economic Obsolescence	
Indirect Effect	--
Total Effect	.22*
Age × Fear of Technological Obsolescence	
Indirect Effect	--
Total Effect	-.08

\*p < .1; \*\*p < .05; \*\*\*p < .01

Source: this study

## 6. DISCUSSION

The empirical results of this research show that, in an upgrading decision context, both fear of psychological obsolescence and fear of technological obsolescence partially mediate the relationship between the time elapsed since last purchase and consumers' intentions to upgrade. As expected, these two mediating effects are positive. The findings show that recency imposes both direct and indirect effects on consumers' intention to upgrade. While the direct effect works mainly in a cognitive manner, the indirect effect stems from an affective mechanism underlying psychological obsolescence and technological obsolescence. Such results are in line with the stream of research that suggests cognition-centered models of persuasion to incorporate the role of affective processes (Cohen & Areni, 1991).

The lack of the mediation for fear of economic obsolescence demands special attention. In a sense, fears of psychological and economic obsolescence can motivate consumers to respond to the marketing for new products, while fear of economic obsolescence fails to trigger their responses. Consumers seem to put more weights on the quality and fashion benefits of the forthcoming products, instead of the saving benefit, when they think to upgrade their products, as the time elapsed since last purchase increases.

The impact of fear of psychological obsolescence on upgrading intention is moderated by the consumer's age. An increase in the consumer's age weakens the effect of the elapsed time on his/her intention to own a more fashionable version. The findings of the research indicate that consumers' age does not moderate the relationship between technological obsolescence and intention to upgrade. That is, the way a penchant of consumers for always owning the newest and/or the best to trigger their upgrading decisions does not vary with their age (Cripps & Meyer, 1994). As aforementioned, fear of economic obsolescence fails to impose any significant influence on consumers' intention to upgrade. Instead, this fear and age impose an interaction effect on intention to upgrade, meaning that older consumers laden with fear of economic obsolescence have stronger intention to upgrade their smartphones than younger consumers anxious about economic obsolescence.

In the end, three inter-relationships among fears of psychological obsolescence, economic obsolescence, and technological obsolescence are discussed in detail. The results of structural modeling demonstrate that the path from fear of technological obsolescence positively influences fear of psychological obsolescence, which in turn heightens fear of economic obsolescence. These affective states are inter-correlated and, in a sense, psychological obsolescence partially mediates the relationship between fear of technological obsolescence and fear of economic obsolescence. These empirical findings are both interesting and insightful from a theoretical perspective (Cooper, 2004). Fear of psychological obsolescence exerts social pressure on consumers, making them emphasize symbolic value of being smart shoppers and/or market mavens. In order to look clever and secure opinion leadership, consumers with psychological obsolescence fear tend to lower life-cycle costs to maximize the value gained from a durable product. In other words, psychological obsolescence fear may stimulate fear of economic obsolescence. Consumers laden with greater fear of technological obsolescence must feel anxious and stressed to keep abreast of latest technological development. The possession of the state-of-the-art knowledge also enables them to judge the symbolic and economic value of their current products. It is therefore natural to conclude that fear of technological obsolescence results in both fear of psychological obsolescence and fear of economic obsolescence.

## 7. CONCLUSION

### *7.1 Theoretical Implications*

Existing research on product obsolescence can be classified into two streams: from the perspective of the firm or from the perspective of the consumer. The first research stream focuses on the firm's decision-making of managing new products and existing products (Strausz, 2009). In contrast, studies in the second research stream mainly emphasize the consumer's replacement decision (Cooper, 2004). Consumers may expect a forthcoming product to the extent that the price they are willing to pay for the current product goes down because of its loss in value. The

value of a durable product quickly decreases not because the product becomes useless or less productive, but simply because newer or superior products are introduced. Contrarily, a durable goods firm may be driven to develop the optimal strategy for introducing an improved version of its current product, given consumers' increased willingness to pay for the new product and its potentially competitive interaction with the old product. The firm inevitably faces cannibalization (Levinthal & Purohit, 1989; Chandy & Tellis, 1998).

In line with an emerging research stream that investigates customer relationship management and customer lifetime value by modeling customer migration (Berger & Nasr, 1998; Pfeifer & Carraway, 2000; Blattberg et al., 2008), this research aims to contribute to the burgeoning literature on the relationship between recency, i.e., how long it has been since the consumer's previous purchase, and consumers' likelihood of purchasing high-technology durables in upgrade decision contexts and to investigate the mediating role played by fear of product obsolescence in the relationship between recency and consumers' intention to upgrade. The connection between recency and fear of product obsolescence is straightforward in the sense that both are time-inherent constructs. We study the recency issue by from the traditional FMCG domain to the high-tech durable context. This research is also intended to bridge the current gap in theory on the obsolescence issue in that product obsolescence represents one of the most widespread concerns in consumer adoption and replacement decisions. The findings of the research confirm the notion that the fear of product obsolescence can play an important role in the formation and changes of consumers' intention to upgrade. In contrast to utilitarian tradeoff approaches, the research adds temporal and affective dimensions in exploring the mechanism that underlie consumers' decision-making of upgrading high-technology durables.

This research contributes to the marketing literature in three main respects. First, the research identifies and captures product obsolescence-specific fears from the consumer perspective (Cooper, 2004), and most importantly, investigates their inter-relationships. Second, it represents an initial effort to empirically test the corresponding links among the time elapsed since last purchase, different types of obsolescence fears, and consumers' upgrading decisions. Finally, we advance an

understanding of how obsolescence fears influence intention to upgrade by adopting a contingency approach. The information processing literature has emphasized the need for more research to address consumer-specific factors as moderators in a new product evaluation domain (Rao & Monroe, 1988; Richardson et al., 1994). The empirical results support the consumers' age plays an important role in the product obsolescence fear-intention to upgrade link. Age negatively moderates the relationship between fear of psychological obsolescence and intention to upgrade, while its interaction with fear of economic obsolescence also imposes a positive impact on intention to upgrade. The empirical results should be able to shed some light on predicting consumer behavior with respect to whether and/or when to upgrade.

## ***7.2 Managerial Implications***

The global mobile communication market is near saturation, with five country markets may have smartphone penetration above 90% in 2018: the Netherlands (94%), Taiwan (93%), Hong Kong (92%), Norway and Ireland (each at 91%) (Zenith, 2018). Despite slowing sales momentum and declining prices, smartphones will still remain the largest sales drivers in consumer electronics in the near future. Although the pool of first-time mobile phone buyers is nearly depleted, there is still significant latent demand that can be unlocked by driving down replacement cycles and minimizing the impact of the second-hand market (Euromonitor, 2018). Our research, with concentration on replacement decision from the temporal and affective perspectives, may shed some light on several managerial issues: innovation management for matching the pace of technological advancement; competitive actions for preemptive advantage; new and old product management for cannibalization prevention; optimal timing and marketing communications for high-tech product launch, etc.

The research findings may offer several guidelines for managing and launching consumer high-technology products. In business practices, firms of durable goods have to keep launching new superior products, in forms of technological improvements and style changes, faster and more frequently than their competitors do in order to maintain market share. From the marketer's perspective,

understanding consumers' upgrading behavior is essential to product planning. Product managers of high-tech companies would like to know what fraction of consumers would upgrade to the new product and improved versions, and how fast (or how late). On the basis of our findings, marketers may, to some extent, help consumers manage the transitions between generations of products by offering a migration path (Mohr, 2001). Consumers in technology-intensive markets must make important decisions about if and when to adopt a new generation of technology (Castaño et al., 2008). In the extreme, they may leapfrog, or pass entirely on purchasing, a current generation of technology in anticipation of a new, better innovation coming down the pike in the near future. In essence, the realities of consumer decision making create a tension for the firm in providing state-of-the-art technology through the introduction of new-product generation and customers' expectations and fears of obsolescence. Therefore, when designing a migration path to help consumers make the transitions between generations of products, marketers should take in account different fears of product obsolescence, as well as consumers' expectation of pace advancements and expectation of magnitude of advancement.

Strategically, marketers can segment markets by the fears consumers have in the sense that segmentation is concerned with where a firm competes. A market segment can be conceptualized as a set of social systems, which is of importance in the diffusion of many technologies exhibiting network externalities (Gatignon & Robertson, 1991). Our findings may lead to a combination of the behavioral and demographic approaches to segmentation that divide consumers into groups on the basis of differences in their fears of product obsolescence and ages. One powerful form of behavioral segmentation is benefit segmentation, which identifies market segments according to the different benefits consumers seek from the product. Different consumers may derive different types of benefits from the same product because of their fears of product obsolescence. Benefits can take a variety of forms for different groups of consumers. Specifically, some consumers who have great fear of economic obsolescence derive benefits from the utilitarian functions products perform. Others worried about psychological obsolescence derive social benefits. Still other consumers with fear of technological obsolescence tend to



derive benefits from innovation, such as being the first to acquire a particular product. A better understanding of obsolescence fears and their corresponding benefits sought offers the best starting point for segmentation. Attention to such benefit segmentation may provide marketers with positioning bases for their products, basic appeals in promotional strategy, specific media most useful in reaching the targeted market segments.

The firm should vary different marketing efforts with consumers' ages. On the basis of the research findings, consumers suffering from the fear of psychological obsolescence easily perceive the old product to be unfashionable and then highly intend to upgrade their product. Young people seem to appreciate more the product design that focus on changes in preferences, trends in style or fashion, and desire for social status. Furthermore, marketing communications specific to young consumers should be integrated to engender the actual activation of psychological obsolescence fear, which may influence the nature of the evaluation process and then create greater persuasion impacts. Older consumers with greater fear of economic obsolescence have greater intention to upgrade. Price-based promotional offers may provide those consumers with the quality benefit, which refers to an ability to upgrade to higher-quality products due to the temporary price reduction of previously unaffordable products. A better understanding of consumer reactions to promotional offers leads to another managerial implication of the research.

### ***7.3 Limitations and Directions for Future Research***

The main limitation of this research stems from concerns about the representativeness of online samples in this study. All surveys have their strengths and weaknesses; online surveys are no different in this regard. The online survey in use represents a double-edged sword for data collection and its very nature inevitably makes the research suffer from coverage error and sampling error. The former error refers to the mismatch between the target population and the frame population and the latter one arises from the fact that not all members of the frame population are measured (Couper, 2000). We adopted an unrestricted, self-selected survey, which is open to the public for anyone to participate in, because Internet-based survey is the lack of a sampling frame, generally available only for specific

populations (government organization, corporations, etc). Although the use of the Internet-based survey mode is justifiable in the sense that the target population is sufficiently computer-literate and the uses of smartphones and web media are highly overlapped, it is a form of convenience sampling and, as such, the generalizability of the findings may be limited. Just like online survey-based studies (e.g., Börsch-Supan et al., 2004), respondents in the sample who have access to the internet are younger and more educated than the population average, and men have better access to the internet than women. Mixed-mode surveys using Internet-based and traditional media is therefore suggested for any future study in this area (Ilieva et al., 2002). Another way to correct for sample selection in online surveys is propensity score weighting method (Valliant & Dever, 2011).

Another area that deserves attention is to determine more factors that moderate the underlying obsolescence fear-intention to upgrade mechanism. It is also logical to extend this research to other product category contexts, such as utilitarian and hedonic durable products. The logic of building up the models in this research may be applied to the development of models for depicting product differences. From a theoretical viewpoint, a more general model of obsolescence fear may be established by integrating the models across product categories. Future research may try to extend the findings to a business marketing context in that the need to manage upgrade options can be especially sensitive for business customers.

An investigation into the moderating effects of situational factors on the recency-upgrading intention link is rooted in existing findings that the relationship of recency with purchase likelihood may differ by consumer-related contingencies (Khan et al., 2009). More moderator variables that reflect consumer heterogeneity can be used for future research. For instance, disposable income reflects an important aspect of consumer resources. Income and wealth are critical variables that may influence consumption.

## References

- Bagozzi, R. P., Yi, Y., and Philips, L. W., 1991, "Assessing Construct Validity in Organizational Research," **Administrative Science Quarterly**, Vol. 36, No. 3, 421-458.
- Bayus, B. L., 1991, "The Consumer Durable Replacement Buyer," **Journal of Marketing**, Vol. 55, No. 1, 42-51.
- Berger, P. D. and Nasr, N. I., 1998, "Customer Lifetime Value: Marketing Models and Applications," **Journal of Interactive Marketing**, Vol. 12, No. 1, 17-30.
- Bitran, G. R. and Mondschein, S. V., 1996, "Mailing Decisions in the Catalog Sales Industry," **Management Science**, Vol. 42, No. 9, 1364-1381.
- Blattberg, R. C., Kim, B.-D., and Neslin, S. A., 2008, **Database Marketing Analyzing and Managing Customers**, 1<sup>st</sup>, New York: Springer.
- Bloch, P. H., Ridgway, N. M., and Dawson, S. A., 1994, "The Shopping Mall as Consumer Habitat," **Journal of Retailing**, Vol. 70, No. 1, 23-42.
- Bohrstedt, G. W. and Marwell, G., 1978, "The Reliability of Products of Two Random Variables," **Sociological Methodology**, Vol. 9, 254-273.
- Bollen, K. A., 1989, **Structural Equations with Latent Variables**, 1<sup>st</sup>, New York: John Wiley & Sons.
- Bollen, K. and Lennox, R., 1991, "Conventional Wisdom on Measurement: A Structural Equation Perspective," **Psychological Bulletin**, Vol. 110, No. 2, 305-314.
- Börsch-Supan, A., Elsner, D., Fabender, H., Kiefer, R., McFadden, D., and Winter, J., 2004, "How to Make Internet Surveys Representative: A Case Study of a Two-Step Weighting Procedure," **MEA Discussion Paper Series 04067**, Munich Center for the Economics of Aging (MEA) at the Max Planck Institute for Social Law and Social Policy.
- Braunsberger, K., Wybenga, H., and Gates, R., 2007, "A Comparison of Reliability between Telephone and Web-Based Surveys," **Journal of Business Research**, Vol. 60, No. 7, 758-764.
- Brucks, M., Zeithaml, V. A., and Naylor, G., 2000, "Price and Brand Name as Indicators of Quality Dimensions for Consumer Durables," **Journal of the Academy of Marketing Science**, Vol. 28, No. 3, 359-374.
- Bult, J. R. and Wansbeek, T., 1995, "Optimal Selection for Direct Mail," **Marketing Science**, Vol. 14, No. 4, 378-394.
- Calantone, R. J., Schmidt, J. B., and Song, X. M., 1996, "Controllable Factors of New Product Success: A Cross-National Comparison," **Marketing Science**, Vol. 15, No. 4, 341-358.
- Castaño, R., Suján, M., Kacker, M., and Suján, H., 2008, "Managing Consumer Uncertainty in

- the Adoption of New Products: Temporal Distance and Mental Simulation,” **Journal of Marketing Research**, Vol. 45, No. 3, 320-336.
- Cavusgil, S. T. and Zou, S., 1994, “Marketing Strategy-Performance Relationships: An Investigation of the Empirical Link in Export Market Ventures,” **Journal of Marketing**, Vol. 58, No. 1, 1-21.
- Chandon, P., Wansink, B., and Laurent, G., 2000, “A Benefit Congruency Framework of Sales Promotion Effectiveness,” **Journal of Marketing**, Vol. 64, No. 4, 65-81.
- Chandy, R. K. and Tellis, G. J., 1998, “Organizing for Radical Product Innovation : the Overlooked Role of Willingness to Cannibalize,” **Journal of Marketing Research**, Vol. 19, No. 4, 474-487.
- Cohen, J. B. and Areni, C. S., 1991, “Affect and Consumer Behavior” in Robertson, T. S. and Kassirjian, H. H. (eds.), **Handbook of Consumer Behavior**, First Edition, Englewood Cliffs, NJ: Prentice-Hall, 188-240.
- Cole, C. A. and Balasubramanian, S. K., 1993, “Age Differences in Consumers' Search for Information: Public Policy Implications,” **Journal of Consumer Research**, Vol. 20, No. 1, 157-169.
- Cole, C. A. and Gaeth, G. J., 1990, “Cognitive and Age-Related Differences in the Ability to Use Nutritional Information in A Complex Environment,” **Journal of Marketing Research**, Vol. 27, No. 2, 175-184.
- Cooper, T., 2004, “Inadequate Life? Evidence of Consumer Attitudes to Product Obsolescence,” **Journal of Consumer Policy**, Vol. 27, No. 4, 421-449.
- Cortina, J. M., Chen, G., and Dunlap, W. P., 2001, “Testing Interaction Effects in Lisrel: Examination and Illustration of Available Procedures,” **Organizational Research Methods**, Vol. 4, No. 4, 324-360.
- Couper, M. P., 2000, “Review: Web Surveys: A Review of Issues and Approaches,” **Public Opinion Quarterly**, Vol. 64, No. 4, 464-494.
- Cripps, J. D. and Meyer, R. J., 1994, “Heuristics and Biases in Timing the Replacement of Durable Products,” **Journal of Consumer Research**, Vol. 21, No. 2, 304-318.
- Deutskens, E., Jong, A., Ruyter, K., and Wetzels, M., 2006, “Comparing the Generalizability of Online and Mail Surveys in Cross-National Service Quality Research,” **Marketing Letters**, Vol. 17, No. 2, 119-136.
- Dhebar, A., 1996, “Speeding High-Tech Producer, Meet the Balking Consumer,” **Sloan Management Review**, Vol. 37, No. 2, 37-49.
- eMarketer, 2016, “Smartphone Owners Wait Years to Replace Handsets,” <https://www.emarketer.com/Article/Smartphone-Owners-Wait-Years-Replace->

- Handsets/1014149, accessed on August 1, 2018.
- Euromonitor, 2018, "Mobile Phone Demand in Detail: Uncounted, New, and Replacement Sales," <http://www.euromonitor.com/mobile-phone-demand-in-detail-uncounted-new-and-replacement-sales/report>, accessed on August 2, 2018.
- Fader, P. S., Hardie, B. G. S., and Lee, K. L., 2005, "RFM and CLV: Using Iso-Value Curves for Customer Base Analysis," **Journal of Marketing Research**, Vol. 42, No. 4, 415-430.
- Gatignon, H. and Robertson, T. S., 1991, "Innovative Decision Processes" in Robertson, T. S. and Kassarijan, H. H. (eds.), **Handbook of Consumer Behavior**, First Edition, Englewood Cliffs, NJ: Prentice-Hall, 316-348.
- Gerbing, D. W. and Anderson, J. C., 1988, "An Updated Paradigm for Scale Development Incorporating Unidimensionality and Its Assessment," **Journal of Marketing Research**, Vol. 25, No. 2, 186-192.
- Gönül, F. and Shi, M. Z., 1998, "Optimal Mailing of Catalogs: A New Methodology Using Estimable Structural Dynamic Programming Models," **Management Science**, Vol. 44, No. 9, 1249-1262.
- Gönül, F. F., Kim, B.-D., and Shi, M., 2000, "Mailing Smarter to Catalog Customers," **Journal of Interactive Marketing**, Vol. 14, No. 2, 2-16.
- Gregoire, Y., 2003, "The Impact of Aging on Consumer Responses: What Do We Know?" in Keller, P. A. and Rook, D. W. (eds.), **NA - Advances in Consumer Research Valdosta**, First Edition, GA: Association for Consumer Research, 19-26.
- Gregory, P. M., 1947, "A Theory of Purposeful Obsolescence," **Southern Economic Journal**, Vol. 14, No. 1, 24-45.
- Grewal, R., Mehta, R., and Kardes, G. R., 2004, "The Timing of Repeat Purchase of Consumer Durable Goods: The Role of Functional Bases of Consumer Attitudes," **Journal of Marketing Research**, Vol. 41, No. 1, 101-115.
- Guiltinan, J., 2009, "Creative Destruction and Destructive Creations: Environmental Ethics and Planned Obsolescence," **Journal of Business Ethics**, Vol. 89, No. 1, 19-28.
- Gupta, S., Hanssens, D., Hardie, B., Kahn, W., Kumar, V., Lin, N., Ravishanker, N., and Sriram, S., 2006, "Modeling Customer Lifetime Value," **Journal of Service Research**, Vol. 9, No. 2, 139-155.
- Hair, J. F., Anderson, R. E., Tatham, R. L., and Black, W. C., 1998, **Multivariate Data Analysis with Readings**, 5<sup>th</sup>, Englewood Cliffs, NJ: Prentice-Hall.
- Higgins, S. H. and Shanklin, W. L., 1992, "Seeking Mass Market Acceptance for High-Technology Consumer Products," **Journal of Consumer Marketing**, Vol. 9, No. 1, 5-

14.

- Homburg, C. and Giering, A., 2001, "Personal Characteristics as Moderators of the Relationship between Customer Satisfaction and Loyalty—an Empirical Analysis," **Psychology & Marketing**, Vol. 18, No. 1, 43-66.
- Hughes, A. M., 1996, "Boosting Responses with RFM: Recency, Frequency, and Monetary Analysis Finds the Buyers in Your Database," **Marketing Tools**, Vol. 3, No.3, 4-8.
- Ilieva, J., Baron, S., and Healey, N. M., 2002, "Online Surveys in Marketing Research," **International Journal of Market Research**, Vol. 44, No. 3, 1-14.
- Jöreskog, K. G. and Sörbom, D., 1996, **Lisrel8: User's Reference Guide**, 1<sup>st</sup>, Chicago: Scientific Software International Inc.
- Khan, R., Lewis, M., and Singh, V., 2009, "Dynamic Customer Management and the Value of One-to-One Marketing," **Marketing Science**, Vol. 28, No. 6, 1063-1079.
- Kim, S.-H. and Srinivasan, V., 2009, "A Conjoint-Hazard Model of the Timing of Buyers' Upgrading to Improved Versions of High-Technology Products," **Journal of Product Innovation Management**, Vol. 26, No. 3, 278-290.
- LaTour, M. and Rotfeld, H. J., 1997, "There Are Threats and (Maybe) Fear-Caused Arousal: Theory and Confusion of Appeals to Fear and Fear Arousal Itself," **Journal of Advertising**, Vol. 26, No. 3, 45-59.
- LeBoeuf, R. A. and Simmons, J. P., 2010, "Branding Alters Attitude Functions and Reduces the Advantage of Function-Matching Persuasive Appeals," **Journal of Marketing Research**, Vol. 47, No. 2, 348-360.
- Lee, I. H. and Lee, J., 1998, "A Theory of Economic Obsolescence," **The Journal of Industrial Economics**, Vol. 46, No. 3, 383-401.
- Levinthal, D. A. and Purohit, D., 1989, "Durable Goods and Product Obsolescence," **Marketing Science**, Vol. 8, No. 1, 35-56.
- Li, T. and Calantone, R. J., 1998, "The Impact of Market Knowledge Competence on New Product Advantage: Conceptualization and Empirical Examination," **Journal of Marketing**, Vol. 62, No. 4, 13-29.
- MacKenzie, S. B., Podsakoff, P. M., and Ahearne, M., 1998, "Some Possible Antecedents and Consequences of in-Role and Extra-Role Salesperson Performance," **Journal of Marketing**, Vol. 62, No. 3, 87-98.
- Mathieu, J. E., Tannenbaum, S. I., and Salas, E., 1992, "Influences of Individual and Situational Characteristics on Measures of Training Effectiveness," **The Academy of Management Journal**, Vol. 35, No. 4, 828-847.
- Mick, D. G. and Fournier, S., 1998, "Paradoxes of Technology: Consumer Cognizance,

- Emotions, and Coping Strategies,” **Journal of Consumer Research**, Vol. 25, No. 2, 123-143.
- Mohr, J. J., 2001, **Marketing of High-Technology Products and Innovations**, 1<sup>st</sup>, Upper Saddle River, NJ: Prentice Hall.
- Morris, M. G., Venkatesh, V., and Ackerman, P. L., 2005, “Gender and Age Differences in Employee Decisions About New Technology: An Extension to the Theory of Planned Behavior,” **IEEE Transactions on Engineering Management**, Vol. 52, No. 1, 69-84.
- Moscovitch, M., 1982, “A Neuropsychological Approach to Perception and Memory in Normal and Pathological Aging” in Craik, F. I. M. and Trehub, S. (eds.), **Aging and Cognitive Processes**, First Edition, Boston, MA: Springer, 55-78.
- Neslin, S. A., Taylor, A., Grantham, K. D., and McNeil, K. R., 2013, “Overcoming the “Recency Trap” in Customer Relationship Management,” **Journal of the Academy of Marketing Science**, Vol. 41, No. 3, 320-327.
- Niehoff, B. P. and Moorman, R. H., 1993, “Justice as A Mediator of the Relationship between Methods of Monitoring and Organizational Citizenship Behavior,” **Academy of Management Journal**, Vol. 36, No. 3, 527-556.
- Nunnally, J. C., 1978, **Psychometric Theory**, 2<sup>nd</sup>, New York: McGraw-Hill.
- Okada, E. M., 2006, “Upgrades and New Purchases,” **Journal of Marketing**, Vol. 70, No. October, 92-102.
- Pfeifer, P. E. and Carraway, R. L., 2000, “Modeling Customer Relationships as Markov Chains,” **Journal of Interactive Marketing**, Vol. 14, No. 2, 43-55.
- Ping, R. A., 1995, “A Parsimonious Estimating Technique for Interaction and Quadratic Latent Variables,” **Journal of Marketing Research**, Vol. 32, No. 3, 336-347.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., and Podsakoff, N. P., 2003, “Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies,” **Journal of Applied Psychology**, Vol. 88, No. 5, 879-903.
- Rao, A. R. and Monroe, K. B., 1988, “The Moderating Effect of Prior Knowledge on Cue Utilization in Product Evaluation,” **Journal of Consumer Research**, Vol. 15, No. 2, 253-264.
- Raymond, J. E., Beard, T. R., and Gropper, D. M., 1993, “Modelling the Consumer's Decision to Replace Durable Goods: A Hazard Function Approach,” **Applied Economics**, Vol. 25, No. 10, 92-102.
- Rhee, S. and McIntyre, S., 2008, “Including the Effects of Prior and Recent Contact Effort in a Customer Scoring Model for Database Marketing,” **Journal of the Academy of Marketing Science**, Vol. 36, No. 4, 538-551.

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- Richardson, P. S., Dick, A. S., and Jain, A. K., 1994, "Extrinsic and Intrinsic Cue Effects on Perceptions of Store Brand Quality," **Journal of Marketing**, Vol. 58, No. 4, 28-36.
- Rosenberg, N., 1976, **Perspectives on Technology**, 1<sup>st</sup>, New York: Cambridge University Press.
- Strausz, R., 2009, "Planned Obsolescence as an Incentive Device for Unobservable Quality," **The Economic Journal**, Vol. 119, No. 540, 1405-1421.
- Valliant, R. and Dever, J. A., 2011, "Estimating Propensity Adjustments for Volunteer Web Surveys," **Sociological Methods & Research**, Vol. 40, No. 1, 105-137.
- Wakefield, K. L. and Baker, J., 1998, "Excitement at the Mall: Determinants and Effects on Shopping Response," **Journal of Retailing**, Vol. 74, No. 4, 515-539.
- Walsh, G., Evanschitzky, H., and Wunderlich, M., 2008, "Identification and Analysis of Moderator Variables: Investigating the Customer Satisfaction-Loyalty Link," **European Journal of Marketing**, Vol. 42, No. 9/10, 977-1004.
- Williams, L. J. and Hazer, J. T., 1986, "Antecedents and Consequences of Organizational Turnover: A Reanalysis Using a Structural Equations Model," **Journal of Applied Psychology**, Vol. 71, No. 2, 219-231.
- Yoon, C., 1997, "Age Differences in Consumers' Processing Strategies: An Investigation of Moderating Influences," **Journal of Consumer Research**, Vol. 24, No. 3, 329-342.
- Zenith, 2018, "Smartphone penetration to reach 66% in 2018," <https://www.zenithmedia.com/smartphone-penetration-reach-66-2018/>, accessed on August 5, 2018.



## About the Authors

### **Chien-Wei Chen**

Chien-Wei Chen is an Associate Professor at the Department of International Business, College of Commerce, National Chengchi University. He holds a Ph. D. from the University of Warwick, UK. His primary research interests include branding, new product marketing, high-tech marketing, and marketing strategy. He has published in many journals such as Marketing Letters, Journal of Business Research, Industrial Marketing Management, Journal of Marketing Theory and Practice, among others.

Email: [cweichen@nccu.edu.tw](mailto:cweichen@nccu.edu.tw)

### **Nai-Hwa Lien**

Nai-Hwa Lien is an Associate Professor at the Department of Business Administration, National Taiwan University. She received a Ph. D. from Cornell University, USA. Her research interests focus on consumer behavior and psychology, marketing communications, and services marketing. She has published in many journals including Journal of Business Research, International Journal of Advertising, The Service Industries Journal, The Journal of Psychology, among others.

Email: [jlien@ntu.edu.tw](mailto:jlien@ntu.edu.tw)