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Exploring the relationship between perceived pace of technology change and adoption resistance to convergence products

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ABSTRACT

Information systems studies oftentimes assume that consumer behaviors are related to the pace of technological innovation, but few of these inquiries empirically demonstrate or discuss this relationship. This study is an empirical assessment of this dynamic. Specifically, we tested a three-part model that attempts to explain how consumers' perceptions of the pace of technological advancement influence both consumers' willingness to purchase said technology, as well as their expectations about its price and quality. This model first assumes that consumers expect that as technology advances in sophistication and quality, it should eventually become less expensive to acquire. The second aspect of this theory posits that the faster technology is perceived to advance, the more strongly consumers will believe that a cheaper better product is just on the horizon. Finally, the expectation that something newer, better, and cheaper is in the immediate offing will strongly predict both consumers' resistance to adopting initial, more expensive technology and their willingness to postpone purchasing such seminal technologies in favor of waiting to buy more attractive iterations of the product later. We found general support for this model in consumer behavior. Theoretical and practical implications of these findings are also discussed.

1. Introduction

Convergence is the process where the functions of unique products are combined for a purpose that can be changed via technology development, circumstance, and point of view. The convergence concept has evolved to include the sophistication of existing industries and the creation of new business opportunities using information technology (IT) in existing industries and the proper combination of products and services. The scope and shape of convergence products continue to change through the combination and convergence of new technologies, regulations, and functions. Under convergence environments, firms strive to occupy the market in advance and secure competitive advantages by launching better-quality products before their competitors. For example, the term “latest model” is now irrelevant to the smartphone industry as many innovative models, such as smart watches and smart rings, are launched immediately after the release of new smartphones; 3D televisions, which were expected to replace televisions, disappeared from the market and were replaced by smart televisions.

However, rapid changes in the technical environment of convergence products create consumer expectations and influence their adoption, rejection, and postponement of adoption of innovative products. In general, psychological factors such as fear, uncertainty, and doubt can contribute to hesitation or refusal to adopt innovative products (Moore, 2006). Most people with uncertainty determine the necessity of a product based on their subjective expectations and may reject or delay adoption until the optimal environment is created (Mahajan, Muller, & Bass, 1990). Studies on consumer behavior suggest that the expectations of potential consumers should be included in discussions on the adoption of new products (e.g., Holak, Lehmann, & Sultan, 1987; Horsky, 1990; Mahajan et al., 1990). Further, most studies on convergent products have been conducted on a specific product category such as tablets, smart watches, smart televisions, smart glasses, or smart car services (Jung, Kim, & Choi, 2016; Kate, Upadhyaya, Joa, & John, 2015; Rauschnabel, Brem, & Ivens, 2015; Wu, Wu, & Chang, 2016; Yoon & Cho, 2016; Yu, Hong, & Hwang, 2016).

In this study, we examine whether consumer perception of rapid technology change leads to adoption rejection or postponement of adoption of convergence products as it fosters the expectation that new and better-quality products will emerge and can be purchased at lower prices. This study shows how the psychological process by which consumers perceive the pace of

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technology change is transformed into resistance, and provides implications for the formation of a practical strategy for convergence products.

2. Theoretical background

2.1. Diverse forms of resistance

Resistance to innovation adoption appears in various forms, from simple rejection to strong resistance, and has been classified and defined by several researchers. Ram and Sheth (1989) proposed three types of innovation resistance according to the degree of resistance: inertia (e.g., people maintain existing products, services, or practices), active resistance (e.g., people take a negative position on innovation adoption because they consider the innovation dangerous), and strong active resistance (e.g., people blame innovation adoption because they perceive the innovation as inappropriate). Szmigin and Foxall (1998) claimed that "rejection" represents the strongest resistance to innovation adoption, while "postponement" is a delay in making a decision, and "opposition" is an intermediate stage that may lead to either adoption or rejection. Additionally, Lapointe and Rivard (2005) proposed four types of resistance: apathy, passive resistance, active resistance, and aggressive resistance. Apathy involves the lack of interest in a new system; passive resistance involves staying with an existing method and delaying the introduction of innovation; active resistance involves opposing an innovation and asking others to participate in that objection; and, aggressive resistance involves threatening behavior, such as boycotts and strikes. In addition, Kleijnen, Lee, and Wetzels (2009) suggested three types of resistance. In their study, postponement is the act of waiting to adopt an innovation until suitable circumstances appear, rejection is the refusal to accept an innovation, and opposition is the objection to and attack of an innovation. They noted that rejection is due to consumers' active evaluation of an innovation via cognitive processes rather than their lack of recognition or negligence. They defined "opposition" as the strongest type of resistance.

Accordingly, resistance appears in a wide range of forms according to its stage and degree. This study, as an early investigation of adoption resistance to convergence products, examines resistance types at the level of individual cognitive judgment, excluding strong resistance to innovation (i.e., preventing others from adopting or opposing and attacking the innovation), and classifies the resistance process into adoption rejection and adoption postponement based on Kleijnen et al. (2009). Table 1 summarizes the types of user resistance.

2.2. Expectations for price and quality

Consumers consider various elements when evaluating and selecting products, including price, brand, and quality (Liang & Chen, 2012). Price is the exchange value of a product in the market, expressed as the value allocated to the efficacy obtained from its use. Price directly stimulates consumer behavior, such as purchasing (Bolton, Warlop, & Alba, 2003; Lii & Erin, 2009; Spreng, MacKenzie, & Olshavsky, 1996). Consumer price expectations may affect purchase timing and brand and quantity decisions. For example, Erdem, Imai, and Keane (2003) examined the impact of future price expectations on purchase timing, purchase quantity, and brand choice for storable goods and found that consumers deliberate the probability of obtaining a better price in the future compared with the inconvenience of stocking-out.

Table 1
Types of user resistance.

Researchers	Types of resistance
Ram and Sheth (1989)	Inertia/Active resistance/Strong active resistance
Hirschheim and Newman (1991)	Preventive/Reactive/Resistance
Szmigin and Foxall (1998)	Rejection/Postponement/Opposition
Lapointe and Rivard (2005)	Apathy/Passive/Active/Aggressive
Woodside and Biemans (2005)	Adoption/Rejection
Laukkanen, Sinkkonen, and Laukkanen (2008)	Postponer/Opponent/Rejector
Kleijnen et al. (2009)	Postponement/Rejection/Opposition
Lian and Yen (2013)	Rejecter/Opponent/Postponer
Gurtner (2014)	Rejection/Opposition
Brahim (2015)	Adoption/Postponer/Opponent

In addition to price, quality, a comprehensive concept reflecting a product's unique characteristics, is another major factor on which market suitability depends (Zaltman & Wallendorf, 1979; Zeithaml, 1988). Quality is divided into objective quality, which is the authentic characteristics of a product, and subjective quality as perceived by consumers. Subjective quality is the quality perceived by a subjective evaluation of the general quality or superiority of a certain product. However, consumer perception of quality is imperfect and slow to consider changes in objective quality (Mitra & Peter, 2005, pp. 05–120). Furthermore, perceived quality is closely related to purchase decisions, a key factor affecting consumers' product selection (Oliver, 1980).

Consumers tend to assume that expensive products are of better quality (known as the "price-quality effect"). This effect is more significant for a product with higher uncertainty, as it is difficult to conduct an objective evaluation using scientific tools in uncertain environments. The standards used by consumers to evaluate product quality have been studied extensively, and price and product quality have been determined as the most important factors in product evaluation.

Perceived quality and price influence the evaluation and adoption of convergence products (e.g., Bass, 1980; Bolton et al., 2003; Garbarino & Edell, 1997; Hartmann, 2006; Li, 2004; Mitra & Peter, 2005, pp. 05–120; Moore, 2006). The perception of function, intended use, performance, appearance, and quality of convergence products are also considered as important factors since convergence products combine multiple functions into a single device. Further, cost significantly affects acceptance, as most convergence products are expensive due to their combination of functions and their intended use. Li (2004) demonstrated that perceived functional characteristics might be related to the adoption of convergence products. Therefore, consumers base their purchase decisions on their beliefs about the firms' future pricing and quality decisions.

Consumers' perception, evaluation, and satisfaction level can affect their subjective comparison point of products or services, which is influenced by their reference point. Examples of important comparison points include expectancy (Oliver, 1980), norm (Swan, Trawick, & Carroll, 1982, pp. 15–22), and desire (Spreng et al., 1996). Expectancy is a reference point used to compare an initial expectation formed before purchasing products or services with the performance after use. This factor influences the performance and satisfaction levels of an information system, as well as the intention of continued use. Thus, an examination of potential consumers' expectations of convergence products should assist in explaining their psychological resistance to innovation.

In summary, this study investigates how quality and price expectations affect innovation resistance, as they are critical factors in the evaluation and adoption of innovative products.

3. Research model and hypotheses

Although many convergent products offer consumers what

manufacturers would argue are more efficient and technologically advanced merchandise, the market's response to such innovations is not always positive. There would be a plethora of reasons why individuals might hesitate to adopt such technology; however, the current studies have been undertaken with the goal of empirically testing what has heretofore only been expressed as theory in the literature. We seek to measure consumers' attitudes about new convergent technology to see if such attitudes might predict consumers' reluctance to purchase said products.

Especially, convergence products built with creative ideas and innovative technologies evolve over time, which may increase consumer uncertainty. In an uncertain situation, people depend on their subjective expectations (Dhebar, 1996; Moore & Lehmann, 1980), and expectation is an intrapersonal factor that influences individuals' motivation (Niederhauser & Perkmen, 2010). Evaluation expectations can help predict the adoption of new products (Holak et al., 1987; Horsky, 1990; Mahajan et al., 1990). The perception of rapid technology change may create consumer expectations for the emergence of higher quality products at lower prices. Moreover, these expectations are eventually expressed in the form of adoption rejection or adoption postponement (Dhebar, 1996; Mahajan et al., 1990). This study demonstrates this structural relationship using the proposed research model, as shown in Fig. 1.

Dynamics in technology change complicate product choice and purchase timing for consumers due to uncertainty. However, most consumers form their subjective expectations in uncertain situations (Dhebar, 1996; Moore & Lehmann, 1980). Convergence products have a strong tendency for rapid development of technology as they are based on IT. Further, they mix various functions into a single device. Thus, the perception of function, performance, and quality of convergence products are important for consumers.

Ram (1987) argued that people are likely to wait for the release of more attractive products with fast technological development or short product lifecycles. Gurevitz (1983) emphasized that rapid IT development can increase concerns about the shortened lifecycles of technological products and the rapid launches of new innovative products. Horsky (1990) suggested that expectations for future higher quality products are formed over time. Thus, consumers expect the emergence of higher quality, such as in functions, performance, appearance, design, when they perceive that technology changes quickly. Therefore, we expected that:

H1. Consumers' perceptions that rapid technological change is occurring would be positively associated with their expectations that higher quality products would soon be available.

Convergence products are expensive due to their combination of various functions. Moore (2006) demonstrated that the price of an existing or similar product is likely to decrease when a new product is launched through technological development. Gurevitz (1983) noted that people expect future price reductions due to the characteristics of technical products and the development of technology. Consumers have price expectations and seek the lowest possible price. Their purchase decisions are driven by their psychological gain or loss based on the difference between the actual price and their internal reference points. Cost affects decision making during product evaluation and selection due to people's general tendency to avoid loss (Zaltman & Wallendorf, 1979). Thaler (1999), through a simulation process, explained that people consider the possibility of future loss when evaluating the advantages and disadvantages of a purchase decision. Hence, consumers expect lower prices in the near future when they perceive rapid technology change. Thus, we expected that:

H2. Consumers' perception that rapid technological change is occurring would be positively associated with consumers' expectation that convergent products would soon be cheaper to acquire.

Postponement is the weakest form of innovation resistance since consumers find the innovation acceptable in principle but do not adopt it at that time (Kleijnen et al., 2009). Rejection is a stronger form of resistance than postponement and occurs when the current belief and structure of a consumer clash with the innovation, or negative image of innovation appears in the mind of a consumer (Ram & Sheth, 1989). Rejection may occur when the innovation does not offer any valuable advantage or is complex and risky (Szmigin & Foxall, 1998).

The adoption of radical innovations requires more commitment, expenditure, and risks, including monetary costs and psychological effort, than the adoption of incremental innovations (Heiskanen et al., 2007). In general, people feel confident about their behavior in optimal circumstances. Consumers who feel that technology is changing quickly are not confident about whether they are making optimal decisions. Moore (2006) noted psychological factors such as fear, uncertainty, and doubt can trigger hesitation or refusal to adopt innovative products. Consumers may regret their purchases since new products with improved functions are launched quickly owing to the development of cutting-edge technology (Dhebar, 1996). Ram (1987) insisted, in line with

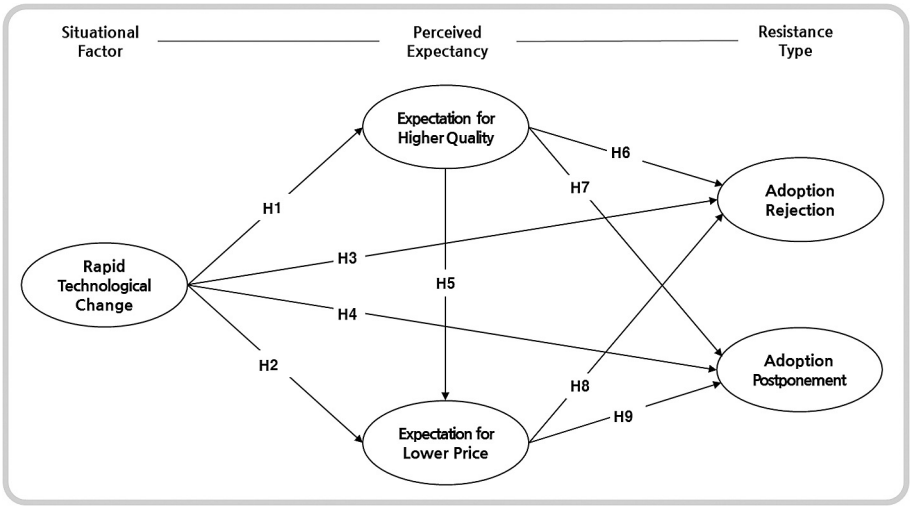


Fig. 1. Research model.

Dhebar (1996), that people tend to wait for a more attractive product when technology change is rapid or the lifecycle of a product is short. Therefore, consumers who consider the technology associated with convergence products is changing quickly will expect the emergence of a new product at a lower price, and will reject or postpone their adoption decision until the optimal environment is realized. Therefore, we expected that:

H3. Consumers' perceptions of rapid technological change would be positively associated with their willingness to not buy new products.

H4. Consumer's perceptions of rapid technology change would have a positive association with their choice to postpone purchasing convergence products.

Consumers rely on various reference sources, such as the cost of goods and previous prices, when evaluating suggested prices (Bolton et al., 2003). According to Moore (2006), the price of an existing or similar product may decrease when advances in technology result in a new product launch. The price of convergence products tends to be high in the early market entry stage due to the relatively high costs of research and development; however, they tend to decrease over time (Moore, 2006). Bass (1980) indicated that the emergence of new technology products lowers the price of existing products, which affects the adoption of innovative products. Therefore, the expectation that higher quality products will emerge in the near future raises consumers' expectations for lower prices.

A perceived risk for the quality of innovation is related to negative resistance (Ram & Sheth, 1989). Kleijnen et al. (2009) demonstrated that adoption might not occur when the functional quality of the innovation is uncertain. Ram (1987) proposed that people tend to postpone the adoption of innovative products when they doubt the performance of current products or expect a quality improvement in the future. Holak et al. (1987) argued that the expectation for using a higher quality personal computer could delay a purchase decision. Additionally, Szmigin and Foxall (1998) claimed that consumers, until the guaranteed functional quality of the innovation, tend to delay innovation adoption. Thus, consumers may choose adoption postponement or rejection rather than immediate adoption. Based on this reasoning, we expected that:

H5. Consumers' expectations for higher quality product would be positively associated with their expectation that such product could be purchased for a lower price in the near future.

H6. Consumers' expectations for higher quality product would be positively associated with their expressing a desire to not buy new products.

H7. Consumers' expectation that higher quality product would be offered for sale in the near future would be positively associated with their choosing to postpone purchasing new products.

Reasonable cost has a significant effect on purchase decision-making (Dodds, Monroe, & Grewal, 1991). A perception that the cost is unreasonable can negatively affect product evaluation and adoption (Garbarino & Edell, 1997). Lii and Erin (2009) as well as Bolton et al. (2003) investigated the impacts of various differential internet pricing tactics on consumers' cognitive (i.e., perceptions of price fairness), emotional, and behavioral responses. The empirical findings show that perceived fairness is significantly related to consumer emotion. While emotion affects behavioral responses, it also mediates the relationship between consumers' perceptions of price fairness and behavioral responses. The concept of cost is closely related to resistance. Hartmann (2006) proposed consumption models explaining that the discounted future price will decrease consumer consumption based on their experiences. Moore and Lehmann (1980) suggested that uncertainty, such as concerns about price reduction, is one of the psychological elements that can lead to the postponement of purchase decisions for innovative products.

The delayed purchase of innovative products due to price reduction expectations has recently been discussed in marketing studies. Kleijnen et al. (2009) indicated that the main economic reason (e.g., price) could be the actual cause of the postponement of the current product usage. Hence, consumers can be reluctant to adopt innovative products or postpone their adoption decision (rather than immediately adopt) when they strongly expect opportunities to purchase the products at lower prices. Therefore, we expected that:

H8. Consumers' expectations for lower prices would be positively associated with consumers' willingness to not buy new products.

H9. Consumers' expectations for lower prices would be positively associated with consumers' postponement of buying new products.

4. Research methodology and analysis results

4.1. Data collection procedure, measurement, and characteristics of the sample

This study examines the situational and psychological factors that affect whether consumers postpone or reject purchasing convergence products to explain why customers who are interested in convergence products do not purchase them. To achieve this, we designed the survey and data collection procedure through the following three phases. In the initial phase, we designed the proper sampling procedure. First, the main convergence product target groups were selected based on previous literature (e.g. Kate et al., 2015; Li, 2004; Moore, 2006; Rauschnabel et al., 2015), and includes smart watches and smart glasses (wearable devices), tablets and netbooks, smart televisions (internet protocol televisions (IPTV)/3DTV), and home networking. Second, the population of this study is general consumers who are interested in convergence products and have purchasing power. Since we were interested in a nationwide sample to avoid any geographical bias, nationwide consumers who would be interested in convergence products were targeted for data collection. For this, we considered general customers who visit the physical stores selling convergence products as the sample to minimize the sample error. Although the sample may not be representative of the general consumers who are interested in convergence products, it addresses the needs of this study. Third, we determined that an off-line survey was more suitable than an online survey to identify consumers who showed rejection or postponement behaviors and to examine the situational factors in their decision-making. Thus, we decided to conduct an off-line survey in nationwide digital appliance stores to identify potential consumers who visit a store selling convergence products but do not purchase the products in the store.

In the second phase, we developed a detailed survey plan including the off-line store selection. First, we obtained a list of stores that sell various convergence products in the major cities of South Korea and selected Hi-mart, one of the most representative digital appliance retailers in Korea. Second, we consulted a manager of a local Hi-mart and requested permission to conduct an on-site survey of customers in the stores. Third, we determined that we would conduct the survey during a weekend when more customers visit the selected stores. Finally, we obtained help from a marketing research firm that specializes in consumer surveys to increase the survey reliability throughout the data collection process.

In the third phase, the survey was conducted in three major Hi-

mart branch stores located in Korea on a weekend in April 2015 with the help of the marketing research firm. The research firm's staff solicited survey responses from customers leaving Hi-mart. They (1) established the customers' level of interest in convergence products, (2) identified customers who did not purchase the convergence products, and (3) requested them to participate in the survey. The sample filtering process was conducted rigorously, which contributes to minimizing the sample error. Further, survey participants were provided a gift card (equivalent to $5 USD) to encourage them to complete the survey.

Through the sampling procedure, 300 respondents participated in the on-site survey, of which 24 incomplete or invalid responses were discarded. With the 276 usable samples, SPSS 20.0 and AMOS 20.0 were used for the statistical analysis and structural equation modeling. Of the respondents, 159 (57.6%) were male and 117 (42.4%) female. Most were 30–49 years old (63.7%) and considered purchasing smart TVs/IPTVs (39.9%) and smart watches (24.3%) in near future. For the frequency of interest products in Table 2, we let the respondents indicate one major product that they want to buy in near future, asking them which product they consider purchasing in near future in the questionnaire. Also, the most important factor in their selection of convergence products was function (49.1%), followed by price (30.1%), and utilization (9.8%). Table 2 shows the general characteristics of the survey respondents.

Our research model contains five constructs. Each construct was measured with multiple items on a 7-point Likert scale ("1 = strongly disagree," "7 = strongly agree"). All items were adapted from the literature and were revised to suit this study. The questionnaire includes questions on socio-demographics (e.g., gender, age, and education) and convergence products. A pilot test was conducted to assess the validity and reliability of the research instrument, and their comments were used to further refine the questions. The operational definitions of the research variables and instrument items are provided in Appendix A.

4.2. Assessment of measurement model

Self-reported data can include common method bias (CMB). Therefore, we performed Harman's one-factor test to assess the common method variance to determine the extent of CMB (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The results indicate that the different scale items in our study did not load into one common factor, suggesting that CMB was not significant. In fact, the analysis revealed five latent factors in the theoretical model corresponding to the five constructs of interest that collectively explain about 80.406% of the total variance (the first factor represents approximately 26.601% of the total variance, the second 18.619%, and so on).

For a good model fit, the chi-square normalized by the degrees of freedom (X^2/df) should be less than 3, while the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), Tucker-Lewis index (TLI), and comparative fit index (CFI) should all exceed 0.9, and the root mean square error of approximation (RMSEA) should be less than 0.08. For our current confirmatory factor analysis (CFA) model, X^2/df is 1.372 (X^2 = 109.793; df = 80), the root mean square residual (RMR) is 0.039, GFI is 0.951, AGFI is 0.927, NFI is 0.975, TLI is 0.989, CFI is 0.992, and RMSRA is 0.037. Therefore, the model fit is adequate (Bagozzi & Yi, 1988).

Convergent validity was evaluated for the four measurement scales using the three criteria suggested by Fornell and Larcker (1981). All of the indicator factor loadings should be significant and exceed 0.7. In addition, the construct reliabilities should all exceed 0.8, and the average variance extracted (AVE) by each construct should exceed the variance resulting from the measurement error for that construct (i.e., the AVE should exceed 0.5). All of the factor loadings in the CFA model exceeded 0.7 and were significant at the p = 0.001 level (see the t-values in Table 3). The composite reliabilities (CR) ranged between 0.879 and 0.927. The AVE ranged from 0.708 to 0.809 (see Table 3), which is greater than the variance due to measurement error. Hence, the three conditions for convergent validity were satisfied.

Discriminant validity describes the extent to which measurements differ from others that should theoretically not be equal. Fornell and Larcker (1981) recommended a stronger discriminant validity test in which the AVE for each construct should exceed the squared correlation between that and any other construct. The factor correlation matrix indicated that the largest squared correlation between any pair of constructs was 0.644, while the smallest AVE was 0.841 (see Table 4). Thus, these findings suggest acceptable levels of convergent and discriminant validity.

4.3. Assessment of the structural model

In this structural model, the relative chi-square is 111.928, X^2/df is 1.382 (df = 81), RMR is 0.043, GFI is 0.951, AGFI is 0.927, NFI is 0.970, TLI is 0.989, CFI is 0.991, and RMSEA is 0.037. These indexes indicate an acceptable goodness-of-fit between the hypothesized model and the observed data. Fig. 2 shows the results of our path coefficients and their significance.

Hypothesis 1, that consumers' perceptions that rapid technological change is occurring would be positively associated with their expectations that higher quality products would soon be available, was supported (β = 0.289, t = 4.625, p < 0.001). Hypothesis 2, that consumers' perception that rapid technological change is occurring would be positively associated with consumers' expectation that convergent products would soon be cheaper to acquire, was also supported (β = 0.218, t = 4.028, p < 0.001).

Table 2
Descriptive statistics of respondent characteristics.

Features		Frequency	Percent	Features		Frequency	Percent
Gender	Male	159	57.6	Interest products (Products to consider purchasing)	Smart TV/IPTV	110	39.9
	Female	117	42.4		Smart watch (wearable)	67	24.3
	Total	276	100		Tablet/Netbook	43	15.6
Age	20–29	60	21.8		Home Networking	52	18.8
	30–39	97	35.1		Other	4	1.4
	40–49	79	28.6		Total	276	100
	50–59	28	10.1	Key considerations to purchase (two choices)	Function	271	49.1
	60 <	12	4.4		Price	166	30.1
	Total	276	100		Utilization	54	9.8
Education level	High school or less	73	26.4		Brand	32	5.8
	University studies	20	7.3		Design	14	2.5
	Graduation	151	54.7		Recommendation	8	1.4
	Graduate or higher	32	11.6		Other	7	1.3
	Total	276	100		Total	552	100

Table 3
Confirmatory factor analysis results.

Variables	Items	*B*	SE *B*	β	*t*-value	CR	AVE
Rapid Technological Change (RTC)	rtc1	1	–	0.906	–	0.913	0.779
	rtc2	1.029	0.039	0.949	26.647		
	rtc3	1.067	0.043	0.917	24.688		
Expectation for Higher Quality (EHQ)	ehq1	1	–	0.901	–	0.927	0.809
	ehq2	1.077	0.045	0.917	23.710		
	ehq3	1.065	0.044	0.921	23.935		
Expectation for Lower Price (ELP)	elp1	1	–	0.870	–	0.899	0.748
	elp2	0.994	0.056	0.846	17.785		
	elp3	0.991	0.052	0.887	19.077		
Adoption Rejection (AR)	ar1	1	–	0.901	–	0.879	0.708
	ar2	0.972	0.052	0.840	18.546		
	ar3	0.995	0.050	0.881	20.032		
Adoption Postponement (AP)	ap1	1	–	0.901	–	0.910	0.771
	ap2	1.039	0.046	0.921	22.590		
	ap3	0.978	0.048	0.862	20.184		
Model fit	$\chi^2 = 109.793$, $\chi^2/df = 1.372$ (df = 80), RMR = 0.039, RMSEA = 0.037, GFI = 0.951, AGFI = 0.927, NFI = 0.970, TLI = 0.989, CFI = 0.992.						

Notes: 1) Item loadings (λ) were significant at the $p = 0.001$ level.
2) B (unstandardized beta), SE B (standard error for the unstandardized beta), β (standardized beta), t (*t*-test statistic), CR (composite reliabilities), AVE (average variance extracted).
3) df (degree of freedom), RMR (root mean square residual), RMSEA (root mean square error of approximation), GFI (goodness of fit index), AGFI (adjusted goodness of fit index), NFI (normed fit index), TLI (Tucker-Lewis index), CFI (comparative fit index).

Hypothesis 3, that consumers' perceptions of rapid technological change would be positively associated with their willingness to not buy new products, was not supported ($\beta = 0.094$, $t = 1.672$, $p = 0.095$). Hypothesis 4, that consumer's perceptions of rapid technology change would have a positive association with their choice to postpone purchasing flagship technology, was not supported ($\beta = 0.055$, $t = 0.883$, $p = 0.377$). Hypothesis 5, that consumers' expectations for higher quality product would be positively associated with their expectation that such product could be purchased for a lower price in the near future, was supported ($\beta = 0.582$, $t = 9.895$, $p < 0.001$). Hypothesis 6, that consumers' expectations for higher quality technology would be positively associated with their expressing a desire to not buy new, flagship technology, was supported ($\beta = 0.350$, $t = 4.874$, $p < 0.001$). However, Hypothesis 7, which stated that consumers' expectation that higher quality technology would be offered for sale in the near future would be positively associated with their choosing to postpone purchasing new technology, was not supported ($\beta = 0.055$, $t = 0.693$, $p = 0.488$). Hypothesis 8, consumers' expectations for lower prices would be positively associated with consumers' willingness to not buy new products, was supported ($\beta = 0.340$, $t = 4.446$, $p < 0.001$). Hypothesis 9, that consumers' expectations for lower prices would be positively associated with consumers' postponement of buying new products, was supported and was statistically significant ($\beta = 0.437$, $t = 5.055$, $p < 0.001$).

5. Discussion and implications

5.1. Discussion

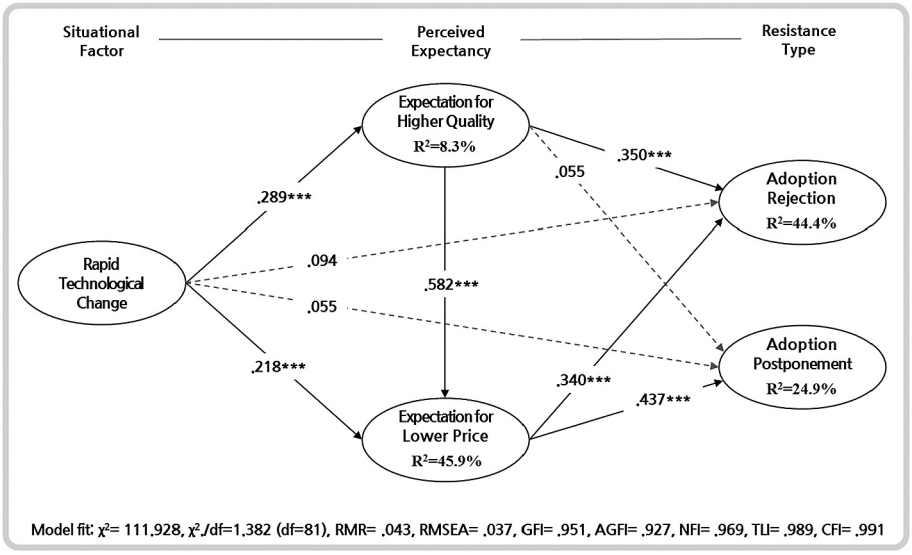
There may be many reasons why individuals hesitate to adopt new, convergent technology. In this study, we seek to measure consumers' attitudes about new, convergent technology to see if such attitudes might predict consumers' reluctance to purchase said products. For this, we demonstrated the effect of rapid technology change perceived by consumers on their expectations for and resistance to convergence product adoption.

The study findings related to the pace of technology change are as follows. First, when consumers perceive rapid technology change, they have strong expectations that higher quality products will emerge soon. In other words, the expectation that a higher quality product will emerge soon is stronger when consumers perceive fast change in the technology associated with a certain product. In this context, a higher quality product is one with improved and stabilized quality elements, including performance and design. As Ram (1987) suggested, consumers tend to wait for the emergence of a more attractive product when technology change is fast and the lifecycle of a product is short. While Ram (1987) conceptually suggested this tendency, this study validated it empirically. Second, consumers' expectations for a lower-price product was stronger when the pace of technology change was perceived as fast. Price has a close relationship with product evaluation and adoption, and it is expected to decrease in the near future when the pace of technology change associated with a certain product is perceived to be fast. The perception of financial risk is significant in a highly uncertain situation. Rapid technology change is likely to be a key element in expectation formation regarding purchase opportunities for lower-price convergence products. These findings show that the effect of the pace of technological change perceived by consumers on both their expectations for quality and price are significant. Third, the pace of technology change was not significantly related to the consumers' resistance to adopt convergence products. However, the perceived pace of technology change indirectly affected their adoption rejection through their expectations for the emergence of higher quality products. Similarly, it had significant effects on both adoption rejection and adoption postponement through their expectations for lower prices. Thus, dynamic technology change increases uncertainty and creates consumer expectations for lower prices and higher quality, important indicators for the adoption of innovative products.

Table 4
Correlation of constructs, internal consistency scores, and average variance extracted.

	Mean	Std. D.	AVE	RTC	EHQ	ELP	AR	AP
RTC	4.609	1.223	0.779	0.883				
EHQ	5.205	1.029	0.809	0.289	0.899			
ELP	4.570	0.924	0.748	0.385	0.644	0.865		
AR	4.478	1.060	0.708	0.325	0.596	0.598	0.841	
AP	4.931	1.018	0.771	0.240	0.351	0.490	0.377	0.878

Notes: 1) All correlations are significant at the level of 0.05.
2) The shaded diagonal represents the square root of the AVE.
3) RTC (rapid technology change), EHQ (expectation for higher quality), ELP (expectation for lower price), AR (adoption rejection), AP (adoption postponement), Std. D. (standard deviation), AVE (average variance extracted).



Notes: 1) *** = p < .001 (Standard. β).
2) ——→ Supported, - - - - - - - - - → Not supported, df (degree of freedom), RMR (root mean square residual), RMSEA (root mean square error of approximation), GFI (goodness of fit index), AGFI (adjusted goodness of fit index), NFI (normed fit index), TLI (Tucker-Lewis index), CFI (comparative fit index).

Fig. 2. Results of structural modeling analysis.

Further, several findings imply the role of the expectation for higher quality products in pricing. First, expectation of better products leads to expectation of price reduction. This result is consistent with Bass (1980), Moore (2006), and Liang and Chen (2012), who suggest that the launch of a new technology product reduces the price of existing products. Consumers believe that the price of existing products will decrease when a new product of higher quality is launched, similar to what occurs to existing versions when an upgraded version is launched. Second, we found that a convergence product is not purchased immediately when better products are expected. This result implies that higher innovation expectations have significant effects on adoption rejection or postponement, which is consistent with Ram's (1987) finding. However, the effect of higher quality product expectations on buying postponement was not significant. Since the higher quality of a convergence product indicates adding functional advantages to the product, the potential customers may consider the uncertainty of the fit between their needs and the new function of the upcoming product. Based on this reason, we interpret that the perceived expectation for higher quality affects adoption rejection, not adoption postponement (Moore, 2006; Thaler, 1999). Finally, the expectation for lower-price products is a powerful determinant for the postponement of innovation adoption because consumers wish to avoid loss (Erdem et al., 2003; Hartmann, 2006). Consumers are likely to postpone buying until the product is available at a lower price. Moreover, the intention to reject buying a convergence product is stronger with higher expectations for lower prices, indicating that perceived cost has a significant effect on new product adoption. These results show that the perception of rapid technology change can enhance the expectation that better products, and opportunities to purchase them at lower prices, will emerge, inducing consumers to reject or postpone convergence product adoption. Therefore, this study suggests the need to consider the paradox of technology by demonstrating the relationship between innovation and the pace of technology change.

Another interesting finding of this study is the differential effects of the expectation for higher quality on adoption rejection and postponement. We found that a new product of higher quality prevents customers from adopting the product, but does not delay their purchasing time. This result implies that the antecedents of adoption rejection and postponement are different. Furthermore, the expectation for lower prices influences both adoption rejection and postponement, suggesting that lower price is a more critical factor than quality in explaining product resistance theoretically (Bolton et al., 2003; Thaler, 1999).

5.2. Implications

This study has several research implications. First, while prior research focused on adoption and diffusion factors, we concentrated on adoption resistance, demonstrating a determinant by classifying resistance types into rejection and postponement. Second, previous studies on innovation adoption and resistance neglected the relationship between the pace of technology change and innovation, despite emphasizing factors such as user convenience, behavioral control, complexity, and user capability in terms of technology change. In contrast, this study posits perceived technology change as a new predictor of innovation resistance. The pace of technological advances is a representative situational factor, implying that convergence product selection is complicated and the environmental factors considered should be expanded. Third, we empirically validated a structural and causal relationship between price and quality expectations, key elements in product selection and adoption resistance. We explain the psychological process through which consumers are influenced by subjective expectations in circumstances of high uncertainty regarding technology change.

Another major finding of this study in theory development is that factors affecting the two types of resistance, rejection and postponement, were different. Adoption rejection was affected by both higher quality and lower-price expectations, while adoption postponement was influenced by only lower-price expectations. However, the expectation for higher quality had an indirect effect on adoption postponement through the expectation for lower price. From this finding, price reduction is a decisive factor in explaining convergence product resistance behaviors inclusive of adoption postponement (Bolton et al., 2003; Erdem et al., 2003). The differential effects of these two expectations highlight the importance of multifaceted marketing strategies for convergent products. Furthermore, by empirically validating the effects of the expectations customers perceive on their innovation resistance, our

study deepens Ram's (1987) findings.

Finally, we investigated the effect of the pace of technology change on product selection behaviors across many convergence products instead of one specific product. Therefore, this study contributes to the generalization of the findings in understanding consumers' decision making for innovative product purchasing.

Our findings also have several practical implications. First, innovative product purchasing must be understood from the consumer's point of view to reduce resistance to convergence product adoption. Most people own a smart device, and the market is inundated with various innovative products equipped with unique features. Consumers are not forced to choose a certain innovative product, even when considered useful and convenient. Therefore, consumer needs and demands must reflect in the early stages of product development. Excessively fast technology change and the resulting short product life cycles can cause innovation rejection. Moreover, pricing policies should consider price reduction expectations as having a decisive effect on adoption postponement. For example, financial benefits for consumers should be strengthened at their initial selection through discounts or promotional activities to increase their adoption of more products. One practical implementation is to offer early customers a monetary compensation program that includes upgrading to a new product for a minimal cost, similar to the financial management technique such as option.

Moreover, the insignificant relationship between the expectation for higher quality products and adoption postponement, such that a new product's market release expectation is not related to customers' decision to delay adoption, may be due their uncertainty of the fit between their needs and the upcoming new products. Instead, convergence product quality expectations were found to only explain the decision of adoption or rejection. Thus, to increase sales in a specific period, sales managers must deliver information about new product specifications or market release plans to customers. Based on the result that lower price expectations affect adoption postponement, monetary discount promotions or price strategy announcements will be effective in increasing sales by preventing customers from delaying product adoption. Accordingly, the differential effects of the higher quality and lower-price expectations highlight the importance of diverse marketing for innovative convergence products.

5.3. Limitations and future research directions

In this study, we examined the relationship between the pace of technology change and innovation resistance, which has not received sufficient attention in prior empirical studies. However, our study has some limitations that future studies should address. First, although this study proposes technology change perceived by consumers as a new predictor of innovation resistance, this factor should be further classified according to the level of technology change perceived to draw additional practical implications. New predictors of innovation resistance should be determined through in-depth data collection methods, such as interviews and open-ended surveys. Second, we did not consider the detailed attributes and characteristics of the convergence products in this study. The findings might vary according to the attributes of the product, the time the product is launched, and its relevance. Future research should reflect these potential additional indicators. Third, the generalizability of the findings can be enhanced by using demographic variables that are known predictors of innovation resistance. This study did not touch how cost can influence consumers' willingness to purchase new technology by respondents' income or purchasing power. Future research needs to be conducted focusing on the moderating role of customers' income in the relationship between cost variable and their attitude toward purchasing decisions such as product adoption/rejection/postponement. Moreover, this study was conducted with cross-sectional data. Therefore, a time-series study or an experimental design can help identify the dynamics of resistance according to the pace of technology change. The validity of this study's findings can be improved if these limitations are addressed.

This study contributes to theoretically understanding product adoption from an endogenous perspective and situational perspective, such as the technological environment. Since fierce market competition or supplier circumstances might affect product adoption, diffusion, and resistance (Shin & Koh, in press), a comparative analysis of possible affecting factors by product types would be also valuable for future research.

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Appendix A. Operational definitions and measures of variables.

Variables	Operational definition and instruments	References
Rapid Technology Change (RTC)	*The degree of the perception that the technology of convergence products is rapidly changing* · I think that the technology of this product is rapidly changing. · The pace of technology change seems to be much faster than what I expected. · The related technology keeps changing and will change quickly in the future.	Horsky (1990) Ram (1987)
Expectation for Higher Quality (EHQ)	*The degree of the expectation for a product that has better function, appearance, and quality than an existing product* · I expect that a better-quality product will be launched. · I expect that a revised and improved product will be launched. · I think that a more attractive convergence product will be launched.	Gurevitz (1983) Li (2004)
Expectation for Lower Price (ELP)	*The degree of the expectation for opportunities to purchase a convergence product at a lower price* · I think that I can buy a product at a lower price. · I expect that I will be able to buy a convergence product at a lower cost. · I want to buy the product at a discounted price.	Dhebar (1996) Moore and Lehmann (1980)
Adoption Rejection (AR)	*The intent to avoid the adoption of a convergence product through cognitive evaluation process* · I think that avoiding adoption of the convergence product is the right choice. · Adoption of the price is not wise. · I will reject any recommendations from people about the convergence product.	Kleijnen et al. (2009) Szmigin and Foxall (1998)
Adoption Postponement (AP)	*The intent to postpone the adoption of a convergence product until the right time comes* · I think that the product is good but will not adopt it immediately. · I think that a later adoption of the product is better. · I am not sure whether adoption of the product is the right decision.	Kleijnen et al. (2009) Szmigin and Foxall (1998)

References

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*(1), 74–94. http://dx.doi.org/10.1007/BF02723327.

Bass, F. M. (1980). The relationship between diffusion rates, experience curves, and demand elasticities for consumer durable technological innovations. *Journal of Business, 53*(7), 51–57. http://www.jstor.org/stable/2352211.

Bolton, L. E., Warlop, L., & Alba, J. W. (2003). Consumer perceptions of price (un) fairness. *Journal of Consumer Research, 29*(4), 474–491. http://dx.doi.org/10.1086/346244.

Brahim, S. B. (2015). Typology of resistance to e-banking adoption by Tunisian. *Journal of Electronic Banking Systems, 2015*(2015). http://dx.doi.org/10.5171/2015.801654. Article ID 801654.

Dhebar, A. (1996). Speeding high-tech producers, meet the balking consumer. *Sloan Management Review, 37*(2), 37–54.

Dodds, W. B., Monroe, K. B., & Grewal, D. (1991). Effects of price, brand and store information on buyers' product evaluation. *Journal of Marketing Research, 28*(3), 307–319. http://dx.doi.org/10.2307/3172866.

Erdem, T., Imai, S., & Keane, M. P. (2003). Brand and quantity choice dynamics under price uncertainty. *Quantitative Marketing and Economics, 1*, 5–64. http://dx.doi.org/10.1023/A:1023536326497.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement errors. *Journal of Marketing Research, 18*(1), 39–50. http://dx.doi.org/10.2307/3151312.

Garbarino, E. C., & Edell, J. A. (1997). Cognitive effort, affect and choice. *Journal of Consumer Research, 24*(2), 147–158. http://dx.doi.org/10.1086/209500.

Gurevitz, S. (1983). Technology will shorten product life cycles. *Business Marketing, 68*(10), 12–13.

Gurtner, S. (2014). Modelling consumer resistance to mobile health applications. In *Proceedings of the European Conference of Information Systems* (pp. 1–19).

Hartmann, W. R. (2006). Intertemporal effects of consumption and their implications for demand elasticity estimates. *Quantitative Marketing and Economics, 4*(4), 325–349. http://dx.doi.org/10.2139/ssrn.929489.

Heiskanen, E., Hyvönen, K., Niva, M., Pantzar, M., Timonen, P., & Varjonen, J. (2007). User involvement in radical innovation: Are consumers conservative? *European Journal of Innovation Management, 10*(2), 489–509. http://dx.doi.org/10.1108/14601060710828790.

Hirschheim, R., & Newman, M. (1991). Information systems development as symbolism: Myth, metaphor, and magic. *Information Systems Research, 2*(1), 29–62.

Holak, L., Lehmann, D. R., & Sultan, F. (1987). The role of expectations in the adoption of innovative consumer durabies: Some preliminary evidence. *Journal of Retailing, 63*(3), 243–259. http://www.scirp.org/reference/ReferencesPapers.aspx?ReferenceID=196896.

Horsky, D. (1990). A diffusion model incorporating product benefits price, income and information. *Marketing Science, 9*(4), 342–365. http://dx.doi.org/10.1287/mksc.9.4.342.

Jung, Y., Kim, S., & Choi, B. (2016). Consumer valuation of the wearables: The case of smartwatches. *Computers in Human Behavior, 63*(10), 899–905. http://dx.doi.org/10.1016/j.chb.2016.06.040.

Kate, M. C., Upadhyaya, S., Joa, C. Y., & John, D. (2015). Bridging the divide: Using UTAUT to predict multigenerational tablet adoption practices. *Computers in Human Behavior, 50*(9), 186–196. http://dx.doi.org/10.1016/j.chb.2015.03.032.

Kleijnen, M., Lee, N., & Wetzels, M. (2009). An exploration of consumer resistance to innovation and its antecedents. *Journal of Economic Psychology, 30*(3), 344–357. http://dx.doi.org/10.1016/j.joep.2009.02.004.

Lapointe, L., & Rivard, S. (2005). A multi-level model of resistance to information technology implementation. *MIS Quarterly, 29*(3), 461–491. http://dl.acm.org/citation.cfm?id=2017270.

Laukkanen, P., Sinkkonen, S., & Laukkanen, T. (2008). Consumer resistance to internet banking: Postponers, opponents and rejectors. *International Journal of Bank Marketing, 26*(6), 440–455.

Li, S. (2004). Exploring the factors influencing the adoption of interactive cable television services in Taiwan. *Journal of Broadcasting and Electronic Media, 48*(3), 466–483. http://dx.doi.org/10.1207/s15506878jobem4803_7.

Liang, A. R., & Chen, H. (2012). Is that deal worth my money? The effect of relative and referent thinking on starting price under different promotion programs using hotel coupons in online auctions. *Computers in Human Behavior, 28*(2), 292–299. http://dx.doi.org/10.1016/j.chb.2011.09.012.

Lian, J., & Yen, D. C. (2013). To buy or not to buy experience goods online: Perspective of innovation barriers. *Computers in Human Behavior, 29*(3), 665–672. http://dx.doi.org/10.1016/j.chb.2012.10.009.

Lii, Y., & Erin, S. (2009). Internet differential pricing: Effects on consumer price perception, emotions, and behavioral responses. *Computers in Human Behavior, 25*(3), 770–777. http://dx.doi.org/10.1016/j.chb.2009.02.005.

Mahajan, V., Muller, E., & Bass, F. M. (1990). New product diffusion models in marketing: A review and directions for research. *Journal of Marketing, 54*(1), 1–26. http://dx.doi.org/10.2307/1252170.

Mitra, D., & Peter, N. G. (2005). *Customer perceptions of product quality: A longitudinal study* (pp. 05–120). Cambridge, MA: Marketing. Science Institute Report.

Moore, G. A. (2006). *Crossing the chasm: Marketing and selling high-tech products to mainstream customers*. New York: Collins Business Essentials.

Moore, W. L., & Lehmann, D. R. (1980). Individual differences in search behavior for a nondurable. *Journal of Consumer Research, 7*, 296–307. http://dx.doi.org/10.1086/208817.

Niederhauser, D. S., & Perkmen, S. (2010). Beyond self-efficacy: Measuring preservice teachers' instructional technology outcome expectations. *Computers in Human Behavior, 26*(3), 436–442. http://dx.doi.org/10.1016/j.chb.2009.12.002.

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research, 17*(4), 460–469. http://dx.doi.org/10.2307/3150499.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903. http://dx.doi.org/10.1037/0021-9010.88.5.879.

Ram, S.. (1987). A model of innovation resistance, in melanie wall and paul anderson (ed.). Advances in consumer research, 14. Provo. UT: Association for Consumer Research, 16(14), 208–212. http://acrwebsite.org/volumes/6688/volumes/v14/NA-14.

Ram, S., & Sheth, J. N. (1989). Consumer resistance to innovations: The marketing problem and its solutions. *Journal of Consumer Marketing, 6*(2), 5–14. http://dx.doi.org/10.1108/EUM0000000002542.

Rauschnabel, P. A., Brem, A., & Ivens, B. S. (2015). Who will buy smart glasses? Empirical results of two pre-market-entry studies on the role of personality in individual awareness and intended adoption of google glass wearables. *Computers in Human Behavior, 49*(8), 635–647. http://dx.doi.org/10.1016/j.chb.2015.03.003.

Shin, S., & Koh, J. (2017). Analysis of mobile broadband service penetration in South Korea. *Journal of Computer Information Systems, 57*(1), 31–38. http://dx.doi.org/10.1080/08874417.2016.1181491 (in press).

Spreng, R. A., MacKenzie, S. B., & Olshavsky, R. W. (1996). A reexamination of the determinants of consumer satisfaction. *Journal of Marketing, 60*(3), 15–32. http://dx.doi.org/10.2307/1251839.

Swan, J. E., Trawick, I. F., & Carroll, M. G. (1982). *Satisfaction related to predictive, desired expectations: A field study* (pp. 15–22). Indiana University.

Szmigin, I., & Foxall, G. (1998). Three forms of innovation resistance: The case of retail payment methods. *Technovation, 18*(6/7), 459–468. http://dx.doi.org/10.1016/S0166-4972(98)00030-3.

Thaler, R. H. (1999). Mental accounting matters. *Journal of Behavioral Decision Making, 12*(3), 183–206. http://dx.doi.org/10.1002/(SICI)1099-0771(199909)12:3<183::AID-BDM318>3.0.CO;2-F.

Woodside, A. G., & Biemans, W. G. (2005). Modeling innovation, manufacturing, diffusion, and adoption/rejection processes. *Journal of Business and Industrial Marketing, 20*(7), 380–393.

Wu, L. H., Wu, L. C., & Chang, S. C. (2016). Exploring consumers' intention to accept smartwatch. *Computers in Human Behavior, 64*(11), 383–392. http://dx.doi.org/10.1016/j.chb.2016.07.005.

Yoon, S.-B., & Cho, E. (2016). Convergence adoption model (CAM) in the context of a smart car service. *Computers in Human Behavior, 60*(7), 500–507. http://dx.doi.org/10.1016/j.chb.2016.02.082.

Yu, E., Hong, A., & Hwang, J. (2016). A socio-technical analysis of factors affecting the adoption of smart TV. *Computers in Human Behavior, 61*(8), 89–102. http://dx.doi.org/10.1016/j.chb.2016.02.099.

Zaltman, G., & Wallendorf, M. (1979). *Consumer behavior: Basic findings and management implications*. New York: Wiley.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality and value: A means-end model and synthesis of evidence. *Journal of Marketing, 52*(3), 2–22. http://dx.doi.org/10.2307/1251446.