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ABSTRACT

By expanding on the regret theory, this study examines how the gap between the expected benefit of the current system and that of the future upgraded system affects consumer behavior when adopting a new technology. An online survey on the potential users of intelligent CCTV for home use shows that the expected benefit of the current system not only is a direct precedence factor for consumer behavior but also forms the anticipated regret through comparison with the expected benefit of the upgraded system in the future, thereby proving that this ultimately affects consumer behavior.

Keywords: expectations gap, anticipated regret, behavioral intention, intelligent CCTV for home use

Introduction

Rapid improvement of new technology based on information technology (IT) is being carried out. However, expectations on such innovative technological improvement can be a factor that leads to the delay of consumer decision to make the purchase or not. As soon as new IT products such as TV or computer are available, one can often see that the prices of these products plummet or the consumers have opportunities to buy products with good specifications and friendlier prices.

In general, consumers make purchasing decisions based on the expected benefits or values created by using the product (Fred D Davis, Bagozzi, & Warshaw, 1989; Oliver, 1980). If an improved product is not scheduled to be introduced in the near future, the cost of the product and the expected benefits of using it would be the consumer's main deciding factor. However, consumer behavior would be affected by future expectations when the consumers know from multiple channels that the future product would be a significant improvement of the current one. Such a phenomenon is expected to be much more apparent for IT-based products that evolve very fast.

The regret theory well explains the decision making process that considers future alternatives. According to the regret theory, anticipated emotion arises when the unselected alternative is compared to the value of the alternative that has been selected, and this leads to consumer behavior (Sheeran & Orbell, 1999; Simonson, 1992; M. Zeelenberg, 1999). The regret theory has been studied as a way to explain decision making under uncertainties (Loomes & Sugden, 1982; M. Zeelenberg, 1999) and has been used as a major theory to explain human behavior in the areas of health or welfare (Abraham & Sheeran, 2004; Conner,

Sandberg, McMillan, & Higgins, 2006). In addition, there are multiple studies that incorporate anticipated regret as a new construct of the theory of planned behavior (TPB) framework (Sandberg & Conner, 2008; Sheeran & Orbell, 1999).

Meanwhile, in the field of consumer research, anticipated regret has been studied as one of the major factors affecting consumers' purchase intention (Bagozzi, Belanche, Casaló, & Flavián, 2016) or loyalty (Lin, Chou, & Lin, 2016; Taylor, Ishida, & Donovan, 2016). However, the development of antecedents for the formation of regret or anticipated regret in conventional literature is very limited. Therefore, this study examines how anticipated regrets are formed and how they affect consumer behavior.

The speed of development is rapid for new IT products, and their lifecycle is being shortened. In addition, consumers are more actively seeking related information compared to the past, through diverse media including the Internet. Therefore, studying the effects of anticipated ~~behavior~~ regret for future products based on the regret theory would not only elaborate the theory but also be expected to managerially provide strategic implications preparing for the rapid technological evolvement of new products.

Research Framework and Hypotheses

There are multiple studies that have looked into the relationship between disconfirmation and human behavior. According to the disconfirmation paradigm, consumer behavior is determined by the initial standard and by the perceived discrepancy of the reference point from that initial standard (Oliver, 1980; Olson & Dover, 1979). In the satisfaction decision, disconfirmation has been set as the perceived discrepancy from the

initial reference point, and the expectation has been set as the initial standard, and positive disconfirmation connects to satisfaction, while negative disconfirmation leads to dissatisfaction (Oliver, 1980). In the GAP model, the quality is determined by the discrepancy in the perception on the services provided by agents (consumer, manager, employee, etc.) as well as the difference of consumer perception between before and after using the product (Parasuraman, Zeithaml, & Berry, 1985). Meanwhile, according to the regret model, the anticipated emotion arises when consumers compare value of the selected alternative to the unselected alternative (Sheeran & Orbell, 1999; Simonson, 1992; M. Zeelenberg, 1999). Figure 1 shows the three ideal models that explain the consumer-behavior decision making process according to disconfirmation or the occurrence of gap. While emotion arises in the present stage by comparing the initial standard of the past and the reference point of the present in the disconfirmation model and the GAP model, the occurrence of emotion in the regret model is flexible in that it can range from the present to the future. However, the direct prediction of behavior in the initial standard also needs to be included in the model. Similar to attitude, the pre-trial belief for the initial standard can be a crucial antecedent of forming the affective stage (Fishbein & Ajzen, 1975; Olson & Dover, 1979), and therefore, the initial standard would have a direct impact on emotion forming in the regret model. In addition, viewing belief in the aspect of performance or benefit, the initial standard would have a direct effect on behavior intention (F. D. Davis, 1989; Fred D Davis et al., 1989; Venkatesh, Morris, Davis, & Davis, 2003).

In psychology, cognition, affection, and conation have been verified as the three aspects that constitute the human mind (Huitt & Cain, 2005). While cognition is related to

"the process of coming to know and understand"; affect is related to "the emotional interpretation of perceptions, information, or knowledge"; and conation is related to "the connection of knowledge and affect to behavior" (Huitt & Cain, 2005). According to this, in this study, the basic framework for the formation of human behavior intention has been set: cognition → affection → conation. In the cognition stage, the difference between the benefit of the already introduced system and the benefit of the system to be upgraded would be acknowledged. In the affection stage, the anticipated regret is formed, which then creates behavioral intention in the conation stage.

[Figure 1 here]

Based on the discussions above, the research framework describes the hypothesized relationships among constructs in a path diagram format (see Figure 2). The framework comprises of two types of expected benefits (current versus upgraded), anticipated regret, and behavior intention. Based on the literature review, this study has generated four hypotheses associated with the model. These hypotheses focus on the interrelationships among constructs.

[Figure 2 here]

Expectation can be defined as the "pretrial beliefs" for a product (McKinney, Yoon, & Zahedi, 2002; Olson & Dover, 1979). Belief is the precise and generally accepted concept that already exists, and the definition of pretrial beliefs seems logical and useful (Olson &

Dover, 1979) in that it well supports the causal relationship with attitude theoretically (Fishbein & Ajzen, 1975; Olson & Dover, 1979). There are three types of expectation (McKinney et al., 2002): "should expectation" that focuses on the normative standard, "ideal expectation" that considers optimal standard, and "will expectation" that focuses on the predicting future performance. In this study, we adopt the will expectation, and the expected benefit of the system is defined as the system's predicting benefit at some time in the future.

Expectation is one of the major antecedents in predicting consumer behavior (McKinney et al., 2002). As the initial standard increases, the gap between the initial standard and the reference point decreases. Therefore, the expectation gap between the current and the upgraded system would decrease as the expectation of the current system benefit increases. In the customer satisfaction study on plant and video disc player, Churchill Jr and Surprenant (1982) proved that there is a negative correlation between expectation and disconfirmation. As a pre-trial belief, expectation is the cause of emotion (Baron, 1992) and is an antecedent of behavior intention (F. D. Davis, 1989). Therefore, the expectation of the current system benefit would lead to future-oriented positive emotion and act as a factor that increases behavior intention. According to Kim and Lennon (2013), who studied the behavior of online consumers based on the stimulus-organism-response model, internal and external information became stimuli, which affected the emotions and behavior of online consumers. Likewise, expectations formed based on internal and external information about a product will affect anticipated regret and behavior intentions such as anticipated regret.

Based on the above, hypotheses are set as the following:

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Hypothesis 1: Expected benefit of the current system decreases the expected benefit GAP between the current system and the upgraded system.

Hypothesis 2: Expected benefit of the current system decreases the anticipated regret.

Hypothesis 3: Expected benefit of the current system increases the behavior intention.

Regret refers to the negative emotion or unpleasant feeling that arises in thinking that the current situation would have been better if a different action were taken in the past (Marcel Zeelenberg & Pieters, 2004). Future-oriented emotion can be divided into anticipated emotion and anticipatory emotion (Baumgartner, Pieters, & Bagozzi, 2008); anticipatory emotion is the current regret that is experienced through the prospect of a future event, while anticipated emotion is what is expected to be experienced in the future. Therefore, anticipated regret refers to the regret that is expected to be experienced in the future. According to the anticipated regret theory, consumers make decisions based on the anticipated regret that arises after a purchase (Sheeran & Orbell, 1999). Currently, there is increasing research on the effect of such anticipated regret on purchase decision making (Baumgartner et al., 2008; Bell, 1982; Chen, Teng, Liu, & Zhu, 2015; Sheeran & Orbell, 1999; Van Der Schalk, Bruder, & Manstead, 2012; M. Zeelenberg, 1999).

Positive or negative emotions can be created by comparing an outcome of one alternative to the outcome of another alternative, that is, counterfactual comparisons (Baron, 1992; Cooke, Meyvis, & Schwartz, 2001). Many theories on consumers support that affection arises because of alternative comparisons. In satisfaction literature, the disconfirmation,

which is defined as the difference between the expectation and performance, acts as a crucial intervening variable that determines satisfaction (Churchill Jr & Surprenant, 1982). In quality GAP literature, the gap in experiences and expectations of consumers becomes the antecedent of consumer evaluation such as satisfaction or quality (Brown & Swartz, 1989; Parasuraman et al., 1985).

People wish to avoid the consequences of a wrong decision (Bell, 1982). Regret is the emotion that people wish to avoid, and anticipated regret leads to behavior (Sheeran & Orbell, 1999). According to recent papers on the relationship between emotion and behavior, behavior is influenced not only by the emotion that arises from experience but also by the anticipation of such emotion (Baumgartner et al., 2008; Chen et al., 2015; Sheeran & Orbell, 1999; Van Der Schalk et al., 2012; M. Zeelenberg, 1999) as well as not only by positive anticipated emotion but also by negative anticipated emotion (Baumgartner et al., 2008).

Based on the above, the following hypotheses are set:

Hypothesis 4: The expected benefit GAP between the current system and future system increases the anticipated regret.

Hypothesis 5: Anticipated regret decreases behavior intention.

Methodology

Selected system: Intelligent CCTV for home use

A combination of a closed circuit television (CCTV) and artificial intelligence that automatically detects events of interest and behavior through the advanced ~~ICT~~ IT has led to the introduction of intelligent CCTV (Li, Huang, Gu, Luo, & Tian, 2008). The currently commercialized intelligent CCTV provides a primary level of artificial intelligence, including the collection of video information through the CCTV, automatic recognition of abnormal conditions, and the notification of such conditions to the users (HRI, 2014).

In this study, the intelligent CCTV for home use has been selected as the object for analysis for the following reasons. First, artificial intelligence-related products in their initial stages are being introduced in the market, and the evolution of artificial intelligence technology based on ICT is expected to bring innovative system improvements. While in comparison with CCTV, the current systems that have been introduced have simple functions of automatic recognition of abnormal conditions and notification of such conditions, when they are combined with artificial intelligence technology in the future, they are expected to have detection capability that is far better than that of a human (HRI, 2014). Next, as the intelligent CCTV for home use has a relatively limited salient belief attribute of safety (Hartmus, 2014; Li et al., 2008; Park & Kim, 2015), it can simplify the measurement of constructs. The benefits of the intelligent CCTV for home use focused on functional characteristics such as safety and a sense of relief.

Data collection and sample description

This study aims to identify the relationships among expected benefits, anticipated regret, and behavioral intentions for intelligent CCTV system.

The survey was conducted by Macromil Embrain, an online research company that has 1 million online panels in Korea. Using online panels enables random sampling and has the advantage of easy extraction of the same population distribution sample as the population. The survey was conducted on people between ages of 20 to 59 years from December 2015 to January 2016. A total of 1,000 samples were secured, but untrustworthy answers were excluded. Finally, a total of 805 samples were used for analysis. The samples were 51.5% male and 48.9% female (Chi-square = 0.01), 20.2% were in their 20s, 24.5% in their 30s, 28.6% in their 40s, and 26.7% in their 50s, representing the population (Chi-square = 2.1) (see Table 1).

[Table 1 here]

Measurement of constructs

In this study, four constructs were measured: expected benefit of the current system, GAP between expected benefit of the current system and expected benefit of the upgraded system, anticipated regret, and behavior intention. The three constructs excluding GAP were all measured using multiple items. For each item, a 7-point Likert scale was used, and the range of the measurement is from 1 (strongly disagree) to 7 (strongly agree).

Benefit is what customer receives when he or she purchase products/services (Cronin Jr, Brady, & Hult, 2000), and it is a concept that includes the perceived quality, intrinsic attributes, and extrinsic attributes (Zeithaml, 1988). Perceived quality is the overall superiority or excellence of the product (Zeithaml, 1988), and comprises two items.

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Considering the characteristics of the system, it was focused on extrinsic instead of intrinsic, and two items relating to safety, which is a crucial characteristic of the system, was formed. The GAP measured the expected benefit of the upgraded system by using the same items of the expected benefit of the current system and the difference of the values.

Regret is expected to arise by doing or not doing a certain action, anticipated regret has been defined in this research as the expected regret that arises by using the intelligent CCTV for home use. According to Connolly and Reb (2005), in decision making, people consider three possible types of regret: outcome regret, option regret, and process regret. In this study, two items related to product and services problem were used to form outcome regret, and process regret was formed with one item of not being able to do more research, and the option regret was formed with one item of comparing the two alternatives.

Behavior intention refers to the intention for using the intelligent CCTV systems that are available in the market. Three items that were used in Venkatesh et al. (2003) were used. In Korea, a majority of the population live in collective shelter complexes, where using a system requires collective agreement. A new item that reflects such conditions was included.

[Table 2 here]

Data Analysis and Results

Measurement model results

Measurement model analysis was conducted for 805 samples by using AMOS 18.0. According to the proposal of Anderson and Gerbing (1988), the confirmatory factor analysis

was conducted on each of the construct in the first stage, and next it was conducted on the overall measurement model.

First, evaluation on the validity for each construct was conducted. According to Campbell and Fiske (1959), there are two major types of validity related to its construction: convergent and discriminant validity. In order to check the convergent validity, the following values were evaluated: the standard factor loading of the item for each construct, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) as the index to confirm the internal consistency construct validity. According to Hair, Anderson, Tatham, and Black (1998), a construct reliability value of above 0.7 means high reliability, while a value between 0.6 and 0.7 is acceptable. In this study, GAP3 was excluded to secure credibility, while GAP1 (0.609) and BE2 (0.694) were used in the final analysis not only because they are considered as major items that form each construct but also because they are acceptable. The Cronbach's alpha and CR values of the four types of constructs used in this study are all above 0.7, and the AVE values were all over the recommended threshold of 0.5 (Segars, 1997). Therefore, the convergent validity was secured. The discriminant validity was tested by comparing the root AVE value of each construct and the correlation values with other constructs. As shown in Table 3, the root AVE value of each construct was bigger than all of the correlation values with the other construct, and thus, discriminant validity was secured (Hair et al., 1998).

This study investigated the common method bias in accordance with Harman's one-factor test (Podsakoff et al., 2003). The results identified four factors with eigenvalues greater than 1.00, and the variance explained by the first factor accounts for only 21.72% of the total

75.68%. Thus, there is no general factor that accounts for most of the variance, and common method bias has no significant impact on this study.

[Table 3 here]

Next, the fitness was evaluated for the overall measurement model. Although goodness-of-fit index (GFI), normalized fit index (NFI), and comparative fit index (CFI) do not yet reach the thresholds of 0.9, the adjusted goodness-of-fit index (AGIF) was higher than the recommended threshold of 0.8, and the root mean square residual (RMSR) was also below the recommended threshold of 0.1, thereby the overall evaluation of the overall measure model was satisfactory (see Table 4).

[Table 4 here]

Structural model results

Further, the authors tested the structural model. Of the five hypotheses, four hypotheses were supported, excluding one that depicted the relationship between the benefit of the current system and anticipated regret (see Figure 3).

First, in forming the gap, the benefit of the current system had a negative impact on the gap (standardized b = -0.49, p < .01). Therefore, H1 is supported. Second, although in relation to the anticipated regret and its relationship with the antecedents, a positive influence of the benefit gap between the current system and the upgraded system on anticipated regret

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was verified (standardized b = 0.26, p < .01), the relationship of benefit of the current system and anticipated regret was not supported statistically (standardized b = 0.09, p = .06). Therefore, H4 is supported, while H2 is rejected. Third, in relation to the behavior intention and its relationship to the antecedents, a positive relationship between the benefit of the current system and behavior intention was supported (standardized b = 0.50, p < .01), while a negative impact of the anticipated regret on behavior intention was verified (standardized b = -0.21, p < .01). Therefore, H3 and H5 are supported.

[Figure 3 here]

Discussion and Implications

Discussion

In this study, empirical research is conducted on how the benefits of the current system influenced by technological advancement and the benefit gap of the upgraded system affect consumer behavior.

The higher the acknowledgement of the benefit of the current system, lower the gap of the upgraded system benefit was conceived to be, which is also in line with the study by Churchill Jr and Surprenant (1982) on plant and video disc player. Further, the higher the acknowledgement of the benefit of the current system, the behavior intention to use the future system was also high. This is in line with the results of the study by Fred D Davis et al. (1989) on a word processing program, where the perceived usefulness and beliefs weighted

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summation had a significant influence on behavior intention. However, the relationship between the benefit of the current system and anticipated regret was not supported statistically. Therefore, it is analyzed that the awareness of the benefit of the current system has an indirect effect on the anticipated regret through the comparison with the benefit of the future system. Similarly, in the satisfaction research on a flu vaccination program by Oliver (1980), while the satisfaction relationship, which is one of expectation and emotion, is supported statistically in the limited sample of students, this is not so in the empirical research on general sample. Likewise, in the empirical research on EDT model on Microsoft Access by Lankton and McKnight (2012), the satisfaction relationship with the usefulness expectation was not statistically supported.

Meanwhile, the anticipated regret is higher when the gap between the current system and upgrade system is large due to technological advancement. This is in line with the research by Brown and Swartz (1989), where the gaps of client expectations and client experiences showed a correlation of -.22 – -.50. The anticipated regret was then verified to have a negative effect on behavior intention. This is also in line with many literatures (Baumgartner et al., 2008; Chen et al., 2015; Sheeran & Orbell, 1999; Van Der Schalk et al., 2012; M. Zeelenberg, 1999).

Managerial implications

Behavior intention is influenced by expectations and anticipated regret. In the perspective of expectation, increasing the expectations of the benefit of the current system as

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well as narrowing down the gap with the expectations on the benefit of the upgraded system is needed to enhance behavior intention. There are three main aspects: the system, context, and individual characteristics, that affect the expectation of humans (Oliver, 1980). Therefore, for the intelligent CCTV, people need to be satisfied in terms of system safety and a sense of relief, while reducing the GAP through active promotion that there is no considerable difference between the benefits of the current system and those of the future system, and finally carrying out customized strategies for each group. In the perspective of anticipated regret, strategies to avoid the higher expectation of the benefit of the upgraded system than the current system to be connected to anticipated regret are needed. One possible solution is to enable the upgrading system with a low cost and to let the consumers be aware of such information. As consumers can choose from the multiple alternatives that exist between the initial standard and the reference point, the leverage of forming the gap through comparing the suggested alternatives could be reduced.

Academic implications

In this study, a research framework applying the regret theory has been built in relation to the rapid technological advancement. The framework can provide knowledge on the process of how anticipated regret is formed through the alternatives comparison, which is an area that has not been dealt with in depth in conventional regret literature. In addition, this reflects the effects of evaluation of the initial standard on affective response and conative response, which supports the previous studies of TRA or TAM.

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The results of the study finds that GAP, which is the difference between two alternatives in the acceptance of new technology, causes emotion such as an anticipated regret and makes decisions in the direction of avoiding such emotion. Moreover, the expectation of the current system is a crucial antecedent of behavior intention. Rather than directly leading to ~~negative~~ emotion, such expectation leads to ~~negative~~ emotion through the process of comparison between alternatives.

Limitations and further research

The limitations of this study are as follows.

The system considered in the analysis is related to ICT, which is subject to rapid technological advancement, while the product lines with slow technological advancement were not included in the research. Therefore, the study is partially limited in proving that it is an appropriate model of explaining new technology adoption. In addition, the expected years of the upgraded product are 7.4 in average, showing that the respondents do not foresee technological advancement that is very fast. Thus, research including more diverse product lines needs to be performed.

In Korea, collective shelter complexes including apartment complexes are very common. This leads to collective agreement with the neighbors for using or changing the intelligent CCTV for home use. The decision making in such conditions would be different from that of the people who live independently. Moreover, personal taste is another major factor that affects expectation. Thus, future research that reflects such aspects of sheltered environment and personal taste is needed for new technology adoption using regret theory.

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Table 1. Respondents' social demographic profiles.

	No. of people	% of total	Chi-square
Gender			
Male	411	51.1	0.01
Female	394	48.9	(Reference value < 3.84)
Age (years)			
20-29	163	20.2	2.1
30-39	197	24.5	(Reference value < 7.81)
40-49	230	28.6	
50-59	215	26.7	

Table 2. Scale items for constructs.

Constructs	Items	Label	Related Literature
Expected Benefit of Current System (BE)	The intelligent CCTV for home use currently available.		
	(a) will bring me many benefits in general	BE1	Zeithaml (1988)
	(b) is excellent	BE2	Zeithaml (1988)
	(c) will help me feel a sense of relief	BE3	New
	(d) will guarantee safety for me and my family	BE4	New
Anticipated Regret (AR)	If I buy the intelligent CCTV for home use currently available,		
	I might regret by thinking, "I should have done more research before buying."	AR1	Connolly and Reb (2005)
	I might regret by thinking, "I should have bought a different product."	AR2	Connolly and Reb (2005)
	I might regret due to product malfunction or problems.	AR3	Connolly and Reb (2005)

	I might regret due to malfunction of security service.	AR4	Connolly and Reb (2005)
Behavioral Intention (BI)	I intent to use the current intelligent CCTV for home use	BI1	Venkatesh et al. (2003)
	I predict I would use the current intelligent CCTV for home use	BI2	Venkatesh et al. (2003)
	I plan to use the current intelligent CCTV for home use	BI3	Venkatesh et al. (2003)
	I will tell others to use the intelligent CCTV for home use that is currently available.	BI4	New

Table 3. Correlation matrix.

	alpha	AVE	CR	BE	GAP	AR	BI
BE	0.887	0.644	0.877	(0.802)			
GAP	0.746	0.503	0.750	-0.503**	(0.709)		
AR	0.895	0.649	0.880	-0.037	0.218**	(0.806)	
BI	0.923	0.742	0.920	0.536**	-0.148**	-0.231**	(0.862)

Note: **$p < 0.01$; (   ) of horizontal is root AVE

Table 4. Fitness of the measurement and the structural model.

Fit Indices	Thresholds	Reference	Measurement Model	Structural Model
Chi-sq.(d.f)	-		911.292 (81)	933.899 (82)
GFI	>0.90	Jöreskog and Sörbom (1989)	.891	.887
AGFI	>0.80	Jöreskog and Sörbom (1989)	.838	.834
NFI	>0.90	Bentler and Bonett (1980)	.891	.888
CFI	>0.90	Bentler (1990)	.899	.896
RMSR	<0.10	Hair et al. (1998)	.040	.046

Simplified Expectation Disconfirmation Model (Lankton & McKnight, 2012)	Expectations → Satisfaction; Expectations → Disconfirmation → Satisfaction
Consumer-oriented GAP Model (adopted from Parasuraman et al. (1985))	Expected service ↕ Perceived service — GAP → Service Quality
Regret Model (adopted from Sheeran and Orbell (1999))	Utility of Selected/selecting alternative ↕ Utility of Referencing alternative — GAP → Anticipated emotion

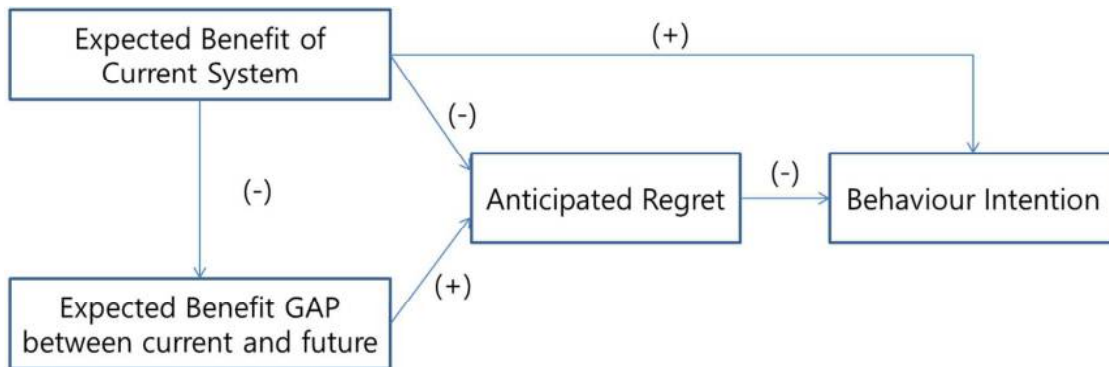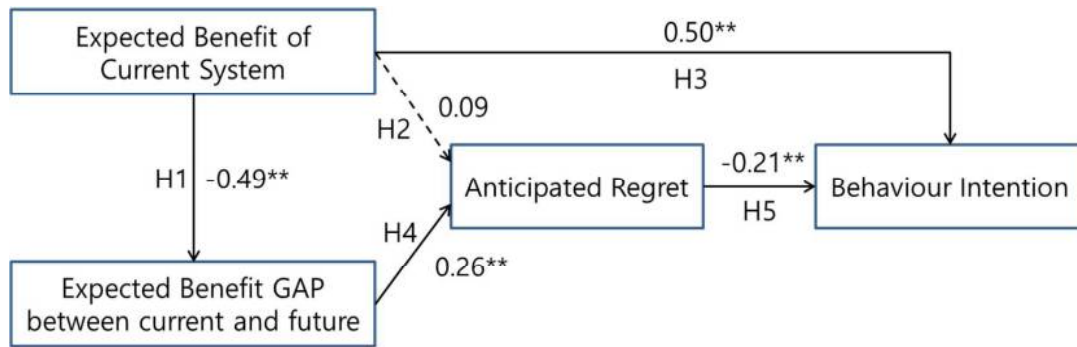**Fig 1.** Expectation-Disconfirmation Model, GAP Model, and Regret Model.

Fig 2. Research framework.

Fig 3. Results of the hypotheses test. ** p< 0.01.